Soil Structure Interaction Analysis for the Hanford Site 241-SY-101 Double-Shell Waste Storage Tanks

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(10) Concrete Section Properties

<p>1' UNIT WIDTH</p> <p>17" 1.417'</p>	$A = (1')(1.417') = \underline{1.42 \text{ sf}}$ $I = \frac{(1)(1.417)^3}{12} = \underline{.24 \text{ ft}^4}$
<p>18" 1.5'</p>	$A = (1)(1.5) = \underline{1.5 \text{ sf}}$ $I = \frac{(1)(1.5)^3}{12} = \underline{.28 \text{ ft}^4}$
<p>30" 2.5'</p>	$A = (1)(2.5) = \underline{2.5 \text{ sf}}$ $I = \frac{(1)(2.5)^3}{12} = \underline{1.30 \text{ ft}^4}$
<p>23" 1.92'</p>	$A = (1)(1.92) = \underline{1.92 \text{ sf}}$ $I = \frac{(1)(1.92)^3}{12} = \underline{.59 \text{ ft}^4}$
<p>11 1/2" .96'</p>	$A = (1)(.96) = \underline{.96 \text{ sf}}$ $I = \frac{(1)(.96)^3}{12} = \underline{.07 \text{ ft}^4}$

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

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(10) Concrete Material Properties

Foundation Concrete:

$$f'_c = 3000 \text{ psi} \quad \text{Ref. Tank Foundation Spec B-101-C2}$$

$$E = 57000 \sqrt{f'_c} = 3122000 \text{ psi} \quad \nu = .2$$

$$G = \frac{E}{2(1+\nu)} = 1300833 \text{ psi} = 187000 \text{ ksf}$$

Tank Wall Concrete:

$$f'_c = 4500 \text{ psi} \quad \text{Ref. Construction Spec. B-101-C3}$$

$$E = 57000 \sqrt{f'_c} = 3824000 \text{ psi} \quad \nu = .2$$

$$G = \frac{E}{2(1+\nu)} = 1593333 \text{ psi} = 230000 \text{ ksf}$$

APPENDIX A
CALCULATIONS

APPENDIX A
CALCULATIONS

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OBJECTIVE

The objective of this soil-structure interaction analysis (SSI), is to determine if equivalent static seismic acceleration analysis is more or less conservative than a dynamic analysis that includes soil-structure effects. The 241-SY-101 tank is a high hazard facility that has been analyzed for static seismic loads, (WHC-SD-WM-DA-087 reference 2), using a 0.2g spectra. The tank has also been analyzed for dynamic loads with out proper soil-structure effects (ARH-R-172 reference 1), using a 0.25g spectra.

DISCUSSION

The 241-SY-101 tank profile is shown in Figure 1, and the liquid level to be analyzed for is shown in Figure 2. The existing analysis for the 241-SY-101 tank is the WHC-SD-WM-DA-087 document, which uses an equivalent static seismic analysis. The spectra used comes from the site design criteria SDC-4.1 Rev.11, 0.2g spectra at 7% damping. For the equivalent static load the peak acceleration of this curve was used to calculated the seismic acceleration stresses and the ASCE 4-86 standard (reference 8) was used to calculated the soil pressures.

To perform these SSI evaluations several computer programs were chosen including ANSYS, FLUSH, SHAKE, and SASSI. ANSYS is a finite element program used to model the primary liner and determine the primary liner/fluid natural frequency. The ANSYS results are then used to model the effective mass and stiffness of the members used in the following SSI program FLUSH and SASSI. The FLUSH program is a 2D SSI program that calculated its own free field soil properties and than gives results in response spectra in 2 directions at any point in the model, as well as soil pressure on the beam members if requested. The SHAKE program is used to calculated the free field soil properties at depth under seismic loads. The SHAKE results are input data to the SASSI 3D SSI program can fully analyze 3 dimensional effects and results in response spectra at any point in the tank model, and in any of the three orthogonal directions. Both the FLUSH and SASSI program can deal with multiple tank or multiple structure situations.

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EL-672.25'

Figure 1

H9105030.3

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Figure 2

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Soil Properties Discussion

The soil properties used in this analysis come from the URS/Blume analysis ARH-R-172 dated October 1974, (Reference 1). Figure 9 shows the URS/Blume soil layers, Figure 9 shows the soil layers used in this analysis. To calculate conservative soil properties for this analysis the upper layers were artificially made stiffer because the ground motion control point is being specified at the free surface, and to have soft upper layers would reduce the seismic input at the tank base. Table 1 shows the assumed shearwave velocities and the calculated and rounded off shear moduli for each layer in Figure .

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Soil Layers Reference I, Figure 11

ASSUMED SOIL LAYERING IN
URS-BLUME SOIL-TANK MODEL

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(10) Soil Properties

For FLUSH input the required properties are poisson's ratio ν , density γ , and shear modulus G .

ν & γ are given in the URS/Blume report
Reference 1

$$G = \frac{V_s^2 \gamma}{g}$$

V_s = soil shear wave velocity
 γ = weight density
 g = acceleration of gravity

for layer 1

V_s is assumed to be 850 feet per ~~second~~ ^{second}
 $\gamma = 108 \text{ pcf}$ $g = 32.2 \text{ ft/s}^2$

$$G = \frac{(850 \text{ fps})^2 (.108 \text{ kcf})}{(32.2 \text{ ft/s}^2)} = 2423 \Rightarrow \text{use } 2400 \text{ ksf}$$

see table 1 for other layers.

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(10)

TABLE 1

Soil Layers Ref. 1	Current Soil Layers	Shear Wave Velocity	Density γ	Shear Modulus G	Poisson's Ratio ν
5	1	850 fps	108 pcf	2400 ksf	.23
6	2	930	127	3400	.18
7	3	1010	108	3400	.27
7	4	1100	108	4050	.27
8	5	1050	127	4350	.39
8	6	1130	115	4550	.39
9	7	1200	108	4800	.42
10	8	1200	108	4800	.43
10	9	1270	108	5400	.43
11	10	1270	108	5400	.44
11	11	1270	108	5400	.44

(10) Time History

Scaling of Time History

A-11

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Hanford Build. 234-5Z East side, N-S TH.

ZPA=0.20g, 100 % HORIZ; DT=0.005 SEC.

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(10) ANSYS Fluid Modeling

This ANSYS fluid Model uses STIF 81 fluid elements and STIF 61 steel shell element to model the fluid primary tank components. The steel tank elements are supported at the top and bottom. The fluid elements are coupled to the tank wall steel elements, constrained at the tank centerline and supported at the tank bottom. The ANSYS model is axisymmetric with non-axisymmetric seismic loading.

The output of this ANSYS model is the natural frequency of the primary tank and fluid. This natural frequency of the tank in mode 30 ~~and~~ is 6.5 hz. Modes 1 thru 29 are fluid circulation modes that have zero mass associated with them.

The results of this ANSYS run can now be used in the FLUSH and SASSI programs to account for the mass and spring rate of the primary tank / fluid elements.

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(10) FLUSH Fluid Modeling

From the "ANSYS" primary tank/fluid model frequency calc. the impulsive frequency is about 6.5 Hz. From the ASCE 4-86 Standard the effective impulsive fluid mass is 55% of the total mass when $D/H = 2$. The intent here is to place a mass-spring system into the concrete tank model to simulate this.

Concrete Tank "FLUSH"
Nodes Added Steel Beams
and Fluid Mass

$$\text{Fluid Mass} = (55\%) \times h \pi R^2 = (.55)(1.7)(62.4)(37.5') \pi (37.5')^2$$

pct

$$= 9681336 \text{ \#}$$

$$\text{Fluid Mass} = \frac{9681336 \text{ \#}}{2R(1000)} = 129 \text{ K/\#}$$

per unit width
of one foot

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(10)

$$\text{Freq} = 6.5 \text{ hz}$$

$$f = \frac{1}{2\pi} \sqrt{\frac{K}{m}}$$

$$f = 3.13 \sqrt{\frac{1}{\Delta}}$$

$$6.5 = 3.13 \sqrt{\frac{1}{\Delta}}$$

$$\Delta = .2319''$$

Δ @ center of mass

$$\Delta = \frac{Pl_1^3}{192EI} \left(\frac{1}{2}\right) + \frac{Pl_2}{AE} \left(\frac{1}{2}\right) \left(\frac{1}{2}\right)$$

$$\frac{129^k (38 \times 12'')^3}{192 (29000) I 2} + \frac{129^k (84 \times 12'')}{A (29000) 2 \cdot 2}$$

$$.2319'' = \frac{1098}{I} + \frac{1.121}{A}$$

$$\text{if } I = 100 \text{ ft}^4 = 2073600 \text{ in}^4$$

$$.2319 = \frac{1098}{2073600} + \frac{1.121}{A} \therefore A = 4.85 \text{ in}^2 = .034 \text{ ft}^2$$

Use Steel Beams $\gamma = 0 \text{ pct}$ $\nu = .3$

$$E = 29000 \text{ ksi} \quad G = \frac{E}{2(1+\nu)} = 1600000 \text{ ksf}$$

$$\text{vertical members} \therefore I = 100 \text{ ft}^4 \quad A = .001 \text{ sf}$$

$$\text{horizontal members} \therefore I = .01 \text{ ft}^4 \quad A = .034 \text{ ft}^2$$

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(10) FLUSH Concrete Elements

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(10) FLUSH Soil Element Size

$$h_{max} = \frac{1}{5} \cdot \frac{V_s}{\lambda_{max}}$$

V_s = shear wave velocity

λ_{max} = highest analysis frequency

Use freq = 12 hz

$V_s = 850$ fps 0' to 20' deep

$V_s = 1010$ fps 20' to 150' deep

$$h_{max} = \frac{1}{5} \cdot \frac{850}{12} = 14.17'$$

‡

$$h_{max} = \frac{1}{5} \cdot \frac{1010}{12} = 16.83'$$

Iterated soil properties give a new $V_s = 748$ fps

$$@ h = 9.5' \quad \lambda_{max} = \frac{1}{5} \frac{V_s}{h} = \frac{748}{5(9.5')} = 15.7 \text{ hz} > 12 \text{ hz}$$

O.K.

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FLUSH Single Tank Element Numbers

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FLUSH Single Tank Node Numbers

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FLUSH Double Tank
 Lined Numbers

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1	12	23	45	60	75	90	106	117	139	154	169	184	200	211								
2	13	24	46	61	76	91	107	118	140	155	170	185	201	212								
3	14	25	47	62	77	92	108	119	141	156	171	186	202	213								
4	15	26	48	63	78	93	109	120	142	157	172	187	203	214								
5	16	27	49	64	79	94	110	121	143	158	173	188	204	215								
6	17	28	50	65	80	95	111	122	144	159	174	189	205	216								
7	18	29	51	66	81	96	112	123	145	160	175	190	206	217								
8	19	30	52	67	82	97	113	124	146	161	176	191	207	218								
9	20	31	53	68	83	98	114	125	147	162	177	192	208	219								
10	21	32	54	69	84	99	115	126	148	163	178	193	209	220								
11	22	33	55	70	85	100	116	127	149	164	179	194	210	221								
234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256

FLUSH Double Tank
Node Numbers

WHC-EP-0504
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(9) Checker EO Werner, W. W. Ch... Date 9-16-91

(10) FLUSH Dynamic Results

Response spectra was requested in the computer run at several tank element locations.

Tank Crown - node 61 page C10 & C14

Tank Haunch - node 92 page C11 & C15

Tank Wall - nodes 23, 96, 123, 190
pages C12, C16, C17, C18, C19

Tank Base - node 63 page C13 & C20

These spectra in some cases have higher accel. peaks than the SDC-4.1 ground motion spectra.

For example, the tank crown and tank haunch for both single and double tank arrangements have high peaks in the 1 to 2 hz area of .5g when SDC-4.1 has .38g (7% damping). Another example is in the tank side wall for the double tank only, there is a spike of accel. in the 8. to 10. hz range of .45g when SDC-4.1 is .38g or less.

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FLUSH Free Field

SURFACE ——— SDC ——— CROWN ·····

HAUNCH ——— MID WALL ——— BASE ———

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FLUSH Single Tank Model

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FLUSH Double Tank Model

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(9) Checker E. O. Wen, NWChen Date 9-16-91

(10) FLUSH Soil Pressure Results

Dynamic soil pressures were calculated in a previous analysis of the SY-101 tank Ref. 2. These soil pressures were calculated using the ASCE 4-86 standard. The FLUSH "Postforce" routine also calculated the dynamic soil pressures using iterated soil properties. The following pages compare the 2 sets of results. See page C23 & C26 for the Postforce output.

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(10)

Dynamic Soil Pressures

WHC-EP-0504
Rev. 0
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(9) Checker E.O. Wain, NW Date 9-16-91

(10)

Calculate Dynamic Soil Loads from the Ref. 2 soil pressures and compare to the FLUSH output

The ASCE 4-86 Standard overestimates the total dynamic soil load by a factor of:

$$\frac{50634 \text{ #}}{19637} = 2.58. \text{ Only at the bottom of the tank}$$

wall is ASCE pressures smaller than the FLUSH output. Overall the ASCE dynamic soil loads are conservative.

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(10) SHAKE Results

The SHAKE program is similar to the free field portion of the FLUSH program, where the soil elements go through iterations to produce new soil properties and response spectra at different layers in the soil.

The resulting response spectra for the layers of interest is shown on page C27. The resulting iterated soil properties are input to SASSI page B46 and are also shown on page C28.

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SHAKE
Free Field Response, .20g Zpa

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 (8) Originator EG Wayne Date 9/13/91
 (9) Checker W. W. Chen Date 9/25/91

(10)

Fluid-Structure Interaction Analysis (SASSI)

The tank fluid effects must be modelled in SASSI with structural-mass elements. Therefore, an ANSYS fluid-structure interaction analysis is carried out to determine how this is to be done. The frequencies and base shears from an ANSYS fluid model are to be reproduced with a structural model when both are subjected to the same seismic loading. See [1] for ANSYSinfo.

STIF61 and STIF81 elements are axisymmetric with non-axisymmetric loading capabilities. Lateral seismic loading is achieved with $MORF=1$.

The 2% damping response spectrum for high hazard facilities

(0.2g) is used to expand the Ansys modes. Ansys input is in Appendix B. The mesh plot showing nodes, elements, masters, restraints, couplings & constraints is included herein.

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 (9) Checker h. w. Zhou Date 9/25/91

(10)

When all modes are expanded, only two are significant. The rest are circulation modes. The slosh mode ($f = 0.2 \text{ Hz}$) produces negligible base shears. The impulse mode (6.5 Hz) produces the base shears on the primary liner:

$$\begin{aligned} F_{z60} &= -1.01 \text{e}6 \# & F_{y60} &= -.33 \text{e}6 \# \\ F_{z51} &= -.58 \text{e}6 \# & F_{y51} &= .23 \text{e}6 \# \end{aligned}$$

These values must be multiplied by π for physical shear values (Ansys user manual, section 2.25). Additionally, F_y times the tank radius gives the end moment.

$$\begin{aligned} F_1 + F_2 &= F \\ -H_f F + H F_2 + M_1 + M_2 &= 0 \\ \frac{H F}{H} &= \frac{F_2}{F} + \frac{M_2 + M_1}{H F} \\ &= \frac{.58 \text{m}}{1.58 \text{m}} + \frac{-.10 \text{m} \times 37.5'}{38.4' \times 1.58 \text{m}} \\ &= 0.30 \end{aligned}$$

Effective mass:

$$\frac{m_f}{m_{TOT}} = \frac{\pi F}{\frac{S_a}{J} m_{TOT}} = \frac{\pi \times 1.58 \text{m}}{.55 \times 18.0 \text{m}} = 0.500$$

where

$$m_{TOT} = 46610 \times 386 = 18.0 \text{m}$$

Ansys output, consistent units

DESIGN CALCULATION

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 (7) Subject _____
 (8) Originator E O Werner Date 9/15/91
 (9) Checker W W Thon Date 9/25/91

(10)

This suggests placing half the fluid mass at 30% height to model the fluid effects; it is not out of line with typical rigid tank modelling techniques (see ASCE 4-86).

The desired results were obtained by placing 50% of the fluid mass in a stiff ring at 0.36H as shown. The results:

$$f = 6.50 \text{ Hz}$$

$$F_{z8} = 0.55 \text{ M}$$

$$F_{z1} = 1.00 \text{ M}$$

only significant mode.

which are close to the fluid-structure interaction results shown above.

Note that the primary liner was modelled in SASSI as a cylinder with radius $R=41'$ connecting the haunch and base areas. It is coincident with the concrete side wall but not otherwise connected to it. The stiff

DESIGN CALCULATION

4

(1) Drawing _____ (2) Doc. No. _____ (3) Page A35 of _____
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 (7) Subject _____
 (8) Originator EO Weir Date 9/13/91
 (9) Checker HW Chen Date 9/25/91

(10)

ring shown above is modelled with beam elements. Section properties:

$$A = 0.6' \times \frac{0.6''}{12''/1'} \times 100 = 3 \text{ ft}^2$$

$$I_2 = 0.6' \times \left(\frac{0.6''}{12''/1'} \right)^3 \times \frac{100}{12}$$

$$= 0.000625 \text{ ft}^4$$

$$I_3 = \frac{.6''}{12''/1'} \times \frac{.06'^3}{12} \times 1000$$

$$= 0.0009 \text{ ft}^4$$

$$J = I_2 + I_3 = .00015 \text{ ft}^4$$

The I_3 calculation is based on a refinement ANSYS run with 1/10 the ring height and 1000E vs 100E (it produced the same results).

Masses are lumped at the beam nodes:

$$\text{ANSYS full mass} = 23400 \frac{16 \text{ sec}^2}{\text{in}^4} \times 356 \frac{\text{in}}{\text{sec}^2} = 9.0e6 \#$$

$$\div 4 \text{ for glr model}$$

$$\div 6 \text{ over 6 nodes}$$

$$\text{Per node: } m = 9.0e6 / 6 / 4 = 375e3 \#$$

Deformed shape plots for the slosh and impulse modes are included. The slosh mode shows very little tank deformation.

DESIGN CALCULATION

(1) Drawing _____ (2) Doc.No. _____ (3) Page _____ of _____
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject _____
 (8) Originator EO Weiner Date 9/15/91
 (9) Checker W. W. Ther Date 9/25/91

ANSYS 4.4
 AUG 26 1991
 16:58:49
 PLOT NO. 1
 PREP7 ELEMENTS
 ELEM NUM
 BC SYMBOLS
 ZV = 1
 ADIST=300
 XF = 225
 YF = 230.4

SY-101 Tank Primary Liner Model, Hrzl, Full

DESIGN CALCULATION

(1) Drawing _____ (2) Doc.No. _____ (3) Page _____ of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator EO Wgner Date 9/13/91
(9) Checker WWT Chen Date 9/25/91

ANSYS 4.4
AUG 26 1991
17:07:27
PLOT NO. 1
POST1 DISPL.
STEP=1
ITER=30
FREQ=6.457
DMX =0.209398
*DSCA=-150
ZV =1
*DIST=300
XF =225
YF =230.4

SY-101 Tank Primary Liner Modal, Hrztl, Full

DESIGN CALCULATION

(1) Drawing _____ (2) Doc.No. _____ (3) Page _____ of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator EO Werner Date 9/13/91
(9) Checker W.W. Chen Date 9/25/91

ANSYS
AUG 14
17:34:33
PLOT NO
POST1
STEP=1
ITER=22
FREQ=0
DMX = 13
*DSCA=
ZV = 1
*DIST=2
*XF = 2
*YF = 2

DESIGN CALCULATION

5

(1) Drawing _____ (2) Doc. No. _____ (3) Page A39 of _____
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject _____
 (8) Originator EO Weimer Date 9/15/91
 (9) Checker W. W. Chen Date 9/25/91

(10)

Fluid-Structure Interaction Testing

The use of ANSYS STIF61 and STIF81 was tested by comparing a wide-tank model with the procedure given by Haroun & Housner [2]. The tank is held only at the bottom. From H & H:

Slosh mode (eq #'s from [2])

$$\omega_s^2 = \frac{1.84g}{R} \tanh\left(\frac{1.84H}{R}\right) \quad (2)$$

$$= \frac{1.84 \times 32.2 \text{ ft/sec}^2}{37.5'} \tanh\left(\frac{1.84 \times 37.5}{37.5}\right)$$

$$= 1.50 \text{ sec}^{-2} \quad f_s = \omega_s / 2\pi = 0.195 \text{ Hz}$$

Use 2% damping; use 0.2g Newmark-Hall spectrum:

$$S_a = 0.028g$$

$$\xi_{\max} = .837 R \frac{S_a}{g} = .837 \times 37.5 \times .028 = .88' = 10.5'' \quad (3)$$

$$\frac{H_s}{H} = 1 - \frac{R}{1.84H} \tanh\left(\frac{.92H}{R}\right) = 1 - \frac{1}{1.84} \tanh(.92) = .605 \quad (11)$$

$\xi_{\max}$ is the slosh height, H_s/H locates the equivalent mass for calculation of the base shear. The equivalent mass is

$$\frac{m_s}{m} = .455 \pi \rho R^3 \tanh\left(\frac{1.84H}{R}\right) \quad (10)$$

DESIGN CALCULATION

9

(1) Drawing _____ (2) Doc. No. _____ (3) Page A40 of _____
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject _____
 (8) Originator EO Warner Date 9/15/91
 (9) Checker LMZ Date 9/25/91

(10)

$$m_s = .455 \pi \times 62.4 \frac{16}{ft^3} \times 37.5^3 ft^3 \tanh(1.84) \\ = 4.47^M$$

$$m = \pi \rho R^2 H = \pi \times 62.4 \times 37.5^3 = 10.3^M$$

$$\frac{m_s}{m} = \frac{4.47}{10.3} = .434$$

For the impulse mode:

$$\omega_f = .0865 \frac{\sqrt{E/A}}{H} = .0865 \frac{\sqrt{30e6 psi / .28 pci \times 386 in/sec^2}}{37.5 ft \times 12 in/ft} \\ \text{Fig 5} \\ = 39.1 sec^{-1} \quad f_f = \omega_f / 2\pi = 6.23 Hz$$

$$\beta_1 = 1.19 \quad \text{Fig 6} \quad \frac{m_f}{m} = 0.55 \quad \text{Fig 7}$$

$$\frac{H_f}{H} = .419 \quad \text{Fig 8} \quad \frac{m_r}{m} = .56 \quad \text{Fig 9}$$

$$\frac{H_r}{H} = .406 \quad \text{Fig 10}$$

$$S_{af} = 0.55 g \quad (0.2 g \text{ ZPA, } 2\% \text{ damping})$$

$$S_{df} = S_{af} / \omega_f^2 = \frac{0.55 \times 386 in/sec^2}{39.1^2 sec^{-2}} = .139"$$

$$W_{max} = \beta_1 S_{df} = 1.19 \times .139" = .165"$$

$$Q_s = m_s S_{af} = .43 \times 10.3^M \times .028 = .124^M$$

$$M_s = H_s Q_s = .605 \times 37.5' \times .124 = 2.81^M$$

$$Q_f = m_f S_{af} = .55 \times 10.3^M \times .55 = 3.12^M$$

$$M_f = H_f Q_f = .419 \times 37.5' \times 3.12^M = 49.0^M$$

DESIGN CALCULATION

10

(1) Drawing _____ (2) Doc. No. _____ (3) Page A41 of _____
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject _____
 (8) Originator EO Weiner Date 9/15/91
 (9) Checker W. W. Thoe Date 9/25/91

(10)

The STIF61/STIF81 run clearly produces only two modes of significance. Base shear & moments are figured with

$$Q = \pi F z \quad M = \pi R F z$$

per formulas in Section 2.2.5 of the ANSYS manual.

$$f_s = .194 \text{ Hz} \quad z_{\max} = 17.1''$$

$$Q_s = \pi \times .0605^M = .190^M$$

$$M_s = \pi \times 37.5 \times .0375 = 4.42^{M1}$$

$$H_s/H = M_s/(H Q_s) = \frac{4.42}{37.5 \times .19} = .620$$

$$f_f = 6.13 \text{ Hz}$$

$$u_{x\max} = .155''$$

$$Q_f = \pi \times .888 = 2.79^M$$

$$M_f = \pi \times 37.5 \times .403 = 47.5^{M1}$$

$$H_f/H = \frac{47.5}{37.5 \times 2.79} = .454$$

These are sufficiently close to the H-H values for purposes of soil-structure interaction modelling.

DESIGN CALCULATION

(1) Drawing _____ (2) Doc. No. _____ (3) Page A42 of _____
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 (7) Subject _____
 (8) Originator EO Weiner Date 9/13/91
 (9) Checker W.W. Chen Date 9/25/91

(10)

SASSI Modelling

The frequency requirement (see [3])

$$h < \frac{1}{5} \frac{V_s}{f_{max}}$$

where

h = max soil element size

V_s = min soil shear velocity = 750 fps

f_{max} = maximum frequency of interest
 = 13 Hz

gives

$$h < \frac{1}{5} \frac{750}{13} = 11.5'$$

Soil elements were kept to 9.5-10.5' in size.

$f_{max} = 13 \text{ Hz}$ is considered adequate because (1) the only structural mode is 6.5 Hz, (2) the surface response spectrum starts dropping off at 8 Hz, and (3) SHAKE analyses show considerable attenuation above 10 Hz at depths corresponding to the haunch and base.

modelling is straight forward using elements:

Bricks: excavated soil

Plate/shell: concrete, primary liner

Beam: Ring used to attach fluid mass.

DESIGN CALCULATION

12

(1) Drawing _____ (2) Doc. No. _____ (3) Page A43 of _____
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 (7) Subject _____
 (8) Originator E O Weiner Date 9/13/91
 (9) Checker W. W. Chen Date 9/25/91

(10)

mesh plots are included. Among them is an edge plot of the entire model. It shows element edges that are shared by an odd number of elements. This plot is one of the better evidences of proper connectivity. There are plots showing boundary conditions. It should be noted that cutting out planes of symmetry or antisymmetry still leaves the user with the task of specifying sym/asymmetry boundary conditions on the model. They are zero dots for

x-symmetry: dots producing deformation out of the $x=0$ plane: u_x , rot_y , rot_z (ANSYS notation)

y-asymmetry: dots producing deformation wholly in the $y=0$ plane: u_y , u_z , Rot_x

The y-asymmetry is a generalization of the FLUSH asymmetric boundary condition practice illustrated in several places in the user manual.

DESIGN CALCULATION

(1) Drawing _____ (2) Doc.No. _____ (3) Page _____ of _____
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject _____
 (8) Originator ED Weiner Date 9/15/91
 (9) Checker WW Chen Date 9/25/91

ANSYS 4.4

AUG 31 1991

14:46:36

PLOT NO. 1

PREP7 ELEMENTS

TYPE NUM

XV = -1

YV = 1

ZV = 0.5

*DIST=42

*XF = 21.5

*YF = 21.5

*ZF = 39.85

VUP = Z

PRECISE HIDDEN

DESIGN CALCULATION

(1) Drawing _____ (2) Doc.No. _____ (3) Page ____ of ____
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject _____
 (8) Originator EO Weiner Date 9/13/91
 (9) Checker W. W. Chou Date 9/25/91

ANSYS 4.4
 AUG 31 1991
 14:53:30
 PLOT NO. 1
 PREP7 ELEMENTS
 TYPE NUM
 XV = -0.8
 YV = 1
 ZV = 0.5
 ADIST=42
 AXF = 21.5
 AYF = 21.5
 AZF = 39.85
 VUP = Z
 PRECISE HIDDEN

DESIGN CALCULATION

(1) Drawing _____ (2) Doc.No. _____ (3) Page _____ of _____
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject _____
 (8) Originator EO Wagner Date 9/15/91
 (9) Checker Wagner Date 9/25/91

ANSYS 4.4
 AUG 20 1991
 12:38:27
 PLOT NO.
 PREP7 ELEMENTS
 TYPE NUM
 XV = -1
 YV = 1
 ZV = 0.5
 DIST=41.899
 XF = 21.5
 YF = 21.5
 ZF = 39.85
 VUP = Z
 PRECISE HIDDEN

DESIGN CALCULATION

(1) Drawing _____ (2) Doc.No. _____ (3) Page _____ of _____
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject _____
 (8) Originator EO Weiner Date 9/12/91
 (9) Checker WWZha Date 9/25/91

ANSYS 4.4
 AUG 31 1991
 14:56:41
 PLOT NO.
 PREP7 ELEMENT
 TYPE NUM
 XV = -0.8
 YV = 1
 ZV = 0.5
 *DIST=42
 *XF = 21.5
 *YF = 21.5
 *ZF = 39.85
 VUP = Z
 EDGE

DESIGN CALCULATION

(1) Drawing _____ (2) Doc.No. _____ (3) Page _____ of _____
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject _____
 (8) Originator ED Weiner Date 7/13/91
 (9) Checker WWZhen Date 9/25/91

SEP 3 1991
 20:02:45
 PLOT NO. 1
 PREP7 NODES
 BC SYMBOLS

 XV = -1
 TV = 1.2
 ZV = 0.4
 *DIST=25
 *XF = 25
 *YF = 25
 *ZF = 34
 VUP = Z

ANSTS 4 4
 SEP 3 1991
 19:47:24
 PLOT NO. 1
 PREP7 NODES
 BC SYMBOLS

 XV = -1
 TV = 1.2
 ZV = 0.5
 *DIST=25
 XF = 20.5
 YF = 20.5
 ZF = 34.85
 VUP = Z

DESIGN CALCULATION

(1) Drawing _____ (2) Doc.No. _____ (3) Page _____ of _____
 (4) Building _____ (5) Rev. _____ (6) Job No. _____
 (7) Subject _____
 (8) Originator SD Lerner Date 9/13/91
 (9) Checker HW Chiu Date 9/25/91

DESIGN CALCULATION

(1) Drawing _____ (2) Doc.No. _____ (3) Page _____ of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator ED Weiner Date 9/15/91
(9) Checker lvwzph Date 9/25/91

SASSI RESULTS

The SASSI 3D response spectra results are shown on pages A51 to A54.
The tank responses are generally less than the SDC-4.1 criteria ground motion spectra. The tank crown and haunch areas show a response slightly higher than the SDC-4.1 (0.4g vs 0.38g) or about 5% different. This difference is much smaller than the FLUSH model results which shows an increase of 32% over the SDC-4.1 criteria.

DESIGN CALCULATION

(1) Drawing _____ (2) Doc.No. _____ (3) Page _____ of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator E.O. Werner Date 9/13/91
(9) Checker WVTHA Date 9/25/91

SASSI

DESIGN CALCULATION

(1) Drawing _____ (2) Doc.No. _____ (3) Page _____ of _____
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator R. A. Giller Date 9-11-91
(9) Checker Wu Chen Date 9-25-91

REFERENCES

1. Analysis of Underground Waste Storage Tanks 241-SY at Hanford Washington. ARH-R-172, October 1974, URS/Blume.
2. Static Load Structural Assessment of the 241-SY-101 Tank for New Liquid Level. WHC-SD-WM-DA-087, May 1991, R. A. Giller.
3. "FLUSH" A Computer Program for Approximate 3-D Analysis of Soil-Structure Interaction Problems, University of California Berkeley.
4. "SHAKE" A Computer Program for Earthquake Response Analysis of Horizontally Layered Sites, University of California Berkeley.
5. "SASSI" System for Analysis of Soil Structure Interaction, University of California Berkeley.
6. Specification for Excavation and Tank Foundations 241-SY Tank Farm, B-101-C2, February 1974.
7. Construction Specification for Completion of 241-SY Tank Farm, B-101-C3, November, 1974.
8. ASCE 4-86 Standard for, Seismic Analysis of Safety-Related Nuclear Structures, 1986.
9. ANSYS Engineering Analysis System User's Manual (rev 4.4) Swanson Analysis Systems Inc. Houston PA 15342, May 1, 1989.
10. M.A. Haroun & G.W. Housner, "Seismic Design of Liquid Storage Tanks", Jnl of Technical Councils of the ASCE, April 1981, pp191-207.
11. J. Lysmer, et al. "SASSI User's Manual" Bechtel Corp. (CE994), 1991.

CHECKLIST FOR INDEPENDENT REVIEW

Document Reviewed SSI Analysis for the 241-SY-101 DST

Author R. A. Giller, E.O. Weiner

Yes No N/A

☒	☐	☐	Problem completely defined.
☒	☐	☐	Necessary assumptions explicitly stated and supported.
☒	☐	☐	Computer codes and data files documented.
☒	☐	☐	Data used in calculations explicitly stated in document.
☒	☐	☐	Data checked for consistency with original source information as applicable.
☐	☐	☒	Mathematical derivations checked including dimensional consistency of results.
☒	☐	☐	Models appropriate and used within range of validity or use outside range of established validity justified.
☒	☐	☐	Hand calculations checked for errors.
☒	☐	☐	Code run streams correct and consistent with analysis documentation.
☒	☐	☐	Code output consistent with input and with results reported in analysis documentation.
☒	☐	☐	Acceptability limits on analytical results applicable and supported. Limits checked against sources.
☒	☐	☐	Safety margins consistent with good engineering practices.
☒	☐	☐	Conclusions consistent with analytical results and applicable limits.
☒	☐	☐	Results and conclusions address all points required in the problem statement.

R. A. Giller

Reviewer(s)

9-25-91

Date

APPENDIX B
COMPUTER INPUT RUN STREAMS

APPENDIX B
COMPUTER INPUT RUN STREAMS

ANSYS Input Run	B-3
FLUSH Input Run (single-tank model)	B-10
FLUSH Input Run (double-tank model)	B-23
SHAKE Input Run	B-41
SASSI Input Run	B-48

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction ANSYS input
 (8) Originator E. O. Weiner

```

/prep7
/title, SY-101 Tank Primary Liner Modal, Hrztl, Full
kan,2
kay,1,0          * reduced extraction
kay,2,-1         * control mode expansion with EXMODE below
et,1,81
et,2,61
ex,1,.3e6        * bulk modulus
dens,1,159e-6    * lbf sec^2 / in^4, sp gr = 1.7
gxy,1,386        * g for k-slosh. See stif81
ex,2,30e6        * shell
nuxy,2,.3
dens,2,725e-6
r,1,.875         * shell thicknesses
r,2,.75
r,3,.5
r,4,.375
n,1              * c/l nodes, origin at bottom
h=3.1            * ft input
n,2,,h
h=h+9
n,4,,h
fill
h=h+19.7
n,8,,h
fill
h=h+6.6
n,10,,h
fill
dr=(37.5)/5.
ngen,6,10,1,10,1,dr  * remaining fluid nodes
ngen,2,10,51,60,1,0  * shell nodes, on top of last col fluid nodes
nscale,0,all,,,12,12,12 * ft to in
nlist,all
type,1 $ mat,1      * fluid elmts
e,1,11,12,2
egen,9,1,-1
egen,5,10,-9
type,2 $ mat,2 $ real,1  * shell elmts
e,61,62
real,2
e,62,63
e,63,64
real,3
e,64,65

```

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
(7) Subject Soil-Structure Interaction ANSYS input
(8) Originator E. O. Weiner

```

egen,4,1,-1
real,4
e,68,69
e,69,70
elist,all
cp,1,ux,52,62      * fluid-struct coupling - radial only
rp8,1,,1,1
cplist,all
ce,1,0,1,uz,1,1,ux,1  * uz = -ux on centerline
rp10,1,,1,,1
m,10,uy,60,10      * masters - vertical surface dofs
m,62,ux,69,1,uz     * masters - structure hrz1
m,18,ux,58,20,uz,uy * masters - remaining fluid, sprinkle
m,26,ux,46,20,uz,uy
m,14,ux,54,20,uz,uy
m,22,ux,42,20,uz
mdele,54,ux,58,1,uz
mlist,all
iter
mode,1,1
exmode,0,1000,1e-30  * expand ALL modes, see stresses to skip circ modes
freq, 0.10, 0.16, 0.26, 0.40, 0.60, 1.10, 1.73, 8.00, 12.00
freq, 20.00, 33.00, 100.00
sv, .02, 0.012, 0.031, 0.084, 0.129, 0.192, 0.351, 0.550, 0.550, 0.412
sv, .02, 0.286, 0.200, 0.200  * SDC 4.1 Rev 11 0.2g 2% damping
svtyp, 2, 386      * scale Sa, units = in/sec**2
sed, 1, 0, -1      * excitation direction, peculiar to harmonic mode=1
d, 1,uy,,, 10      * no vertical motion on centerline
d, 1,uy,,,51,10    * ditto tank bottom
d,70,ux,,,,,uy,uz  * shell dome junction - no displ
d,61,ux,,,,,uy,uz  * shell bottom contact - no displ
d,51,ux            * cannot couple to ground
d,60,ux            * cannot couple to ground
dlist
cgomga,1e-6
wsort,y,-1
stat
afwrite
finish
/input,27
finish
/post1
stress,sdmi,61,11   * stress - direct, meridional, at i-node
                  ,sdti,61,12   * direct tangential
                  ,sbmi,61,13   * bending

```

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction ANSYS input
 (8) Originator E. O. Weiner

```

      ,sbt,61,14
      ,txzi,61,35      * shear force/len
      ,prs ,81,1      * fluid pressure
*create,mac      * see 3.0.8.3
set,1,arg1      * modes 1-n are carried as iters 1-n
*get,sdti,sdti,50      * test signif hoop membrane stress - impulse mode
stst=abs(sdti)
*if,stst,gt,300,:doit
*get,txzi,txzi,46      * test signif base shear - impulse mode
ttst=abs(txzi)
*if,ttst,gt,100,:doit
*get,uy,uy,60      * test signif vert fluid displ - slosh mode
utst=abs(uy)
*if,utst,gt,1.,:doit
*go,:dont
:doit
nrsel,node,10,60,10      * fluid surface
nasel,node,61,70      * shell
prdisp
prrfor
ersel,type,2      * shell elmts
easel,elem,37,45      * fluid elmts by wall
prstrs,sdmi,sdti,sbmi,sbt,txzi,prs
:dont
*end
*use,mac,1
rp44,,1      * look at all modes expanded
finish

/prep7
/title, SY-101 Tank Primary Liner, Fluid Attached, Single Point, 1000x Ring
/com, .26" wall, .36H, fine ring
kan,2
kay,1,0      * reduced extraction
kay,2,-1      * control mode expansion with EXMODE below
et,1,61
ex,1,30e6
dens,1,0
ex,2,30000e6
dens,2,17.5
r,1,.26      * shell thickness - unweighted sections
r,2,.6      * weighted section
n,1,41,15.5
ngen,3,1,1,1,1,,6.83
ngen,2,1,3,3,1,, .06

```


DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
(7) Subject Soil-Structure Interaction ANSYS input
(8) Originator E. O. Weiner

```
ngen,5,1,4,4,1,,6.07
nscale,0,all,,,12,12,12      * ft to in
nlist,all
type,1 $ mat,1 $ real,1      * shell elmts
e,1,2
egen,2,1,-1
mat,2 $ real,2
e,3,4
mat,1 $real,1
e,4,5
egen,4,1,-1
elist,all
m,3,ux,4,1,uz      * masters - structure hrzl
mlist,all
iter
mode,1,1
exmode,0,1000,1e-30
freq, 0.10, 0.16, 0.26, 0.40, 0.60, 1.10, 1.73, 8.00, 12.00
freq, 20.00, 33.00, 100.00
sv, .02, 0.012, 0.031, 0.084, 0.129, 0.192, 0.351, 0.550, 0.550, 0.412
sv, .02, 0.286, 0.200, 0.200      * SDC 4.1 Rev 11 0.2g 2% damping
svtyp, 2, 386      * scale Sa, units = in/sec**2
sed, 1, 0, -1      * excitation direction, peculiar to harmonic mode=1
d,8,ux,,,,,uy,uz      * shell dome junction - no displ
d,1,ux,,,,,uy,uz      * shell bottom contact - no displ
dlist
cgomga,1e-6
afwrite
finish
/input,27
finish
/post1
stress,sdmi,61,11      * stress, direct, meridional, at i-node
      ,sdti,61,12      * direct tangential
      ,sbmi,61,13      * bending
      ,sbt,61,14
      ,txzi,61,35      * membrane shear force/len
*create,mac      * see 3.0.8.3
set,1,arg1      * modes 1-n are carried as iters 1-n
prdisp
prrrfor
prstrs,sdmi,sdti,sbmi,sbt,txzi
*end
*use,mac,1
rp10,,1      * print all modes expanded
```

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction ANSYS input
 (8) Originator E. O. Weiner

finish

```

/prep7
/title, Housner-Haroun Comparison, 37.5' x 37.5'
kan,2
kay,1,0          * reduced extraction
kay,2,-1         * control mode expansion with EXMODE below
et,1,81
et,2,61
ex,1,.3e6        * bulk modulus
dens,1,93.5e-6   * lbf sec^2 / in^4, sp gr = 1
gxy,1,386        * g for k-slosh. See stif81
ex,2,30e6        * shell
nuxy,2,.3
dens,2,725e-6
r,1,.45          * shell thicknesses
n,1              * c/l nodes, origin at bottom
h=37.5           * ft input
n,10,,h
fill
dr=(37.5)/5.
ngen,6,10,1,10,1,dr * remaining fluid nodes
ngen,2,10,51,60,1,0 * shell nodes, on top of last col fluid nodes
nscale,0,all,,,12,12,12 * ft to in
nlist,all
type,1 $ mat,1    * fluid elmts
e,1,11,12,2
egen,9,1,-1
egen,5,10,-9
type,2 $ mat,2 $ real,1 * shell elmts
e,61,62
egen,9,1,-1
elist,all
cp,1,ux,52,62    * fluid-struct coupling - radial only
rp9,1,,1,1
cplist,all
ce,1,0,1,uz,1,1,ux,1 * uz = -ux on centerline
rp10,1,,1,,1
m,10,uy,60,10    * masters - vertical surface dofs, all
m,62,ux,69,1,uz  * masters - structure hrz1, all
m,18,ux,58,20,uz,uy * masters - remaining fluid, sprinkle
m,26,ux,46,20,uz,uy
m,14,ux,54,20,uz,uy
m,22,ux,42,20,uz
mdele,54,ux,58,1,uz

```

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____(7) Subject Soil-Structure Interaction ANSYS input(8) Originator E. O. Weiner

```

mlist,all
iter
mode,1,1
exmode,0,1000,1e-30      * expand ALL modes, see stresses to skip circ modes
freq, 0.10, 0.16, 0.26, 0.40, 0.60, 1.10, 1.73, 8.00, 12.00
freq, 20.00, 33.00, 100.00
sv, .02, 0.012, 0.031, 0.084, 0.129, 0.192, 0.351, 0.550, 0.550, 0.412
sv, .02, 0.286, 0.200, 0.200      * SDC 4.1 Rev 11 0.2g 2% damping
svtyp, 2, 386      * scale Sa, units = in/sec**2
sed, 1, 0, -1      * excitation direction, see 2.25.4
d, 1,uy,,, 10      * no vertical fluid motion on centerline
d, 1,uy,,,51,10      * or tank bottom
d,61,ux,,,,,uy,uz      * shell bottom contact - no displ
d,51,ux      * cannot couple to ground
dlist
cgomga,1e-6
wsort,y,-1
stat
afwrite
finish
/input,27
finish
/post1
stress,sdmi,61,11      * stress - direct, meridional, at i-node
      ,sdti,61,12      * direct tangential
      ,sbmi,61,13      * bending
      ,sbt,61,14
      ,txzi,61,35      * shear force/len
      ,prs,81,1      * fluid pressure
*create,mac      * see 3.0.8.3
set,1,arg1      * modes 1-n are carried as iters 1-n, screen out cir modes
*get,sdti,sdti,50      * test signif hoop membrane stress - impulse mode
stst=abs(sdti)
*if,stst,gt,100,:doit
*get,txzi,txzi,46      * test signif base shear - impulse mode
ttst=abs(txzi)
*if,ttst,gt,30,:doit
*get,uy,uy,60      * test signif vert fluid displ - slosh mode
utst=abs(uy)
*if,utst,gt,.3,:doit
*go,:dont
:doit
nrsl,node,10,60,10      * fluid surface
nasl,node,61,70      * shell
prdisp

```

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
(7) Subject Soil-Structure Interaction ANSYS input
(8) Originator E. O. Weiner

```
prerfor  
ersel,type,2      * shell elmts  
easel,elem,37,45 * fluid elmts by wall  
prstrs,sdmi,sdti,sbmi,sbti,txzi,prs  
:dont  
*end  
*use,mac,1  
rp44,,1          * look at all modes expanded  
finish
```

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction FLUSH single tank input
 (8) Originator R. A. Giller

1 1 400
 241-SY-101 Tank, Structure to Structure Interaction
 90 26 0 146 134 23 5 1 11 66.
 1 5
 BOTH LEFT
 4096 2000 .005 1.1
 HOR
 12. 4
 1. 4
 3. 8
 6. 16
 12. 32
 2 0 4 1 5 0
 0
 12. 12. 12. 12. 12.
 0
 .07
 61 000101 000000
 63 000101 000000
 92 000101 000000
 96 000101 000000

1	1	2	13	12	1	1	.23	108.	2400.	1493.	.046
2	2	3	14	13	2	1	.18	127.	3400.	1036.	.087
3	3	4	15	14	3	1	.27	108.	3400.	1618.	.085
4	4	5	16	15	4	1	.27	108.	4050.	2076.	.087
5	5	6	17	16	5	1	.39	127.	4350.	1983.	.098
6	6	7	18	17	6	1	.39	115.	4550.	1872.	.108
7	7	8	19	18	7	1	.42	108.	4800.	1776.	.118
8	8	9	20	19	8	1	.43	108.	4800.	1684.	.126
9	9	10	21	20	9	1	.43	108.	5400.	1672.	.130
10	10	11	22	21	10	1	.44	108.	5400.	1617.	.135
11	11	134	135	22	11	1	.44	108.	5400.	1688.	.136
12	12	13	24	23	1	1	.23	108.	2400.	1493.	.046
13	13	14	25	24	2	1	.18	108.	3400.	1036.	.087
14	14	15	27	25	3	1	.27	108.	3400.	1618.	.085
15	15	16	29	27	4	1	.27	108.	4050.	2076.	.087
16	16	17	31	29	5	1	.39	127.	4350.	1983.	.098
17	17	18	33	31	6	1	.39	115.	4550.	1872.	.108
18	18	19	35	33	7	1	.42	108.	4800.	1776.	.118
19	19	20	36	35	8	1	.43	108.	4800.	1684.	.126
20	20	21	37	36	9	1	.43	108.	5400.	1672.	.130
21	21	22	38	37	10	1	.44	108.	5400.	1617.	.135
22	22	135	136	38	11	1	.44	108.	5400.	1688.	.136
23	23	24	46	45	1	1	.23	108.	2400.	1493.	.046
24	24	25	46	46	2	1	.18	127.	2400.	1036.	.087

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction FLUSH single tank input
 (8) Originator R. A. Giller

25	33	35	41	39 7	1	.42	108.	4800.	1776.	.118
26	35	36	42	41 8	1	.43	108.	4800.	1684.	.126
27	36	37	43	42 9	1	.43	108.	5400.	1672.	.130
28	37	38	44	43 10	1	.44	108.	5400.	1617.	.135
29	38	136	137	44 11	1	.44	108.	5400.	1688.	.136
30	39	41	50	48 7	1	.42	108.	4800.	1776.	.118
31	41	42	51	50 8	1	.43	108.	4800.	1684.	.126
32	42	43	52	51 9	1	.43	108.	5400.	1672.	.130
33	43	44	53	52 10	1	.44	108.	5400.	1617.	.135
34	44	137	138	53 11	1	.44	108.	5400.	1688.	.136
35	45	46	61	60 1	1	.23	108.	2400.	1493.	.046
36	48	50	56	54 7	1	.42	108.	4800.	1776.	.118
37	50	51	57	56 8	1	.43	108.	4800.	1684.	.126
38	51	52	58	57 9	1	.43	108.	5400.	1672.	.130
39	52	53	59	58 10	1	.44	108.	5400.	1617.	.135
40	53	138	139	59 11	1	.44	108.	5400.	1688.	.136
41	54	56	65	63 7	1	.42	108.	4800.	1776.	.118
42	56	57	66	65 8	1	.43	108.	4800.	1684.	.126
43	57	58	67	66 9	1	.43	108.	5400.	1672.	.130
44	58	59	68	67 10	1	.44	108.	5400.	1617.	.135
45	59	139	140	68 11	1	.44	108.	5400.	1688.	.136
46	60	61	76	75 1	1	.23	108.	2400.	1493.	.046
47	63	65	71	69 7	1	.42	108.	4800.	1776.	.118
48	65	66	72	71 8	1	.43	108.	4800.	1684.	.126
49	66	67	73	72 9	1	.43	108.	5400.	1672.	.130
50	67	68	74	73 10	1	.44	108.	5400.	1617.	.135
51	68	140	141	74 11	1	.44	108.	5400.	1688.	.136
52	69	71	80	78 7	1	.42	108.	4800.	1776.	.118
53	71	72	81	80 8	1	.43	108.	4800.	1684.	.126
54	72	73	82	81 9	1	.43	108.	5400.	1672.	.130
55	73	74	83	82 10	1	.44	108.	5400.	1617.	.135
56	74	141	142	83 11	1	.44	108.	5400.	1688.	.136
57	75	76	91	90 1	1	.23	108.	2400.	1493.	.046
58	92	91	76	76 2	1	.18	127.	3400.	1036.	.087
59	78	80	86	84 7	1	.42	108.	4800.	1776.	.118
60	80	81	87	86 8	1	.43	108.	4800.	1684.	.126
61	81	82	88	87 9	1	.43	108.	5400.	1672.	.130
62	82	83	89	88 10	1	.44	108.	5400.	1617.	.135
63	83	142	143	89 11	1	.44	108.	5400.	1688.	.136
64	84	86	102	100 7	1	.42	108.	4800.	1776.	.118
65	86	87	103	102 8	1	.43	108.	4800.	1684.	.126
66	87	88	104	103 9	1	.43	108.	5400.	1672.	.130
67	88	89	105	104 10	1	.44	108.	5400.	1617.	.135
68	89	143	144	105 11	1	.44	108.	5400.	1688.	.136
69	90	91	107	106 1	1	.23	108.	2400.	1493.	.046

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction FLUSH single tank input
 (8) Originator R. A. Giller

70	91	92	108	107	2	1	.18	127.	3400.	1036.	.087
71	92	94	109	108	3	1	.27	108.	3400.	1618.	.085
72	94	96	110	109	4	1	.27	108.	4050.	2076.	.087
73	96	98	111	110	5	1	.39	127.	4350.	1983.	.098
74	98	100	112	111	6	1	.39	115.	4550.	1872.	.108
75	100	102	113	112	7	1	.42	108.	4800.	1776.	.118
76	102	103	114	113	8	1	.43	108.	4800.	1684.	.126
77	103	104	115	114	9	1	.43	108.	5400.	1672.	.130
78	104	105	116	115	10	1	.44	108.	5400.	1617.	.135
79	105	144	145	116	11	1	.44	108.	5400.	1688.	.136
80	106	107	118	117	1	1	.23	108.	2400.	1493.	.046
81	107	108	119	118	2	1	.18	127.	3400.	1036.	.087
82	108	109	120	119	3	1	.27	108.	3400.	1618.	.085
83	109	110	121	120	4	1	.27	108.	4050.	2076.	.087
84	110	111	122	121	5	1	.39	127.	4350.	1983.	.098
85	111	112	123	122	6	1	.39	115.	4550.	1872.	.108
86	112	113	124	123	7	1	.42	108.	4800.	1776.	.118
87	113	114	125	124	8	1	.43	108.	4800.	1684.	.126
88	114	115	126	125	9	1	.43	108.	5400.	1672.	.130
89	115	116	127	126	10	1	.44	108.	5400.	1617.	.135
90	116	145	146	127	11	1	.44	108.	5400.	1688.	.136
91	61	62	46	47	0	0	.20	150.	230000.	230000.	.02
	1.42		.24			.83					
92	46	47	25	26	0	0	.20	150.	230000.	230000.	.02
	2.5		1.30			.83					
93	25	26	27	28	0	0	.20	150.	230000.	230000.	.02
	2.5		1.30			.83					
94	27	28	29	30	0	0	.20	150.	230000.	230000.	.02
	1.5		.28			.83					
95	29	30	31	32	0	0	.20	150.	230000.	230000.	.02
	1.5		.28			.83					
96	31	32	33	34	0	0	.20	150.	230000.	230000.	.02
	1.5		.28			.83					
97	33	34	39	40	0	0	.20	150.	187000.	187000.	.02
	1.92		.59			.83					
98	39	40	48	49	0	0	.20	150.	187000.	187000.	.02
	.96		.07			.83					
99	48	49	54	55	0	0	.20	150.	187000.	187000.	.02
	.96		.07			.83					
100	54	55	63	64	0	0	.20	150.	187000.	187000.	.02
	1.92		.59			.83					
101	63	64	69	70	0	0	.20	150.	187000.	187000.	.02
	1.92		.59			.83					
102	69	70	78	79	0	0	.20	150.	187000.	187000.	.02
	.96		.07			.83					

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction FLUSH single tank input
 (8) Originator R. A. Giller

103	78	79	84	85	0	0	.20	150.	187000.	187000.	.02
	.96		.07			.83					
104	84	85	100	101	0	0	.20	150.	187000.	187000.	.02
	1.92		.59			.83					
105	61	62	76	77	0	0	.20	150.	230000.	230000.	.02
	1.42		.24			.83					
106	76	77	92	93	0	0	.20	150.	230000.	230000.	.02
	2.5		1.30			.83					
107	92	93	94	95	0	0	.20	150.	230000.	230000.	.02
	2.5		1.30			.83					
108	94	95	96	97	0	0	.20	150.	230000.	230000.	.02
	1.5		.28			.83					
109	96	97	98	99	0	0	.20	150.	230000.	230000.	.02
	1.5		.28			.83					
110	98	99	100	101	0	0	.20	150.	230000.	230000.	.02
	1.5		.28			.83					
111	25	26	128	129	0	0	.30	0.	1600000.	1600000.	.02
	.001		100			0					
112	128	129	33	34	0	0	.30	0.	1600000.	1600000.	.02
	.001		100			0					
113	128	129	130	131	0	0	.30	0.	1600000.	1600000.	.02
	.034		.01			0					
114	130	131	132	133	0	0	.30	0.	1600000.	1600000.	.02
	.034		.01			0					
115	92	93	132	133	0	0	.30	0.	1600000.	1600000.	.02
	.001		100			0					
116	132	133	100	101	0	0	.30	0.	1600000.	1600000.	.02
	.001		100			0					
1	SEED AND IDRESS (1972) -- SAND										
1.000	.984	.934	.826	.656	.443	.246	.115	.049	.049	.049	
0.5	0.8	1.7	3.2	5.6	10.0	15.5	21.0	24.6	24.8	24.6	
1		0.0		55.0		0		0.0			
2		0.0		45.0		0		0.0			
3		0.0		38.0		0		0.0			
4		0.0		28.5		0		0.0			
5		0.0		19.0		0		0.0			
6		0.0		9.5		0		0.0			
7		0.0		0.0		0		0.0			
8		0.0		-15.0		0		0.0			
9		0.0		-30.0		0		0.0			
10		0.0		-50.0		0		0.0			
11		0.0		-75.0		0		0.0			
12		12.0		55.0		0		0.0			
13		12.0		45.0		0		0.0			
14		12.0		38.0		0		0.0			

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction FLUSH single tank input
 (8) Originator R. A. Giller

15	12.0	28.5	0	0.0
16	12.0	19.0	0	0.0
17	12.0	9.5	0	0.0
18	12.0	0.0	0	0.0
19	12.0	-15.0	0	0.0
20	12.0	-30.0	0	0.0
21	12.0	-50.0	0	0.0
22	12.0	-75.0	0	0.0
23	24.0	55.0	0	0.0
24	24.0	45.0	0	0.0
25	24.0	38.0	0	0.0
26	24.0	38.0	4	0.0
27	24.0	28.5	0	0.0
28	24.0	28.5	4	0.0
29	24.0	19.0	0	0.0
30	24.0	19.0	4	0.0
31	24.0	9.5	0	0.0
32	24.0	9.5	4	0.0
33	24.0	0.0	0	0.0
34	24.0	0.0	4	0.0
35	24.0	-15.0	0	0.0
36	24.0	-30.0	0	0.0
37	24.0	-50.0	0	0.0
38	24.0	-75.0	0	0.0
39	34.0	0.0	0	0.0
40	34.0	0.0	4	0.0
41	34.0	-15.0	0	0.0
42	34.0	-30.0	0	0.0
43	34.0	-50.0	0	0.0
44	34.0	-75.0	0	0.0
45	45.0	55.0	0	0.0
46	45.0	45.0	0	0.0
47	45.0	45.0	4	0.0
48	45.0	0.0	0	0.0
49	45.0	0.0	4	0.0
50	45.0	-15.0	0	0.0
51	45.0	-30.0	0	0.0
52	45.0	-50.0	0	0.0
53	45.0	-75.0	0	0.0
54	56.0	0.0	0	0.0
55	56.0	0.0	4	0.0
56	56.0	-15.0	0	0.0
57	56.0	-30.0	0	0.0
58	56.0	-50.0	0	0.0
59	56.0	-75.0	0	0.0

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction FLUSH single tank input
 (8) Originator R. A. Giller

60	66.0	55.0	0	0.0
61	66.0	48.0	0	0.0
62	66.0	48.0	4	0.0
63	66.0	0.0	0	0.0
64	66.0	0.0	4	0.0
65	66.0	-15.0	0	0.0
66	66.0	-30.0	0	0.0
67	66.0	-50.0	0	0.0
68	66.0	-75.0	0	0.0
69	76.0	0.0	0	0.0
70	76.0	0.0	4	0.0
71	76.0	-15.0	0	0.0
72	76.0	-30.0	0	0.0
73	76.0	-50.0	0	0.0
74	76.0	-75.0	0	0.0
75	87.0	55.0	0	0.0
76	87.0	45.0	0	0.0
77	87.0	45.0	4	0.0
78	87.0	0.0	0	0.0
79	87.0	0.0	4	0.0
80	87.0	-15.0	0	0.0
81	87.0	-30.0	0	0.0
82	87.0	-50.0	0	0.0
83	87.0	-75.0	0	0.0
84	98.0	0.0	0	0.0
85	98.0	0.0	4	0.0
86	98.0	-15.0	0	0.0
87	98.0	-30.0	0	0.0
88	98.0	-50.0	0	0.0
89	98.0	-75.0	0	0.0
90	108.0	55.0	0	0.0
91	108.0	45.0	0	0.0
92	108.0	38.0	0	0.0
93	108.0	38.0	4	0.0
94	108.0	28.5	0	0.0
95	108.0	28.5	4	0.0
96	108.0	19.0	0	0.0
97	108.0	19.0	4	0.0
98	108.0	9.5	0	0.0
99	108.0	9.5	4	0.0
100	108.0	0.0	0	0.0
101	108.0	0.0	4	0.0
102	108.0	-15.0	0	0.0
103	108.0	-30.0	0	0.0
104	108.0	-50.0	0	0.0

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction FLUSH single tank input
 (8) Originator R. A. Giller

105	108.0	-75.0	0	0.0
106	120.0	55.0	0	0.0
107	120.0	45.0	0	0.0
108	120.0	38.0	0	0.0
109	120.0	28.5	0	0.0
110	120.0	19.0	0	0.0
111	120.0	9.5	0	0.0
112	120.0	0.0	0	0.0
113	120.0	-15.0	0	0.0
114	120.0	-30.0	0	0.0
115	120.0	-50.0	0	0.0
116	120.0	-75.0	0	0.0
117	132.0	55.0	0	0.0
118	132.0	45.0	0	0.0
119	132.0	38.0	0	0.0
120	132.0	28.5	0	0.0
121	132.0	19.0	0	0.0
122	132.0	9.5	0	0.0
123	132.0	0.0	0	0.0
124	132.0	-15.0	0	0.0
125	132.0	-30.0	0	0.0
126	132.0	-50.0	0	0.0
127	132.0	-75.0	0	0.0
128	24.0	19.0	0	0.0
129	24.0	19.0	4	0.0
130	66.0	19.0	0	129.0
131	66.0	19.0	4	0.0
132	108.0	19.0	0	0.0
133	108.0	19.0	4	0.0
134	0.0	-100.0	0	0.0
135	12.0	-100.0	0	0.0
136	24.0	-100.0	0	0.0
137	34.0	-100.0	0	0.0
138	45.0	-100.0	0	0.0
139	56.0	-100.0	0	0.0
140	66.0	-100.0	0	0.0
141	76.0	-100.0	0	0.0
142	87.0	-100.0	0	0.0
143	98.0	-100.0	0	0.0
144	108.0	-100.0	0	0.0
145	120.0	-100.0	0	0.0
146	132.0	-100.0	0	0.0

COMM CONTROL MOTION - HORIZONTAL, ZPA=0.2G, 2000 POINTS, DT=0.005 SEC

0.014141 0.015267 0.015951 0.016336 0.016758 0.016979 0.016954 0.016629
 0.016387 0.014176 0.012741 0.012053 0.012072 0.013171 0.014876 0.017093

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
(7) Subject Soil-Structure Interaction FLUSH single tank input
(8) Originator R. A. Giller

0.01984	0.021099	0.023141	0.026073	0.029939	0.037493	0.045393	0.05311
0.06014	0.06091	0.059508	0.055398	0.049001	0.037907	0.026378	0.014272
0.001441	-0.00677	-0.01338	-0.01761	-0.01990	-0.01439	-0.00808	-0.00104
0.006429	0.012848	0.018841	0.024301	0.029027	0.034387	0.038556	0.041552
0.043204	0.042491	0.039895	0.03584	0.031054	0.026087	0.021089	0.016132
0.01135	0.006611	0.002235	-0.00184	-0.00566	-0.00886	-0.01144	-0.01315
-0.01381	-0.01283	-0.00985	-0.00415	0.004511	0.016791	0.030787	0.045693
0.060681	0.073881	0.085265	0.094298	0.10078	0.10586	0.10828	0.10854
0.10743	0.099773	0.091325	0.082144	0.072774	0.060798	0.049628	0.039169
0.029597	0.022669	0.017903	0.015289	0.014354	0.017219	0.02086	0.024616
0.027679	0.030691	0.032532	0.033329	0.033026	0.029921	0.026439	0.02358
0.021906	0.023391	0.025428	0.027969	0.03118	0.035398	0.039848	0.044269
0.048323	0.053083	0.056118	0.057932	0.059805	0.045853	0.030447	0.012098
-0.00802	-0.04041	-0.07013	-0.09856	-0.12732	-0.13763	-0.14449	-0.14655
-0.14507	-0.13217	-0.11847	-0.10416	-0.08990	-0.07835	-0.06819	-0.05979
-0.05395	-0.04765	-0.04442	-0.04291	-0.04212	-0.04422	-0.04824	-0.05424
-0.06112	-0.06946	-0.07723	-0.08476	-0.09199	-0.09783	-0.10186	-0.10388
-0.10425	-0.10403	-0.10263	-0.10052	-0.09864	-0.09453	-0.09178	-0.09016
-0.08947	-0.08805	-0.08727	-0.08651	-0.08492	-0.08225	-0.07819	-0.07344
-0.06886	-0.06435	-0.06082	-0.05857	-0.05807	-0.05861	-0.05987	-0.06021
-0.05828	-0.05260	-0.04369	-0.03127	-0.01547	0.002165	0.020401	0.037552
0.052543	0.065438	0.074942	0.080607	0.082711	0.081845	0.080291	0.079037
0.078263	0.078916	0.080944	0.085248	0.091849	0.098656	0.10578	0.11357
0.12335	0.13698	0.15169	0.16498	0.17556	0.18212	0.18122	0.17632
0.17065	0.16412	0.15822	0.15447	0.15272	0.2	0.14403	0.13623
0.13238	0.13297	0.13592	0.13886	0.14099	0.14301	0.1462	0.15176
0.15391	0.15342	0.15132	0.14713	0.14372	0.09985	0.05871	0.015343
-0.03387	-0.05317	-0.07290	-0.0917	-0.11191	-0.10793	-0.10694	-0.10617
-0.1034	-0.11177	-0.11725	-0.12081	-0.1245	-0.11521	-0.10683	-0.09761
-0.08761	-0.08534	-0.08618	-0.08861	-0.08937	-0.08298	-0.07344	-0.06224
-0.0501	-0.04108	-0.03075	-0.01980	-0.00955	0.001083	0.010458	0.019357
0.027549	0.032723	0.034824	0.035142	0.036391	0.039454	0.045406	0.052987
0.060168	0.068784	0.074023	0.078624	0.087285	0.076087	0.066732	0.053456
0.035166	-0.01344	-0.05908	-0.10375	-0.15238	-0.14338	-0.13559	-0.12458
-0.11021	-0.11389	-0.11867	-0.12308	-0.1247	-0.10939	-0.09127	-0.07275
-0.05666	-0.04892	-0.04437	-0.03996	-0.03384	-0.02184	-0.01246	-0.00624
-0.00062	-0.01846	-0.03492	-0.05171	-0.06869	-0.08951	-0.10701	-0.12281
-0.13979	-0.13467	-0.12981	-0.12317	-0.11463	-0.1114	-0.10978	-0.11091
-0.11487	-0.11704	-0.1195	-0.12092	-0.12082	-0.11817	-0.11247	-0.102
-0.08590	-0.06542	-0.04249	-0.01931	0.002564	0.022328	0.038801	0.051288
0.059384	0.062803	0.062503	0.059657	0.055638	0.052055	0.049549	0.048618
0.048914	0.048999	0.048277	0.046563	0.04408	0.040725	0.035995	0.030222
0.024863	0.013962	0.005742	0.000264	-0.00218	-0.00194	0.001463	0.006745
0.012477	0.016899	0.020495	0.022402	0.021659	0.02228	0.020458	0.016544
0.010334	0.006712	0.000955	-0.00629	-0.01483	-0.02664	-0.04011	-0.05471

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction FLUSH single tank input
 (8) Originator R. A. Giller

-0.06936	-0.08042	-0.08842	-0.09207	-0.09103	-0.08632	-0.07788	-0.06579
-0.05034	-0.03170	-0.01282	0.004337	0.018346	0.027584	0.032927	0.035129
0.035029	0.033055	0.028724	0.022628	0.016595	-0.00261	-0.01996	-0.03684
-0.05421	-0.06420	-0.07293	-0.08025	-0.08700	-0.08468	-0.08129	-0.07542
-0.06649	-0.05902	-0.04980	-0.03985	-0.03013	-0.01718	-0.00521	0.005792
0.015197	0.020207	0.022028	0.021871	0.021967	0.025485	0.031382	0.038908
0.04692	0.053524	0.059644	0.065705	0.071684	0.076125	0.07762	0.076248
0.074536	0.05535	0.039579	0.025241	0.009967	0.010209	0.009576	0.008196
0.005200	0.006306	0.006404	0.007003	0.008499	0.003900	-0.00044	-0.00319
-0.00263	0.011082	0.028327	0.047776	0.067487	0.076787	0.083788	0.08993
0.096717	0.11244	0.12395	0.12937	0.13129	0.080407	0.031112	-0.01958
-0.07339	-0.08886	-0.09833	-0.10028	-0.09909	-0.08579	-0.07621	-0.06714
-0.05513	-0.04665	-0.03730	-0.03029	-0.02751	-0.02119	-0.01464	-0.00384
0.012131	0.029471	0.043533	0.052974	0.060981	0.036901	0.015012	-0.00773
-0.03294	-0.03904	-0.04177	-0.04020	-0.03673	-0.02186	-0.00852	0.004418
0.0179	0.024227	0.02967	0.032661	0.031634	0.032906	0.029738	0.023559
0.015677	0.003860	-0.00842	-0.01999	-0.02933	-0.03323	-0.03310	-0.02856
-0.01972	-0.01149	-0.00233	0.005643	0.011447	0.00577	-0.00184	-0.01129
-0.02212	-0.01983	-0.01591	-0.00953	-0.00127	0.001995	0.003935	0.003403
-0.00011	-0.00307	-0.00871	-0.01671	-0.02671	-0.03925	-0.05089	-0.05927
-0.06291	-0.05969	-0.05316	-0.04473	-0.03569	-0.02868	-0.02342	-0.02022
-0.01865	-0.01930	-0.02127	-0.02470	-0.02913	-0.04095	-0.05198	-0.06186
-0.07035	-0.07519	-0.07830	-0.08020	-0.08141	-0.08123	-0.07968	-0.07628
-0.07098	-0.05606	-0.03957	-0.02218	-0.00506	0.007921	0.019003	0.027953
0.034438	0.041506	0.046225	0.049089	0.049908	0.046512	0.040442	0.03343
0.027883	0.027035	0.029172	0.03389	0.041106	0.04952	0.061157	0.07639
0.094819	0.11441	0.13263	0.14769	0.15966	0.14614	0.12965	0.10874
0.083204	0.068622	0.05417	0.040987	0.028477	0.025148	0.022598	0.022282
0.024985	0.027227	0.030343	0.032935	0.034565	0.030174	0.026041	0.022168
0.017938	0.016762	0.015419	0.014815	0.015315	0.022082	0.028856	0.035255
0.041109	0.042755	0.042888	0.04091	0.03676	0.034526	0.031992	0.030062
0.029073	0.027056	0.026716	0.028752	0.033201	0.041554	0.050064	0.057733
0.063946	0.066209	0.066508	0.065519	0.064557	0.067024	0.07117	0.076589
0.082474	0.086258	0.08989	0.093516	0.097018	0.1021	0.10684	0.1117
0.11675	0.11539	0.11311	0.1109	0.11093	0.11773	0.12728	0.13713
0.14465	0.14301	0.13694	0.12797	0.1187	0.10605	0.093288	0.078541
0.06236	0.019662	-0.01860	-0.05337	-0.08754	-0.07648	-0.06428	-0.04955
-0.03395	-0.02829	-0.02663	-0.02676	-0.02495	-0.02062	-0.01378	-0.00713
-0.00266	-0.01363	-0.02645	-0.03979	-0.05227	-0.05946	-0.06618	-0.07424
-0.08426	-0.09859	-0.11135	-0.122	-0.13157	-0.12284	-0.11394	-0.10477
-0.09614	-0.09254	-0.08991	-0.08686	-0.08244	-0.07230	-0.06257	-0.05487
-0.05070	-0.05323	-0.05960	-0.06801	-0.07609	-0.07743	-0.07401	-0.06453
-0.04932	-0.03246	-0.01348	0.006791	0.027902	0.051105	0.071285	0.086202
0.094841	0.095445	0.092598	0.089683	0.089377	0.091582	0.094163	0.095724
0.097514	0.066759	0.037868	0.008212	-0.02363	-0.02982	-0.03268	-0.03088

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction FLUSH single tank input
 (8) Originator R. A. Giller

-0.02619	-0.01290	-0.00030	0.011912	0.02407	0.031598	0.037897	0.041589
0.041339	0.042843	0.043216	0.045616	0.050674	0.05447	0.055657	0.054355
0.053227	0.054563	0.059149	0.066133	0.074023	0.083818	0.092539	0.10203
0.11488	0.11069	0.10537	0.094796	0.079889	0.032174	-0.01139	-0.05277
-0.09617	-0.09225	-0.08867	-0.08276	-0.07531	-0.07619	-0.08054	-0.08780
-0.09560	-0.0972	-0.09481	-0.08883	-0.08180	-0.07279	-0.06595	-0.05875
-0.04846	-0.05334	-0.05919	-0.06945	-0.08405	-0.10085	-0.11564	-0.12816
-0.14011	-0.1329	-0.12606	-0.11887	-0.11139	-0.11235	-0.11335	-0.11386
-0.11353	-0.10542	-0.09608	-0.08561	-0.07526	-0.06986	-0.06785	-0.06855
-0.07000	-0.06852	-0.06568	-0.06155	-0.05614	-0.05042	-0.04323	-0.03466
-0.02544	-0.02164	-0.02115	-0.02528	-0.03327	-0.0521	-0.07075	-0.08837
-0.10451	-0.10893	-0.11035	-0.10883	-0.10528	-0.09990	-0.09443	-0.08957
-0.08596	-0.08424	-0.08316	-0.08184	-0.08008	-0.07212	-0.06414	-0.05577
-0.04678	-0.04120	-0.03565	-0.03027	-0.02551	-0.01614	-0.00953	-0.00476
0.000692	-0.01313	-0.02575	-0.03988	-0.05661	-0.07366	-0.08937	-0.10374
-0.11873	-0.11218	-0.1066	-0.09993	-0.09102	-0.09302	-0.09389	-0.09401
-0.09315	-0.08085	-0.06618	-0.04918	-0.03115	-0.01855	-0.00758	0.002513
0.012931	0.027089	0.040969	0.053502	0.063995	0.070227	0.074561	0.077967
0.081409	0.083471	0.08483	0.084933	0.08422	0.074272	0.064652	0.055241
0.046218	0.039919	0.034246	0.02816	0.020858	0.013536	0.006871	0.001973
-0.00074	0.006960	0.017568	0.031079	0.046541	0.060089	0.073063	0.084823
0.094677	0.10454	0.11114	0.11448	0.11474	0.11085	0.10493	0.098458
0.092931	0.090137	0.088987	0.089124	0.090173	0.090831	0.091976	0.094029
0.09732	0.10146	0.10549	0.10904	0.11265	0.10442	0.095895	0.086295
0.076029	0.065527	0.056226	0.047249	0.037597	0.030555	0.024269	0.019299
0.015221	0.019518	0.024206	0.029277	0.034105	0.03714	0.038996	0.040187
0.040992	0.041947	0.04165	0.040298	0.038535	0.030978	0.022871	0.013961
0.004804	-0.00452	-0.01291	-0.02097	-0.02932	-0.03415	-0.03787	-0.03968
-0.03964	-0.03615	-0.03151	-0.02565	-0.01864	-0.01339	-0.00809	-0.00335
0.000392	0.004383	0.007077	0.008398	0.008426	0.009130	0.009417	0.009633
0.009852	0.010095	0.010663	0.011791	0.013383	0.017079	0.021072	0.025641
0.030691	0.035853	0.040536	0.045243	0.0508	0.056804	0.062874	0.068234
0.072837	0.0692	0.06468	0.058743	0.051496	0.044146	0.036834	0.029293
0.021075	0.011098	0.001494	-0.00726	-0.01536	-0.01307	-0.01022	-0.00669
-0.00300	-0.00103	-0.00018	0.000041	0.000295	-0.00094	-0.00323	-0.00733
-0.01308	-0.02691	-0.04092	-0.05483	-0.06841	-0.07458	-0.07880	-0.08052
-0.07994	-0.07680	-0.07201	-0.06527	-0.05633	-0.04545	-0.03340	-0.02113
-0.00959	0.001179	0.010516	0.018765	0.026148	0.031664	0.035157	0.03643
0.036136	0.028058	0.019568	0.010576	0.001349	-0.00488	-0.00978	-0.01332
-0.01592	-0.01624	-0.01575	-0.01430	-0.01202	-0.00633	-0.00027	0.005914
0.01182	0.016294	0.019841	0.022758	0.025442	0.026338	0.026868	0.026897
0.026664	0.025366	0.024709	0.024764	0.025334	0.028922	0.032531	0.035888
0.038603	0.039665	0.039326	0.037465	0.034086	0.029761	0.024158	0.017529
0.010091	0.001852	-0.00691	-0.01580	-0.02425	-0.03476	-0.04464	-0.05383
-0.06169	-0.06890	-0.07346	-0.07573	-0.07622	-0.07318	-0.06844	-0.06242

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____(7) Subject Soil-Structure Interaction FLUSH single tank input(8) Originator R. A. Giller

-0.05615	-0.04639	-0.03798	-0.03097	-0.02535	-0.02369	-0.02349	-0.02461
-0.02698	-0.02992	-0.03417	-0.03948	-0.04539	-0.05167	-0.05795	-0.06407
-0.06974	-0.07354	-0.07566	-0.07549	-0.07286	-0.06658	-0.05882	-0.04979
-0.03941	-0.03561	-0.03135	-0.02759	-0.02486	-0.01820	-0.01204	-0.00625
-0.00109	0.003697	0.007425	0.010325	0.012843	0.013481	0.014247	0.015016
0.015737	0.017693	0.02044	0.024309	0.029109	0.034502	0.039644	0.044201
0.048098	0.052596	0.056387	0.059295	0.061179	0.061862	0.062094	0.062243
0.062316	0.063372	0.064123	0.064845	0.065809	0.066497	0.067618	0.069378
0.071833	0.078101	0.084593	0.091415	0.09854	0.10109	0.1018	0.1002
0.097194	0.084165	0.070865	0.05623	0.039816	0.024856	0.010722	-0.00210
-0.01430	-0.01793	-0.02136	-0.024	-0.02568	-0.02752	-0.02880	-0.02932
-0.02891	-0.02591	-0.02220	-0.01773	-0.01256	-0.01176	-0.01154	-0.01224
-0.01353	-0.01728	-0.02140	-0.02643	-0.03245	-0.03848	-0.04404	-0.04905
-0.05389	-0.05438	-0.05431	-0.05339	-0.05193	-0.04783	-0.04361	-0.03900
-0.03417	-0.03035	-0.02748	-0.02551	-0.02415	-0.02287	-0.02204	-0.02130
-0.02009	-0.01861	-0.01603	-0.01206	-0.00647	-0.00039	0.006403	0.013296
0.020023	0.020572	0.020168	0.018274	0.01506	0.011525	0.008080	0.004551
0.000417	-0.00091	-0.00252	-0.00405	-0.00572	-0.00562	-0.00659	-0.00868
-0.01162	-0.01857	-0.02548	-0.03204	-0.03804	-0.04040	-0.04160	-0.04147
-0.04025	-0.03825	-0.03596	-0.03334	-0.03021	-0.02626	-0.02216	-0.01825
-0.01477	-0.01221	-0.01017	-0.00857	-0.00743	-0.00615	-0.00562	-0.00574
-0.00624	-0.00939	-0.01278	-0.01629	-0.01954	-0.02382	-0.02735	-0.03055
-0.03375	-0.03589	-0.03753	-0.03849	-0.03892	-0.03456	-0.02954	-0.02373
-0.01754	-0.01140	-0.00619	-0.00164	0.002728	0.004317	0.005331	0.005769
0.006400	0.002951	0.001074	0.000612	0.001348	0.006142	0.011729	0.017398
0.022383	0.026039	0.028443	0.029454	0.028987	0.028981	0.028317	0.027437
0.026411	0.026246	0.026071	0.026206	0.026748	0.027034	0.027339	0.027707
0.028357	0.0313	0.034996	0.03965	0.045328	0.051169	0.057603	0.064293
0.07084	0.077453	0.083191	0.088041	0.092148	0.093507	0.094159	0.094174
0.093704	0.090788	0.087033	0.082189	0.076541	0.072163	0.068415	0.065311
0.062382	0.06216	0.062407	0.064006	0.067308	0.072247	0.077339	0.082138
0.086884	0.083255	0.079661	0.075602	0.070739	0.071412	0.071295	0.070537
0.069362	0.062592	0.0552	0.046848	0.037748	0.028864	0.020659	0.012938
0.005016	0.000381	-0.00426	-0.00828	-0.01162	-0.01648	-0.02196	-0.02838
-0.03546	-0.04042	-0.04491	-0.04883	-0.05226	-0.05588	-0.05865	-0.06028
-0.06079	-0.05902	-0.05658	-0.05366	-0.05041	-0.0478	-0.04481	-0.04158
-0.03867	-0.03059	-0.02373	-0.01756	-0.01167	-0.00887	-0.00739	-0.00706
-0.00674	-0.01457	-0.02161	-0.02860	-0.03561	-0.04030	-0.04336	-0.04500
-0.04613	-0.04374	-0.04129	-0.03841	-0.03505	-0.02845	-0.02186	-0.01541
-0.00927	-0.00682	-0.00518	-0.00440	-0.00448	-0.00341	-0.00325	-0.00388
-0.00515	-0.00845	-0.01210	-0.01589	-0.01952	-0.02197	-0.02422	-0.02655
-0.02920	-0.03296	-0.03683	-0.04039	-0.04326	-0.04538	-0.04690	-0.04810
-0.04916	-0.05123	-0.05345	-0.05622	-0.05987	-0.06281	-0.06649	-0.07071
-0.07526	-0.07881	-0.08129	-0.08181	-0.07991	-0.07493	-0.06779	-0.05886
-0.04884	-0.03832	-0.02851	-0.01987	-0.01261	-0.00659	-0.00249	-0.00024

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction FLUSH single tank input
 (8) Originator R. A. Giller

0.000672	-0.00152	-0.00395	-0.00625	-0.00801	-0.00855	-0.00786	-0.00594
-0.00306	-0.00057	0.002212	0.00536	0.009155	0.014183	0.019574	0.024668
0.028872	0.030557	0.030886	0.029947	0.028133	0.027382	0.026915	0.026747
0.026391	0.022266	0.017537	0.012948	0.009414	0.011728	0.015408	0.0199
0.024624	0.026691	0.029055	0.032383	0.036813	0.045991	0.053356	0.058106
0.061153	0.041923	0.022146	0.000590	-0.02298	-0.03574	-0.04667	-0.05541
-0.06323	-0.06385	-0.06400	-0.06258	-0.05924	-0.05490	-0.05034	-0.04667
-0.04472	-0.04221	-0.04112	-0.04072	-0.04087	-0.04217	-0.04473	-0.04812
-0.05149	-0.05323	-0.05393	-0.05360	-0.05256	-0.05181	-0.05127	-0.05123
-0.05190	-0.05301	-0.05491	-0.05713	-0.05889	-0.05970	-0.05842	-0.05427
-0.04689	-0.03655	-0.02457	-0.01213	-0.00012	0.00738	0.012905	0.015822
0.01617	0.013755	0.010217	0.006000	0.001470	-0.00082	-0.00180	-0.00102
0.001088	0.006478	0.011612	0.016534	0.021608	0.024645	0.027565	0.030163
0.032853	0.033613	0.035518	0.037889	0.039692	0.045337	0.050486	0.055492
0.059876	0.064431	0.067768	0.070851	0.074233	0.076867	0.078498	0.0796
0.0819	0.087804	0.097086	0.1086	0.11982	0.13014	0.13569	0.13769
0.13872	0.12383	0.1067	0.085081	0.060124	0.012221	-0.03154	-0.07146
-0.10949	-0.10279	-0.09266	-0.07816	-0.06102	-0.05634	-0.05396	-0.05312
-0.05186	-0.04482	-0.03665	-0.02884	-0.0226	-0.03161	-0.04115	-0.04994
-0.05751	-0.04930	-0.04134	-0.03444	-0.02901	-0.02868	-0.02969	-0.03141
-0.03282	-0.03490	-0.03582	-0.03693	-0.03956	-0.04051	-0.04046	-0.03763
-0.03246	-0.02117	-0.01151	-0.00375	0.002562	0.005789	0.007585	0.008365
0.009244	0.015969	0.02593	0.040236	0.05842	0.07673	0.093955	0.10917
0.12307	0.11644	0.1067	0.091541	0.070847	0.049975	0.0298	0.012654
-0.00079	0.000932	0.005904	0.013904	0.024355	0.024144	0.022504	0.017131
0.007116	-0.00226	-0.01408	-0.02731	-0.04134	-0.05819	-0.07352	-0.08570
-0.09358	-0.09524	-0.09337	-0.08964	-0.08561	-0.08237	-0.08017	-0.07965
-0.08142	-0.08053	-0.08115	-0.08304	-0.08661	-0.08673	-0.08725	-0.08674
-0.08478	-0.08055	-0.07556	-0.06978	-0.06386	-0.05972	-0.05763	-0.05651
-0.05400	-0.04640	-0.03490	-0.02035	-0.00452	0.012612	0.028989	0.045797
0.063917	0.078834	0.090114	0.095953	0.098273	0.066872	0.037276	0.008423
-0.02080	-0.01728	-0.01071	-0.00053	0.011237	0.016062	0.018338	0.018401
0.017227	0.017891	0.017939	0.016807	0.014011	0.010818	0.008321	0.008513
0.01194	0.021353	0.031507	0.041981	0.0527	0.060793	0.066634	0.06992
0.072254	0.056813	0.041671	0.024753	0.005082	-0.00654	-0.01628	-0.02283
-0.02723	-0.01923	-0.01105	-0.00221	0.007303	0.010202	0.011305	0.009725
0.005525	0.001819	-0.00243	-0.00631	-0.00944	-0.01241	-0.01425	-0.01438
-0.01256	-0.00616	0.001047	0.008402	0.015478	0.020231	0.024472	0.028513
0.032727	0.037288	0.042218	0.047633	0.053572	0.057638	0.061176	0.063692
0.064925	0.060608	0.053696	0.043918	0.032264	0.019275	0.007336	-0.00313
-0.01175	-0.01748	-0.01961	-0.01841	-0.01532	-0.00747	-0.00106	0.003104
0.004794	-0.00339	-0.01395	-0.02704	-0.04255	-0.05329	-0.06388	-0.07302
-0.08033	-0.07983	-0.07746	-0.07285	-0.06599	-0.05916	-0.05088	-0.04129
-0.03086	-0.01839	-0.00701	0.003390	0.013588	0.011024	0.007750	0.003070
-0.00261	-0.00330	-0.00291	-0.00162	-0.00022	0.004242	0.007870	0.010597

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction FLUSH single tank input
 (8) Originator R. A. Giller

0.012417	0.009389	0.005219	-0.00030	-0.00698	-0.01383	-0.01969	-0.02351
-0.02495	-0.02409	-0.02131	-0.01689	-0.01113	-0.00093	0.009607	0.019839
0.029333	0.038224	0.046418	0.053729	0.059815	0.065411	0.070334	0.074779
0.078061	0.081753	0.083301	0.083662	0.083697	0.083398	0.082539	0.081405
0.080635	0.080847	0.081717	0.083482	0.086621	0.090481	0.095105	0.099959
0.10508	0.10042	0.095925	0.091082	0.085759	0.078881	0.071588	0.063644
0.055429	0.046404	0.038935	0.032806	0.02736	0.032727	0.038975	0.046021
0.052783	0.056981	0.057948	0.055408	0.05014	0.03291	0.014721	-0.00465
-0.02537	-0.0383	-0.04958	-0.05772	-0.06281	-0.05883	-0.05366	-0.04739
-0.03995	-0.03358	-0.02688	-0.02030	-0.01415	-0.00620	0.001416	0.008986
0.016261	0.019097	0.02036	0.020307	0.019463	0.018825	0.017145	0.014755
0.01265	0.005708	-0.00050	-0.00638	-0.01156	-0.01718	-0.02121	-0.02460
-0.02837	-0.03063	-0.03304	-0.03532	-0.03757	-0.04016	-0.04280	-0.0454
-0.04794	-0.04971	-0.05108	-0.05173	-0.05174	-0.04891	-0.04655	-0.04481
-0.04339	-0.04530	-0.04776	-0.05140	-0.05645	-0.06312	-0.07045	-0.07832
-0.08667	-0.09507	-0.10299	-0.11011	-0.11655	-0.12101	-0.12452	-0.12685
-0.12833	-0.12435	-0.12065	-0.11723	-0.11394	-0.11212	-0.11029	-0.10828
-0.10583	-0.10053	-0.09404	-0.08588	-0.07601	-0.06871	-0.06102	-0.05319
-0.04495	-0.03877	-0.03244	-0.02657	-0.02158	-0.01569	-0.01094	-0.00709
-0.00360	-0.00300	-0.00290	-0.00413	-0.00665	-0.01016	-0.01187	-0.01145
-0.00990	0.000482	0.011943	0.025291	0.039875	0.051142	0.060003	0.066652
0.072342	0.079718	0.086291	0.091277	0.094522	0.095728	0.096315	0.096697
0.097009	0.094396	0.091645	0.089001	0.08675	0.07806	0.069304	0.030445

1 000101
 2 000101
 3 000101
 5 000101
 7 000101
 0

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____(7) Subject Soil-Structure Interaction FLUSH double tank input(8) Originator R. A. Giller

1 1 400
 241-SY-101 Tank, Structure to Structure Interaction
 158 52 0 256 234 46 5 1 11 66.

1 1
 BOTH LEFT
 4096 2000 .005 1.1

HOR

12. 4
 1. 4
 3. 8
 6. 16
 12. 32

2 0 7 1 5 0

0 12. 12. 12. 12. 12.

0

.07

61 000101 000000
 63 000101 000000
 92 000101 000000
 96 000101 000000
 29 000101 000000
 123 000101 000000
 190 000101 000000

1	1	2	13	12	1	1	.23	108.	2400.	1493.	.046
2	2	3	14	13	2	1	.18	127.	3400.	1036.	.087
3	3	4	15	14	3	1	.27	108.	3400.	1618.	.085
4	4	5	16	15	4	1	.27	108.	4050.	2076.	.087
5	5	6	17	16	5	1	.39	127.	4350.	1983.	.098
6	6	7	18	17	6	1	.39	115.	4550.	1872.	.108
7	7	8	19	18	7	1	.42	108.	4800.	1776.	.118
8	8	9	20	19	8	1	.43	108.	4800.	1684.	.126
9	9	10	21	20	9	1	.43	108.	5400.	1672.	.130
10	10	11	22	21	10	1	.44	108.	5400.	1617.	.135
11	11	234	235	22	11	1	.44	108.	5400.	1688.	.136
12	12	13	24	23	1	1	.23	108.	2400.	1493.	.046
13	13	14	25	24	2	1	.18	127.	3400.	1036.	.087
14	14	15	27	25	3	1	.27	108.	3400.	1618.	.085
15	15	16	29	27	4	1	.27	108.	4050.	2076.	.087
16	16	17	31	29	5	1	.39	127.	4350.	1983.	.098
17	17	18	33	31	6	1	.39	115.	4550.	1872.	.108
18	18	19	35	33	7	1	.42	108.	4800.	1776.	.118
19	19	20	36	35	8	1	.43	108.	4800.	1684.	.126
20	20	21	37	36	9	1	.43	108.	5400.	1672.	.130
21	21	22	38	37	10	1	.44	108.	5400.	1617.	.135

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____(7) Subject Soil-Structure Interaction FLUSH double tank input(8) Originator R. A. Giller

22	22	235	236	3811	1	.44	108.	5400.	1688.	.136
23	23	24	46	45 1	1	.23	108.	2400.	1493.	.046
24	24	25	46	46 2	1	.18	127.	3400.	1036.	.087
25	33	35	41	39 7	1	.42	108.	4800.	1776.	.118
26	35	36	42	41 8	1	.43	108.	4800.	1684.	.126
27	36	37	43	42 9	1	.43	108.	5400.	1672.	.130
28	37	38	44	4310	1	.44	108.	5400.	1617.	.135
29	38	236	237	4411	1	.44	108.	5400.	1688.	.136
30	39	41	50	48 7	1	.42	108.	4800.	1776.	.118
31	41	42	51	50 8	1	.43	108.	4800.	1684.	.126
32	42	43	52	51 9	1	.43	108.	5400.	1672.	.130
33	43	44	53	5210	1	.44	108.	5400.	1617.	.135
34	44	237	238	5311	1	.44	108.	5400.	1688.	.136
35	45	46	61	60 1	1	.23	108.	2400.	1493.	.046
36	48	50	56	54 7	1	.42	108.	4800.	1776.	.118
37	50	51	57	56 8	1	.43	108.	4800.	1684.	.126
38	51	52	58	57 9	1	.43	108.	5400.	1672.	.130
39	52	53	59	5810	1	.44	108.	5400.	1617.	.135
40	53	238	239	5911	1	.44	108.	5400.	1688.	.136
41	54	56	65	63 7	1	.42	108.	4800.	1776.	.118
42	56	57	66	65 8	1	.43	108.	4800.	1684.	.126
43	57	58	67	66 9	1	.43	108.	5400.	1672.	.130
44	58	59	68	6710	1	.44	108.	5400.	1617.	.135
45	59	239	240	6811	1	.44	108.	5400.	1688.	.136
46	60	61	76	75 1	1	.23	108.	2400.	1493.	.046
47	63	65	71	69 7	1	.42	108.	4800.	1776.	.118
48	65	66	72	71 8	1	.43	108.	4800.	1684.	.126
49	66	67	73	72 9	1	.43	108.	5400.	1672.	.130
50	67	68	74	7310	1	.44	108.	5400.	1617.	.135
51	68	240	241	7411	1	.44	108.	5400.	1688.	.136
52	69	71	80	78 7	1	.42	108.	4800.	1776.	.118
53	71	72	81	80 8	1	.43	108.	4800.	1684.	.126
54	72	73	82	81 9	1	.43	108.	5400.	1672.	.130
55	73	74	83	8210	1	.44	108.	5400.	1617.	.135
56	74	241	242	8311	1	.44	108.	5400.	1688.	.136
57	75	76	91	90 1	1	.23	108.	2400.	1493.	.046
58	92	91	76	76 2	1	.18	127.	3400.	1036.	.087
59	78	80	86	84 7	1	.42	108.	4800.	1776.	.118
60	80	81	87	86 8	1	.43	108.	4800.	1684.	.126
61	81	82	88	87 9	1	.43	108.	5400.	1672.	.130
62	82	83	89	8810	1	.44	108.	5400.	1617.	.135
63	83	242	243	8911	1	.44	108.	5400.	1688.	.136
64	84	86	102	100 7	1	.42	108.	4800.	1776.	.118
65	86	87	103	102 8	1	.43	108.	4800.	1684.	.126
66	87	88	104	103 9	1	.43	108.	5400.	1672.	.130

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction FLUSH double tank input
 (8) Originator R. A. Giller

67	88	89	105	10410	1	.44	108.	5400.	1617.	.135
68	89	243	244	10511	1	.44	108.	5400.	1688.	.136
69	90	91	107	106 1	1	.23	108.	2400.	1493.	.046
70	91	92	108	107 2	1	.18	127.	3400.	1036.	.087
71	92	94	109	108 3	1	.27	108.	3400.	1618.	.085
72	94	96	110	109 4	1	.27	108.	4050.	2076.	.087
73	96	98	111	110 5	1	.39	127.	4350.	1983.	.098
74	98	100	112	111 6	1	.39	115.	4550.	1872.	.108
75	100	102	113	112 7	1	.42	108.	4800.	1776.	.118
76	102	103	114	113 8	1	.43	108.	4800.	1684.	.126
77	103	104	115	114 9	1	.43	108.	5400.	1672.	.130
78	104	105	116	11510	1	.44	108.	5400.	1617.	.135
79	105	244	245	11611	1	.44	108.	5400.	1688.	.136
80	106	107	118	117 1	1	.23	108.	2400.	1493.	.046
81	107	108	119	118 2	1	.18	127.	3400.	1036.	.087
82	108	109	121	119 3	1	.27	108.	3400.	1618.	.085
83	109	110	123	121 4	1	.27	108.	4020.	2076.	.087
84	110	111	125	123 5	1	.39	127.	4350.	1983.	.098
85	111	112	127	125 6	1	.39	115.	4550.	1872.	.108
86	112	113	129	127 7	1	.42	108.	4800.	1776.	.118
87	113	114	130	129 8	1	.43	108.	4800.	1684.	.126
88	114	115	131	130 9	1	.43	108.	5400.	1672.	.130
89	115	116	132	13110	1	.44	108.	5400.	1617.	.135
90	116	245	246	13211	1	.44	108.	5400.	1688.	.136
91	117	118	140	139 1	1	.23	108.	2400.	1493.	.046
92	118	119	140	140 2	1	.18	127.	3400.	1036.	.087
93	127	129	135	133 7	1	.42	108.	4800.	1776.	.118
94	129	130	136	135 8	1	.43	108.	4800.	1684.	.126
95	130	131	137	136 9	1	.43	108.	5400.	1672.	.130
96	131	132	138	13710	1	.44	108.	5400.	1617.	.135
97	132	246	247	13811	1	.44	108.	5400.	1688.	.136
98	133	135	144	142 7	1	.42	108.	4800.	1776.	.118
99	135	136	145	144 8	1	.43	108.	4800.	1684.	.126
100	136	137	146	145 9	1	.43	108.	5400.	1672.	.130
101	137	138	147	14610	1	.44	108.	5400.	1617.	.135
102	138	247	248	14711	1	.44	108.	5400.	1688.	.136
103	139	140	155	154 1	1	.23	108.	2400.	1493.	.046
104	142	144	150	148 7	1	.42	108.	4800.	1776.	.118
105	144	145	151	150 8	1	.43	108.	4800.	1684.	.126
106	145	146	152	151 9	1	.43	108.	5400.	1672.	.130
107	146	147	153	15210	1	.44	108.	5400.	1617.	.135
108	147	248	249	15311	1	.44	108.	5400.	1688.	.136
109	148	150	159	157 7	1	.42	108.	4800.	1776.	.118
110	150	151	160	159 8	1	.43	108.	4800.	1684.	.126
111	151	152	161	160 9	1	.43	108.	5400.	1672.	.130

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction FLUSH double tank input
 (8) Originator R. A. Giller

112	152	153	162	16110	1	.44	108.	5400.	1617.	.135
113	153	249	250	16211	1	.44	108.	5400.	1688.	.136
114	154	155	170	169 1	1	.23	108.	2400.	1493.	.046
115	157	159	165	163 7	1	.42	115.	4800.	1776.	.118
116	159	160	166	165 8	1	.43	108.	4800.	1684.	.126
117	160	161	167	166 9	1	.43	108.	5400.	1672.	.130
118	161	162	168	16710	1	.44	108.	5400.	1617.	.135
119	162	250	251	16811	1	.44	108.	5400.	1688.	.136
120	163	165	174	172 7	1	.42	108.	4800.	1776.	.118
121	165	166	175	174 8	1	.43	108.	4800.	1684.	.126
122	166	167	176	175 9	1	.43	108.	5400.	1672.	.130
123	167	168	177	17610	1	.44	108.	5400.	1617.	.135
124	168	251	252	17711	1	.44	108.	5400.	1688.	.136
125	169	170	185	184 1	1	.23	108.	2400.	1493.	.046
126	186	185	170	170 2	1	.18	127.	3400.	1036.	.087
127	172	174	180	178 7	1	.42	108.	4800.	1776.	.118
128	174	175	181	180 8	1	.43	108.	4800.	1684.	.126
129	175	176	182	181 9	1	.43	108.	5400.	1672.	.130
130	176	177	183	18210	1	.44	108.	5400.	1617.	.135
131	177	252	253	18311	1	.44	108.	5400.	1688.	.136
132	178	180	196	194 7	1	.42	108.	4800.	1776.	.118
133	180	181	197	196 8	1	.43	108.	4800.	1684.	.126
134	181	182	198	197 9	1	.43	108.	5400.	1672.	.130
135	182	183	199	19810	1	.44	108.	5400.	1617.	.135
136	183	253	254	19911	1	.44	108.	5400.	1688.	.136
137	184	185	201	200 1	1	.23	108.	2400.	1493.	.046
138	185	186	202	201 2	1	.18	127.	3400.	1036.	.087
139	186	188	203	202 3	1	.27	108.	3400.	1618.	.085
140	188	190	204	203 4	1	.27	108.	4050.	2076.	.087
141	190	192	205	204 5	1	.39	127.	4350.	1983.	.098
142	192	194	206	205 6	1	.39	115.	4550.	1872.	.108
143	194	196	207	206 7	1	.42	108.	4800.	1776.	.118
144	196	197	208	207 8	1	.43	108.	4800.	1684.	.126
145	197	198	209	208 9	1	.43	108.	5400.	1672.	.130
146	198	199	210	20910	1	.44	108.	5400.	1617.	.135
147	199	254	255	21011	1	.44	108.	5400.	1688.	.136
148	200	201	212	211 1	1	.23	108.	2400.	1493.	.046
149	201	202	213	212 2	1	.18	127.	3400.	1036.	.087
150	202	203	214	213 3	1	.27	108.	3400.	1618.	.085
151	203	204	215	214 4	1	.27	108.	4050.	2076.	.087
152	204	205	216	215 5	1	.39	127.	4350.	1983.	.098
153	205	206	217	216 6	1	.39	115.	4550.	1872.	.108
154	206	207	218	217 7	1	.42	108.	4800.	1776.	.118
155	207	208	219	218 8	1	.43	108.	4800.	1684.	.126
156	208	209	220	219 9	1	.43	108.	5400.	1672.	.130

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction FLUSH double tank input
 (8) Originator R. A. Giller

157	209	210	221	22010	1	.44	108.	5400.	1617.	.135
158	210	255	256	22111	1	.44	108.	5400.	1688.	.136
159	61	62	46	47 0 0		.20	150.	230000.	230000.	.02
	1.42		.24		.83					
160	46	47	25	26 0 0		.20	150.	230000.	230000.	.02
	2.5		1.3		.83					
161	25	26	27	28 0 0		.20	150.	230000.	230000.	.02
	2.5		1.3		.83					
162	27	28	29	30 0 0		.20	150.	230000.	230000.	.02
	1.5		.28		.83					
163	29	30	31	32 0 0		.20	150.	230000.	230000.	.02
	1.5		.28		.83					
164	31	32	33	34 0 0		.20	150.	230000.	230000.	.02
	1.5		.28		.83					
165	33	34	39	40 0 0		.20	150.	187000.	187000.	.02
	1.92		.59		.83					
166	39	40	48	49 0 0		.20	150.	187000.	187000.	.02
	.96		.07		.83					
167	48	49	54	55 0 0		.20	150.	187000.	187000.	.02
	.96		.07		.83					
168	54	55	63	64 0 0		.20	150.	187000.	187000.	.02
	1.92		.59		.83					
169	63	64	69	70 0 0		.20	150.	187000.	187000.	.02
	1.92		.59		.83					
170	69	70	78	79 0 0		.20	150.	187000.	187000.	.02
	.96		.07		.83					
171	78	79	84	85 0 0		.20	150.	187000.	187000.	.02
	.96		.07		.83					
172	84	85	100	101 0 0		.20	150.	187000.	187000.	.02
	1.92		.59		.83					
173	61	62	76	77 0 0		.20	150.	230000.	230000.	.02
	1.42		.24		.83					
174	76	77	92	93 0 0		.20	150.	230000.	230000.	.02
	2.5		1.30		.83					
175	92	93	94	95 0 0		.20	150.	230000.	230000.	.02
	2.5		1.30		.83					
176	94	95	96	97 0 0		.20	150.	230000.	230000.	.02
	1.5		.28		.83					
177	96	97	98	99 0 0		.20	150.	230000.	230000.	.02
	1.5		.28		.83					
178	98	99	100	101 0 0		.20	150.	230000.	230000.	.02
	1.5		.28		.83					
179	155	156	140	141 0 0		.20	150.	230000.	230000.	.02
	1.42		.24		.83					
180	140	141	119	120 0 0		.20	150.	230000.	230000.	.02

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____(7) Subject Soil-Structure Interaction FLUSH double tank input(8) Originator R. A. Giller

	2.5		1.30		.83					
181	119	120	121	122	0	0	.20	150.	230000.	230000. .02
	2.5		1.30		.83					
182	121	122	123	124	0	0	.20	150.	230000.	230000. .02
	1.5		.28		.83					
183	123	124	125	126	0	0	.20	150.	230000.	230000. .02
	1.5		.28		.83					
184	125	126	127	128	0	0	.20	150.	230000.	230000. .02
	1.5		.28		.83					
185	127	128	133	134	0	0	.20	150.	187000.	187000. .02
	1.92		.59		.83					
186	133	134	142	143	0	0	.20	150.	187000.	187000. .02
	.96		.07		.83					
187	142	143	148	149	0	0	.20	150.	187000.	187000. .02
	.96		.07		.83					
188	148	149	157	158	0	0	.20	150.	187000.	187000. .02
	1.92		.59		.83					
189	157	158	163	164	0	0	.20	150.	187000.	187000. .02
	1.92		.59		.83					
190	163	164	172	173	0	0	.20	150.	187000.	187000. .02
	.96		.07		.83					
191	172	173	178	179	0	0	.20	150.	187000.	187000. .02
	.96		.07		.83					
192	178	179	194	195	0	0	.20	150.	187000.	187000. .02
	1.92		.59		.83					
193	155	156	170	171	0	0	.20	150.	230000.	230000. .02
	1.42		.24		.83					
194	170	171	186	187	0	0	.20	150.	230000.	230000. .02
	2.5		1.30		.83					
195	186	187	188	189	0	0	.20	150.	230000.	230000. .02
	2.5		1.30		.83					
196	188	189	190	191	0	0	.20	150.	230000.	230000. .02
	1.5		.28		.83					
197	190	191	192	193	0	0	.20	150.	230000.	230000. .02
	1.5		.28		.83					
198	192	193	194	195	0	0	.20	150.	230000.	230000. .02
	1.5		.28		.83					
199	25	26	222	223	0	0	.30	0.	1600000.	1600000. .02
	.001		100		0					
200	222	223	33	34	0	0	.30	0.	1600000.	1600000. .02
	.001		100		0					
201	222	223	224	225	0	0	.30	0.	1600000.	1600000. .02
	.034		.01		0					
202	224	225	226	227	0	0	.30	0.	1600000.	1600000. .02
	.034		.01		0					

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction FLUSH double tank input
 (8) Originator R. A. Giller

203	92	93	226	227	0	0	.30	0.	1600000.	1600000.	.02
	.001		100			0					
204	226	227	100	101	0	0	.30	0.	1600000.	1600000.	.02
	.001		100			0					
205	119	120	228	229	0	0	.30	0.	1600000.	1600000.	.02
	.001		100			0					
206	228	229	127	128	0	0	.30	0.	1600000.	1600000.	.02
	.001		100			0					
207	228	229	230	231	0	0	.30	0.	1600000.	1600000.	.02
	.034		.01			0					
208	230	231	232	233	0	0	.30	0.	1600000.	1600000.	.02
	.034		.01			0					
209	186	187	232	233	0	0	.30	0.	1600000.	1600000.	.02
	.001		100			0					
210	232	233	194	195	0	0	.30	0.	1600000.	1600000.	.02
	.001		100			0					
1	SEED AND IDRESS (1972) -- SAND										
1.000	.984	.934	.826	.656	.443	.246	.115	.049	.049	.049	
0.5	0.8	1.7	3.2	5.6	10.0	15.5	21.0	24.6	24.8	24.6	
1		0.0		55.0	0		0.0				
2		0.0		45.0	0		0.0				
3		0.0		38.0	0		0.0				
4		0.0		28.5	0		0.0				
5		0.0		19.0	0		0.0				
6		0.0		9.5	0		0.0				
7		0.0		0.0	0		0.0				
8		0.0		-15.0	0		0.0				
9		0.0		-30.0	0		0.0				
10		0.0		-50.0	0		0.0				
11		0.0		-75.0	0		0.0				
12		12.0		55.0	0		0.0				
13		12.0		45.0	0		0.0				
14		12.0		38.0	0		0.0				
15		12.0		28.5	0		0.0				
16		12.0		19.0	0		0.0				
17		12.0		9.5	0		0.0				
18		12.0		0.0	0		0.0				
19		12.0		-15.0	0		0.0				
20		12.0		-30.0	0		0.0				
21		12.0		-50.0	0		0.0				
22		12.0		-75.0	0		0.0				
23		24.0		55.0	0		0.0				
24		24.0		45.0	0		0.0				
25		24.0		38.0	0		0.0				
26		24.0		38.0	4		0.0				

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction FLUSH double tank input
 (8) Originator R. A. Giller

27	24.0	28.5	0	0.0
28	24.0	28.5	4	0.0
29	24.0	19.0	0	0.0
30	24.0	19.0	4	0.0
31	24.0	9.5	0	0.0
32	24.0	9.5	4	0.0
33	24.0	0.0	0	0.0
34	24.0	0.0	4	0.0
35	24.0	-15.0	0	0.0
36	24.0	-30.0	0	0.0
37	24.0	-50.0	0	0.0
38	24.0	-75.0	0	0.0
39	34.0	0.0	0	0.0
40	34.0	0.0	4	0.0
41	34.0	-15.0	0	0.0
42	34.0	-30.0	0	0.0
43	34.0	-50.0	0	0.0
44	34.0	-75.0	0	0.0
45	45.0	55.0	0	0.0
46	45.0	45.0	0	0.0
47	45.0	45.0	4	0.0
48	45.0	0.0	0	0.0
49	45.0	0.0	4	0.0
50	45.0	-15.0	0	0.0
51	45.0	-30.0	0	0.0
52	45.0	-50.0	0	0.0
53	45.0	-75.0	0	0.0
54	56.0	0.0	0	0.0
55	56.0	0.0	4	0.0
56	56.0	-15.0	0	0.0
57	56.0	-30.0	0	0.0
58	56.0	-50.0	0	0.0
59	56.0	-75.0	0	0.0
60	66.0	55.0	0	0.0
61	66.0	48.0	0	0.0
62	66.0	48.0	4	0.0
63	66.0	0.0	0	0.0
64	66.0	0.0	4	0.0
65	66.0	-15.0	0	0.0
66	66.0	-30.0	0	0.0
67	66.0	-50.0	0	0.0
68	66.0	-75.0	0	0.0
69	76.0	0.0	0	0.0
70	76.0	0.0	4	0.0
71	76.0	-15.0	0	0.0

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction FLUSH double tank input
 (8) Originator R. A. Giller

72	76.0	-30.0	0	0.0
73	76.0	-50.0	0	0.0
74	76.0	-75.0	0	0.0
75	87.0	55.0	0	0.0
76	87.0	45.0	0	0.0
77	87.0	45.0	4	0.0
78	87.0	0.0	0	0.0
79	87.0	0.0	4	0.0
80	87.0	-15.0	0	0.0
81	87.0	-30.0	0	0.0
82	87.0	-50.0	0	0.0
83	87.0	-75.0	0	0.0
84	98.0	0.0	0	0.0
85	98.0	0.0	4	0.0
86	98.0	-15.0	0	0.0
87	98.0	-30.0	0	0.0
88	98.0	-50.0	0	0.0
89	98.0	-75.0	0	0.0
90	108.0	55.0	0	0.0
91	108.0	45.0	0	0.0
92	108.0	38.0	0	0.0
93	108.0	38.0	4	0.0
94	108.0	28.5	0	0.0
95	108.0	28.5	4	0.0
96	108.0	19.0	0	0.0
97	108.0	19.0	4	0.0
98	108.0	9.5	0	0.0
99	108.0	9.5	4	0.0
100	108.0	0.0	0	0.0
101	108.0	0.0	4	0.0
102	108.0	-15.0	0	0.0
103	108.0	-30.0	0	0.0
104	108.0	-50.0	0	0.0
105	108.0	-75.0	0	0.0
106	120.0	55.0	0	0.0
107	120.0	45.0	0	0.0
108	120.0	38.0	0	0.0
109	120.0	28.5	0	0.0
110	120.0	19.0	0	0.0
111	120.0	9.5	0	0.0
112	120.0	0.0	0	0.0
113	120.0	-15.0	0	0.0
114	120.0	-30.0	0	0.0
115	120.0	-50.0	0	0.0
116	120.0	-75.0	0	0.0

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction FLUSH double tank input
 (8) Originator R. A. Giller

117	132.0	55.0	0	0.0
118	132.0	45.0	0	0.0
119	132.0	38.0	0	0.0
120	132.0	38.0	4	0.0
121	132.0	28.5	0	0.0
122	132.0	28.5	4	0.0
123	132.0	19.0	0	0.0
124	132.0	19.0	4	0.0
125	132.0	9.5	0	0.0
126	132.0	9.5	4	0.0
127	132.0	0.0	0	0.0
128	132.0	0.0	4	0.0
129	132.0	-15.0	0	0.0
130	132.0	-30.0	0	0.0
131	132.0	-50.0	0	0.0
132	132.0	-75.0	0	0.0
133	142.0	0.0	0	0.0
134	142.0	0.0	4	0.0
135	142.0	-15.0	0	0.0
136	142.0	-30.0	0	0.0
137	142.0	-50.0	0	0.0
138	142.0	-75.0	0	0.0
139	153.0	55.0	0	0.0
140	153.0	45.0	0	0.0
141	153.0	45.0	4	0.0
142	153.0	0.0	0	0.0
143	153.0	0.0	4	0.0
144	153.0	-15.0	0	0.0
145	153.0	-30.0	0	0.0
146	153.0	-50.0	0	0.0
147	153.0	-75.0	0	0.0
148	164.0	0.0	0	0.0
149	164.0	0.0	4	0.0
150	164.0	-15.0	0	0.0
151	164.0	-30.0	0	0.0
152	164.0	-50.0	0	0.0
153	164.0	-75.0	0	0.0
154	174.0	55.0	0	0.0
155	174.0	48.0	0	0.0
156	174.0	48.0	4	0.0
157	174.0	0.0	0	0.0
158	174.0	0.0	4	0.0
159	174.0	-15.0	0	0.0
160	174.0	-30.0	0	0.0
161	174.0	-50.0	0	0.0

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction FLUSH double tank input
 (8) Originator R. A. Giller

162	174.0	-75.0	0	0.0
163	184.0	0.0	0	0.0
164	184.0	0.0	4	0.0
165	184.0	-15.0	0	0.0
166	184.0	-30.0	0	0.0
167	184.0	-50.0	0	0.0
168	184.0	-75.0	0	0.0
169	195.0	55.0	0	0.0
170	195.0	45.0	0	0.0
171	195.0	45.0	4	0.0
172	195.0	0.0	0	0.0
173	195.0	0.0	4	0.0
174	195.0	-15.0	0	0.0
175	195.0	-30.0	0	0.0
176	195.0	-50.0	0	0.0
177	195.0	-75.0	0	0.0
178	206.0	0.0	0	0.0
179	206.0	0.0	4	0.0
180	206.0	-15.0	0	0.0
181	206.0	-30.0	0	0.0
182	206.0	-50.0	0	0.0
183	206.0	-75.0	0	0.0
184	216.0	55.0	0	0.0
185	216.0	45.0	0	0.0
186	216.0	38.0	0	0.0
187	216.0	38.0	4	0.0
188	216.0	28.5	0	0.0
189	216.0	28.5	4	0.0
190	216.0	19.0	0	0.0
191	216.0	19.0	4	0.0
192	216.0	9.5	0	0.0
193	216.0	9.5	4	0.0
194	216.0	0.0	0	0.0
195	216.0	0.0	4	0.0
196	216.0	-15.0	0	0.0
197	216.0	-30.0	0	0.0
198	216.0	-50.0	0	0.0
199	216.0	-75.0	0	0.0
200	228.0	55.0	0	0.0
201	228.0	45.0	0	0.0
202	228.0	38.0	0	0.0
203	228.0	28.5	0	0.0
204	228.0	19.0	0	0.0
205	228.0	9.5	0	0.0
206	228.0	0.0	0	0.0

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____(7) Subject Soil-Structure Interaction FLUSH double tank input(8) Originator R. A. Giller

207	228.0	-15.0	0	0.0
208	228.0	-30.0	0	0.0
209	228.0	-50.0	0	0.0
210	228.0	-75.0	0	0.0
211	240.0	55.0	0	0.0
212	240.0	45.0	0	0.0
213	240.0	38.0	0	0.0
214	240.0	28.5	0	0.0
215	240.0	19.0	0	0.0
216	240.0	9.5	0	0.0
217	240.0	0.0	0	0.0
218	240.0	-15.0	0	0.0
219	240.0	-30.0	0	0.0
220	240.0	-50.0	0	0.0
221	240.0	-75.0	0	0.0
222	24.0	19.0	0	0.0
223	24.0	19.0	4	0.0
224	66.0	19.0	0	129.0
225	66.0	19.0	4	0.0
226	108.0	19.0	0	0.0
227	108.0	19.0	4	0.0
228	132.0	19.0	0	0.0
229	132.0	19.0	4	0.0
230	174.0	19.0	0	129.0
231	174.0	19.0	4	0.0
232	216.0	19.0	0	0.0
233	216.0	19.0	4	0.0
234	0.0	-100.0	0	0.0
235	12.0	-100.0	0	0.0
236	24.0	-100.0	0	0.0
237	34.0	-100.0	0	0.0
238	45.0	-100.0	0	0.0
239	56.0	-100.0	0	0.0
240	66.0	-100.0	0	0.0
241	76.0	-100.0	0	0.0
242	87.0	-100.0	0	0.0
243	98.0	-100.0	0	0.0
244	108.0	-100.0	0	0.0
245	120.0	-100.0	0	0.0
246	132.0	-100.0	0	0.0
247	142.0	-100.0	0	0.0
248	153.0	-100.0	0	0.0
249	164.0	-100.0	0	0.0
250	174.0	-100.0	0	0.0
251	184.0	-100.0	0	0.0

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction FLUSH double tank input
 (8) Originator R. A. Giller

252	195.0	-100.0	0	0.0
253	206.0	-100.0	0	0.0
254	216.0	-100.0	0	0.0
255	228.0	-100.0	0	0.0
256	240.0	-100.0	0	0.0

COMM CONTROL MOTION - HORIZONTAL, ZPA=0.2G, 2000 POINTS, DT=0.005 SEC

0.014141	0.015267	0.015951	0.016336	0.016758	0.016979	0.016954	0.016629
0.016387	0.014176	0.012741	0.012053	0.012072	0.013171	0.014876	0.017093
0.01984	0.021099	0.023141	0.026073	0.029939	0.037493	0.045393	0.05311
0.06014	0.06091	0.059508	0.055398	0.049001	0.037907	0.026378	0.014272
0.001441	-0.00677	-0.01338	-0.01761	-0.01990	-0.01439	-0.00808	-0.00104
0.006429	0.012848	0.018841	0.024301	0.029027	0.034387	0.038556	0.041552
0.043204	0.042491	0.039895	0.03584	0.031054	0.026087	0.021089	0.016132
0.01135	0.006611	0.002235	-0.00184	-0.00566	-0.00886	-0.01144	-0.01315
-0.01381	-0.01283	-0.00985	-0.00415	0.004511	0.016791	0.030787	0.045693
0.060681	0.073881	0.085265	0.094298	0.10078	0.10586	0.10828	0.10854
0.10743	0.099773	0.091325	0.082144	0.072774	0.060798	0.049628	0.039169
0.029597	0.022669	0.017903	0.015289	0.014354	0.017219	0.02086	0.024616
0.027679	0.030691	0.032532	0.033329	0.033026	0.029921	0.026439	0.02358
0.021906	0.023391	0.025428	0.027969	0.03118	0.035398	0.039848	0.044269
0.048323	0.053083	0.056118	0.057932	0.059805	0.045853	0.030447	0.012098
-0.00802	-0.04041	-0.07013	-0.09856	-0.12732	-0.13763	-0.14449	-0.14655
-0.14507	-0.13217	-0.11847	-0.10416	-0.08990	-0.07835	-0.06819	-0.05979
-0.05395	-0.04765	-0.04442	-0.04291	-0.04212	-0.04422	-0.04824	-0.05424
-0.06112	-0.06946	-0.07723	-0.08476	-0.09199	-0.09783	-0.10186	-0.10388
-0.10425	-0.10403	-0.10263	-0.10052	-0.09864	-0.09453	-0.09178	-0.09016
-0.08947	-0.08805	-0.08727	-0.08651	-0.08492	-0.08225	-0.07819	-0.07344
-0.06886	-0.06435	-0.06082	-0.05857	-0.05807	-0.05861	-0.05987	-0.06021
-0.05828	-0.05260	-0.04369	-0.03127	-0.01547	0.002165	0.020401	0.037552
0.052543	0.065438	0.074942	0.080607	0.082711	0.081845	0.080291	0.079037
0.078263	0.078916	0.080944	0.085248	0.091849	0.098656	0.10578	0.11357
0.12335	0.13698	0.15169	0.16498	0.17556	0.18212	0.18122	0.17632
0.17065	0.16412	0.15822	0.15447	0.15272	0.2	0.14403	0.13623
0.13238	0.13297	0.13592	0.13886	0.14099	0.14301	0.1462	0.15176
0.15391	0.15342	0.15132	0.14713	0.14372	0.09985	0.05871	0.015343
-0.03387	-0.05317	-0.07290	-0.0917	-0.11191	-0.10793	-0.10694	-0.10617
-0.1034	-0.11177	-0.11725	-0.12081	-0.1245	-0.11521	-0.10683	-0.09761
-0.08761	-0.08534	-0.08618	-0.08861	-0.08937	-0.08298	-0.07344	-0.06224
-0.0501	-0.04108	-0.03075	-0.01980	-0.00955	0.001083	0.010458	0.019357
0.027549	0.032723	0.034824	0.035142	0.036391	0.039454	0.045406	0.052987
0.060168	0.068784	0.074023	0.078624	0.087285	0.076087	0.066732	0.053456
0.035166	-0.01344	-0.05908	-0.10375	-0.15238	-0.14338	-0.13559	-0.12458
-0.11021	-0.11389	-0.11867	-0.12308	-0.1247	-0.10939	-0.09127	-0.07275
-0.05666	-0.04892	-0.04437	-0.03996	-0.03384	-0.02184	-0.01246	-0.00624
-0.00062	-0.01846	-0.03492	-0.05171	-0.06869	-0.08951	-0.10701	-0.12281

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction FLUSH double tank input
 (8) Originator R. A. Giller

-0.13979	-0.13467	-0.12981	-0.12317	-0.11463	-0.1114	-0.10978	-0.11091
-0.11487	-0.11704	-0.1195	-0.12092	-0.12082	-0.11817	-0.11247	-0.102
-0.08590	-0.06542	-0.04249	-0.01931	0.002564	0.022328	0.038801	0.051288
0.059384	0.062803	0.062503	0.059657	0.055638	0.052055	0.049549	0.048618
0.048914	0.048999	0.048277	0.046563	0.04408	0.040725	0.035995	0.030222
0.024863	0.013962	0.005742	0.000264	-0.00218	-0.00194	0.001463	0.006745
0.012477	0.016899	0.020495	0.022402	0.021659	0.02228	0.020458	0.016544
0.010334	0.006712	0.000955	-0.00629	-0.01483	-0.02664	-0.04011	-0.05471
-0.06936	-0.08042	-0.08842	-0.09207	-0.09103	-0.08632	-0.07788	-0.06579
-0.05034	-0.03170	-0.01282	0.004337	0.018346	0.027584	0.032927	0.035129
0.035029	0.033055	0.028724	0.022628	0.016595	-0.00261	-0.01996	-0.03684
-0.05421	-0.06420	-0.07293	-0.08025	-0.08700	-0.08468	-0.08129	-0.07542
-0.06649	-0.05902	-0.04980	-0.03985	-0.03013	-0.01718	-0.00521	0.005792
0.015197	0.020207	0.022028	0.021871	0.021967	0.025485	0.031382	0.038908
0.04692	0.053524	0.059644	0.065705	0.071684	0.076125	0.07762	0.076248
0.074536	0.05535	0.039579	0.025241	0.009967	0.010209	0.009576	0.008196
0.005200	0.006306	0.006404	0.007003	0.008499	0.003900	-0.00044	-0.00319
-0.00263	0.011082	0.028327	0.047776	0.067487	0.076787	0.083788	0.08993
0.096717	0.11244	0.12395	0.12937	0.13129	0.080407	0.031112	-0.01958
-0.07339	-0.08886	-0.09833	-0.10028	-0.09909	-0.08579	-0.07621	-0.06714
-0.05513	-0.04665	-0.03730	-0.03029	-0.02751	-0.02119	-0.01464	-0.00384
0.012131	0.029471	0.043533	0.052974	0.060981	0.036901	0.015012	-0.00773
-0.03294	-0.03904	-0.04177	-0.04020	-0.03673	-0.02186	-0.00852	0.004418
0.0179	0.024227	0.02967	0.032661	0.031634	0.032906	0.029738	0.023559
0.015677	0.003860	-0.00842	-0.01999	-0.02933	-0.03323	-0.03310	-0.02856
-0.01972	-0.01149	-0.00233	0.005643	0.011447	0.00577	-0.00184	-0.01129
-0.02212	-0.01983	-0.01591	-0.00953	-0.00127	0.001995	0.003935	0.003403
-0.00011	-0.00307	-0.00871	-0.01671	-0.02671	-0.03925	-0.05089	-0.05927
-0.06291	-0.05969	-0.05316	-0.04473	-0.03569	-0.02868	-0.02342	-0.02022
-0.01865	-0.01930	-0.02127	-0.02470	-0.02913	-0.04095	-0.05198	-0.06186
-0.07035	-0.07519	-0.07830	-0.08020	-0.08141	-0.08123	-0.07968	-0.07628
-0.07098	-0.05606	-0.03957	-0.02218	-0.00506	0.007921	0.019003	0.027953
0.034438	0.041506	0.046225	0.049089	0.049908	0.046512	0.040442	0.03343
0.027883	0.027035	0.029172	0.03389	0.041106	0.04952	0.061157	0.07639
0.094819	0.11441	0.13263	0.14769	0.15966	0.14614	0.12965	0.10874
0.083204	0.068622	0.05417	0.040987	0.028477	0.025148	0.022598	0.022282
0.024985	0.027227	0.030343	0.032935	0.034565	0.030174	0.026041	0.022168
0.017938	0.016762	0.015419	0.014815	0.015315	0.022082	0.028856	0.035255
0.041109	0.042755	0.042888	0.04091	0.03676	0.034526	0.031992	0.030062
0.029073	0.027056	0.026716	0.028752	0.033201	0.041554	0.050064	0.057733
0.063946	0.066209	0.066508	0.065519	0.064557	0.067024	0.07117	0.076589
0.082474	0.086258	0.08989	0.093516	0.097018	0.1021	0.10684	0.1117
0.11675	0.11539	0.11311	0.1109	0.11093	0.11773	0.12728	0.13713
0.14465	0.14301	0.13694	0.12797	0.1187	0.10605	0.093288	0.078541
0.06236	0.019662	-0.01860	-0.05337	-0.08754	-0.07648	-0.06428	-0.04955

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction FLUSH double tank input
 (8) Originator R. A. Giller

-0.03395	-0.02829	-0.02663	-0.02676	-0.02495	-0.02062	-0.01378	-0.00713
-0.00266	-0.01363	-0.02645	-0.03979	-0.05227	-0.05946	-0.06618	-0.07424
-0.08426	-0.09859	-0.11135	-0.122	-0.13157	-0.12284	-0.11394	-0.10477
-0.09614	-0.09254	-0.08991	-0.08686	-0.08244	-0.07230	-0.06257	-0.05487
-0.05070	-0.05323	-0.05960	-0.06801	-0.07609	-0.07743	-0.07401	-0.06453
-0.04932	-0.03246	-0.01348	0.006791	0.027902	0.051105	0.071285	0.086202
0.094841	0.095445	0.092598	0.089683	0.089377	0.091582	0.094163	0.095724
0.097514	0.066759	0.037868	0.008212	-0.02363	-0.02982	-0.03268	-0.03088
-0.02619	-0.01290	-0.00030	0.011912	0.02407	0.031598	0.037897	0.041589
0.041339	0.042843	0.043216	0.045616	0.050674	0.05447	0.055657	0.054355
0.053227	0.054563	0.059149	0.066133	0.074023	0.083818	0.092539	0.10203
0.11488	0.11069	0.10537	0.094796	0.079889	0.032174	-0.01139	-0.05277
-0.09617	-0.09225	-0.08867	-0.08276	-0.07531	-0.07619	-0.08054	-0.08780
-0.09560	-0.0972	-0.09481	-0.08883	-0.08180	-0.07279	-0.06595	-0.05875
-0.04846	-0.05334	-0.05919	-0.06945	-0.08405	-0.10085	-0.11564	-0.12816
-0.14011	-0.1329	-0.12606	-0.11887	-0.11139	-0.11235	-0.11335	-0.11386
-0.11353	-0.10542	-0.09608	-0.08561	-0.07526	-0.06986	-0.06785	-0.06855
-0.07000	-0.06852	-0.06568	-0.06155	-0.05614	-0.05042	-0.04323	-0.03466
-0.02544	-0.02164	-0.02115	-0.02528	-0.03327	-0.0521	-0.07075	-0.08837
-0.10451	-0.10893	-0.11035	-0.10883	-0.10528	-0.09990	-0.09443	-0.08957
-0.08596	-0.08424	-0.08316	-0.08184	-0.08008	-0.07212	-0.06414	-0.05577
-0.04678	-0.04120	-0.03565	-0.03027	-0.02551	-0.01614	-0.00953	-0.00476
0.000692	-0.01313	-0.02575	-0.03988	-0.05661	-0.07366	-0.08937	-0.10374
-0.11873	-0.11218	-0.1066	-0.09993	-0.09102	-0.09302	-0.09389	-0.09401
-0.09315	-0.08085	-0.06618	-0.04918	-0.03115	-0.01855	-0.00758	0.002513
0.012931	0.027089	0.040969	0.053502	0.063995	0.070227	0.074561	0.077967
0.081409	0.083471	0.08483	0.084933	0.08422	0.074272	0.064652	0.055241
0.046218	0.039919	0.034246	0.02816	0.020858	0.013536	0.006871	0.001973
-0.00074	0.006960	0.017568	0.031079	0.046541	0.060089	0.073063	0.084823
0.094677	0.10454	0.11114	0.11448	0.11474	0.11085	0.10493	0.098458
0.092931	0.090137	0.088987	0.089124	0.090173	0.090831	0.091976	0.094029
0.09732	0.10146	0.10549	0.10904	0.11265	0.10442	0.095895	0.086295
0.076029	0.065527	0.056226	0.047249	0.037597	0.030555	0.024269	0.019299
0.015221	0.019518	0.024206	0.029277	0.034105	0.03714	0.038996	0.040187
0.040992	0.041947	0.04165	0.040298	0.038535	0.030978	0.022871	0.013961
0.004804	-0.00452	-0.01291	-0.02097	-0.02932	-0.03415	-0.03787	-0.03968
-0.03964	-0.03615	-0.03151	-0.02565	-0.01864	-0.01339	-0.00809	-0.00335
0.000392	0.004383	0.007077	0.008398	0.008426	0.009130	0.009417	0.009633
0.009852	0.010095	0.010663	0.011791	0.013383	0.017079	0.021072	0.025641
0.030691	0.035853	0.040536	0.045243	0.0508	0.056804	0.062874	0.068234
0.072837	0.0692	0.06468	0.058743	0.051496	0.044146	0.036834	0.029293
0.021075	0.011098	0.001494	-0.00726	-0.01536	-0.01307	-0.01022	-0.00669
-0.00300	-0.00103	-0.00018	0.000041	0.000295	-0.00094	-0.00323	-0.00733
-0.01308	-0.02691	-0.04092	-0.05483	-0.06841	-0.07458	-0.07880	-0.08052
-0.07994	-0.07680	-0.07201	-0.06527	-0.05633	-0.04545	-0.03340	-0.02113

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction FLUSH double tank input
 (8) Originator R. A. Giller

-0.00959	0.001179	0.010516	0.018765	0.026148	0.031664	0.035157	0.03643
0.036136	0.028058	0.019568	0.010576	0.001349	-0.00488	-0.00978	-0.01332
-0.01592	-0.01624	-0.01575	-0.01430	-0.01202	-0.00633	-0.00027	0.005914
0.01182	0.016294	0.019841	0.022758	0.025442	0.026338	0.026868	0.026897
0.026664	0.025366	0.024709	0.024764	0.025334	0.028922	0.032531	0.035888
0.038603	0.039665	0.039326	0.037465	0.034086	0.029761	0.024158	0.017529
0.010091	0.001852	-0.00691	-0.01580	-0.02425	-0.03476	-0.04464	-0.05383
-0.06169	-0.06890	-0.07346	-0.07573	-0.07622	-0.07318	-0.06844	-0.06242
-0.05615	-0.04639	-0.03798	-0.03097	-0.02535	-0.02369	-0.02349	-0.02461
-0.02698	-0.02992	-0.03417	-0.03948	-0.04539	-0.05167	-0.05795	-0.06407
-0.06974	-0.07354	-0.07566	-0.07549	-0.07286	-0.06658	-0.05882	-0.04979
-0.03941	-0.03561	-0.03135	-0.02759	-0.02486	-0.01820	-0.01204	-0.00625
-0.00109	0.003697	0.007425	0.010325	0.012843	0.013481	0.014247	0.015016
0.015737	0.017693	0.02044	0.024309	0.029109	0.034502	0.039644	0.044201
0.048098	0.052596	0.056387	0.059295	0.061179	0.061862	0.062094	0.062243
0.062316	0.063372	0.064123	0.064845	0.065809	0.066497	0.067618	0.069378
0.071833	0.078101	0.084593	0.091415	0.09854	0.10109	0.1018	0.1002
0.097194	0.084165	0.070865	0.05623	0.039816	0.024856	0.010722	-0.00210
-0.01430	-0.01793	-0.02136	-0.024	-0.02568	-0.02752	-0.02880	-0.02932
-0.02891	-0.02591	-0.02220	-0.01773	-0.01256	-0.01176	-0.01154	-0.01224
-0.01353	-0.01728	-0.02140	-0.02643	-0.03245	-0.03848	-0.04404	-0.04905
-0.05389	-0.05438	-0.05431	-0.05339	-0.05193	-0.04783	-0.04361	-0.03900
-0.03417	-0.03035	-0.02748	-0.02551	-0.02415	-0.02287	-0.02204	-0.02130
-0.02009	-0.01861	-0.01603	-0.01206	-0.00647	-0.00039	0.006403	0.013296
0.020023	0.020572	0.020168	0.018274	0.01506	0.011525	0.008080	0.004551
0.000417	-0.00091	-0.00252	-0.00405	-0.00572	-0.00562	-0.00659	-0.00868
-0.01162	-0.01857	-0.02548	-0.03204	-0.03804	-0.04040	-0.04160	-0.04147
-0.04025	-0.03825	-0.03596	-0.03334	-0.03021	-0.02626	-0.02216	-0.01825
-0.01477	-0.01221	-0.01017	-0.00857	-0.00743	-0.00615	-0.00562	-0.00574
-0.00624	-0.00939	-0.01278	-0.01629	-0.01954	-0.02382	-0.02735	-0.03055
-0.03375	-0.03589	-0.03753	-0.03849	-0.03892	-0.03456	-0.02954	-0.02373
-0.01754	-0.01140	-0.00619	-0.00164	0.002728	0.004317	0.005331	0.005769
0.006400	0.002951	0.001074	0.000612	0.001348	0.006142	0.011729	0.017398
0.022383	0.026039	0.028443	0.029454	0.028987	0.028981	0.028317	0.027437
0.026411	0.026246	0.026071	0.026206	0.026748	0.027034	0.027339	0.027707
0.028357	0.0313	0.034996	0.03965	0.045328	0.051169	0.057603	0.064293
0.07084	0.077453	0.083191	0.088041	0.092148	0.093507	0.094159	0.094174
0.093704	0.090788	0.087033	0.082189	0.076541	0.072163	0.068415	0.065311
0.062382	0.06216	0.062407	0.064006	0.067308	0.072247	0.077339	0.082138
0.086884	0.083255	0.079661	0.075602	0.070739	0.071412	0.071295	0.070537
0.069362	0.062592	0.0552	0.046848	0.037748	0.028864	0.020659	0.012938
0.005016	0.000381	-0.00426	-0.00828	-0.01162	-0.01648	-0.02196	-0.02838
-0.03546	-0.04042	-0.04491	-0.04883	-0.05226	-0.05588	-0.05865	-0.06028
-0.06079	-0.05902	-0.05658	-0.05366	-0.05041	-0.0478	-0.04481	-0.04158
-0.03867	-0.03059	-0.02373	-0.01756	-0.01167	-0.00887	-0.00739	-0.00706

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction FLUSH double tank input
 (8) Originator R. A. Giller

-0.01256	-0.00616	0.001047	0.008402	0.015478	0.020231	0.024472	0.028513
0.032727	0.037288	0.042218	0.047633	0.053572	0.057638	0.061176	0.063692
0.064925	0.060608	0.053696	0.043918	0.032264	0.019275	0.007336	-0.00313
-0.01175	-0.01748	-0.01961	-0.01841	-0.01532	-0.00747	-0.00106	0.003104
0.004794	-0.00339	-0.01395	-0.02704	-0.04255	-0.05329	-0.06388	-0.07302
-0.08033	-0.07983	-0.07746	-0.07285	-0.06599	-0.05916	-0.05088	-0.04129
-0.03086	-0.01839	-0.00701	0.003390	0.013588	0.011024	0.007750	0.003070
-0.00261	-0.00330	-0.00291	-0.00162	-0.00022	0.004242	0.007870	0.010597
0.012417	0.009389	0.005219	-0.00030	-0.00698	-0.01383	-0.01969	-0.02351
-0.02495	-0.02409	-0.02131	-0.01689	-0.01113	-0.00093	0.009607	0.019839
0.029333	0.038224	0.046418	0.053729	0.059815	0.065411	0.070334	0.074779
0.078061	0.081753	0.083301	0.083662	0.083697	0.083398	0.082539	0.081405
0.080635	0.080847	0.081717	0.083482	0.086621	0.090481	0.095105	0.099959
0.10508	0.10042	0.095925	0.091082	0.085759	0.078881	0.071588	0.063644
0.055429	0.046404	0.038935	0.032806	0.02736	0.032727	0.038975	0.046021
0.052783	0.056981	0.057948	0.055408	0.05014	0.03291	0.014721	-0.00465
-0.02537	-0.0383	-0.04958	-0.05772	-0.06281	-0.05883	-0.05366	-0.04739
-0.03995	-0.03358	-0.02688	-0.02030	-0.01415	-0.00620	0.001416	0.008986
0.016261	0.019097	0.02036	0.020307	0.019463	0.018825	0.017145	0.014755
0.01265	0.005708	-0.00050	-0.00638	-0.01156	-0.01718	-0.02121	-0.02460
-0.02837	-0.03063	-0.03304	-0.03532	-0.03757	-0.04016	-0.04280	-0.0454
-0.04794	-0.04971	-0.05108	-0.05173	-0.05174	-0.04891	-0.04655	-0.04481
-0.04339	-0.04530	-0.04776	-0.05140	-0.05645	-0.06312	-0.07045	-0.07832
-0.08667	-0.09507	-0.10299	-0.11011	-0.11655	-0.12101	-0.12452	-0.12685
-0.12833	-0.12435	-0.12065	-0.11723	-0.11394	-0.11212	-0.11029	-0.10828
-0.10583	-0.10053	-0.09404	-0.08588	-0.07601	-0.06871	-0.06102	-0.05319
-0.04495	-0.03877	-0.03244	-0.02657	-0.02158	-0.01569	-0.01094	-0.00709
-0.00360	-0.00300	-0.00290	-0.00413	-0.00665	-0.01016	-0.01187	-0.01145
-0.00990	0.000482	0.011943	0.025291	0.039875	0.051142	0.060003	0.066652
0.072342	0.079718	0.086291	0.091277	0.094522	0.095728	0.096315	0.096697
0.097009	0.094396	0.091645	0.089001	0.08675	0.07806	0.069304	0.030445

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DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction FLUSH double tank input
 (8) Originator R. A. Giller

-0.00674	-0.01457	-0.02161	-0.02860	-0.03561	-0.04030	-0.04336	-0.04500
-0.04613	-0.04374	-0.04129	-0.03841	-0.03505	-0.02845	-0.02186	-0.01541
-0.00927	-0.00682	-0.00518	-0.00440	-0.00448	-0.00341	-0.00325	-0.00388
-0.00515	-0.00845	-0.01210	-0.01589	-0.01952	-0.02197	-0.02422	-0.02655
-0.02920	-0.03296	-0.03683	-0.04039	-0.04326	-0.04538	-0.04690	-0.04810
-0.04916	-0.05123	-0.05345	-0.05622	-0.05987	-0.06281	-0.06649	-0.07071
-0.07526	-0.07881	-0.08129	-0.08181	-0.07991	-0.07493	-0.06779	-0.05886
-0.04884	-0.03832	-0.02851	-0.01987	-0.01261	-0.00659	-0.00249	-0.00024
0.000672	-0.00152	-0.00395	-0.00625	-0.00801	-0.00855	-0.00786	-0.00594
-0.00306	-0.00057	0.002212	0.00536	0.009155	0.014183	0.019574	0.024668
0.028872	0.030557	0.030886	0.029947	0.028133	0.027382	0.026915	0.026747
0.026391	0.022266	0.017537	0.012948	0.009414	0.011728	0.015408	0.0199
0.024624	0.026691	0.029055	0.032383	0.036813	0.045991	0.053356	0.058106
0.061153	0.041923	0.022146	0.000590	-0.02298	-0.03574	-0.04667	-0.05541
-0.06323	-0.06385	-0.06400	-0.06258	-0.05924	-0.05490	-0.05034	-0.04667
-0.04472	-0.04221	-0.04112	-0.04072	-0.04087	-0.04217	-0.04473	-0.04812
-0.05149	-0.05323	-0.05393	-0.05360	-0.05256	-0.05181	-0.05127	-0.05123
-0.05190	-0.05301	-0.05491	-0.05713	-0.05889	-0.05970	-0.05842	-0.05427
-0.04689	-0.03655	-0.02457	-0.01213	-0.00012	0.00738	0.012905	0.015822
0.01617	0.013755	0.010217	0.006000	0.001470	-0.00082	-0.00180	-0.00102
0.001088	0.006478	0.011612	0.016534	0.021608	0.024645	0.027565	0.030163
0.032853	0.033613	0.035518	0.037889	0.039692	0.045337	0.050486	0.055492
0.059876	0.064431	0.067768	0.070851	0.074233	0.076867	0.078498	0.0796
0.0819	0.087804	0.097086	0.1086	0.11982	0.13014	0.13569	0.13769
0.13872	0.12383	0.1067	0.085081	0.060124	0.012221	-0.03154	-0.07146
-0.10949	-0.10279	-0.09266	-0.07816	-0.06102	-0.05634	-0.05396	-0.05312
-0.05186	-0.04482	-0.03665	-0.02884	-0.0226	-0.03161	-0.04115	-0.04994
-0.05751	-0.04930	-0.04134	-0.03444	-0.02901	-0.02868	-0.02969	-0.03141
-0.03282	-0.03490	-0.03582	-0.03693	-0.03956	-0.04051	-0.04046	-0.03763
-0.03246	-0.02117	-0.01151	-0.00375	0.002562	0.005789	0.007585	0.008365
0.009244	0.015969	0.02593	0.040236	0.05842	0.07673	0.093955	0.10917
0.12307	0.11644	0.1067	0.091541	0.070847	0.049975	0.0298	0.012654
-0.00079	0.000932	0.005904	0.013904	0.024355	0.024144	0.022504	0.017131
0.007116	-0.00226	-0.01408	-0.02731	-0.04134	-0.05819	-0.07352	-0.08570
-0.09358	-0.09524	-0.09337	-0.08964	-0.08561	-0.08237	-0.08017	-0.07965
-0.08142	-0.08053	-0.08115	-0.08304	-0.08661	-0.08673	-0.08725	-0.08674
-0.08478	-0.08055	-0.07556	-0.06978	-0.06386	-0.05972	-0.05763	-0.05651
-0.05400	-0.04640	-0.03490	-0.02035	-0.00452	0.012612	0.028989	0.045797
0.063917	0.078834	0.090114	0.095953	0.098273	0.066872	0.037276	0.008423
-0.02080	-0.01728	-0.01071	-0.00053	0.011237	0.016062	0.018338	0.018401
0.017227	0.017891	0.017939	0.016807	0.014011	0.010818	0.008321	0.008513
0.01194	0.021353	0.031507	0.041981	0.0527	0.060793	0.066634	0.06992
0.072254	0.056813	0.041671	0.024753	0.005082	-0.00654	-0.01628	-0.02283
-0.02723	-0.01923	-0.01105	-0.00221	0.007303	0.010202	0.011305	0.009725
0.005525	0.001819	-0.00243	-0.00631	-0.00944	-0.01241	-0.01425	-0.01438

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction SHAKE free field input
 (8) Originator E. O. Weiner

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4096      SY-101 NH/PFP SHAKE
2      Read soil profile data.
1 11 11  ARH-R-172 APP
1 2 1 8.0 2423. 0.05 0.1080 146.5 1.
2 2 1 2.0 2850. 0.05 0.1270 113.7 1.
3 2 1 3.1 2850. 0.05 0.1270 98.7 1.
4 2 1 5.6 2901. 0.05 0.1080 85.6 1.
5 2 1 9.5 3421. 0.05 0.1080 83.8 1.
6 2 1 9.5 4058. 0.05 0.1080 84.3 1.
7 2 1 9.5 4348. 0.05 0.1270 79.1 1.
8 2 1 9.5 4560. 0.05 0.1150 74.5 1.
9 2 1 43.3 4830. 0.05 0.1080 64.7 1.
10 2 1 50.0 5410. 0.05 0.1080 57.8 1.
11      .142 4500.
3      Assign motion to surface
1
8      Material property strain dependence
2 .1 10 100.
11 100. CLAY -- N REACTOR IMPELL PHASE II 1985, STIFFNESS
.0001 .000316 .001 .00316 .01 .0316 .1 .316
1. 3.16 10.
1.0 .99 .98 .94 .88 .80 .69 .60
.54 .51 .50
11 100. CLAY -- N REACTOR IMPELL PHASE II 1985, DAMPING
.0001 .000316 .001 .00316 .01 .0316 .1 .316
1. 3.16 10.
1.2 1.2 1.3 3.1 3.4 5.2 7.6 11.
15. 15. 15.
11 100. SAND -- SEED & IDRISS 1970, STIFFNESS
.0001 .000316 .001 .00316 .01 .0316 .1 .316
1. 3.16 10.
1.0 .99 .96 .89 .74 .53 .30 .15
.06 .06 .06
11 100. SAND -- SEED & IDRISS 1970, DAMPING
.0001 .000316 .001 .00316 .01 .0316 .1 .316
1. 3.16 10.
0.5 0.9 1.7 3.1 5.6 9.7 15.5 21.
25. 25. 25.
1      Read input motion
2000 4096 .005 Newmark-Hall 0.2g SDC4.1 Rev 11, PFP
.200 33.
0.014141 0.015267 0.015951 0.016336 0.016758 0.016979 0.016954 0.016629
0.016387 0.014176 0.012741 0.012053 0.012072 0.013171 0.014876 0.017093
0.01984 0.021099 0.023141 0.026073 0.029939 0.037493 0.045393 0.05311
0.06014 0.06091 0.059508 0.055398 0.049001 0.037907 0.026378 0.014272
  
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DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
(7) Subject Soil-Structure Interaction SHAKE free field input
(8) Originator E. O. Weiner

0.001441	-0.00677	-0.01338	-0.01761	-0.01990	-0.01439	-0.00808	-0.00104
0.006429	0.012848	0.018841	0.024301	0.029027	0.034387	0.038556	0.041552
0.043204	0.042491	0.039895	0.03584	0.031054	0.026087	0.021089	0.016132
0.01135	0.006611	0.002235	-0.00184	-0.00566	-0.00886	-0.01144	-0.01315
-0.01381	-0.01283	-0.00985	-0.00415	0.004511	0.016791	0.030787	0.045693
0.060681	0.073881	0.085265	0.094298	0.10078	0.10586	0.10828	0.10854
0.10743	0.099773	0.091325	0.082144	0.072774	0.060798	0.049628	0.039169
0.029597	0.022669	0.017903	0.015289	0.014354	0.017219	0.02086	0.024616
0.027679	0.030691	0.032532	0.033329	0.033026	0.029921	0.026439	0.02358
0.021906	0.023391	0.025428	0.027969	0.03118	0.035398	0.039848	0.044269
0.048323	0.053083	0.056118	0.057932	0.059805	0.045853	0.030447	0.012098
-0.00802	-0.04041	-0.07013	-0.09856	-0.12732	-0.13763	-0.14449	-0.14655
-0.14507	-0.13217	-0.11847	-0.10416	-0.08990	-0.07835	-0.06819	-0.05979
-0.05395	-0.04765	-0.04442	-0.04291	-0.04212	-0.04422	-0.04824	-0.05424
-0.06112	-0.06946	-0.07723	-0.08476	-0.09199	-0.09783	-0.10186	-0.10388
-0.10425	-0.10403	-0.10263	-0.10052	-0.09864	-0.09453	-0.09178	-0.09016
-0.08947	-0.08805	-0.08727	-0.08651	-0.08492	-0.08225	-0.07819	-0.07344
-0.06886	-0.06435	-0.06082	-0.05857	-0.05807	-0.05861	-0.05987	-0.06021
-0.05828	-0.05260	-0.04369	-0.03127	-0.01547	0.002165	0.020401	0.037552
0.052543	0.065438	0.074942	0.080607	0.082711	0.081845	0.080291	0.079037
0.078263	0.078916	0.080944	0.085248	0.091849	0.098656	0.10578	0.11357
0.12335	0.13698	0.15169	0.16498	0.17556	0.18212	0.18122	0.17632
0.17065	0.16412	0.15822	0.15447	0.15272	0.2	0.14403	0.13623
0.13238	0.13297	0.13592	0.13886	0.14099	0.14301	0.1462	0.15176
0.15391	0.15342	0.15132	0.14713	0.14372	0.09985	0.05871	0.015343
-0.03387	-0.05317	-0.07290	-0.0917	-0.11191	-0.10793	-0.10694	-0.10617
-0.1034	-0.11177	-0.11725	-0.12081	-0.1245	-0.11521	-0.10683	-0.09761
-0.08761	-0.08534	-0.08618	-0.08861	-0.08937	-0.08298	-0.07344	-0.06224
-0.0501	-0.04108	-0.03075	-0.01980	-0.00955	0.001083	0.010458	0.019357
0.027549	0.032723	0.034824	0.035142	0.036391	0.039454	0.045406	0.052987
0.060168	0.068784	0.074023	0.078624	0.087285	0.076087	0.066732	0.053456
0.035166	-0.01344	-0.05908	-0.10375	-0.15238	-0.14338	-0.13559	-0.12458
-0.11021	-0.11389	-0.11867	-0.12308	-0.1247	-0.10939	-0.09127	-0.07275
-0.05666	-0.04892	-0.04437	-0.03996	-0.03384	-0.02184	-0.01246	-0.00624
-0.00062	-0.01846	-0.03492	-0.05171	-0.06869	-0.08951	-0.10701	-0.12281
-0.13979	-0.13467	-0.12981	-0.12317	-0.11463	-0.1114	-0.10978	-0.11091
-0.11487	-0.11704	-0.1195	-0.12092	-0.12082	-0.11817	-0.11247	-0.102
-0.08590	-0.06542	-0.04249	-0.01931	0.002564	0.022328	0.038801	0.051288
0.059384	0.062803	0.062503	0.059657	0.055638	0.052055	0.049549	0.048618
0.048914	0.048999	0.048277	0.046563	0.04408	0.040725	0.035995	0.030222
0.024863	0.013962	0.005742	0.000264	-0.00218	-0.00194	0.001463	0.006745
0.012477	0.016899	0.020495	0.022402	0.021659	0.02228	0.020458	0.016544
0.010334	0.006712	0.000955	-0.00629	-0.01483	-0.02664	-0.04011	-0.05471
-0.06936	-0.08042	-0.08842	-0.09207	-0.09103	-0.08632	-0.07788	-0.06579
-0.05034	-0.03170	-0.01282	0.004337	0.018346	0.027584	0.032927	0.035129

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction SHAKE free field input
 (8) Originator E. O. Weiner

0.035029	0.033055	0.028724	0.022628	0.016595	-0.00261	-0.01996	-0.03684
-0.05421	-0.06420	-0.07293	-0.08025	-0.08700	-0.08468	-0.08129	-0.07542
-0.06649	-0.05902	-0.04980	-0.03985	-0.03013	-0.01718	-0.00521	0.005792
0.015197	0.020207	0.022028	0.021871	0.021967	0.025485	0.031382	0.038908
0.04692	0.053524	0.059644	0.065705	0.071684	0.076125	0.07762	0.076248
0.074536	0.05535	0.039579	0.025241	0.009967	0.010209	0.009576	0.008196
0.005200	0.006306	0.006404	0.007003	0.008499	0.003900	-0.00044	-0.00319
-0.00263	0.011082	0.028327	0.047776	0.067487	0.076787	0.083788	0.08993
0.096717	0.11244	0.12395	0.12937	0.13129	0.080407	0.031112	-0.01958
-0.07339	-0.08886	-0.09833	-0.10028	-0.09909	-0.08579	-0.07621	-0.06714
-0.05513	-0.04665	-0.03730	-0.03029	-0.02751	-0.02119	-0.01464	-0.00384
0.012131	0.029471	0.043533	0.052974	0.060981	0.036901	0.015012	-0.00773
-0.03294	-0.03904	-0.04177	-0.04020	-0.03673	-0.02186	-0.00852	0.004418
0.0179	0.024227	0.02967	0.032661	0.031634	0.032906	0.029738	0.023559
0.015677	0.003860	-0.00842	-0.01999	-0.02933	-0.03323	-0.03310	-0.02856
-0.01972	-0.01149	-0.00233	0.005643	0.011447	0.00577	-0.00184	-0.01129
-0.02212	-0.01983	-0.01591	-0.00953	-0.00127	0.001995	0.003935	0.003403
-0.00011	-0.00307	-0.00871	-0.01671	-0.02671	-0.03925	-0.05089	-0.05927
-0.06291	-0.05969	-0.05316	-0.04473	-0.03569	-0.02868	-0.02342	-0.02022
-0.01865	-0.01930	-0.02127	-0.02470	-0.02913	-0.04095	-0.05198	-0.06186
-0.07035	-0.07519	-0.07830	-0.08020	-0.08141	-0.08123	-0.07968	-0.07628
-0.07098	-0.05606	-0.03957	-0.02218	-0.00506	0.007921	0.019003	0.027953
0.034438	0.041506	0.046225	0.049089	0.049908	0.046512	0.040442	0.03343
0.027883	0.027035	0.029172	0.03389	0.041106	0.04952	0.061157	0.07639
0.094819	0.11441	0.13263	0.14769	0.15966	0.14614	0.12965	0.10874
0.083204	0.068622	0.05417	0.040987	0.028477	0.025148	0.022598	0.022282
0.024985	0.027227	0.030343	0.032935	0.034565	0.030174	0.026041	0.022168
0.017938	0.016762	0.015419	0.014815	0.015315	0.022082	0.028856	0.035255
0.041109	0.042755	0.042888	0.04091	0.03676	0.034526	0.031992	0.030062
0.029073	0.027056	0.026716	0.028752	0.033201	0.041554	0.050064	0.057733
0.063946	0.066209	0.066508	0.065519	0.064557	0.067024	0.07117	0.076589
0.082474	0.086258	0.08989	0.093516	0.097018	0.1021	0.10684	0.1117
0.11675	0.11539	0.11311	0.1109	0.11093	0.11773	0.12728	0.13713
0.14465	0.14301	0.13694	0.12797	0.1187	0.10605	0.093288	0.078541
0.06236	0.019662	-0.01860	-0.05337	-0.08754	-0.07648	-0.06428	-0.04955
-0.03395	-0.02829	-0.02663	-0.02676	-0.02495	-0.02062	-0.01378	-0.00713
-0.00266	-0.01363	-0.02645	-0.03979	-0.05227	-0.05946	-0.06618	-0.07424
-0.08426	-0.09859	-0.11135	-0.122	-0.13157	-0.12284	-0.11394	-0.10477
-0.09614	-0.09254	-0.08991	-0.08686	-0.08244	-0.07230	-0.06257	-0.05487
-0.05070	-0.05323	-0.05960	-0.06801	-0.07609	-0.07743	-0.07401	-0.06453
-0.04932	-0.03246	-0.01348	0.006791	0.027902	0.051105	0.071285	0.086202
0.094841	0.095445	0.092598	0.089683	0.089377	0.091582	0.094163	0.095724
0.097514	0.066759	0.037868	0.008212	-0.02363	-0.02982	-0.03268	-0.03088
-0.02619	-0.01290	-0.00030	0.011912	0.02407	0.031598	0.037897	0.041589
0.041339	0.042843	0.043216	0.045616	0.050674	0.05447	0.055657	0.054355

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
(7) Subject Soil-Structure Interaction SHAKE free field input
(8) Originator E. O. Weiner

0.053227	0.054563	0.059149	0.066133	0.074023	0.083818	0.092539	0.10203
0.11488	0.11069	0.10537	0.094796	0.079889	0.032174	-0.01139	-0.05277
-0.09617	-0.09225	-0.08867	-0.08276	-0.07531	-0.07619	-0.08054	-0.08780
-0.09560	-0.0972	-0.09481	-0.08883	-0.08180	-0.07279	-0.06595	-0.05875
-0.04846	-0.05334	-0.05919	-0.06945	-0.08405	-0.10085	-0.11564	-0.12816
-0.14011	-0.1329	-0.12606	-0.11887	-0.11139	-0.11235	-0.11335	-0.11386
-0.11353	-0.10542	-0.09608	-0.08561	-0.07526	-0.06986	-0.06785	-0.06855
-0.07000	-0.06852	-0.06568	-0.06155	-0.05614	-0.05042	-0.04323	-0.03466
-0.02544	-0.02164	-0.02115	-0.02528	-0.03327	-0.0521	-0.07075	-0.08837
-0.10451	-0.10893	-0.11035	-0.10883	-0.10528	-0.09990	-0.09443	-0.08957
-0.08596	-0.08424	-0.08316	-0.08184	-0.08008	-0.07212	-0.06414	-0.05577
-0.04678	-0.04120	-0.03565	-0.03027	-0.02551	-0.01614	-0.00953	-0.00476
0.000692	-0.01313	-0.02575	-0.03988	-0.05661	-0.07366	-0.08937	-0.10374
-0.11873	-0.11218	-0.1066	-0.09993	-0.09102	-0.09302	-0.09389	-0.09401
-0.09315	-0.08085	-0.06618	-0.04918	-0.03115	-0.01855	-0.00758	0.002513
0.012931	0.027089	0.040969	0.053502	0.063995	0.070227	0.074561	0.077967
0.081409	0.083471	0.08483	0.084933	0.08422	0.074272	0.064652	0.055241
0.046218	0.039919	0.034246	0.02816	0.020858	0.013536	0.006871	0.001973
-0.00074	0.006960	0.017568	0.031079	0.046541	0.060089	0.073063	0.084823
0.094677	0.10454	0.11114	0.11448	0.11474	0.11085	0.10493	0.098458
0.092931	0.090137	0.088987	0.089124	0.090173	0.090831	0.091976	0.094029
0.09732	0.10146	0.10549	0.10904	0.11265	0.10442	0.095895	0.086295
0.076029	0.065527	0.056226	0.047249	0.037597	0.030555	0.024269	0.019299
0.015221	0.019518	0.024206	0.029277	0.034105	0.03714	0.038996	0.040187
0.040992	0.041947	0.04165	0.040298	0.038535	0.030978	0.022871	0.013961
0.004804	-0.00452	-0.01291	-0.02097	-0.02932	-0.03415	-0.03787	-0.03968
-0.03964	-0.03615	-0.03151	-0.02565	-0.01864	-0.01339	-0.00809	-0.00335
0.000392	0.004383	0.007077	0.008398	0.008426	0.009130	0.009417	0.009633
0.009852	0.010095	0.010663	0.011791	0.013383	0.017079	0.021072	0.025641
0.030691	0.035853	0.040536	0.045243	0.0508	0.056804	0.062874	0.068234
0.072837	0.0692	0.06468	0.058743	0.051496	0.044146	0.036834	0.029293
0.021075	0.011098	0.001494	-0.00726	-0.01536	-0.01307	-0.01022	-0.00669
-0.00300	-0.00103	-0.00018	0.000041	0.000295	-0.00094	-0.00323	-0.00733
-0.01308	-0.02691	-0.04092	-0.05483	-0.06841	-0.07458	-0.07880	-0.08052
-0.07994	-0.07680	-0.07201	-0.06527	-0.05633	-0.04545	-0.03340	-0.02113
-0.00959	0.001179	0.010516	0.018765	0.026148	0.031664	0.035157	0.03643
0.036136	0.028058	0.019568	0.010576	0.001349	-0.00488	-0.00978	-0.01332
-0.01592	-0.01624	-0.01575	-0.01430	-0.01202	-0.00633	-0.00027	0.005914
0.01182	0.016294	0.019841	0.022758	0.025442	0.026338	0.026868	0.026897
0.026664	0.025366	0.024709	0.024764	0.025334	0.028922	0.032531	0.035888
0.038603	0.039665	0.039326	0.037465	0.034086	0.029761	0.024158	0.017529
0.010091	0.001852	-0.00691	-0.01580	-0.02425	-0.03476	-0.04464	-0.05383
-0.06169	-0.06890	-0.07346	-0.07573	-0.07622	-0.07318	-0.06844	-0.06242
-0.05615	-0.04639	-0.03798	-0.03097	-0.02535	-0.02369	-0.02349	-0.02461
-0.02698	-0.02992	-0.03417	-0.03948	-0.04539	-0.05167	-0.05795	-0.06407

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction SHAKE free field input
 (8) Originator E. O. Weiner

-0.06974	-0.07354	-0.07566	-0.07549	-0.07286	-0.06658	-0.05882	-0.04979
-0.03941	-0.03561	-0.03135	-0.02759	-0.02486	-0.01820	-0.01204	-0.00625
-0.00109	0.003697	0.007425	0.010325	0.012843	0.013481	0.014247	0.015016
0.015737	0.017693	0.02044	0.024309	0.029109	0.034502	0.039644	0.044201
0.048098	0.052596	0.056387	0.059295	0.061179	0.061862	0.062094	0.062243
0.062316	0.063372	0.064123	0.064845	0.065809	0.066497	0.067618	0.069378
0.071833	0.078101	0.084593	0.091415	0.09854	0.10109	0.1018	0.1002
0.097194	0.084165	0.070865	0.05623	0.039816	0.024856	0.010722	-0.00210
-0.01430	-0.01793	-0.02136	-0.024	-0.02568	-0.02752	-0.02880	-0.02932
-0.02891	-0.02591	-0.02220	-0.01773	-0.01256	-0.01176	-0.01154	-0.01224
-0.01353	-0.01728	-0.02140	-0.02643	-0.03245	-0.03848	-0.04404	-0.04905
-0.05389	-0.05438	-0.05431	-0.05339	-0.05193	-0.04783	-0.04361	-0.03900
-0.03417	-0.03035	-0.02748	-0.02551	-0.02415	-0.02287	-0.02204	-0.02130
-0.02009	-0.01861	-0.01603	-0.01206	-0.00647	-0.00039	0.006403	0.013296
0.020023	0.020572	0.020168	0.018274	0.01506	0.011525	0.008080	0.004551
0.000417	-0.00091	-0.00252	-0.00405	-0.00572	-0.00562	-0.00659	-0.00868
-0.01162	-0.01857	-0.02548	-0.03204	-0.03804	-0.04040	-0.04160	-0.04147
-0.04025	-0.03825	-0.03596	-0.03334	-0.03021	-0.02626	-0.02216	-0.01825
-0.01477	-0.01221	-0.01017	-0.00857	-0.00743	-0.00615	-0.00562	-0.00574
-0.00624	-0.00939	-0.01278	-0.01629	-0.01954	-0.02382	-0.02735	-0.03055
-0.03375	-0.03589	-0.03753	-0.03849	-0.03892	-0.03456	-0.02954	-0.02373
-0.01754	-0.01140	-0.00619	-0.00164	0.002728	0.004317	0.005331	0.005769
0.006400	0.002951	0.001074	0.000612	0.001348	0.006142	0.011729	0.017398
0.022383	0.026039	0.028443	0.029454	0.028987	0.028981	0.028317	0.027437
0.026411	0.026246	0.026071	0.026206	0.026748	0.027034	0.027339	0.027707
0.028357	0.0313	0.034996	0.03965	0.045328	0.051169	0.057603	0.064293
0.07084	0.077453	0.083191	0.088041	0.092148	0.093507	0.094159	0.094174
0.093704	0.090788	0.087033	0.082189	0.076541	0.072163	0.068415	0.065311
0.062382	0.06216	0.062407	0.064006	0.067308	0.072247	0.077339	0.082138
0.086884	0.083255	0.079661	0.075602	0.070739	0.071412	0.071295	0.070537
0.069362	0.062592	0.0552	0.046848	0.037748	0.028864	0.020659	0.012938
0.005016	0.000381	-0.00426	-0.00828	-0.01162	-0.01648	-0.02196	-0.02838
-0.03546	-0.04042	-0.04491	-0.04883	-0.05226	-0.05588	-0.05865	-0.06028
-0.06079	-0.05902	-0.05658	-0.05366	-0.05041	-0.0478	-0.04481	-0.04158
-0.03867	-0.03059	-0.02373	-0.01756	-0.01167	-0.00887	-0.00739	-0.00706
-0.00674	-0.01457	-0.02161	-0.02860	-0.03561	-0.04030	-0.04336	-0.04500
-0.04613	-0.04374	-0.04129	-0.03841	-0.03505	-0.02845	-0.02186	-0.01541
-0.00927	-0.00682	-0.00518	-0.00440	-0.00448	-0.00341	-0.00325	-0.00388
-0.00515	-0.00845	-0.01210	-0.01589	-0.01952	-0.02197	-0.02422	-0.02655
-0.02920	-0.03296	-0.03683	-0.04039	-0.04326	-0.04538	-0.04690	-0.04810
-0.04916	-0.05123	-0.05345	-0.05622	-0.05987	-0.06281	-0.06649	-0.07071
-0.07526	-0.07881	-0.08129	-0.08181	-0.07991	-0.07493	-0.06779	-0.05886
-0.04884	-0.03832	-0.02851	-0.01987	-0.01261	-0.00659	-0.00249	-0.00024
0.000672	-0.00152	-0.00395	-0.00625	-0.00801	-0.00855	-0.00786	-0.00594
-0.00306	-0.00057	0.002212	0.00536	0.009155	0.014183	0.019574	0.024668

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction SHAKE free field input
 (8) Originator E. O. Weiner

0.028872	0.030557	0.030886	0.029947	0.028133	0.027382	0.026915	0.026747
0.026391	0.022266	0.017537	0.012948	0.009414	0.011728	0.015408	0.0199
0.024624	0.026691	0.029055	0.032383	0.036813	0.045991	0.053356	0.058106
0.061153	0.041923	0.022146	0.000590	-0.02298	-0.03574	-0.04667	-0.05541
-0.06323	-0.06385	-0.06400	-0.06258	-0.05924	-0.05490	-0.05034	-0.04667
-0.04472	-0.04221	-0.04112	-0.04072	-0.04087	-0.04217	-0.04473	-0.04812
-0.05149	-0.05323	-0.05393	-0.05360	-0.05256	-0.05181	-0.05127	-0.05123
-0.05190	-0.05301	-0.05491	-0.05713	-0.05889	-0.05970	-0.05842	-0.05427
-0.04689	-0.03655	-0.02457	-0.01213	-0.00012	0.00738	0.012905	0.015822
0.01617	0.013755	0.010217	0.006000	0.001470	-0.00082	-0.00180	-0.00102
0.001088	0.006478	0.011612	0.016534	0.021608	0.024645	0.027565	0.030163
0.032853	0.033613	0.035518	0.037889	0.039692	0.045337	0.050486	0.055492
0.059876	0.064431	0.067768	0.070851	0.074233	0.076867	0.078498	0.0796
0.0819	0.087804	0.097086	0.1086	0.11982	0.13014	0.13569	0.13769
0.13872	0.12383	0.1067	0.085081	0.060124	0.012221	-0.03154	-0.07146
-0.10949	-0.10279	-0.09266	-0.07816	-0.06102	-0.05634	-0.05396	-0.05312
-0.05186	-0.04482	-0.03665	-0.02884	-0.0226	-0.03161	-0.04115	-0.04994
-0.05751	-0.04930	-0.04134	-0.03444	-0.02901	-0.02868	-0.02969	-0.03141
-0.03282	-0.03490	-0.03582	-0.03693	-0.03956	-0.04051	-0.04046	-0.03763
-0.03246	-0.02117	-0.01151	-0.00375	0.002562	0.005789	0.007585	0.008365
0.009244	0.015969	0.02593	0.040236	0.05842	0.07673	0.093955	0.10917
0.12307	0.11644	0.1067	0.091541	0.070847	0.049975	0.0298	0.012654
-0.00079	0.000932	0.005904	0.013904	0.024355	0.024144	0.022504	0.017131
0.007116	-0.00226	-0.01408	-0.02731	-0.04134	-0.05819	-0.07352	-0.08570
-0.09358	-0.09524	-0.09337	-0.08964	-0.08561	-0.08237	-0.08017	-0.07965
-0.08142	-0.08053	-0.08115	-0.08304	-0.08661	-0.08673	-0.08725	-0.08674
-0.08478	-0.08055	-0.07556	-0.06978	-0.06386	-0.05972	-0.05763	-0.05651
-0.05400	-0.04640	-0.03490	-0.02035	-0.00452	0.012612	0.028989	0.045797
0.063917	0.078834	0.090114	0.095953	0.098273	0.066872	0.037276	0.008423
-0.02080	-0.01728	-0.01071	-0.00053	0.011237	0.016062	0.018338	0.018401
0.017227	0.017891	0.017939	0.016807	0.014011	0.010818	0.008321	0.008513
0.01194	0.021353	0.031507	0.041981	0.0527	0.060793	0.066634	0.06992
0.072254	0.056813	0.041671	0.024753	0.005082	-0.00654	-0.01628	-0.02283
-0.02723	-0.01923	-0.01105	-0.00221	0.007303	0.010202	0.011305	0.009725
0.005525	0.001819	-0.00243	-0.00631	-0.00944	-0.01241	-0.01425	-0.01438
-0.01256	-0.00616	0.001047	0.008402	0.015478	0.020231	0.024472	0.028513
0.032727	0.037288	0.042218	0.047633	0.053572	0.057638	0.061176	0.063692
0.064925	0.060608	0.053696	0.043918	0.032264	0.019275	0.007336	-0.00313
-0.01175	-0.01748	-0.01961	-0.01841	-0.01532	-0.00747	-0.00106	0.003104
0.004794	-0.00339	-0.01395	-0.02704	-0.04255	-0.05329	-0.06388	-0.07302
-0.08033	-0.07983	-0.07746	-0.07285	-0.06599	-0.05916	-0.05088	-0.04129
-0.03086	-0.01839	-0.00701	0.003390	0.013588	0.011024	0.007750	0.003070
-0.00261	-0.00330	-0.00291	-0.00162	-0.00022	0.004242	0.007870	0.010597
0.012417	0.009389	0.005219	-0.00030	-0.00698	-0.01383	-0.01969	-0.02351
-0.02495	-0.02409	-0.02131	-0.01689	-0.01113	-0.00093	0.009607	0.019839

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction SHAKE free field input
 (8) Originator E. O. Weiner

0.029333	0.038224	0.046418	0.053729	0.059815	0.065411	0.070334	0.074779
0.078061	0.081753	0.083301	0.083662	0.083697	0.083398	0.082539	0.081405
0.080635	0.080847	0.081717	0.083482	0.086621	0.090481	0.095105	0.099959
0.10508	0.10042	0.095925	0.091082	0.085759	0.078881	0.071588	0.063644
0.055429	0.046404	0.038935	0.032806	0.02736	0.032727	0.038975	0.046021
0.052783	0.056981	0.057948	0.055408	0.05014	0.03291	0.014721	-0.00465
-0.02537	-0.0383	-0.04958	-0.05772	-0.06281	-0.05883	-0.05366	-0.04739
-0.03995	-0.03358	-0.02688	-0.02030	-0.01415	-0.00620	0.001416	0.008986
0.016261	0.019097	0.02036	0.020307	0.019463	0.018825	0.017145	0.014755
0.01265	0.005708	-0.00050	-0.00638	-0.01156	-0.01718	-0.02121	-0.02460
-0.02837	-0.03063	-0.03304	-0.03532	-0.03757	-0.04016	-0.04280	-0.0454
-0.04794	-0.04971	-0.05108	-0.05173	-0.05174	-0.04891	-0.04655	-0.04481
-0.04339	-0.04530	-0.04776	-0.05140	-0.05645	-0.06312	-0.07045	-0.07832
-0.08667	-0.09507	-0.10299	-0.11011	-0.11655	-0.12101	-0.12452	-0.12685
-0.12833	-0.12435	-0.12065	-0.11723	-0.11394	-0.11212	-0.11029	-0.10828
-0.10583	-0.10053	-0.09404	-0.08588	-0.07601	-0.06871	-0.06102	-0.05319
-0.04495	-0.03877	-0.03244	-0.02657	-0.02158	-0.01569	-0.01094	-0.00709
-0.00360	-0.00300	-0.00290	-0.00413	-0.00665	-0.01016	-0.01187	-0.01145
-0.00990	0.000482	0.011943	0.025291	0.039875	0.051142	0.060003	0.066652
0.072342	0.079718	0.086291	0.091277	0.094522	0.095728	0.096315	0.096697
0.097009	0.094396	0.091645	0.089001	0.08675	0.07806	0.069304	0.030445

4					Strain compatible soil properties
1	5	5.		.65	
5					Time histories
1	5	9			
0	1	1			
1	1	1			
9					Response spectra
0	1				
1	0	1	1	4	
.07					
9					
1	1				
1	0	1	1	4	
.07					
9					
5	1				
1	0	1	1	4	
.07					
9					
9	1				
1	0	1	1	4	
.07					
0					Stop

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction SASSI single tank input
 (8) Originator E. O. Weiner

```
# USER=w91428
# QSUB -eo
# QSUB -lM 4.0Mw
# QSUB -lT 30:00
# site, point inp & nqs
set -x
ja
mkdir /tmp/w91428
tt=/tmp/w91428/tank
mkdir $tt
cd $tt
t=/w/w91428/tank
p=/tmp/sassi
/w/w91428/eaprogs/sassi/sassi.mk
rm output
nasa $t/site.inp >>output
ls -l | nasa >>output
cat <<'eof' >input
  1      SY-101 Qtr Model Seismic - site mode 1
 10  12      0
32.2
  1      8.0      108.0      810.4      1368.6      0.027      0.027
  2      2.0      127.0      777.5      1244.5      0.040      0.040
  3      3.1      127.0      758.1      1238.0      0.047      0.047
  4      5.6      108.0      806.4      1458.8      0.054      0.054
  5      9.5      108.0      851.0      1728.4      0.062      0.062
  6      9.5      108.0      908.4      2064.9      0.067      0.067
  7      9.5      127.0      833.2      1962.1      0.078      0.078
  8      9.5      115.0      863.0      2209.7      0.087      0.087
  9     43.3      108.0      861.4      2205.6      0.101      0.101
 10     50.0      108.0      910.1      2330.2      0.101      0.101
      142.0      4517.6      9945.0      0.101      0.101
      .005      4096
 12  20  31  41  53  70  90 113 139 164 205 266
  2      SY-101 Qtr Model Seismic - site mode 2
  1
      1
  X      1      2
  1  500
  1.      1.
  0      End
eof
$P/site <input >>output
cfs store fort.1:syl01/qm.1
cfs store fort.2:syl01/qm.2
```

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction SASSI single tank input
 (8) Originator E. O. Weiner

```
cat <<'eof' >input
  1      SY-101 Qtr Model Seismic - point3
  8      10.
  0      End
```

```
eof
$p/point3 <input >>output
cfs store fort.3:syl01/qm.3
ls -l | nasa >>output
ja -s | nasa >>output
ja -st
cfs store output:syl01/qmsite.out
```

```
# USER=w91428
# QSUB -eo
# QSUB -lM 3.6Mw
# QSUB -lT 30:00
# house nqs
set -x
ja
mkdir /tmp/w91428
tt=/tmp/w91428/tank
mkdir $tt
cd $tt
t=/w/w91428/tank
p=/tmp/sassi
/w/w91428/eaprogs/sassi/sassi.mk
rm output
nasa $t/house.inp >>output
ls -l | nasa >>output
cat <<'eof' >input
```

```
  1      SY-101 Quarter Model - house
      0      0      0
174 138  4  8  7  2  1  3
32.2
72.2
  1  1  1 10 31
  2 -1  1  9 31
C  1  1  1  1  1  1  0.  0. 15.5
C  2  1  1  1  1  1 11.  0. 15.5
C  3  13. 45. 15.5
C  4  1  1  1 11. 90. 15.5
C  5 21. 0. 15.5
C  9  1  1  1 21. 90. 15.5 1
C  7 23. 45. 15.5
C 10 31. 0. 15.5
```

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction SASSI single tank input
 (8) Originator E. O. Weiner

C 16	1	1	1			31.	90.	15.5	1
C 17						41.	0.	15.5	
C 23	1	1	1			41.	90.	15.5	1
C 5	1		1		1	21.	0.	15.5	
C 10	1		1		1	31.	0.	15.5	
C 17	1		1		1	41.	0.	15.5	
C 24						43.	0.	15.5	
C 30	1	1	1			43.	90.	15.5	1
C 24	1		1		1	43.	0.	15.5	
C 31	1	1	1	1	1	0.	0.	25.	
C 32	1		1	1	1	11.	0.	25.	
C 33			1	1	1	13.	45.	25.	
C 34	1	1	1	1	1	11.	90.	25.	
C 35			1	1	1	21.	0.	25.	
C 39	1	1	1	1	1	21.	90.	25.	1
C 37			1	1	1	23.	45.	25.	
C 40			1	1	1	31.	0.	25.	
C 46	1	1	1	1	1	31.	90.	25.	1
C 47						41.	0.	25.	
C 53	1	1	1			41.	90.	25.	1
C 35	1		1	1	1	21.	0.	25.	
C 40	1		1	1	1	31.	0.	25.	
C 47	1		1		1	41.	0.	25.	
C 54						41.	0.	22.3	
C 60	1	1	1			41.	90.	22.3	1
C 54	1		1		1	41.	0.	22.3	
C 61	1	1	1	1	1	0.	0.	34.5	
C 62	1		1	1	1	11.	0.	34.5	
C 63			1	1	1	13.	45.	34.5	
C 64	1	1	1	1	1	11.	90.	34.5	
C 65			1	1	1	21.	0.	34.5	
C 69	1	1	1	1	1	21.	90.	34.5	1
C 67			1	1	1	23.	45.	34.5	
C 70			1	1	1	31.	0.	34.5	
C 76	1	1	1	1	1	31.	90.	34.5	1
C 77						41.	0.	34.5	
C 83	1	1	1			41.	90.	34.5	1
C 65	1		1	1	1	21.	0.	34.5	
C 70	1		1	1	1	31.	0.	34.5	
C 77	1		1		1	41.	0.	34.5	
C 84						41.	0.	29.1	
C 90	1	1	1			41.	90.	29.1	1
C 84	1		1		1	41.	0.	29.1	
C 91	1	1	1	1	1	0.	0.	44.	
C 92	1		1	1	1	11.	0.	44.	

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____(7) Subject Soil-Structure Interaction SASSI single tank input(8) Originator E. O. Weiner

C 93			1	1	1	13.	45.	44.	
C 94	1	1	1	1	1	11.	90.	44.	
C 95			1	1	1	21.	0.	44.	
C 99	1	1	1	1	1	21.	90.	44.	1
C 97			1	1	1	23.	45.	44.	
C 100			1	1	1	31.	0.	44.	
C 106	1	1	1	1	1	31.	90.	44.	1
C 107						41.	0.	44.	
C 113	1	1	1			41.	90.	44.	1
C 95	1		1	1	1	21.	0.	44.	
C 100	1		1	1	1	31.	0.	44.	
C 107	1		1		1	41.	0.	44.	
C 114						41.	0.	35.2	
C 120	1	1	1			41.	90.	35.2	1
C 114	1		1		1	41.	0.	35.2	
C 121	1	1	1	1	1	0.	0.	53.5	
C 122	1		1	1	1	11.	0.	53.5	
C 123			1	1	1	13.	45.	53.5	
C 124	1	1	1	1	1	11.	90.	53.5	
C 125			1	1	1	21.	0.	53.5	
C 129	1	1	1	1	1	21.	90.	53.5	1
C 127			1	1	1	23.	45.	53.5	
C 130			1	1	1	31.	0.	53.5	
C 136	1	1	1	1	1	31.	90.	53.5	1
C 137						41.	0.	53.5	
C 143	1	1	1			41.	90.	53.5	1
C 125	1		1	1	1	21.	0.	53.5	
C 130	1		1	1	1	31.	0.	53.5	
C 137	1		1		1	41.	0.	53.5	
C 144						41.	0.	41.3	
C 150	1	1	1			41.	90.	41.3	1
C 144	1		1		1	41.	0.	41.3	
C 151	1	1	1		1	0.	0.	64.2	
C 152	1		1		1	11.	0.	64.2	
C 153						13.	45.	64.2	
C 154	1	1	1			11.	90.	64.2	
C 155						21.	0.	62.2	
C 159	1	1	1			21.	90.	62.2	1
C 157						23.	45.	62.2	
C 160						31.	0.	59.1	
C 166	1	1	1			31.	90.	59.1	1
C 155	1		1		1	21.	0.	62.2	
C 160	1		1		1	31.	0.	59.1	
C 167						41.	0.	47.4	
C 173	1	1	1			41.	90.	47.4	1

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____(7) Subject Soil-Structure Interaction SASSI single tank input(8) Originator E. O. Weiner

C 167		1		1		1		41.		0.		47.4		
C 174	1	1	1	1	1	1		0.		0.		65.2		
138														
1	53	-1	61	83	-1	91	113	-1	121	143	-1	151	166	-1
1		8.0		108.0		810.4		1368.6		0.027		0.027		
2		2.0		127.0		777.5		1244.5		0.040		0.040		
3		3.1		127.0		758.1		1238.0		0.047		0.047		
4		5.6		108.0		806.4		1458.8		0.054		0.054		
5		9.5		108.0		851.0		1728.4		0.062		0.062		
6		9.5		108.0		908.4		2064.9		0.067		0.067		
7		9.5		127.0		833.2		1962.1		0.078		0.078		
8		9.5		115.0		863.0		2209.7		0.087		0.087		
1	80	0	-1											
1	2	3	4	1	32	33	34	31	3	-1				
2	5	6	3	2	35	36	33	32	3	-1				
3	6	7	8	3	36	37	38	33	3	-1				
4	8	9	4	3	38	39	34	33	3	-1				
5	10	11	6	5	40	41	36	35	3	-1.				
6	11	12	6	6	41	42	36	36	3	-1				
7	12	13	7	6	42	43	37	36	3	-1				
8	13	14	8	7	43	44	38	37	3	-1				
9	14	15	8	8	44	45	38	38	3	-1				
10	15	16	9	8	45	46	39	38	3	-1				
11	17	18	11	10	47	48	41	40	3	-1				
16	22	23	16	15	52	53	46	45	3	-1				
17	32	33	34	31	62	63	64	61	3	-1				
18	35	36	33	32	65	66	63	62	3	-1				
19	36	37	38	33	66	67	68	63	3	-1				
20	38	39	34	33	68	69	64	63	3	-1				
21	40	41	36	35	70	71	66	65	3	-1				
22	41	42	36	36	71	72	66	66	3	-1				
23	42	43	37	36	72	73	67	66	3	-1				
24	43	44	38	37	73	74	68	67	3	-1				
25	44	45	38	38	74	75	68	68	3	-1				
26	45	46	39	38	75	76	69	68	3	-1				
27	47	48	41	40	77	78	71	70	3	-1				
32	52	53	46	45	82	83	76	75	3	-1				
33	62	63	64	61	92	93	94	91	3	-1				
34	65	66	63	62	95	96	93	92	3	-1				
35	66	67	68	63	96	97	98	93	3	-1				
36	68	69	64	63	98	99	94	93	3	-1				
37	70	71	66	65	100	101	96	95	3	-1				
38	71	72	66	66	101	102	96	96	3	-1				
39	72	73	67	66	102	103	97	96	3	-1				
40	73	74	68	67	103	104	98	97	3	-1				

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____

(7) Subject Soil-Structure Interaction SASSI single tank input

(8) Originator E. O. Weiner

41	74	75	68	68	104	105	98	98	3	-1
42	75	76	69	68	105	106	99	98	3	-1
43	77	78	71	70	107	108	101	100	3	-1
48	82	83	76	75	112	113	106	105	3	-1
49	92	93	94	91	122	123	124	121	3	-1
50	95	96	93	92	125	126	123	122	3	-1
51	96	97	98	93	126	127	128	123	3	-1
52	98	99	94	93	128	129	124	123	3	-1
53	100	101	96	95	130	131	126	125	3	-1
54	101	102	96	96	131	132	126	126	3	-1
55	102	103	97	96	132	133	127	126	3	-1
56	103	104	98	97	133	134	128	127	3	-1
57	104	105	98	98	134	135	128	128	3	-1
58	105	106	99	98	135	136	129	128	3	-1
59	107	108	101	100	137	138	131	130	3	-1
64	112	113	106	105	142	143	136	135	3	-1
65	122	123	124	121	152	153	154	151	3	-1
66	125	126	123	122	155	156	153	152	3	-1
67	126	127	128	123	156	157	158	153	3	-1
68	128	129	124	123	158	159	154	153	3	-1
69	130	131	126	125	160	161	156	155	3	-1
70	131	132	126	126	161	162	156	156	3	-1
71	132	133	127	126	162	163	157	156	3	-1
72	133	134	128	127	163	164	158	157	3	-1
73	134	135	128	128	164	165	158	158	3	-1
74	135	136	129	128	165	166	159	158	3	-1
75	137	138	131	130	137	138	161	160	3	-1
80	142	143	136	135	142	143	166	165	3	-1

3	62	1	-1							
1	432.e6	.2			144.		.04		.04	
1	2	3	4	1	1		2.			
2	5	6	3	2	1		1.			
3	6	7	8	3	1		1.			
4	8	9	4	3	1		1.			
5	10	11	6	5	1		1.			
6	11	12	6		1		1.			
7	12	13	7	6	1		1.			
8	13	14	8	7	1		1.			
9	14	15	8		1		1.			
10	15	16	9	8	1		1.			
11	17	18	11	10	1		2.			
16	22	23	16	15	1		2.			
17	24	25	18	17	1		2.			
22	29	30	23	22	1		2.			
23	17	47	48	18	1		1.5			

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction SASSI single tank input
 (8) Originator E. O. Weiner

28	22	52	53	23	1	1.5		
29	47	77	78	48	1	1.5		
34	52	82	83	53	1	1.5		
35	77	107	108	78	1	1.5		
40	82	112	113	83	1	1.5		
41	107	137	138	108	1	2.5		
46	112	142	143	113	1	2.5		
47	152	153	154	151	1	1.25		
48	155	156	153	152	1	1.25		
49	156	157	158	153	1	1.25		
50	158	159	154	153	1	1.25		
51	160	161	156	155	1	1.25		
52	161	162	156		1	1.25		
53	162	163	157	156	1	1.25		
54	163	164	158	157	1	1.25		
55	164	165	158		1	1.25		
56	165	166	159	158	1	1.25		
57	137	138	161	160	1	2.5		
62	142	143	166	165	1	2.5		
3	36	1	-1					
1	4320.e6	.3			0.	.02	.02	
1	17	54	55	18	1	.0217		
6	22	59	60	23	1	.0217		
7	54	84	85	55	1	.0217		
12	59	89	90	60	1	.0217		
13	84	114	115	85	1	.0217		
18	89	119	120	90	1	.0217		
19	114	144	145	115	1	.0217		
24	119	149	150	120	1	.0217		
25	144	167	168	145	1	.0217		
30	149	172	173	150	1	.0217		
31	167	137	138	168	1	.0217		
36	172	142	143	173	1	.0217		
2	6	1	1	-1				
1	4320e6	.3						
1	3.	0.			0.	.0015	.000625	.0009
1	84	85	114	1	1			
6	89	90	120	1	1			
84	0	487.		487.	487.			
85	0	974.		974.	974.			
86	0	974.		974.	974.			
87	0	974.		974.	974.			
88	0	974.		974.	974.			
89	0	974.		974.	974.			
90	0	487.		487.	487.			

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction SASSI single tank input
 (8) Originator E. O. Weiner

0 End

```
eof
$P/house <input >>output
cfs store fort.4:syl01/qm.4
ls -l | nasa >>output
ja -s | nasa >>output
ja -st
cfs store output:syl01/qmhouse.out
```

```
# USER=w91428
# QSUB -eo
# QSUB -lM 3.6Mw
# QSUB -lT 30:00
# analys inp & nqs, no tape5/6 save
set -x
ja
mkdir /tmp/w91428
tt=/tmp/w91428/tank
mkdir $tt
cd $tt
t=/w/w91428/tank
p=/tmp/sassi
/w/w91428/eaprogs/sassi/sassi.mk
rm output
nasa $t/analys.inp >>output
cfs get fort.1:syl01/qm.1
cfs get fort.3:syl01/qm.3
cfs get fort.4:syl01/qm.4
ls -l | nasa >>output
$P/analys <<'eof' >>output
  1      SY-101 Qtr Model Seismic - analys mode 1
  1      1      1      0
  0.      0.      0.
0 End
```

```
eof
#cfs store fort.95:syl01/qm.5
#cfs store fort.96:syl01/qm.6
cfs store fort.8:syl01/qm.8
ls -l | nasa >>output
ja -s | nasa >>output
ja -st
cfs store output:syl01/qmanalys.out
```

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
(7) Subject Soil-Structure Interaction SASSI single tank input
(8) Originator E. O. Weiner

```
# USER=w91428
# QSUB -eo
# QSUB -lM 3.6Mw
# QSUB -lT 30:00
# motion, stress inp & nqs
set -x
ja
mkdir /tmp/w91428
tt=/tmp/w91428/tank
mkdir $tt
cd $tt
t=/w/w91428/tank
p=/tmp/sassi
/w/w91428/eaprogs/sassi/sassi.mk
rm output
nasa $t/motion.inp >>output
cfs get fort.8:syl01/qm.8
ls -l | nasa >>output
rm input
cat <<'eof' >>input
  1      SY-101 Qtr Model Seismic - motion
  1      8      1      0      10.
151      010101      000001      000001
137      010101      000001      000001
143      010101      000001      000001
  84      110101      000001      000001
  90      010101      000001      000001
  17      010101      000001      000001
  23      010101      000001      000001
   1      010101      000001      000001

      .07
4096 2000      .005      1.1
eof
cat $t/pfphist.dat >>input
cat <<'eof' >>input
  0      End
eof
$p/motion <input >>output
cfs store fort.12:syl01/qm.12
rm input
cat <<'eof' >>input
  1      SY-101 Qtr Model Seismic - stress
  2      0      0
  3      1      15
```

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
(7) Subject Soil-Structure Interaction SASSI single tank input
(8) Originator E. O. Weiner

```
11      111111
16      111111
17      111111
22      111111
23      111111
28      111111
29      111111
34      111111
35      111111
40      111111
41      111111
46      111111
57      111111
62      111111
47      111111
  3      2      4
  1      111111
  6      111111
31      111111
36      111111
4096 2000      .005      1.1
eof
cat $t/pfphist.dat >>input
cat <<'eof' >>input
  0      End
eof
$P/stress <input >>output
ls -l | nasa >>output
ja -s | nasa >>output
ja -st
cfs store output:syl01/qmmotion.out
```

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APPENDIX C
COMPUTER OUTPUT

APPENDIX C
COMPUTER OUTPUT

ANSYS Output	C-3
FLUSH Free-Field Spectra (single and double tanks)	C-5
FLUSH Tank Spectra (single and double tanks)	C-11
FLUSH Soil Pressure (single and double tanks)	C-19
SHAKE Free-Field Spectra (single tank)	C-25
SASSI Spectra (single tank)	C-27

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
(7) Subject Soil-Structure Interaction ANSYS output
(8) Originator E. O. Weiner

ANSYS 4.4
AUG 26 1991
17:07:27
PLOT NO. 1
POST1 DISPL.
STEP=1
ITER=30
FREQ=6.457
DMX =0.209398
^DSCA=-150
ZV =1
^DIST=300
XF =225
YF =230.4

SY-101 Tank Primary Liner Model, Hz1, Full

DESIGN CALCULATION

- (4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction ANSYS output
 (8) Originator E. O. Weiner

ANSYS 4.4
 AUG 26 1991
 16:58:49
 PLOT NO. 1
 PREP7 ELEMENTS
 ELEM NUM
 BC SYMBOLS
 ZV = 1
 ^DIST=300
 XF = 225
 YF = 230.4

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction FLUSH free field spectra
 (8) Originator R. A. Giller

DESIGN CALCULATION

- (4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction FLUSH free field spectra
 (8) Originator R. A. Giller

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
(7) Subject Soil-Structure Interaction FLUSH free field spectra
(8) Originator R. A. Giller

DESIGN CALCULATION

- (4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
(7) Subject Soil-Structure Interaction FLUSH free field spectra
(8) Originator R. A. Giller

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
(7) Subject Soil-Structure Interaction FLUSH free field spectra
(8) Originator R. A. Giller

RESPONSE SPECTRUM ANALYSIS FOR 241-SY-101 Tank, Structure to Structure Interaction

HORIZONTAL MOTION AT TOP OF LAYER

(Base)

CURVE 1 - ABSOLUTE SPECTRAL ACCELERATIONS (G) 7 0/0 DAMPING

EVERY 1 POINT IS PLOTTED*

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
(7) Subject Soil-Structure Interaction FLUSH single tank spectra
(8) Originator R. A. Giller

RESPONSE SPECTRUM ANALYSIS FOR 241-SY-101 Tank, Structure to Structure Interaction

HORIZONTAL MOTION AT MODAL POINT

CURVE 1 - ABSOLUTE SPECTRAL ACCELERATIONS (G) 7 0/0 DAMPING

EVERY 1 POINT IS PLOTTED*

PLOT NUMBER 11

DESIGN CALCULATION

- (4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
(7) Subject Soil-Structure Interaction FLUSH single tank spectra
(8) Originator R. A. Giller

DEVELOPMENT OF THE SPECTRA FOR 241-SY-101 Tank, Structure to Structure Interaction

92
(HAWAII)

HORIZONTAL MOTION AT MODAL POINT

7.0% DAMPING

ACCELERATIONS (G)

POINT IS PLOTTED*

C-11

DESIGN CALCULATION

- (4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
(7) Subject Soil-Structure Interaction FLUSH single tank spectra
(8) Originator R. A. Giller

DESIGN CALCULATION

- (4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction FLUSH single tank spectra
 (8) Originator R. A. Giller

RESPONSE SPECTRUM ANALYSIS FOR 241-SY-101 Tank, Structure to Structure Interaction

CURVE 1 - ABSOLUTE SPECTRAL ACCELERATIONS (G) 7 0/0 DAMPING
 HORIZONTAL MOTION AT MODAL POINT 63
 (Base)
 EVERY 1 POINT IS PLOTTED*

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
(7) Subject Soil-Structure Interaction FLUSH double tank spectra
(8) Originator R. A. Giller

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction FLUSH double tank spectra
 (8) Originator R. A. Giller

DESIGN CALCULATION

- (4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
(7) Subject Soil-Structure Interaction FLUSH double tank spectra
(8) Originator R. A. Giller

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction FLUSH double tank spectra
 (8) Originator R. A. Giller

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
(7) Subject Soil-Structure Interaction FLUSH Postforce output
(8) Originator R. A. Giller

FLUSH Single Tank

*
* Current Date : Wed Sep 4 10:52:59 PDT 1991 *
*
* SYSTEM BULLETIN for - postforce *
* ----- *
*
* There is currently NO SYSTEM BULLETIN for this *
* Code or Processor on the Cray. *
*
* To obtain Quality Assurance information about this *
* program, please keyin the following: *
* /p/qainfo postforce *
*

** **
** **
** PROGRAM NAME FORCE3 **
** VERSION CDC-SCM-3.0 **
** WHC Version cft 5/23/88 **
** BY LYSMER, TSAI AND HWANG **
** MODIFICATIONS V3.0 05/15/79 RICHARD HWANG **
** REFERENCES FORCE3 MANUAL **
** EERC 75-30 FLUSH MANUAL **
** **

***** INFORMATION ON TAPE 1 *****
241-SY-101 Tank, Structure to Structure Interaction

*** INPUT DATA ***
TOTAL NUMBER OF SOLID ELEMENTS = 90
TOTAL NUMBER OF BEAM ELEMENTS = 26
TOTAL NUMBER OF VOID ELEMENTS = 0
TOTAL NUMBER OF NODAL POINTS = 146
1ST NODAL POINT ON RIGID BASE = 134
DEGREES OF FREEDOM = 266
NO. OF FIXED BOUNDARY CONDITIONS = 23
NO. OF ITERATIONS = 5
NO. OF STRAIN-DEPENDENT MATERIALS = 1

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction FLUSH Postforce output
 (8) Originator R. A. Giller

NUMBER OF SEMI-INFINITE LAYERS = 11
 LAYER NUMBER OF INPUT MOTION = 1
 FREE FIELD IS CONNECTED TO THE BOTH SIDE(S) OF THE MESH
 NUMBERING SYSTEM OF MESH STARTS FROM LEFT SIDE OF THE MESH

*** HORIZONTAL INPUT MOTION ***

TOTAL NO. OF POINTS USED IN FFT = 4096
 FIRST POINT TO BE READ = 1
 LAST POINT TO BE READ = 2000
 TIME STEP OF RECORD = 0.005 SEC.
 DURATION OF RECORD = 10.000 SEC.
 QUIET ZONE OF RECORD = 10.480 SEC.
 TOTAL DURATION OF ANALYSIS = 20.480 SEC.
 EQ. MULTIPLICATION FACTOR = 1.100
 MAX. ACCEL. AFTER SCALING = 0.220 (G)

*** FREQUENCY CONTENT OF ANALYSIS ***

NO. OF INTERPOLATION CONTROL RANGES = 4
 HIGHEST FREQUENCY OF ANALYSIS = 12.000 HZ.

FREQUENCY RANGE(HZ)		INTERPOLATION CONTROL
0.0 (HZ)	TO 1.0 (HZ)	KINT = 4
1.0 (HZ)	TO 3.0 (HZ)	KINT = 8
3.0 (HZ)	TO 6.0 (HZ)	KINT = 16
6.0 (HZ)	TO 12.0 (HZ)	KINT = 32

 * COMPUTE FORCES TRANSMITTED *

AT NODE	TO ELEMENTS		
92	58	70	71
94	71	72	
96	72	73	
98	73	74	
100	64	74	75

AT NODE	HORIZONTAL COMPONENT	VERTICAL COMPONENT
92		
94		
96		
98		
100		

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
(7) Subject Soil-Structure Interaction FLUSH Postforce output
(8) Originator R. A. Giller

* SUMMARY OF COMPUTED PEAK FORCES *

241-SY-101 Tank, SSI, FORCE run.
241-SY-101 Tank, Structure to Structure Interaction
COMM CONTROL MOTION - HORIZONTAL, ZPA=0.2G, 2000 POINTS, DT=0.005 SEC

AT NODE	X-FORCE LBS/FT	AT TIME SEC	Y-FORCE LBS/FT	AT TIME SEC
92	2645.428	1.125	2706.225	1.220
94	3260.820	1.130	6336.177	1.125
96	343.912	1.060	7856.369	1.105
98	4535.406	1.060	7596.416	1.085
100	8852.489	1.175	12988.321	1.100

**** THAT IS ALL, FOLKS. HAVE A GOOD DAY ****

WHC-EP-0504
Rev. 0

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
(7) Subject Soil-Structure Interaction FLUSH Postforce output
(8) Originator R. A. Giller

FLUSH Double Tank

*
* Current Date : Wed Sep 4 10:59:06 PDT 1991 *
*
* SYSTEM BULLETIN for - postforce *
* ----- *
*
* There is currently NO SYSTEM BULLETIN for this *
* Code or Processor on the Cray. *
*
* To obtain Quality Assurance information about this *
* program, please keyin the following: *
* /p/qainfo postforce *
*

**
**
** PROGRAM NAME FORCE3
** VERSION CDC-SCM-3.0
** WHC Version cft 5/23/88
**
** MODIFICATIONS BY LYSMER, TSAI AND HWANG
** V3.0 05/15/79 RICHARD HWANG
** REFERENCES FORCE3 MANUAL
** EERC 75-30 FLUSH MANUAL
**
**

241-SY-101 Tank, Structure to Structure Interaction

*** INPUT DATA ***

TOTAL NUMBER OF SOLID ELEMENTS = 158
TOTAL NUMBER OF BEAM ELEMENTS = 52
TOTAL NUMBER OF VOID ELEMENTS = 0
TOTAL NUMBER OF NODAL POINTS = 256
1ST NODAL POINT ON RIGID BASE = 234
DEGREES OF FREEDOM = 466
NO. OF FIXED BOUNDARY CONDITIONS = 46
NO. OF ITERATIONS = 5
NO. OF STRAIN-DEPENDENT MATERIALS = 1

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction FLUSH Postforce output
 (8) Originator R. A. Giller

NUMBER OF SEMI-INFINITE LAYERS = 11
 LAYER NUMBER OF INPUT MOTION = 1
 FREE FIELD IS CONNECTED TO THE BOTH SIDE(S) OF THE MESH
 NUMBERING SYSTEM OF MESH STARTS FROM LEFT SIDE OF THE MESH

*** HORIZONTAL INPUT MOTION ***

TOTAL NO. OF POINTS USED IN FFT = 4096
 FIRST POINT TO BE READ = 1
 LAST POINT TO BE READ = 2000
 TIME STEP OF RECORD = 0.005 SEC.
 DURATION OF RECORD = 10.000 SEC.
 QUIET ZONE OF RECORD = 10.480 SEC.
 TOTAL DURATION OF ANALYSIS = 20.480 SEC.
 EQ. MULTIPLICATION FACTOR = 1.100
 MAX. ACCEL. AFTER SCALING = 0.220 (G)

*** FREQUENCY CONTENT OF ANALYSIS ***

NO. OF INTERPOLATION CONTROL RANGES = 4
 HIGHEST FREQUENCY OF ANALYSIS = 12.000 HZ.

FREQUENCY RANGE(HZ)		INTERPOLATION CONTROL
0.0 (HZ) TO	1.0 (HZ)	KINT = 4
1.0 (HZ) TO	3.0 (HZ)	KINT = 8
3.0 (HZ) TO	6.0 (HZ)	KINT = 16
6.0 (HZ) TO	12.0 (HZ)	KINT = 32

 * COMPUTE FORCES TRANSMITTED *

AT NODE	TO ELEMENTS		
92	58	70	71
94	71	72	
96	72	73	
98	73	74	
100	64	74	75

AT NODE	HORIZONTAL COMPONENT	VERTICAL COMPONENT
92		
94		
96		
98		
100		

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
(7) Subject Soil-Structure Interaction FLUSH Postforce output
(8) Originator R. A. Giller

* SUMMARY OF COMPUTED PEAK FORCES *

241-SY-101 Tank, SSI, FORCE run.

241-SY-101 Tank, Structure to Structure Interaction

COMM CONTROL MOTION - HORIZONTAL, ZPA=0.2G, 2000 POINTS, DT=0.005 S

AT NODE	X-FORCE LBS/FT	AT TIME SEC	Y-FORCE LBS/FT	AT TIME SEC
92	6085.163	1.205	4713.112	1.150
94	1739.334	1.120	7637.170	1.115
96	390.975	1.475	9363.413	1.095
98	4915.199	1.080	8751.241	1.080
100	4597.939	1.405	20852.326	1.125

**** THAT IS ALL, FOLKS. HAVE A GOOD DAY ****

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
(7) Subject Soil-Structure Interaction SHAKE free field spectra
(8) Originator R. A. Giller

Free Field Response, .20g Zpa

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____(7) Subject Soil-Structure Interaction SHAKE soil properties output(8) Originator E. O. Weiner

	Soil Layers	Layer thickness	Soil Density (pcf)	Shear Wave Velocity	Soil Shear Mod. (ksf)	Damping (%)
1	8.0	108.0	810.4	1368.6	0.027	0.027
2	2.0	127.0	777.5	1244.5	0.040	0.040
3	3.1	127.0	758.1	1238.0	0.047	0.047
4	5.6	108.0	806.4	1458.8	0.054	0.054
5	9.5	108.0	851.0	1728.4	0.062	0.062
6	9.5	108.0	908.4	2064.9	0.067	0.067
7	9.5	127.0	833.2	1962.1	0.078	0.078
8	9.5	115.0	863.0	2209.7	0.087	0.087
9	43.3	108.0	861.4	2205.6	0.101	0.101
10	50.0	108.0	910.1	2330.2	0.101	0.101
		142.0	4517.6	9945.0	0.101	0.101

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
(7) Subject Soil-Structure Interaction SASSI spectra output
(8) Originator E. O. Weiner

DESIGN CALCULATION

- (4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
(7) Subject Soil-Structure Interaction SASSI spectra output
(8) Originator E. O. Weiner

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
(7) Subject Soil-Structure Interaction SASSI spectra output
(8) Originator E. O. Weiner

MOTION - SY-101 Qtr Model Seismic - motion

ABSOLUTE SPECTRAL ACCELERATIONS AT MODAL PT. NO. 84 IN THE X-DIRECTION
CURVE 1 IS FOR 0.070 DAMPING RMAX = 0.436 AT FRQ = 6.805

C-27

TABLE OF FUNCTION VALUES (ALL POINTS INCLUDED)

CURVE

CYCLES PER SEC.

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
(7) Subject Soil-Structure Interaction SASSI spectra output
(8) Originator E. O. Weiner

NOTION - 31-101 Wtr Model Seismic - motion

ABSOLUTE SPECTRAL ACCELERATIONS AT MODAL PT. NO. 77 IN THE X-DIRECTION
CURVE 1 IS FOR 0.070 DAMPING RMAX= 0.363 AT FRO= 1.857

TABLE OF FUNCTION VALUES (ALL POINTS INCLUDED)

CURVE

DESIGN CALCULATION

(4) Building 241-SY-101 (5) Rev. _____ (6) Job No. _____
 (7) Subject Soil-Structure Interaction SASSI spectra output
 (8) Originator E. O. Weiner

MOTION - SY-101 Qtr Model Seismic - motion

ABSOLUTE SPECTRAL ACCELERATIONS AT MODAL PT. NO. 1 IN THE X-DIRECTION
 CURVE 1 IS FOR 0.070 DAMPING RMAX= 0.425 AT FRQ= 9.698

TABLE OF FUNCTION VALUES (ALL POINTS INCLUDED)

CURVE

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