STONE & WEBSTER ENGINEERING CORPORATION

CALCULATION TITLE PAGE

CLIENT & PROJECT Private Fuel Storage, LLC/PFSF at Skull Valley	PAGE 1 OF 8
CALCULATION TITLE (Indicative of the Objective) Stability of Canister Transfer Building	TOTAL NO. OF PAGES = 8 incl. Attachments QA CATEGORY ( ) √ I - Nuclear Safety Related _ II - _ III - _ Other ____

CALCULATION IDENTIFICATION NUMBER

J.O. No.	GROUP DESIGNATION	CURRENT CALC. NO.	OPTIONAL TASK CODE	OPTIONAL WORK PACKAGE
05996.02	**Structural**	**SC-9**	–	–

APPROVALS - SIGNATURE & DATE

PREPARER(s)/DATE(s)	REVIEWER(s)/DATE(s)	INDEPENDENT REVIEWER(s)/DATE(s)	REV NO. OR NEW CALC. NO.	SUPERSEDES CALC NO. OR REV NO.	CONFIRMATION REQUIRED YES	CONFIRMATION REQUIRED NO
B.E.Ebbeson 12/11/98 Bruce E. Ebbeson	Jay Henderson 12/11/98 Jay Henderson	J. HENDERSON Jay Henderson 12/14/98	0	N/A		✓

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CALCULATION SHEET

J.O./W.O./CALCULATION NO.	REVISION	PAGE
05996.02-SC-09	0	2

PREPARER/DATE	REVIEWER/CHECKER/DATE	INDEPENDENT REVIEWER
B. Ebbeson 12/11/98	J. Henderson 12/11/98	J. Henderson 12/11/98

SUBJECT/TITLE	QA CATEGORY/CODE CLASS
PFSF / Skull Valley / Stability of Canister Transfer Building	I

TABLE OF CONTENTS AND HISTORICAL DATA

(Revisions, Additions, Deletions, Etc.)

HISTORICAL DATA - REVISION 0

Page No.	Description
None	Original Issue

OBJECTIVE:

The purpose of this calculation is to determine the safety factor against sliding and overturning of the Canister Transfer Building during a seismic event.

CALCULATION METHOD & ASSUMPTIONS:

By reviewing the structure it is obvious that the Z direction acceleration is of the most concern. To determine the loading magnitudes, the lower bound soil case, which has the highest Z acceleration is used to accelerate the building masses. The calculated overturning moments and sliding forces are then compared to the resisting forces in order to determine the factors of safety.

SOURCES OF DATA AND EQUATIONS:

References provided within the calculation body.

CONCLUSION:

The Canister Transfer Building the following minimum Safety Factors:
1. against sliding = 1.14
2. against overturning = 1.47

These are greater than the minimum values of 1.1 given in Ref 4.

References:

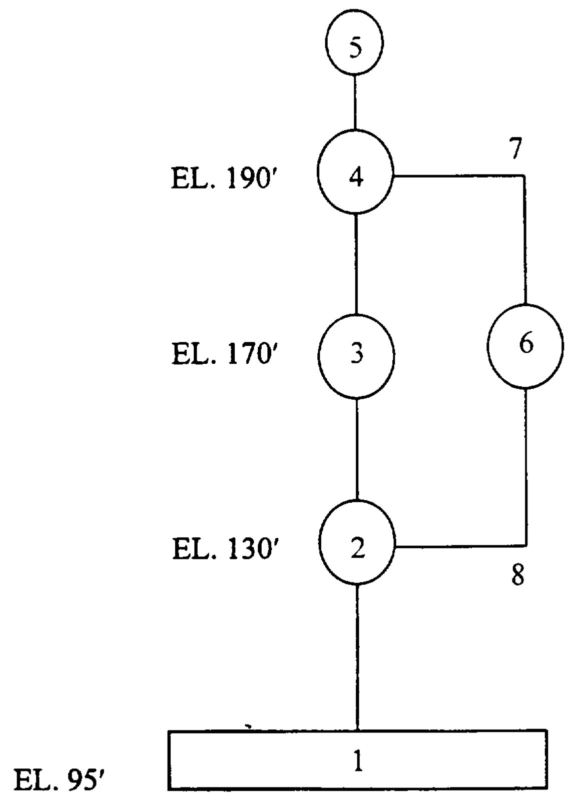
1. Calculation 05996.02-SC-04, "Development of Soil Impedence Functions for Canister Transfer Bldg."R/0

2. Storage Facility Design Criteria, Revision 2, Section 4.0 "Geotechnical Design Criteria"

3. Calculation 05996.02-SC-05, "Seismic Analysis of Canister Transfer Bldg"

4. Storage Facility Design Criteria, Revision 2, June 20, 1997

Analysis



Canister Transfer Building Stick Model [from Ref 3]

CHECK OVERALL STABILITY OF CANISTER TRANSFER BUILDING

Determine the overturning moments for the Canister Transfer building by accelerating the mass points on the stick model by the appropriate accelerations. Reference 3 provides the values for mass, the computed accelerations and the locations of the lumped masses.

To determine the sliding forces, the same reference is used for the masses and accelerations.

The overturning in the Z direction is judged to be one the worst cases when combined with the Lower bound soil case which has the highest Z acceleration. Therefore the parameters of the Lower bound soil case as indicated on the following table , will be used as one of the verification cases.

LOWER BOUND ACCETERATIONS

stick model (Joint) — Ref 3 (mass) — Ref 3 (a_x, a_y, a_z)

Joint	EL.	mass	Z	a_x	a_y	a_z
1	95.	1257	0	.791	.491	.754
2	130.	480	1.09	.795	.510	.797
3	170.	153.7	3.15	.808	.534	.869
4	190.	166.9	0	.809	.537	.936
5	191.	52.9	0	.809	.911	.936
6	170.	142.2	-3.15	.808	.534	1.036

Vertical force due to D.W.
= 32.2[1257+480+153.7+166.9+5209+142.2]=72537 kips

Vertical force due to uplift
= 32.2[1257(.491)+480(.510)+153.7(.534)+166.9(.537)+52.9(.911)+142.2(.534)]
=37282 kips

Overturning due to D.L. (about B-B or F-F)
=32.2[1257(72.5)+480(72.5-1.09)+(153.7+142.2)(72.5+3.15)+(166.9+52.9)(.72.5)]
=5272094 ft-kips

Shear (E-W)
32.2[1257(.754)+480(.797)+153.7(.869)+166.9(.936)+52.9(.936)+142.2(1.036)]
=58506 kips

Shear (N-S)
32.2[1257(.791)+480(.795)+153.7(.808)+166.9(.809)+52.9(.809)+142.2(.808)]
=57728 kips

Overturning due to uplift (about B-B or F-F)
32.2[1257(72.5)(.491)+480(72.5-1.09)(.510)+(153.7+142.2)(72.5+3.15)(.534)+(166.9)(72.5)(.537)+(52.9)(72.5)(.911)]
=2710354 ft-kips

Overturning due to Z acceleration (about B-B or F-F)
32.2[1257(.754)(5')+480(.797)(35')+(153.7)(.869)(75')+(166.9)(.936)(95')+(52.9)(.936)(95')+(142.2)(1.036)(75')]
=1891410 ft-kips

CHECK SLIDING

Conservatively assume X & Z occur simultaneously

$V = \sqrt{58506^2 + 57728^2} = 82192$ kip

From the Geotechnical Design Criteria, (Ref 4 section 4) a cohesion of 2.2 ksf should be used to resist sliding.

Area of mat = 43640 ft^2 (Ref 1)
Sliding resistance = 43640(2.2) = 96008 kips

$$\text{Factor of Safety(F.S.)} = \frac{96008}{82000} = 1.17 \quad \text{OK}$$

CHECK OVERTURNING ABOUT N-S AXIS

Overturning due to Z acceleration = 1891410 ft-k
Overturning due to uplift = 2710000 ft-k

$$SRSS = \sqrt{1891410^2 + 2710000^2} = 3300000\ ft - kip$$

Resisting moment = 5272000 ft-k

$$\text{Factor of Safety(F.S.)} = \frac{5272000}{3300000} = 1.6 \quad \text{OK}$$

Since the upper bound soil case has the highest vertical accelerations, overturning and sliding for this case will also be checked

UPPER BOUND ACCETERATIONS [Ref 3]

Joint	EL.	mass	Z	a_y	a_z
1	95.	1257	0	.5495	.744
2	130.	480	1.09	.567	.763
3	170.	153.7	3.15	.5875	.806
4	190.	166.9	0	.594	.862
5	191.	52.9	0	1.368	.862
6	170.	142.2	-3.15	.5875	1.2903

Shear (E-W)
32.2[1257(.744)+480(.763)+153.7(.8064)+166.9(.8617)+52.9(.8617)+142.2(1.2903)]
=57904 kips

Shear (N-S)
32.2[1257(.824)+480(.84)+153.7(.872)+166.9(.8771)+52.9(.8771)+142.2(.872)]
=60851 kips

Conservatively assuming X & Z occur simultaneously

$$V = \sqrt{57904^2 + 60851^2} = 83999 \text{ kip}$$

Sliding resistance = 43640(2.2) = 96008 kips

$$\text{Factor of Safety(F.S.)} = \frac{96008}{83999} = 1.14 \quad \text{OK}$$ <u>**GOVERNS**</u>

Overturning due to uplift (about B-B or F-F)
32.2[1257(72.5)(.5495)+480(72.5-1.09)(.567)+(153.7+142.2)(72.5+3.15)(.5875)+(166.9)(72.5)(.594)+(52.9)(72.5)(1.368)]
=3062000 ft-kips

Overturning due to Z acceleration (about B-B or F-F)
32.2[1257(.744)(5')+480(.763)(35')+(153.7)(.806)(75')+(166.9)(.862)(95')+(52.9)(.862)(95')+(142.2)(1.2903)(75')]
=1885000 ft-kips

$$\text{SRSS} = = \sqrt{306200^2 + 1885000^2} = 3596000 \text{ ft} - \text{kip}$$

$$\text{F.S.} = \frac{5272000}{3596000} = 1.47 \quad \text{OK}$$ <u>**GOVERNS**</u>

OVERSIZE

DOCUMENT

PAGE(S) PULLED

SEE APERTURE CARD FILES

APERTURE CARD/PAPER COPY AVAILABLE THROUGH NRC FILE CENTER

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ACCESSION NUMBERS OF OVERSIZE PAGES:

9903020131

136

138

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DRP-OF

THIS PAGE IS AN OVERSIZED DRAWING

THAT CAN BE VIEWED AT THE RECORD TITLED: 0599602-EC-2-A: CANISTER TRANSFER BUILDING MAT FOUNDATION PLAN

WITHIN THIS PACKAGE...OR, BY SEARCHING USING THE DRAWING NUMBER: 0599602-EC-2-A

NOTE: Because of this page's large file size, it may be more convenient to copy the file to a local drive and use the Imaging (Wang) viewer, which can be accessed from the Programs/Accessories menu.

D-1

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9903020139

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9903020142

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0599602-EC-7-A:

CANISTER TRANSFER BUILDING ELEVATIONS - SH 2

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0599602-EC-7-A

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9903020143

200/25 TON BRIDGE CRANE

This attachment includes the following design drawings and documents for the Private Fuel Storage Facility 200/25 ton Overhead Bridge Crane:

APPENDIX B SUPPLEMENT TO GENERIC TOPICAL LICENSING REPORT EDR-1, REV. 0, FACILITY SPECIFIC CRANE DATA, 200 TON BRIDGE CRANE

APPENDIX C SUPPLEMENT TO GENERIC TOPICAL LICENSING REPORT EDR-1, REV. 1, SUMMARY OF REGULATORY POSITIONS, 200 TON BRIDGE CRANE

SEISMIC QUALIFICATION ANALYSIS, DECEMBER 1998 (200 TON OVERHEAD BRIDGE CRANE)

TECHNICAL DESCRIPTION OF HOIST AND TRAVERSE MOTION ELECTRICAL CONTROLS SYSTEM (150 & 200 TON CRANES), EDERER DOCUMENT EA-37547, REV. B

TECHNICAL DESCRIPTION OF RADIO CONTROLS SYSTEMS (150 & 200 TON CRANES) EDERER DOCUMENT EA-37548, REV. A

EDERER DRAWING B-36951, REV. A, REEVING DIAGRAM SIXTEEN PARTS (MAIN HOIST)

EDERER DRAWING B-36952, REV. A, REEVING DIAGRAM EIGHT PARTS (AUX HOIST)

EDERER DRAWING B-37061, REV. A, MAIN HOIST BLOCK & HOOK DIM (200 TON CRANE)

EDERER DRAWING B-37062, REV. -, AUX HOIST BLOCK & HOOK (200 &150 TON CRANES)

EDERER DRAWING C-36975, REV. A, SISTER HOOK 200 TON (200 & 150 TON CRANES)

EDERER DRAWING PA-2189, REV. C, CLEARANCE DWG. 200/25 TON BRIDGE CRANE

EDERER DRAWING D-36976, REV. A, BRIDGE ARRANGEMENT 200/25 TON CAPACITY

EDERER DRAWING B-36977, REV. A, TROLLEY ARRANGEMENT 200/25 TON CAPACITY