



**LOUISIANA**  
**POWER & LIGHT**

142 DELARONDE STREET  
P. O. BOX 6008 • NEW ORLEANS, LOUISIANA 70174 • (504) 366-2345

June 24, 1981

W3P81-1517  
Q-3-A29.03  
Q-3-A29.18.19

Mr. R. L. Tedesco  
Assistant Director for Licensing  
U. S. Nuclear Regulatory Commission  
Washington, D. C. 20555

SUBJECT: Waterford 3 SES  
Docket No. 50-382  
Structural Engineering Branch  
SER Open Item Nos. 48 and 49

Dear Mr. Tedesco:

Attached please find material provided to address SER Open Item No. 48, "Reanalysis of Category I Structures", and No. 49, "Re-evaluate Foundation Mat for Changes in the Value of the Subgrade Modulus".

If you have further questions on this information, please contact us.

Yours very truly,

L. V. Maurin  
Assistant Vice President  
Nuclear Operations

LVM/MPF/ddc

Attachment

cc: Mr. E. L. Blake, Mr. W. M. Stevenson



THIS DOCUMENT CONTAINS  
POOR QUALITY PAGES

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S. 1/1

SER OPEN ITEM 49

The design of the common foundation mat of the Category I structures has been re-evaluated for changes in the value of the subgrade modulus. Shear and moment curves of the critical sections - Sections A-A and B-B as indicated in Page E1, have been plotted as shown in Pages E2 to E7. The individual curves have been developed as shown in Pages E8 to E25. The cases of different subgrade modulus have included: 1) constant modulus-150 lb/cu. in., 2) variable modulus - 70-150 lb/cu. in. varied from place to place over the mat area adjusted for net pressure versus soil stress-strain characteristics, and 3) rigid mat which discounts the effects of subsoil rigidity. Cases 1 and 2 are obtained from the results of stress analysis using a finite element structural model. Case 3 is calculated using conventional methods based on idealized mat elements with assumed boundary conditions. In Case 3, mat under Reactor Building is considered as a circular plate with partial edge fixity, and other areas of the mat is considered to be formed by beam elements.

The effects due to changes in subgrade modulus on stress distribution are reflected in the shear and moment curves. In general, the curves of higher subgrade modulus are enveloped by the ones with lower subgrade modulus, especially at governing sections. The design envelopes which represent the mat capacity have been established to enclose the three cases of subgrade modulus described previously.

# EBASCO SERVICES INCORPORATED

BY f.a. DATE 4-16-81

NEW YORK

SHEET 51 OF       

CHKD. BY J. CHEN DATE 4/23/81

OPS NO. 5234 014

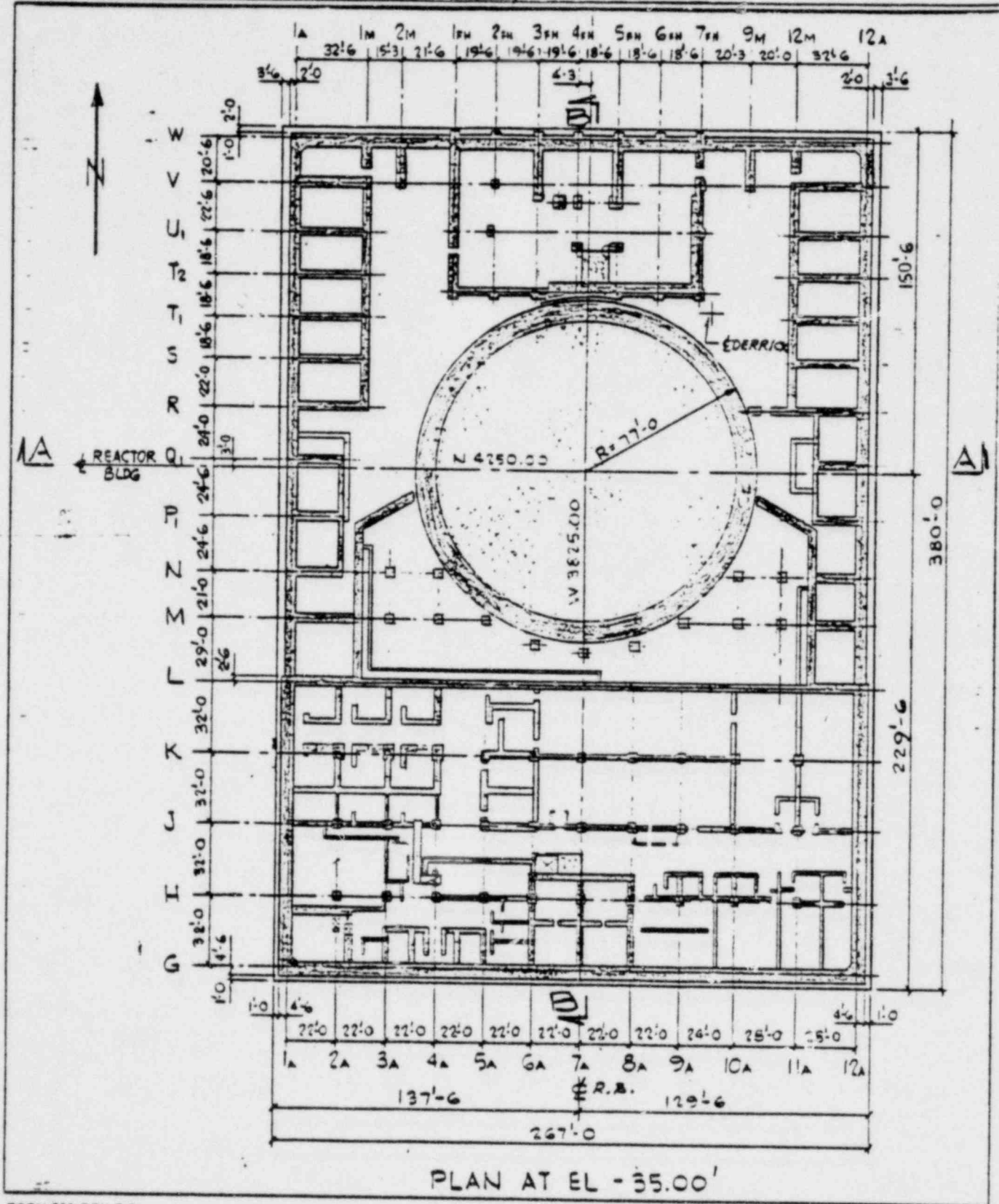
DEPT. NO. 350

CLIENT LOUISIANA POWER & LIGHT CO.

PROJECT WATERFORD STEAM ELECTRIC STATION

1977 1165 MW INSTALLATION - UNIT 3

SUBJECT COMMON FOUNDATION MAT - PLAN AT EL 35.00'



NEW YORK

NEW YORK

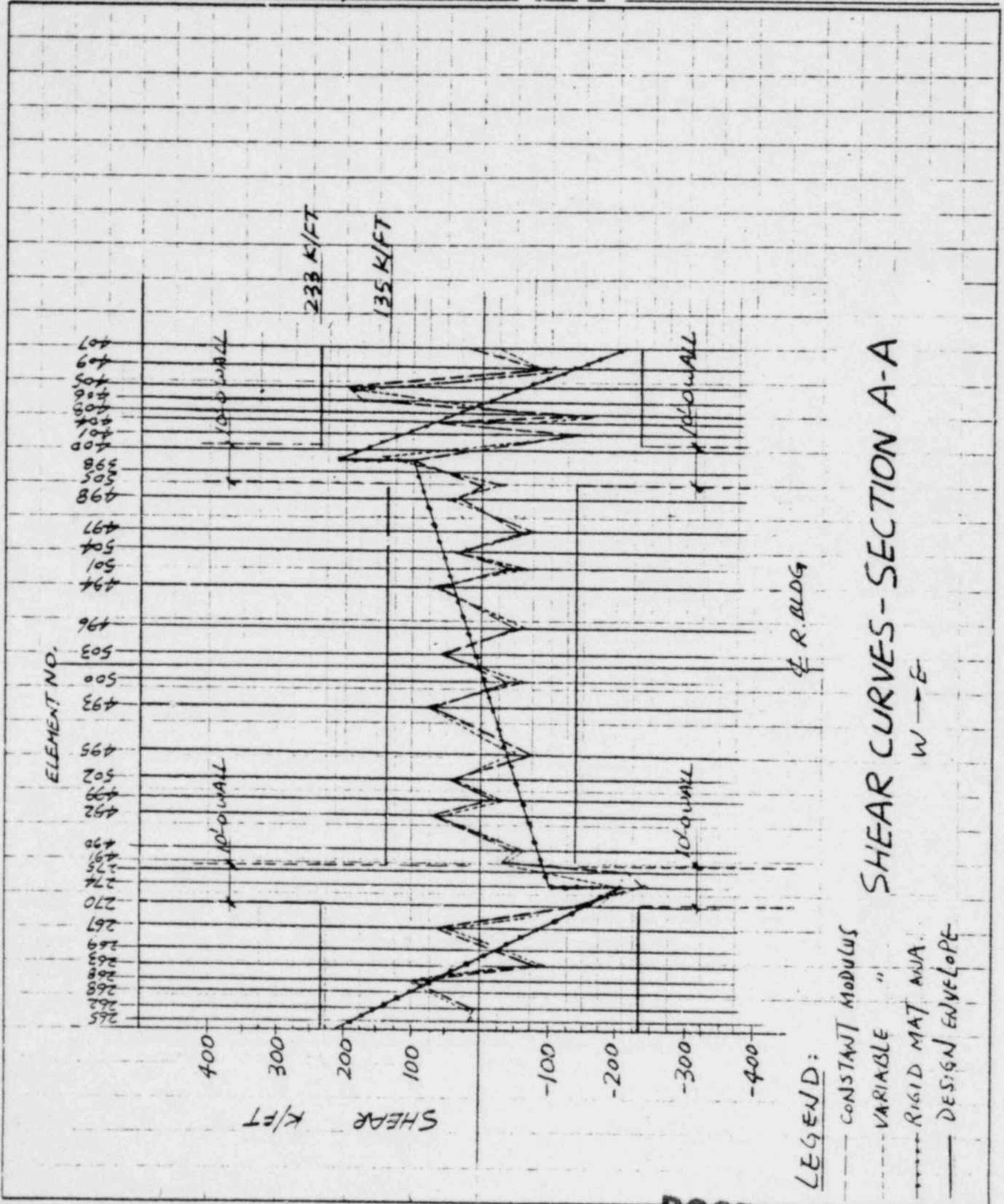
SHEET E2 OF       

OFFS NO. 5234.014 DEPT. 550  
NO. 550

CLIENT LOUISIANA POWER & LIGHT CO.  
WATERFORD STEAM ELECTRIC STATION

PROJECT 1977 1165 MW INSTALLATION - UNIT 3

SUBJECT COMMON MAT ANALYSIS



**POOR ORIGINAL**



**POOR ORIGINAL**

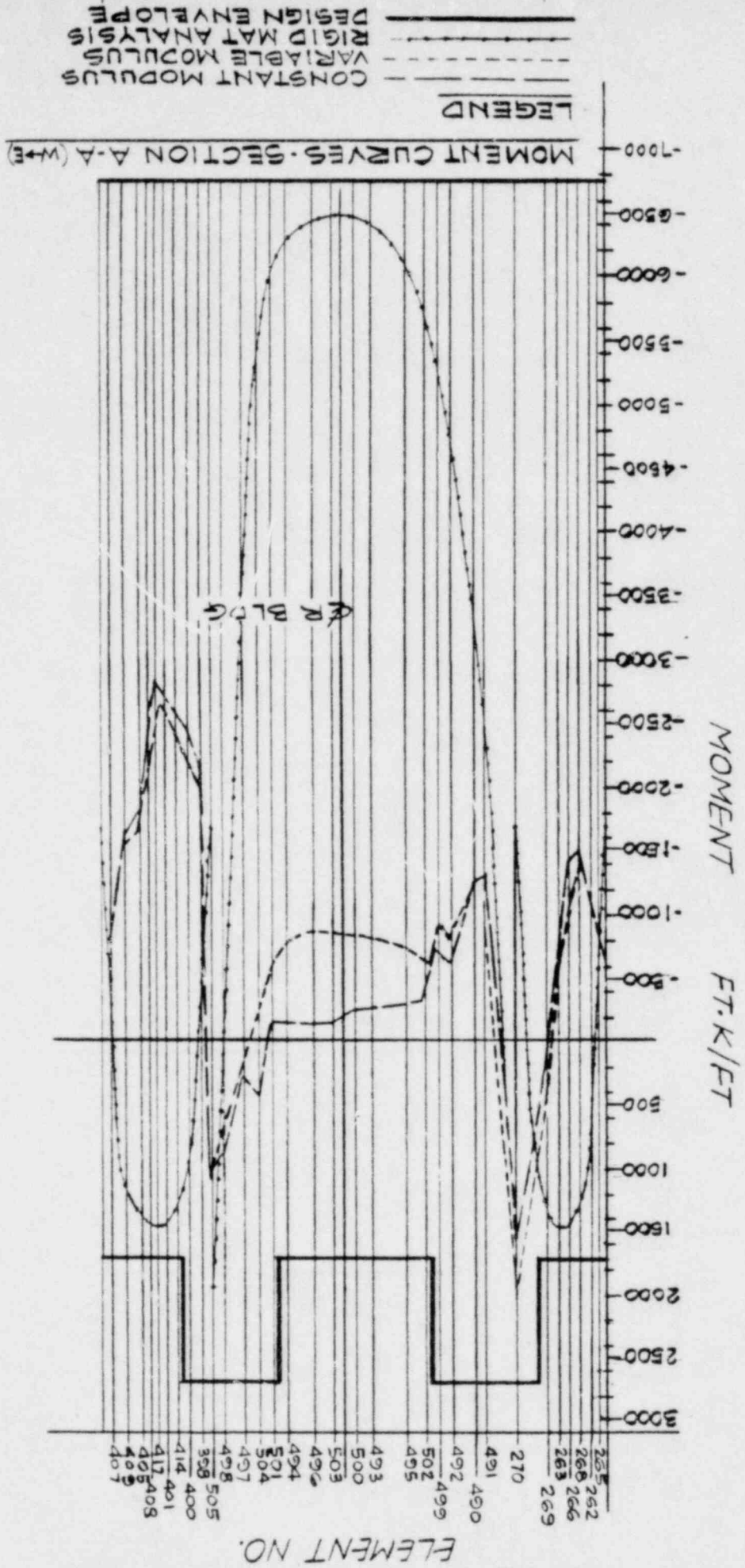
**POOR ORIGINAL**

EBASCO SERVICES INCORPORATED

SHEET 55 OF 55

CLIENT: LOUISIANA POWER & LIGHT CO.  
 PROJECT: WATSFORD STEAM ELECTRIC STATION  
 SUBJECT: 1977 1165 MW INSTALLATION

DWG NO: 5234-014  
 BY: D. DAURIO  
 CHECKED BY: J. CHEN  
 DEPT. NO: 550  
 DATE: 5/29/81  
 DATE: 5/27/81



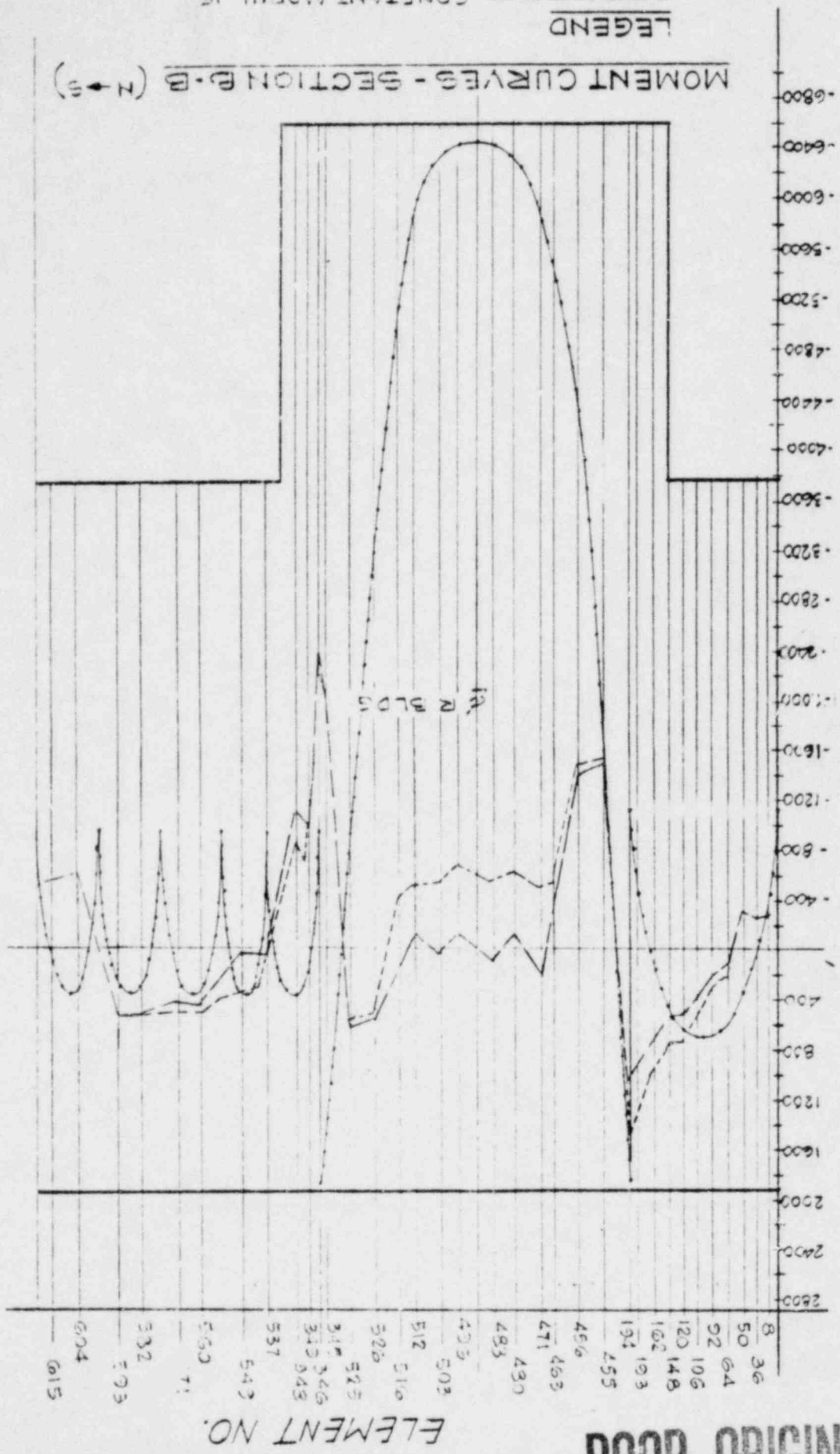
POOR ORIGINAL

LOUISIANA POWER & LIGHT CO.  
BAYFORD STEEL REINFORCING STATION  
STATION 100+00 TO 100+100

DESIGN NO. 5234-014  
BY P. DAURIO  
CHECKED BY J. CHEN

DEPT. NO. 550  
DATE 5/20/81  
DATE 5/27/81

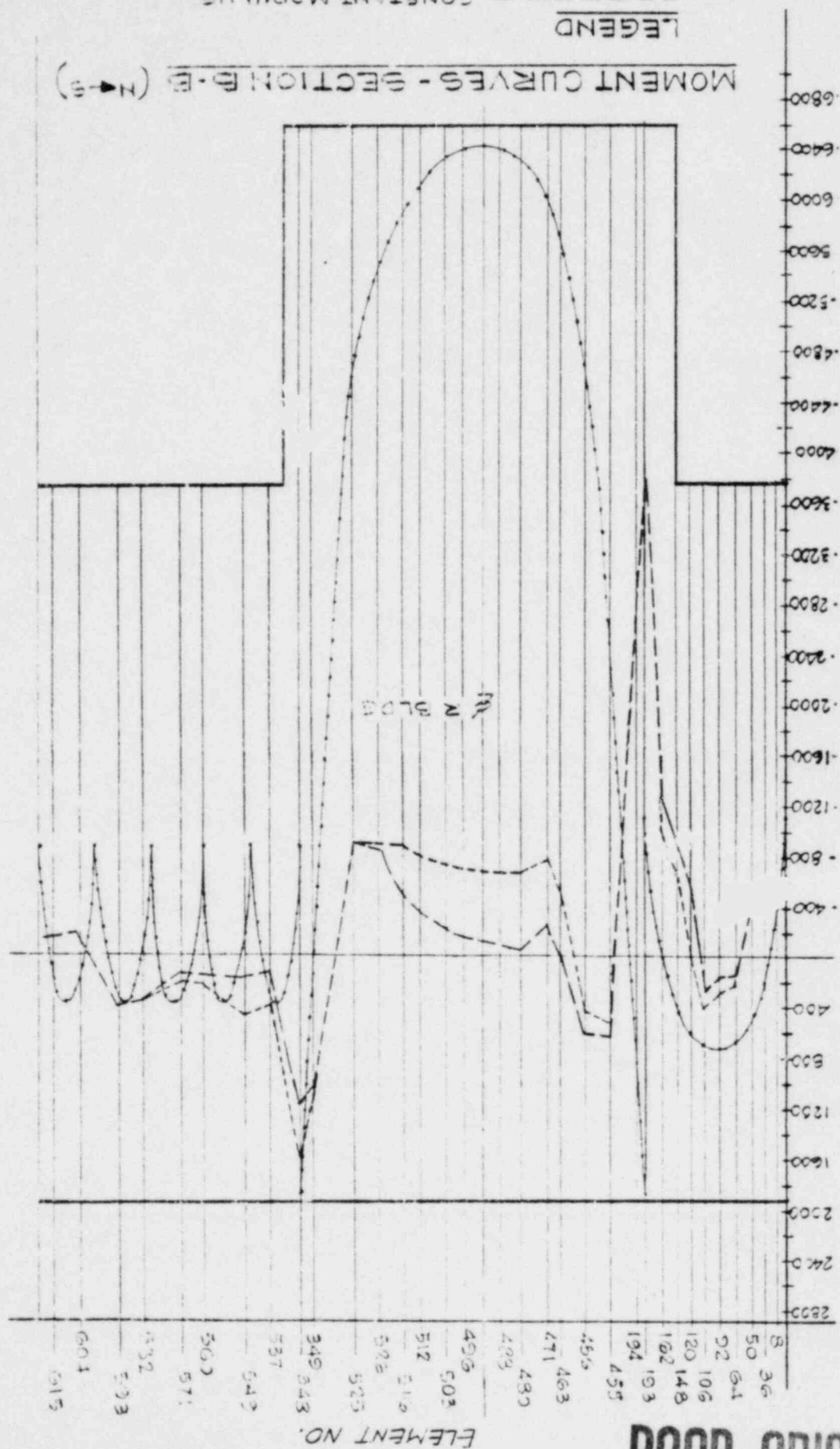
SECTION 100+00 TO 100+100



POOR ORIGINAL



5234014  
D. DAURIO  
5/20/81  
5/27/81



**POOR ORIGINAL**

NEW YORK

SUBJECT: COMMON MAT ANALYSIS



POOR ORIGINAL

# EBASCO SERVICES INCORPORATED

BY J. CHEN DATE 6/4/81

NEW YORK

SHEET 29 OF       

CHKD. BY J. Yang DATE 6/4/81

OPS NO. 5234.014

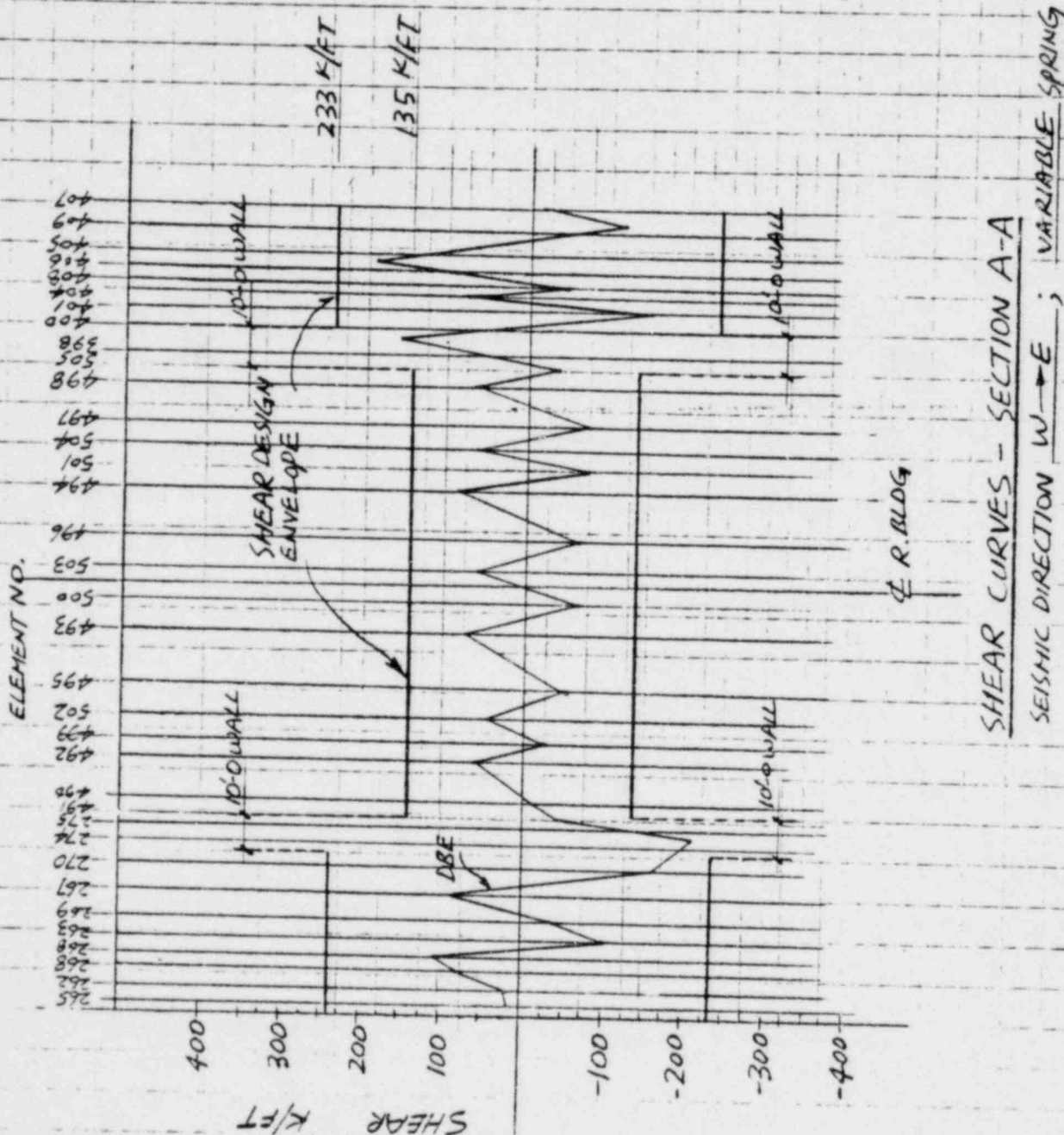
DEPT NO. 550

CLIENT LOUISIANA POWER & LIGHT CO.

PROJECT WATERFORD STEAM ELECTRIC STATION

1977 1165 MW INSTALLATION - UNIT 3

SUBJECT COMMON MAT ANALYSIS



# EBASCO SERVICES INCORPORATED

BY J. CHEN DATE 6/4/81

NEW YORK

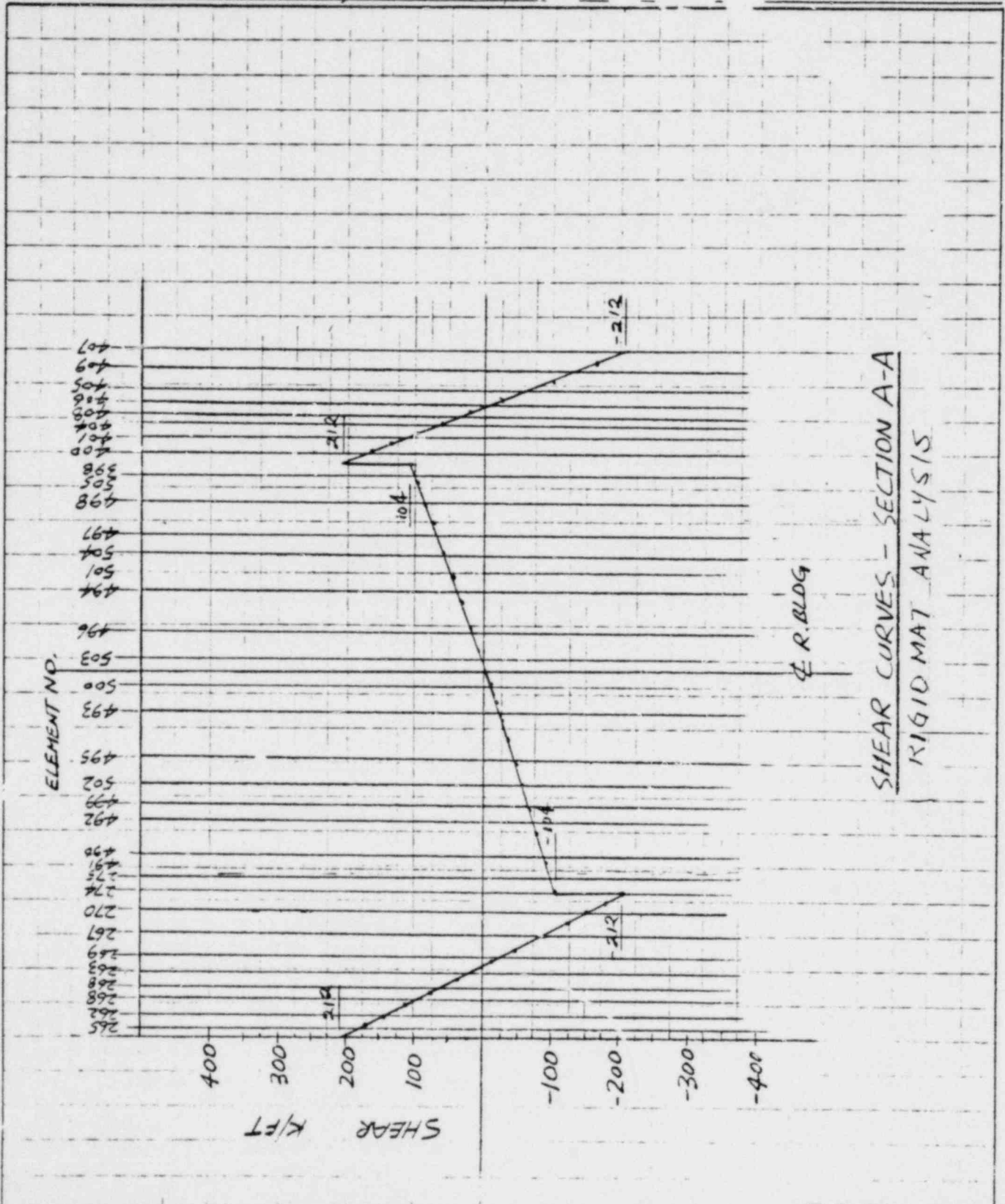
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CH'D. BY J. YANG DATE 6/1/81

OFFS NO. 5234.014 DEPT NO. 550

CLIENT LOUISIANA POWER & LIGHT CO.  
WATERFORD STEAM ELECTRIC STATION  
 PROJECT 1977 1165 MW INSTALLATION - UNIT 3.

SUBJECT COMMON MAT ANALYSIS





# EBASCO SERVICES INCORPORATED

BY F. ALEXANDER DATE 5-27-81

NEW YORK

SHEET 611 OF       

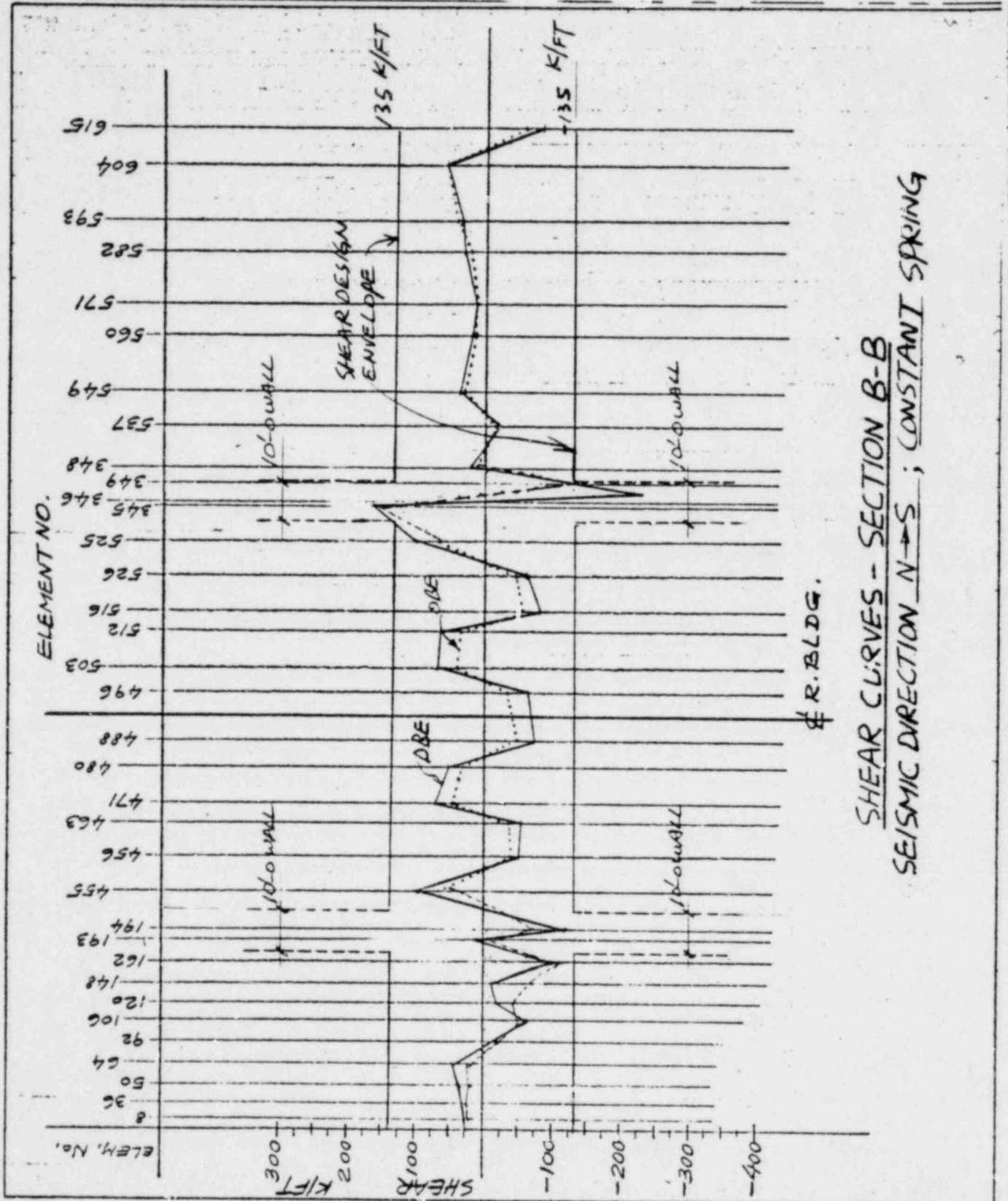
CHKD. BY L. CHEN DATE 5/27/81

QFS NO. 5334.014 DEPT. NO. 550

CLIENT LOUISIANA POWER & LIGHT CO.  
WATERFORD STEAM ELECTRIC STATION

PROJECT 1977 1165 MW INSTALLATION - UNIT 3

SUBJECT COMMON MAT ANALYSIS





# EBASCO SERVICES INCORPORATED

BY J. CHEN DATE 6/4/91

NEW YORK

SHEET E13 OF       

CHKD. BY J. YANG DATE 6/4/81

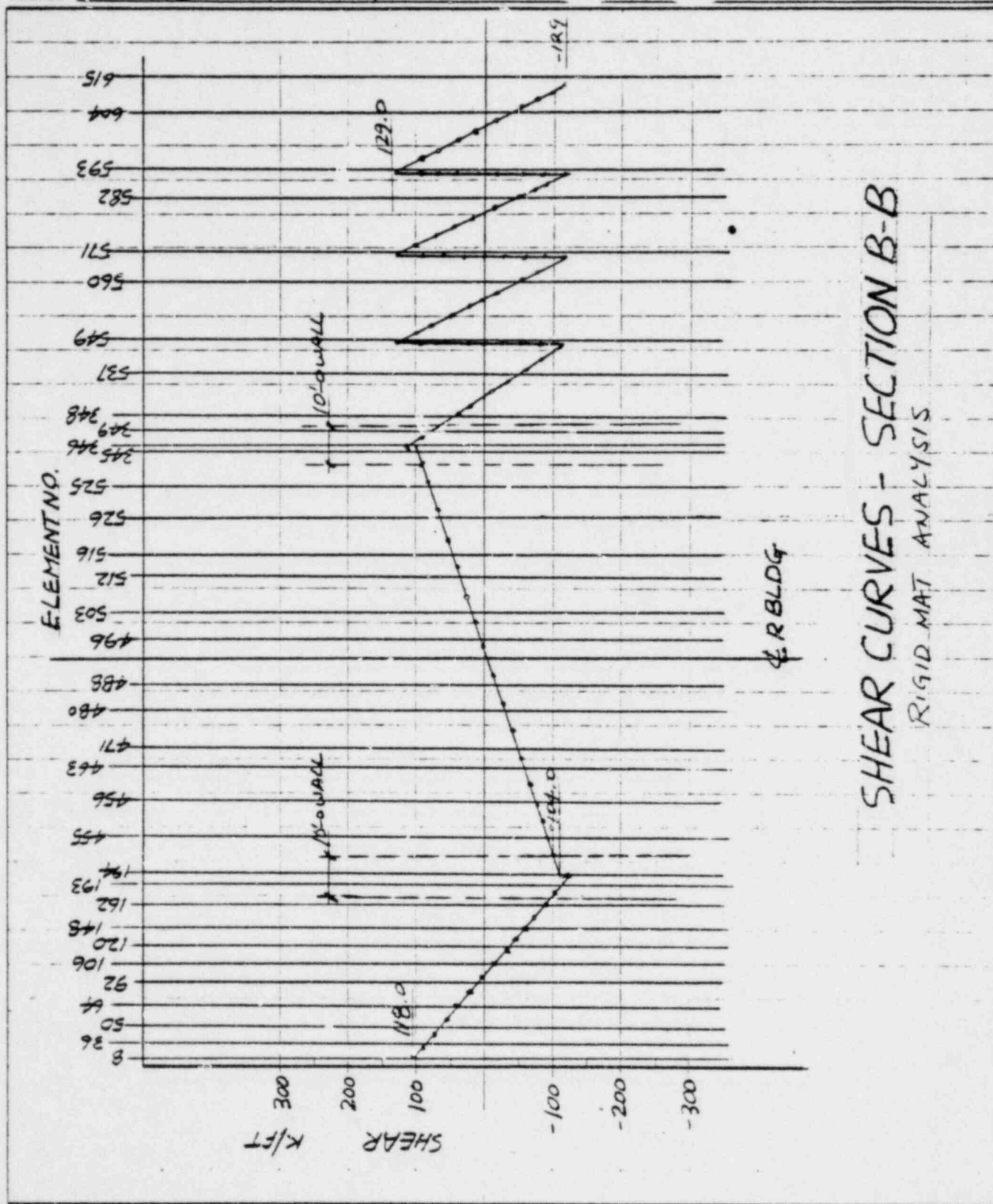
OFFS NO. 5234.014

DEPT. NO. 550

CLIENT LOUISIANA POWER & LIGHT CO.

PROJECT WATERFORD STEAM ELECTRIC STATION  
1977 1165 MW INSTALLATION - UNIT 3

SUBJECT COMMON MAT ANALYSIS



# EBASCO SERVICES INCORPORATED

BY P. ALEXANDER DATE 5-28-81

NEW YORK

SHEET E14 OF       

CHKD. BY J. CHEN DATE 5/28/81

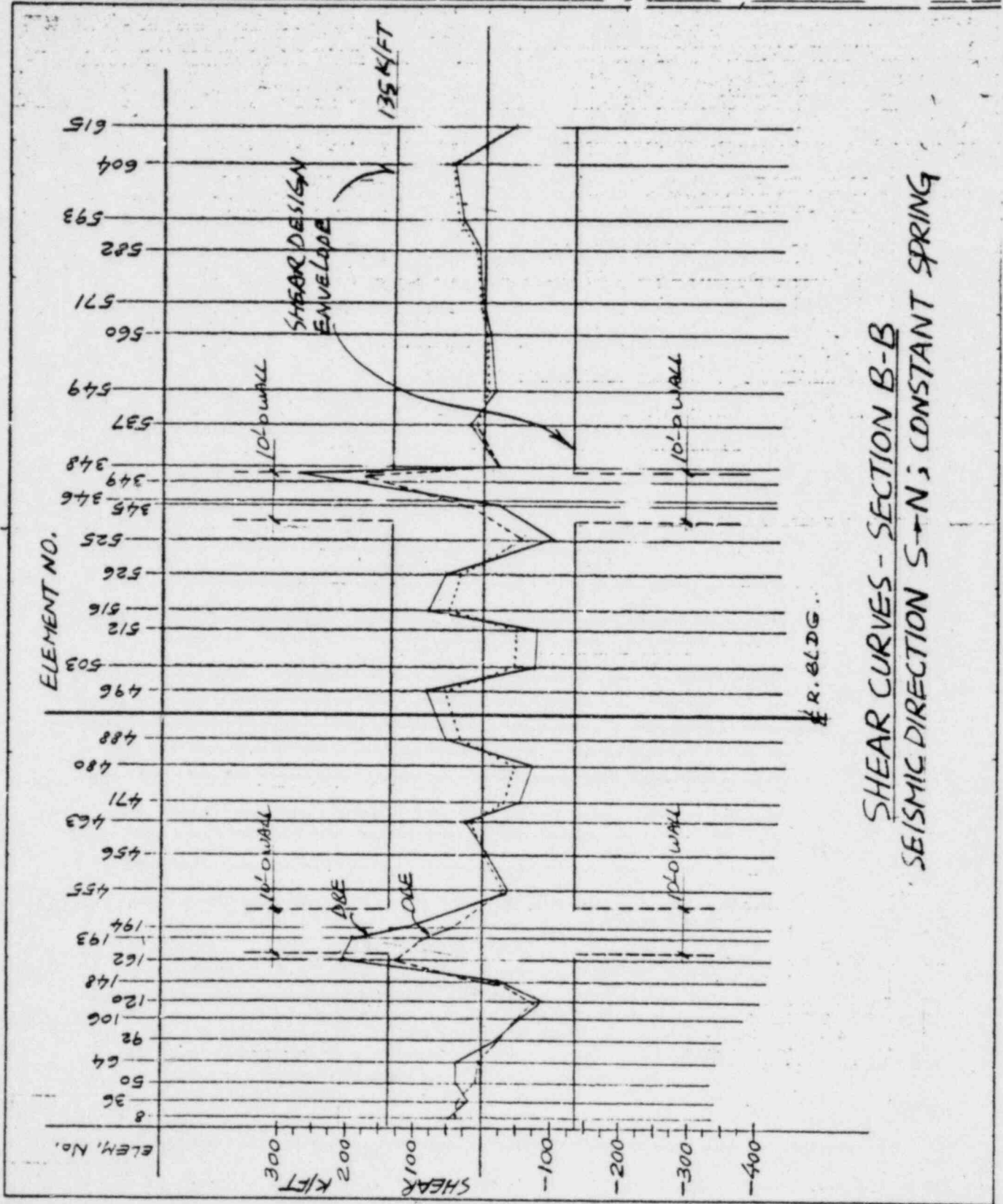
OFS NO. 5234.014

DEPT. NO. 550

CLIENT LOUISIANA POWER & LIGHT CO.

PROJECT WATERFORD STEAM ELECTRIC STATION

SUBJECT COMMON MAT ANALYSIS



SHEAR CURVES - SECTION B-B  
SEISMIC DIRECTION S-N; CONSTANT SPRING

POOR ORIGINAL



# EBASCO SERVICES INCORPORATED

BY F. ALEXANDREZ DATE 5-27-81

NEW YORK

SHEET E/5 OF       

CHKD. BY J. CHEN DATE 5/27/81

OFF. NO. 5334.014

DEPT. NO. 520

CLIENT

LOUISIANA POWER & LIGHT CO.

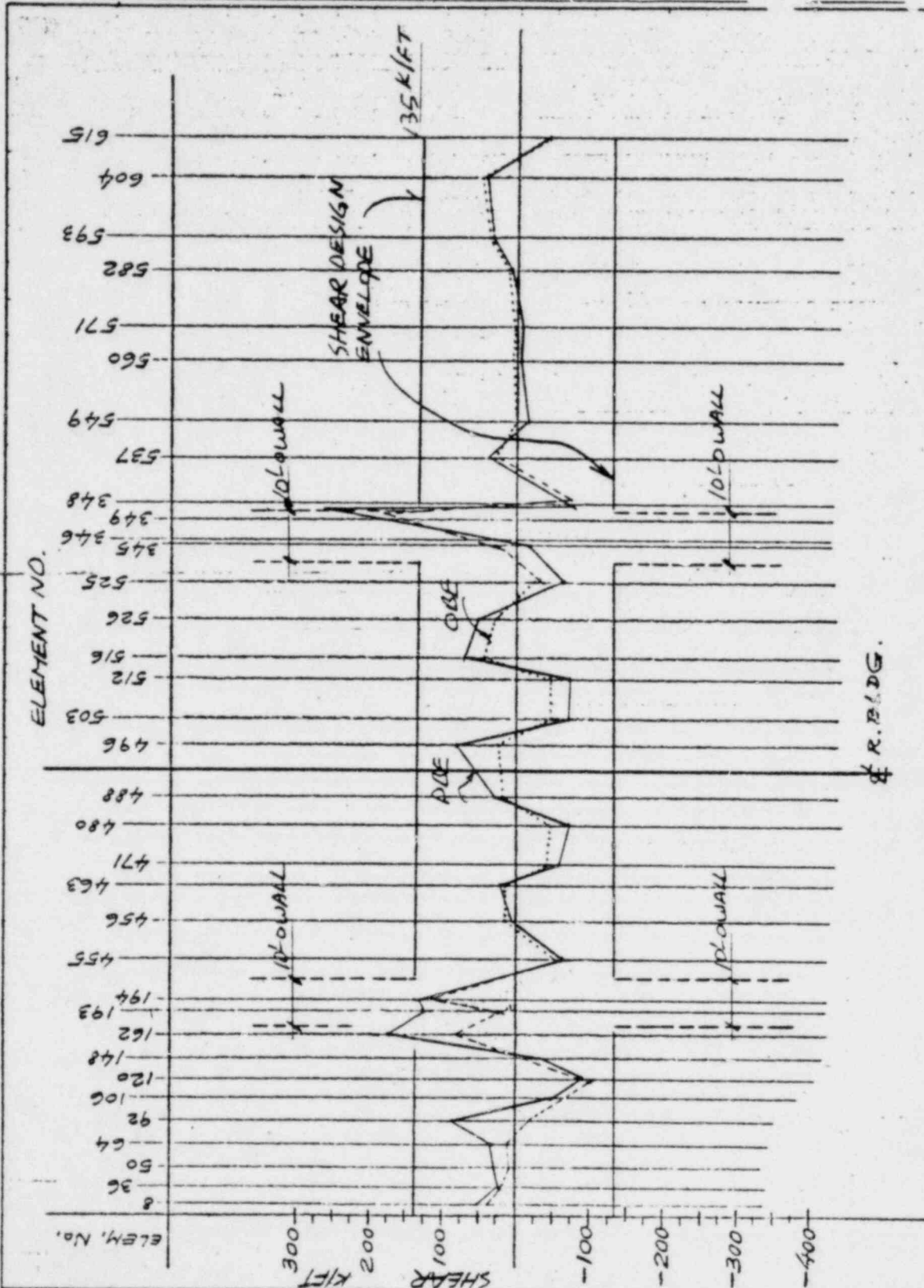
PROJECT

WATERFORD STEAM ELECTRIC STATION

SUBJECT

1977 1165 MW INSTALLATION - UNIT 3

COMMON MAT ANALYSIS



SHEAR CURVES - SECTION B-B  
SEISMIC DIRECTION S-N; VARIABLE SPRING

# EBASCO SERVICES INCORPORATED

BY P. ALEXANDER DATE 5-7-81

NEW YORK

SHEET E16 OF       

CHKD. BY J. CHEN DATE 5-7-81

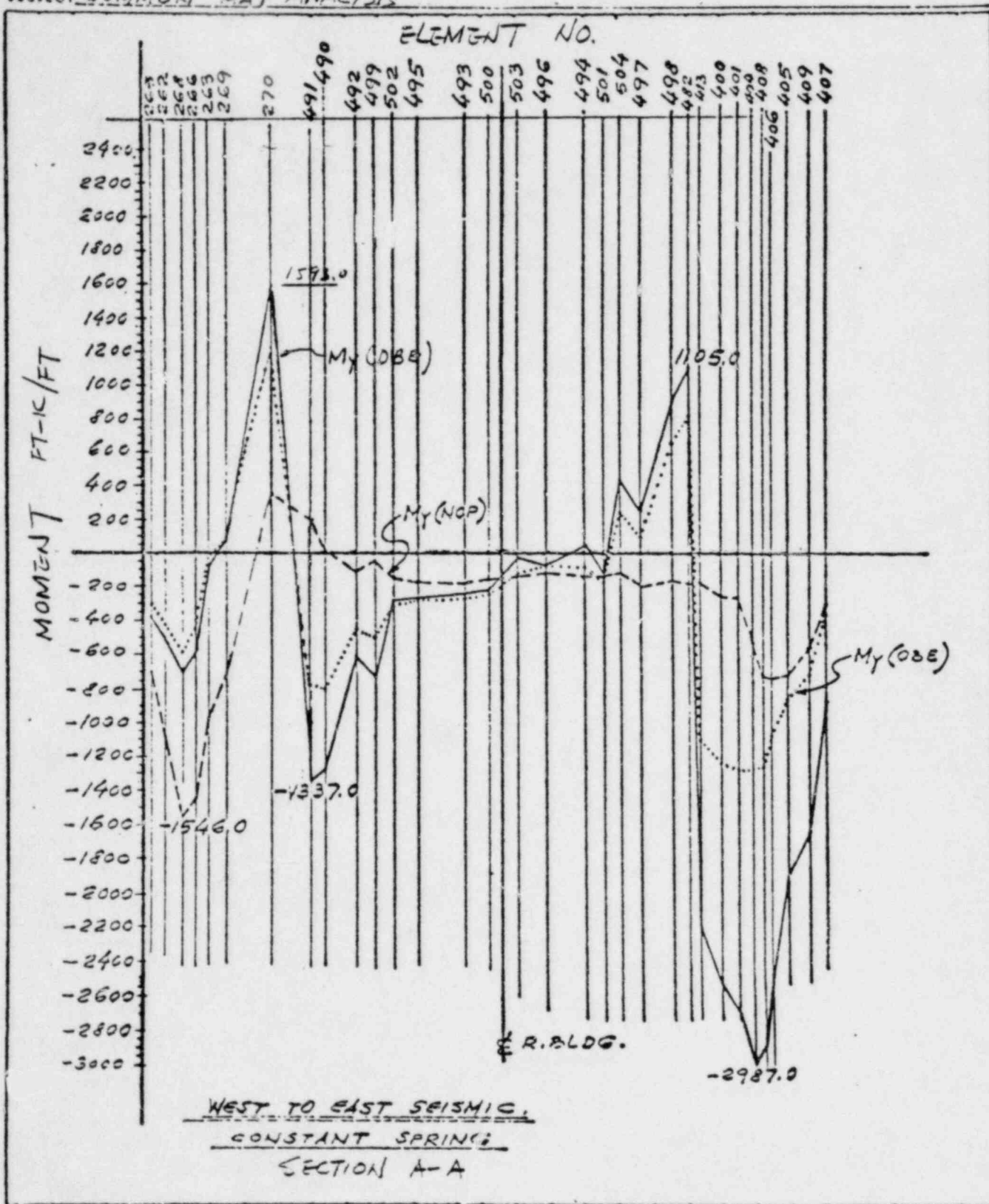
OFFS NO. 5234-014

DEPT. NO. 550

CLIENT LOUISIANA POWER & LIGHT CO.

PROJECT WATERFORD STEAM-ELECTRIC STATION

SUBJECT COMMON MAT ANALYSIS



POOR ORIGINAL

# EBASCO SERVICES INCORPORATED

BY F. ALEXANDROSCU DATE 4-28-81

NEW YORK

SHEET E17 OF       

CHKD. BY J. CHEN DATE 5/6/81

OPS NO. 5234.014

DEPT. NO. 550

CLIENT

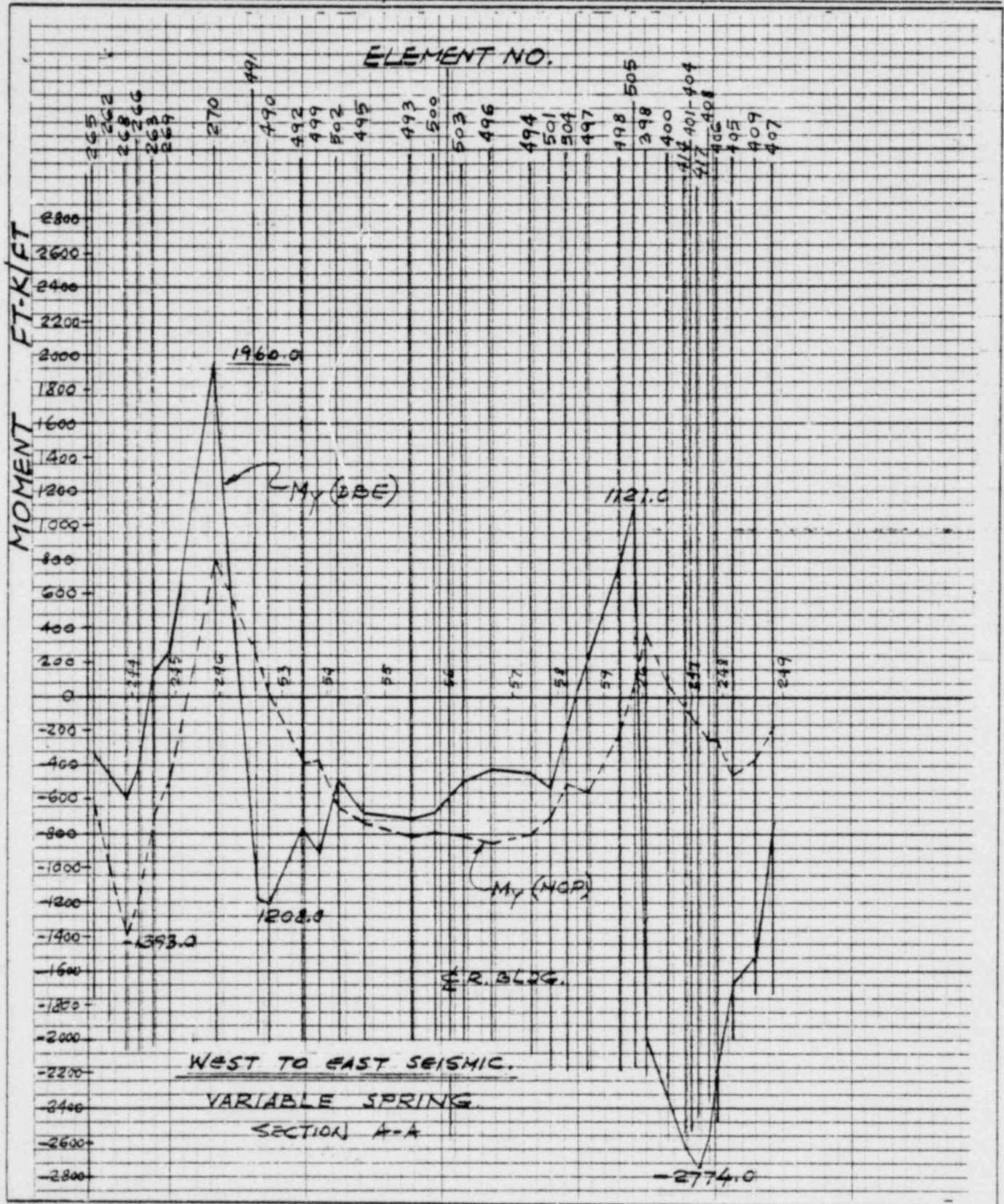
LOUISIANA POWER & LIGHT CO.

PROJECT

WATERFORD STEAM ELECTRIC STATION

1977 1165 MW INSTALLATION - UNIT 3

SUBJECT COMMON MAT ANALYSIS



Ans.  $\frac{618}{617}$  or  $\frac{618}{617}$

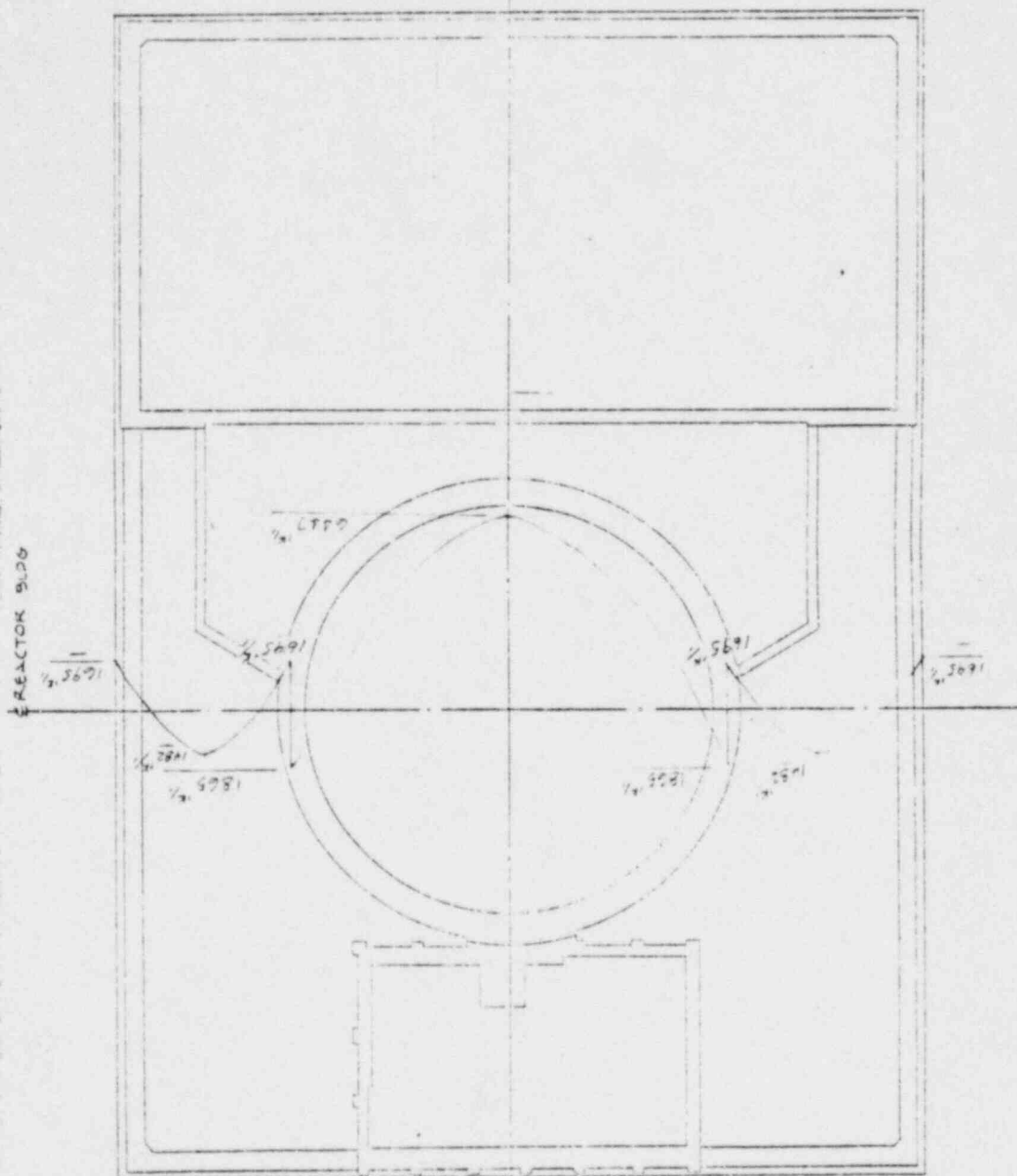
OFFS NO. 5234014

507.1

СНЕСКО ВЪЗЛУЧЕН

DEPT. NO. 550

DATE 5/25/85

DATE 5/25/91

REACTOR BLDG

SECTION A-A

**POOR ORIGINAL**



CLIENT LOUISIANA POWER & LIGHT CO.

PROJECT WATERFORD SES UNIT NO 3

SUBJECT COMMON EDN NAT - KENTH -

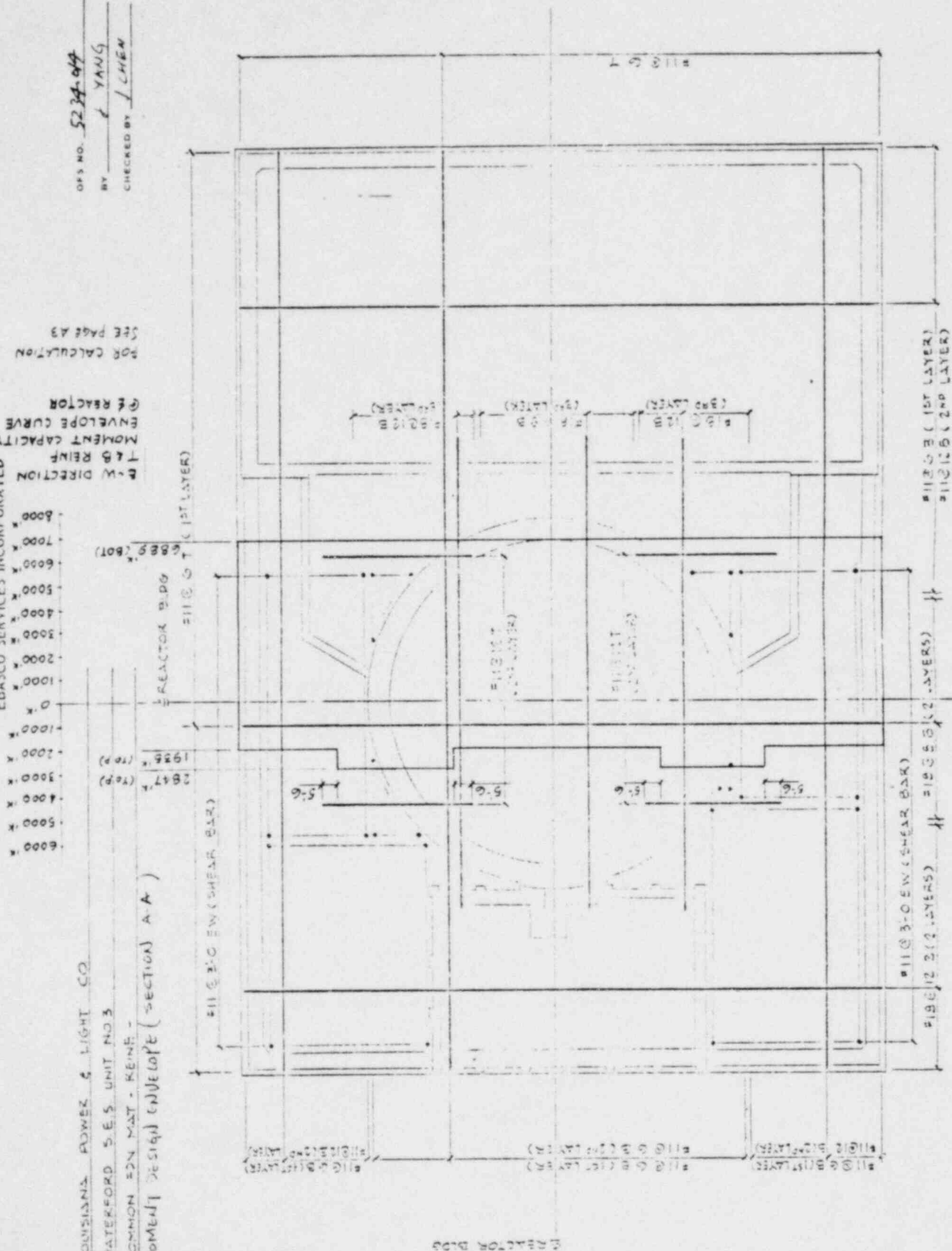
MOMENT DESIGN ENVELOPE (SECTION A-A)

EBASCO SERVICES INCORPORATED

E-W DIRECTION  
T & B REINFP  
MOMENT CAPACITY  
ENVELOPE CURVE  
OF REACTOR

FOR CALCULATION  
SEE PAGE A3

OPS NO. 5234-049  
BY J. YANG  
CHECKED BY J. CHEN



POOR ORIGINAL

## EBASCO SERVICES INCORPORATED

BY F. ALEXANDRSCU DATE 5-20-81

NEW YORK

SHEET E20 OF \_\_\_\_\_

CHNO. BY V. CHEN DATE 5/27/91

OFS NO. 5234.014

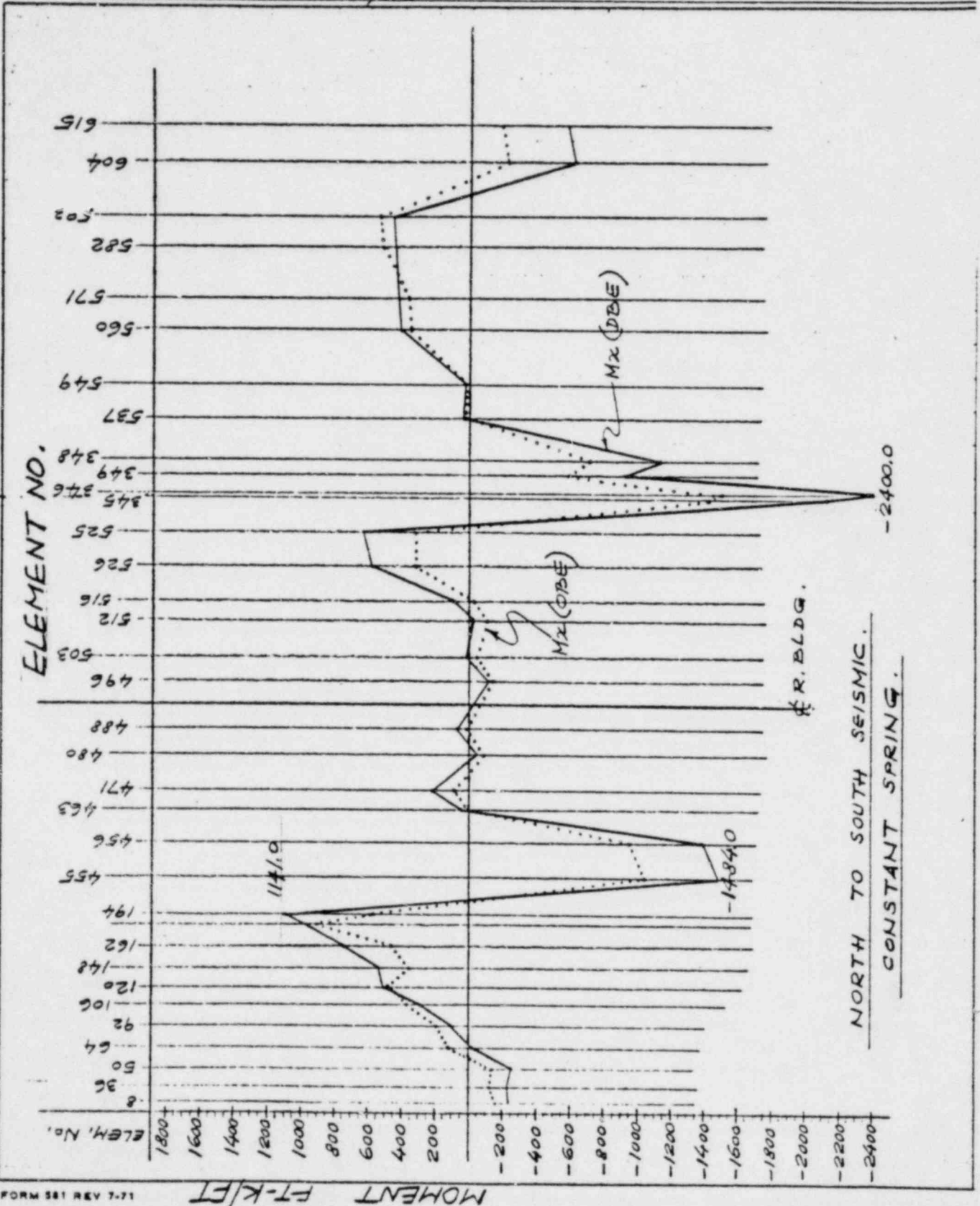
DEPT.  
NO. **550**

CLIENT \_\_\_\_\_ LOUISIANA POWER & LIGHT CO.  
 WATERBURY, CT.

~~WATERFORD STEAM ELECTRIC STATION~~

PROJECT 1977 1165 MW INSTALLATION - UNIT 3

SUBJECT COMMON MAT ANALYSIS



# EBASCO SERVICES INCORPORATED

NEW YORK

SHEET 521 OF

NO. 520

DATE 10/1/50

OFF NO. 5834.014

NO. 520

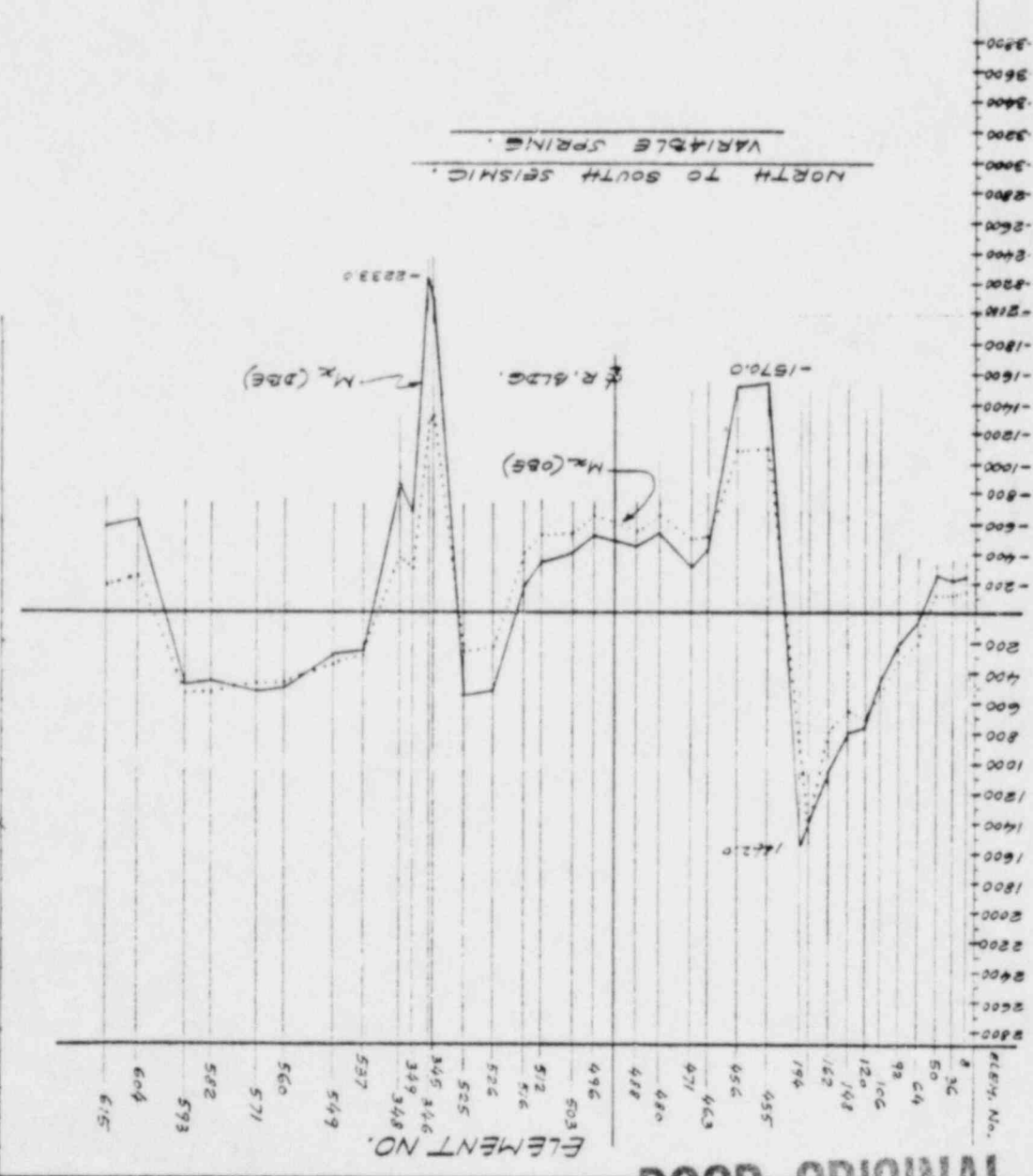
LOUISIANA POWER & LIGHT CO.

RETIRED STEAM ELECTRIC STATION

1972 1105 MW INSTALLATION - UNIT 3

SUBJECT COMMON MAT ANALYSIS

31



POOR ORIGINAL

EBASCO SERVICES INCORPORATED

SHEET E23 OF

CLIENT LOUISIANA POWER & LIGHT CO

PROJECT WATERFORD 5-E5 UNIT NO.3

SUBJECT COMMON EN MAT - RADIO MAT ANALYSIS

OPS NO. 5234 014

DEPT. NO. 550

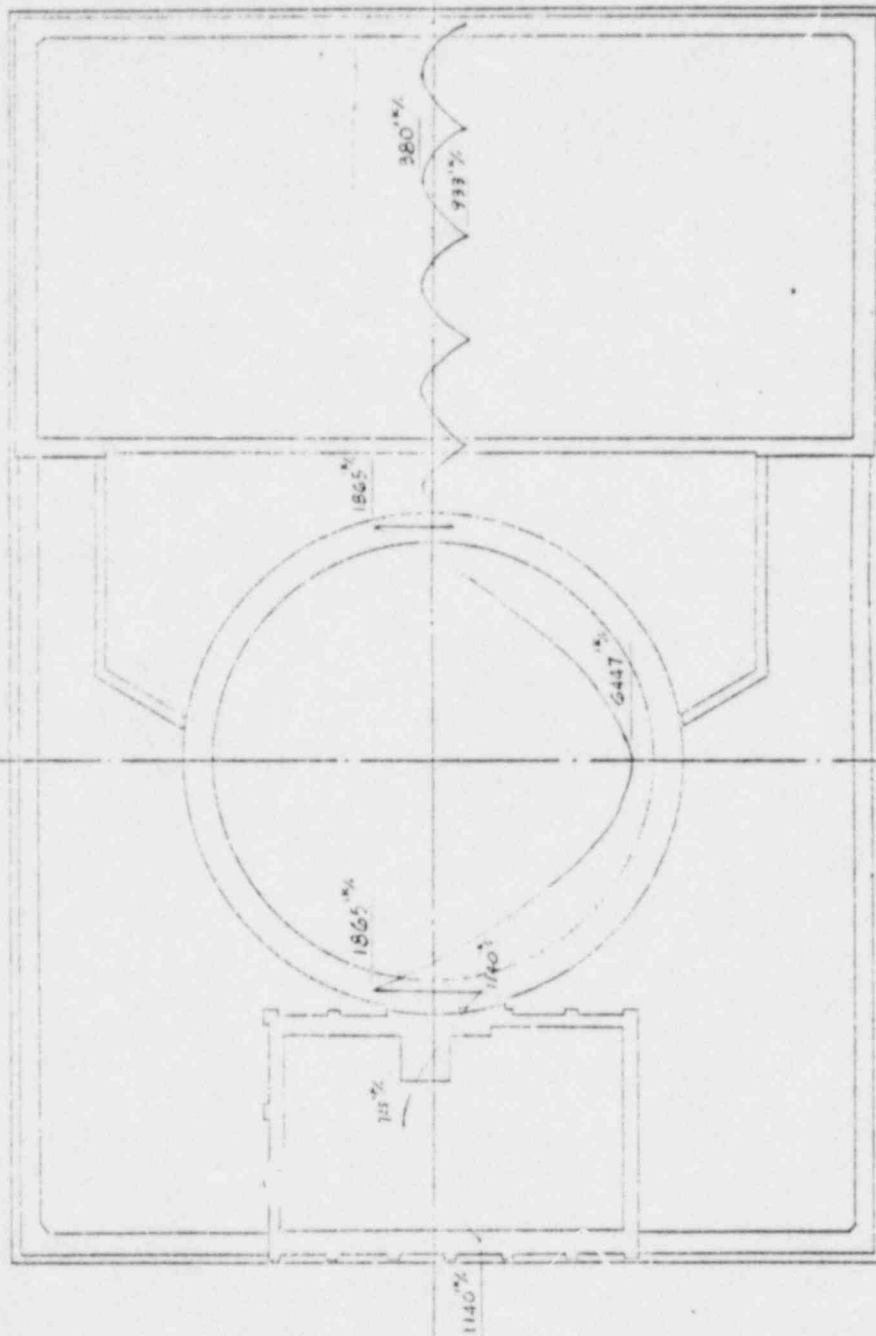
BY T. G. G.

ATE 5/25/81

CHECKED BY J. CHEN

DATE 5/25/81

REACTOR BUILDING



SECTION B-B

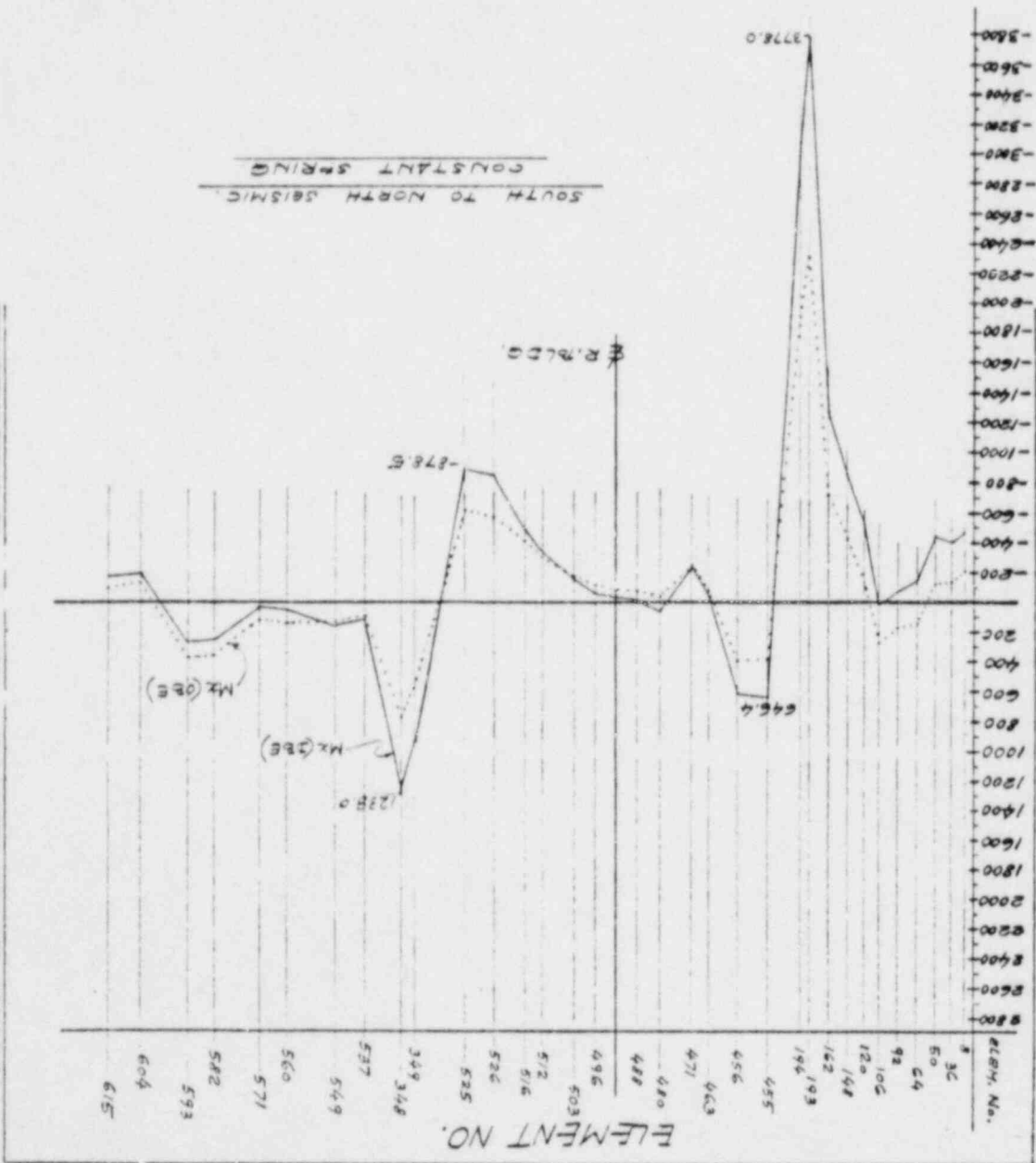
REACTOR BUILDING

POOR ORIGINAL



# EBASCO SERVICES INCORPORATED

NEW YORK  
 SHEET 5-21 OF  
 DEPT NO 550  
 OPS NO 5234.014  
 CHRG BY J. CHEN DATE 5/22/81  
 CLIENT LOUISIANA POWER & LIGHT CO.  
 PROJECT WATERFORD STEAM ELECTRIC STATION  
 SUBJECT COMMON MAT 1972 1165 MB INSTALLATION - UNIT 3



POOR ORIGINAL

# EBASCO SERVICES INCORPORATED

NEW YORK

SHEET 12 OF 12

REV. 11/20/50 DATE 5-21-51

CHD BY LCHN DATE 5/23/51

CLIENT LOUISIANA POWER & LIGHT CO.

PROJECT WATERFORD STEAM ELECTRIC STATION

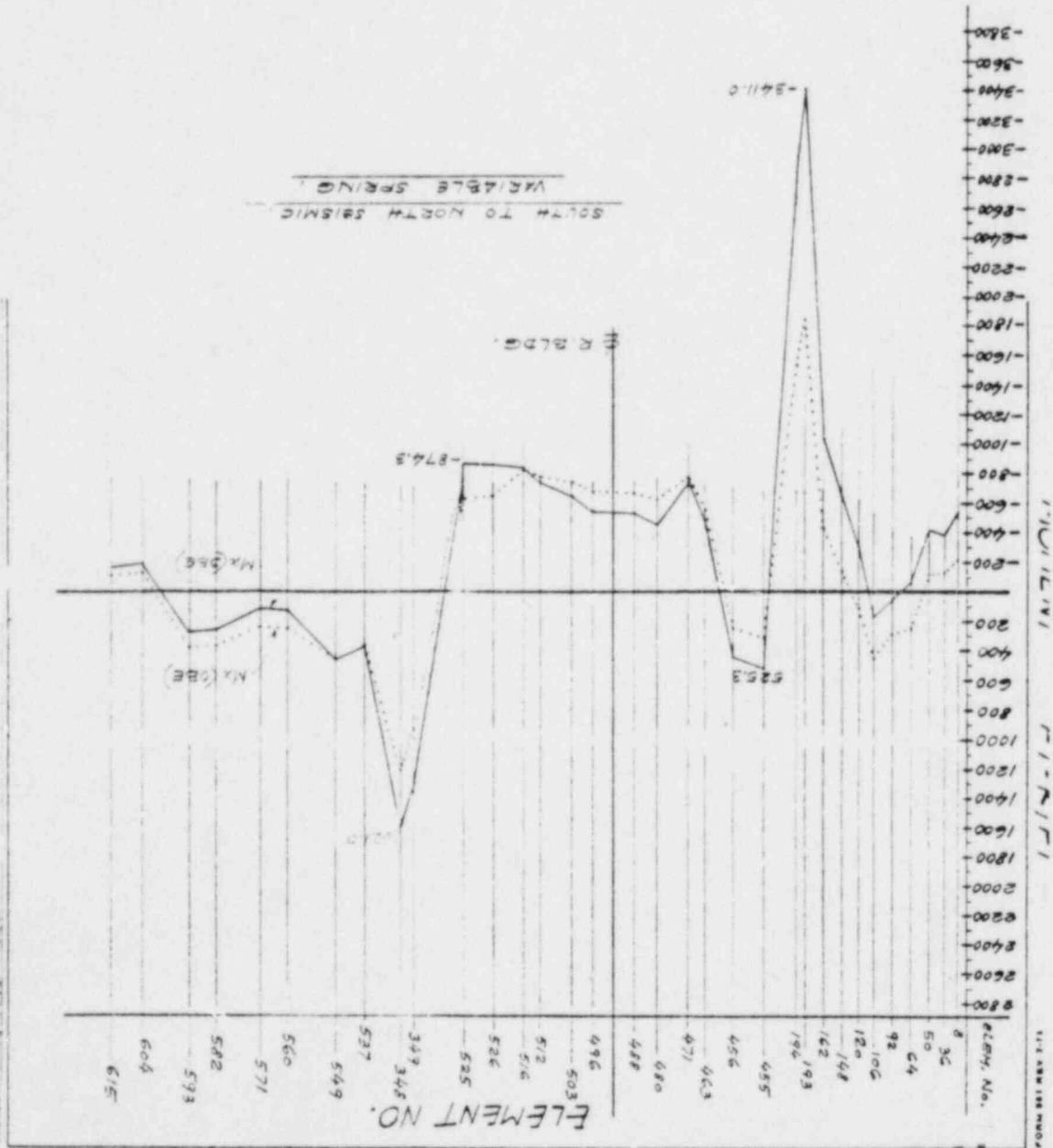
SUBJECT COMMON M47

1577 1165 BR INSTALLATION - UNIT 3

DEPT NO. 550

OFF NO. 5234-014

NO. 550



POOR ORIGINAL

SER OPEN ITEM 48

Additional dynamic analyses of the Category I structures have been performed to determine the effects of the appropriate ties between the various cantilever stick levels, the effects of the inclusion of torsional soil spring, and the effects of considering the actual and accidental eccentricities for all mass points. The results of the dynamic analyses have been evaluated and included in Amendment 19 to the FSAR in the response to Question 130.28 and in Chapter 3.7, Page 3.7-12.

As requested during the SEB Audit conducted during the week of April 6, 1981, the mode shapes of the dynamic analyses have been plotted and are attached for your information and use.

In each dynamic analysis, the first six mode shapes of three translational, two rotational, and one torsional displacement components have been plotted. The plottings for E-W earthquake with and without torsional degree of freedom are presented in Pages A1 to A12, and B1 to B12 respectively. The similar plottings for N-S earthquake are shown in Pages C1 to C12 and D1 to D12. For each mode, mode shapes are presented in two sheets, one for translational components and one for rotational components. In each sheet, the plottings are constructed from normalized displacement values versus the maximum value.





# WATERFORD UNIT 3, DYNAMIC ANALYSIS, TORSIONAL EFFECT STUDIES, MODE SHAPE PLOTTINGS

MODE NO 10 =  $f_2 = 1.044 \text{ Hz}$

E-W DIRECTION, TORSIONAL DCF INCLUDED, SOIL SHEAR MODULUS 6.6500 PSI

MODE SHAPE FOR ROTATIONS, COMPONENTS X Y Z

MODE	SHAPE	X (Rotation in Degrees)	Y (Rotation in Degrees)	Z (Rotation in Degrees)
1	1	.00000	.00000	.00000
2	2	.00000	.00000	.00000
3	3	.00000	.00000	.00000
4	4	.00000	.00000	.00000
5	5	.00000	.00000	.00000
6	6	.00000	.00000	.00000
7	7	.00000	.00000	.00000
8	8	.00000	.00000	.00000
9	9	.00000	.00000	.00000
10	10	.00000	.00000	.00000
11	11	.00000	.00000	.00000
12	12	.00000	.00000	.00000
13	13	.00000	.00000	.00000
14	14	.00000	.00000	.00000
15	15	.00000	.00000	.00000
16	16	.00000	.00000	.00000
17	17	.00000	.00000	.00000
18	18	.00000	.00000	.00000
19	19	.00000	.00000	.00000
20	20	.00000	.00000	.00000
21	21	.00000	.00000	.00000
22	22	.00000	.00000	.00000
23	23	.00000	.00000	.00000
24	24	.00000	.00000	.00000
25	25	.00000	.00000	.00000
26	26	.00000	.00000	.00000
27	27	.00000	.00000	.00000
28	28	.00000	.00000	.00000
29	29	.00000	.00000	.00000
30	30	.00000	.00000	.00000
31	31	.00000	.00000	.00000
32	32	.00000	.00000	.00000
33	33	.00000	.00000	.00000
34	34	.00000	.00000	.00000
35	35	.00000	.00000	.00000
36	36	.00000	.00000	.00000
37	37	.00000	.00000	.00000
38	38	.00000	.00000	.00000
39	39	.00000	.00000	.00000
40	40	.00000	.00000	.00000
41	41	.00000	.00000	.00000
42	42	.00000	.00000	.00000
43	43	.00000	.00000	.00000
44	44	.00000	.00000	.00000
45	45	.00000	.00000	.00000
46	46	.00000	.00000	.00000
47	47	.00000	.00000	.00000
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49	49	.00000	.00000	.00000
50	50	.00000	.00000	.00000



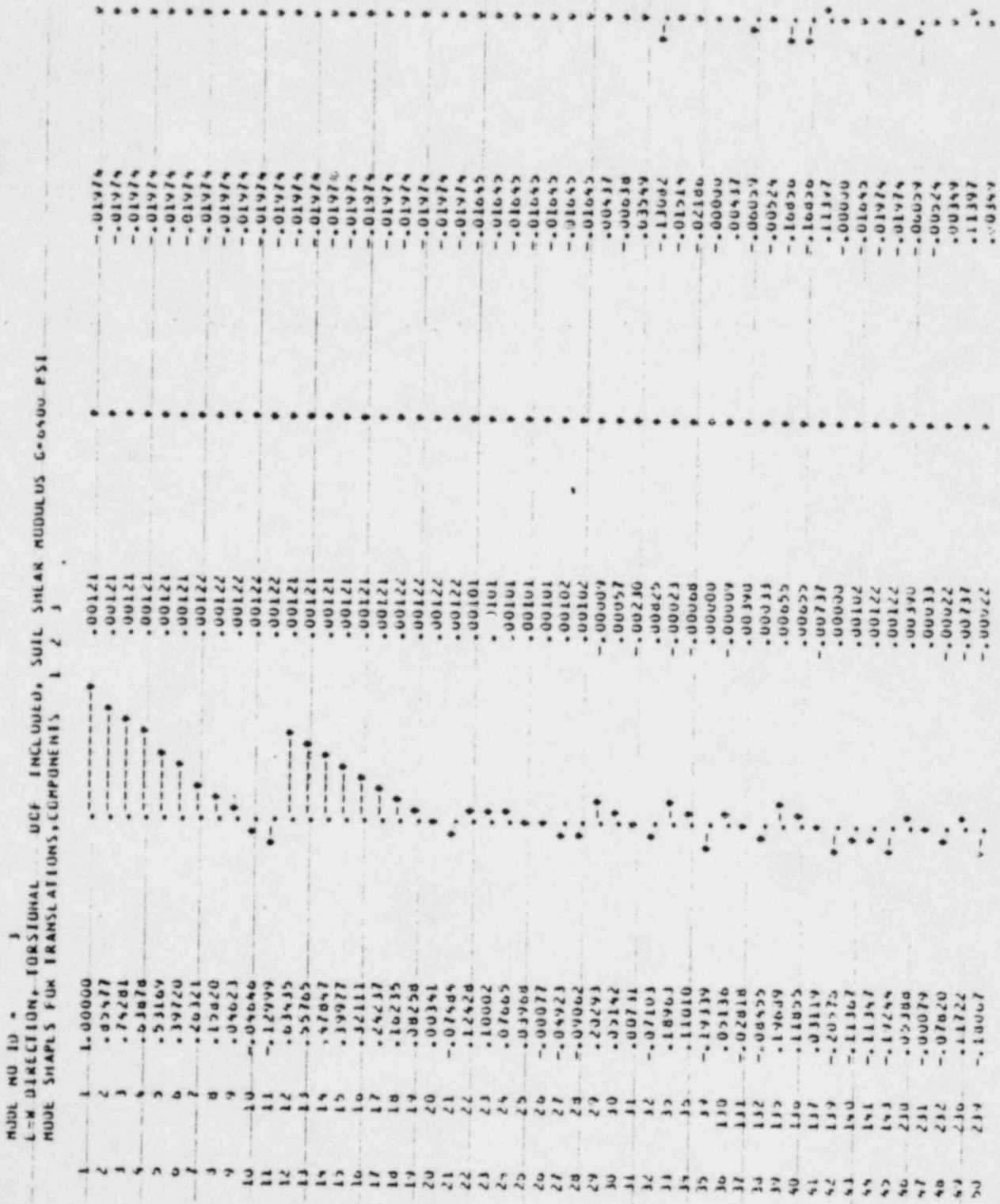
# WATSEFUKU UNIT 3, DYNAMIC ANALYSIS, TORSIONAL EFFECT STUDIES, MODE SHAPE PLOTTING

$\lambda = 1.184 \text{ Hz}$

MODE NO	TO	2	DEF. INCLUDED, SOIL SHEAR MODULUS G=6000 PSI	MODE SHAPE FOR ROTATIONS, COMPONENTS	$X_4$ (Rotation in 4-5 direction)	$X_5$ (Rotation in E-W direction)	$X_6$ (Torsion)
1	1	1	-0.0000	0	0.0005	-0.0005	-0.00613
2	2	2	-0.0000	0	0.0005	-0.0005	-0.00612
3	3	3	-0.0000	0	0.0004	-0.0004	-0.00608
4	4	4	-0.0000	0	0.0003	-0.0003	-0.00603
5	5	5	-0.0000	0	0.0001	-0.0001	-0.00600
6	6	6	-0.0000	0	0.0001	-0.0001	-0.00600
7	7	7	-0.0000	0	0.0001	-0.0001	-0.00600
8	8	8	-0.0000	0	0.0001	-0.0001	-0.00600
9	9	9	-0.0000	0	0.0001	-0.0001	-0.00600
10	10	10	-0.0000	0	0.0001	-0.0001	-0.00600
11	11	11	-0.0000	0	0.0001	-0.0001	-0.00600
12	12	12	-0.0000	0	0.0001	-0.0001	-0.00600
13	13	13	-0.0000	0	0.0001	-0.0001	-0.00600
14	14	14	-0.0000	0	0.0001	-0.0001	-0.00600
15	15	15	-0.0000	0	0.0001	-0.0001	-0.00600
16	16	16	-0.0000	0	0.0001	-0.0001	-0.00600
17	17	17	-0.0000	0	0.0001	-0.0001	-0.00600
18	18	18	-0.0000	0	0.0001	-0.0001	-0.00600
19	19	19	-0.0000	0	0.0001	-0.0001	-0.00600
20	20	20	-0.0000	0	0.0001	-0.0001	-0.00600
21	21	21	-0.0000	0	0.0001	-0.0001	-0.00600
22	22	22	-0.0000	0	0.0001	-0.0001	-0.00600
23	23	23	-0.0000	0	0.0001	-0.0001	-0.00600
24	24	24	-0.0000	0	0.0001	-0.0001	-0.00600
25	25	25	-0.0000	0	0.0001	-0.0001	-0.00600
26	26	26	-0.0000	0	0.0001	-0.0001	-0.00600
27	27	27	-0.0000	0	0.0001	-0.0001	-0.00600
28	28	28	-0.0000	0	0.0001	-0.0001	-0.00600
29	29	29	-0.0000	0	0.0001	-0.0001	-0.00600
30	30	30	-0.0000	0	0.0001	-0.0001	-0.00600
31	31	31	-0.0000	0	0.0001	-0.0001	-0.00600
32	32	32	-0.0000	0	0.0001	-0.0001	-0.00600
33	33	33	-0.0000	0	0.0001	-0.0001	-0.00600
34	34	34	-0.0000	0	0.0001	-0.0001	-0.00600
35	35	35	-0.0000	0	0.0001	-0.0001	-0.00600
36	36	36	-0.0000	0	0.0001	-0.0001	-0.00600
37	37	37	-0.0000	0	0.0001	-0.0001	-0.00600
38	38	38	-0.0000	0	0.0001	-0.0001	-0.00600
39	39	39	-0.0000	0	0.0001	-0.0001	-0.00600
40	40	40	-0.0000	0	0.0001	-0.0001	-0.00600
41	41	41	-0.0000	0	0.0001	-0.0001	-0.00600
42	42	42	-0.0000	0	0.0001	-0.0001	-0.00600
43	43	43	-0.0000	0	0.0001	-0.0001	-0.00600
44	44	44	-0.0000	0	0.0001	-0.0001	-0.00600
45	45	45	-0.0000	0	0.0001	-0.0001	-0.00600
46	46	46	-0.0000	0	0.0001	-0.0001	-0.00600
47	47	47	-0.0000	0	0.0001	-0.0001	-0.00600
48	48	48	-0.0000	0	0.0001	-0.0001	-0.00600
49	49	49	-0.0000	0	0.0001	-0.0001	-0.00600
50	50	50	-0.0000	0	0.0001	-0.0001	-0.00600

A4

WATERFORD UNIT 3, DYNAMIC ANALYSIS, TORSIONAL EFFECT STUDIES, MUDE SHAPE PLOTTINGS





# WATERFORD UNIT 3, DYNAMIC ANALYSIS, TORSIONAL EFFECT STUDIES, MODE SHAPE PLOTTINGS

MODE NO 10 - 3			E-W DIRECTION, TORSIONAL			DOF INCLUDED, SOIL SHEAR MODULUS G=5000 PSI		
MODE SHAPES FOR ROTATIONS, COMPONENTS 4 5 6								
1	1	0.0000	0	0	0	0.0000	0	0.0000
2	2	0.0000	0	0	0	0.0000	0	0.0000
3	3	0.0000	0	0	0	0.0000	0	0.0000
4	4	0.0000	0	0	0	0.0000	0	0.0000
5	5	0.0000	0	0	0	0.0000	0	0.0000
6	6	0.0000	0	0	0	0.0000	0	0.0000
7	7	0.0000	0	0	0	0.0000	0	0.0000
8	8	0.0000	0	0	0	0.0000	0	0.0000
9	9	0.0000	0	0	0	0.0000	0	0.0000
10	10	0.0000	0	0	0	0.0000	0	0.0000
11	11	0.0000	0	0	0	0.0000	0	0.0000
12	12	0.0000	0	0	0	0.0000	0	0.0000
13	13	0.0000	0	0	0	0.0000	0	0.0000
14	14	0.0000	0	0	0	0.0000	0	0.0000
15	15	0.0000	0	0	0	0.0000	0	0.0000
16	16	0.0000	0	0	0	0.0000	0	0.0000
17	17	0.0000	0	0	0	0.0000	0	0.0000
18	18	0.0000	0	0	0	0.0000	0	0.0000
19	19	0.0000	0	0	0	0.0000	0	0.0000
20	20	0.0000	0	0	0	0.0000	0	0.0000
21	21	0.0000	0	0	0	0.0000	0	0.0000
22	22	0.0000	0	0	0	0.0000	0	0.0000
23	23	0.0000	0	0	0	0.0000	0	0.0000
24	24	0.0000	0	0	0	0.0000	0	0.0000
25	25	0.0000	0	0	0	0.0000	0	0.0000
26	26	0.0000	0	0	0	0.0000	0	0.0000
27	27	0.0000	0	0	0	0.0000	0	0.0000
28	28	0.0000	0	0	0	0.0000	0	0.0000
29	29	0.0000	0	0	0	0.0000	0	0.0000
30	30	0.0000	0	0	0	0.0000	0	0.0000
31	31	0.0000	0	0	0	0.0000	0	0.0000
32	32	0.0000	0	0	0	0.0000	0	0.0000
33	33	0.0000	0	0	0	0.0000	0	0.0000
34	34	0.0000	0	0	0	0.0000	0	0.0000
35	35	0.0000	0	0	0	0.0000	0	0.0000
36	36	0.0000	0	0	0	0.0000	0	0.0000
37	37	0.0000	0	0	0	0.0000	0	0.0000
38	38	0.0000	0	0	0	0.0000	0	0.0000
39	39	0.0000	0	0	0	0.0000	0	0.0000
40	40	0.0000	0	0	0	0.0000	0	0.0000
41	41	0.0000	0	0	0	0.0000	0	0.0000
42	42	0.0000	0	0	0	0.0000	0	0.0000
43	43	0.0000	0	0	0	0.0000	0	0.0000
44	44	0.0000	0	0	0	0.0000	0	0.0000
45	45	0.0000	0	0	0	0.0000	0	0.0000
46	46	0.0000	0	0	0	0.0000	0	0.0000
47	47	0.0000	0	0	0	0.0000	0	0.0000
48	48	0.0000	0	0	0	0.0000	0	0.0000
49	49	0.0000	0	0	0	0.0000	0	0.0000
50	50	0.0000	0	0	0	0.0000	0	0.0000

## WATERFORD UNIT 3, DYNAMIC ANALYSIS, TORSIONAL EFFECT STUDIES, MODE SHAPE PLOTTINGS

MODE NO 10 • 4

E-W DIRECTION, FUNCTIONAL

NUDE SHAPES FOR TRANSLAT

E-M. DIRECTION, MODE SHAPES FOR	TORSIONAL DEF. INCLUDED,		SOIL SHEAR MODULUS	
	1	2	1	2
1	0.000	0.000	0.000	0.000
2	0.000	0.000	0.000	0.000
3	0.000	0.000	0.000	0.000
4	0.000	0.000	0.000	0.000
5	0.000	0.000	0.000	0.000
6	0.000	0.000	0.000	0.000
7	0.000	0.000	0.000	0.000
8	0.000	0.000	0.000	0.000
9	0.000	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000
11	0.000	0.000	0.000	0.000
12	0.000	0.000	0.000	0.000
13	0.000	0.000	0.000	0.000
14	0.000	0.000	0.000	0.000
15	0.000	0.000	0.000	0.000
16	0.000	0.000	0.000	0.000
17	0.000	0.000	0.000	0.000
18	0.000	0.000	0.000	0.000
19	0.000	0.000	0.000	0.000
20	0.000	0.000	0.000	0.000
21	0.000	0.000	0.000	0.000
22	0.000	0.000	0.000	0.000
23	0.000	0.000	0.000	0.000
24	0.000	0.000	0.000	0.000
25	0.000	0.000	0.000	0.000
26	0.000	0.000	0.000	0.000
27	0.000	0.000	0.000	0.000
28	0.000	0.000	0.000	0.000
29	0.000	0.000	0.000	0.000
30	0.000	0.000	0.000	0.000
31	0.000	0.000	0.000	0.000
32	0.000	0.000	0.000	0.000
33	0.000	0.000	0.000	0.000
34	0.000	0.000	0.000	0.000
35	0.000	0.000	0.000	0.000
36	0.000	0.000	0.000	0.000
37	0.000	0.000	0.000	0.000
38	0.000	0.000	0.000	0.000
39	0.000	0.000	0.000	0.000
40	0.000	0.000	0.000	0.000
41	0.000	0.000	0.000	0.000
42	0.000	0.000	0.000	0.000
43	0.000	0.000	0.000	0.000
44	0.000	0.000	0.000	0.000
45	0.000	0.000	0.000	0.000
46	0.000	0.000	0.000	0.000
47	0.000	0.000	0.000	0.000
48	0.000	0.000	0.000	0.000
49	0.000	0.000	0.000	0.000
50	0.000	0.000	0.000	0.000
51	0.000	0.000	0.000	0.000
52	0.000	0.000	0.000	0.000
53	0.000	0.000	0.000	0.000
54	0.000	0.000	0.000	0.000
55	0.000	0.000	0.000	0.000
56	0.000	0.000	0.000	0.000
57	0.000	0.000	0.000	0.000
58	0.000	0.000	0.000	0.000
59	0.000	0.000	0.000	0.000
60	0.000	0.000	0.000	0.000
61	0.000	0.000	0.000	0.000
62	0.000	0.000	0.000	0.000
63	0.000	0.000	0.000	0.000
64	0.000	0.000	0.000	0.000
65	0.000	0.000	0.000	0.000
66	0.000	0.000	0.000	0.000
67	0.000	0.000	0.000	0.000
68	0.000	0.000	0.00	

[illegible]

# WATERFORD UNIT 3, DYNAMIC ANALYSIS, TORSIONAL EFFECT STUDIES, MUDE SHAPE PLUTTINGS

MUDE NO 10 -		L-W DIRECTION, TORSIONAL		DOF INCLUDED, SOIL SHEAR MODULUS G=6400 PSI	
MUDE SHAPES FOR ROTATIONS		COMPONENTS		N	
1	2	3	4	5	6
1	1	0.0000	0.0000	0.0000	0.0000
2	2	0.0000	0.0000	0.0000	0.0000
3	3	0.0000	0.0000	0.0000	0.0000
4	4	0.0000	0.0000	0.0000	0.0000
5	5	0.0000	0.0000	0.0000	0.0000
6	6	0.0000	0.0000	0.0000	0.0000
7	7	0.0000	0.0000	0.0000	0.0000
8	8	0.0000	0.0000	0.0000	0.0000
9	9	0.0000	0.0000	0.0000	0.0000
10	10	0.0000	0.0000	0.0000	0.0000
11	11	0.0000	0.0000	0.0000	0.0000
12	12	0.0000	0.0000	0.0000	0.0000
13	13	0.0000	0.0000	0.0000	0.0000
14	14	0.0000	0.0000	0.0000	0.0000
15	15	0.0000	0.0000	0.0000	0.0000
16	16	0.0000	0.0000	0.0000	0.0000
17	17	0.0000	0.0000	0.0000	0.0000
18	18	0.0000	0.0000	0.0000	0.0000
19	19	0.0000	0.0000	0.0000	0.0000
20	20	0.0000	0.0000	0.0000	0.0000
21	21	0.0000	0.0000	0.0000	0.0000
22	22	0.0000	0.0000	0.0000	0.0000
23	23	0.0000	0.0000	0.0000	0.0000
24	24	0.0000	0.0000	0.0000	0.0000
25	25	0.0000	0.0000	0.0000	0.0000
26	26	0.0000	0.0000	0.0000	0.0000
27	27	0.0000	0.0000	0.0000	0.0000
28	28	0.0000	0.0000	0.0000	0.0000
29	29	0.0000	0.0000	0.0000	0.0000
30	30	0.0000	0.0000	0.0000	0.0000
31	31	0.0000	0.0000	0.0000	0.0000
32	32	0.0000	0.0000	0.0000	0.0000
33	33	0.0000	0.0000	0.0000	0.0000
34	34	0.0000	0.0000	0.0000	0.0000
35	35	0.0000	0.0000	0.0000	0.0000
36	36	0.0000	0.0000	0.0000	0.0000
37	37	0.0000	0.0000	0.0000	0.0000
38	38	0.0000	0.0000	0.0000	0.0000
39	39	0.0000	0.0000	0.0000	0.0000
40	40	0.0000	0.0000	0.0000	0.0000
41	41	0.0000	0.0000	0.0000	0.0000
42	42	0.0000	0.0000	0.0000	0.0000
43	43	0.0000	0.0000	0.0000	0.0000
44	44	0.0000	0.0000	0.0000	0.0000
45	45	0.0000	0.0000	0.0000	0.0000
46	46	0.0000	0.0000	0.0000	0.0000
47	47	0.0000	0.0000	0.0000	0.0000
48	48	0.0000	0.0000	0.0000	0.0000
49	49	0.0000	0.0000	0.0000	0.0000
50	50	0.0000	0.0000	0.0000	0.0000

## WATERFORD UNIT 1, DYNAMIC ANALYSIS, TORSIONAL EFFECT STUDIES, NOISE SHAPE PLOTTINGS

RUDE NO 10 - 5

E-W DIRECTION, CURSORS	DOF INCLUDED, SOIL	SHEAR MODULUS
MODE SHAPES FOR TRANSLATIONS, COMPONENTS	1	2
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7
8	8	8
9	9	9
10	10	10
11	11	11
12	12	12
13	13	13
14	14	14
15	15	15
16	16	16
17	17	17
18	18	18
19	19	19
20	20	20
21	21	21
22	22	22
23	23	23
24	24	24
25	25	25
26	26	26
27	27	27
28	28	28
29	29	29
30	30	30
31	31	31
32	32	32
33	33	33
34	34	34
35	35	35
36	36	36
37	37	37
38	38	38
39	39	39
40	40	40
41	41	41
42	42	42
43	43	43
44	44	44
45	45	45
46	46	46
47	47	47
48	48	48
49	49	49
50	50	50
51	51	51
52	52	52
53	53	53
54	54	54
55	55	55
56	56	56
57	57	57
58	58	58
59	59	59
60	60	60
61	61	61
62	62	62
63	63	63
64	64	64
65	65	65
66	66	66
67	67	67
68	68	68
69	69	69
70	70	70
71	71	71
72	72	72
73	73	73
74	74	74
75	75	75
76	76	76
77	77	77
78	78	78
79	79	79
80	80	80
81	81	81
82	82	82
83	83	83
84	84	84
85	85	85
86	86	86
87	87	87
88	88	88
89	89	89
90	90	90
91	91	91
92	92	92
93	93	93
94	94	94
95	95	95
96	96	96
97	97	97
98	98	98
99	99	99
100	100	100

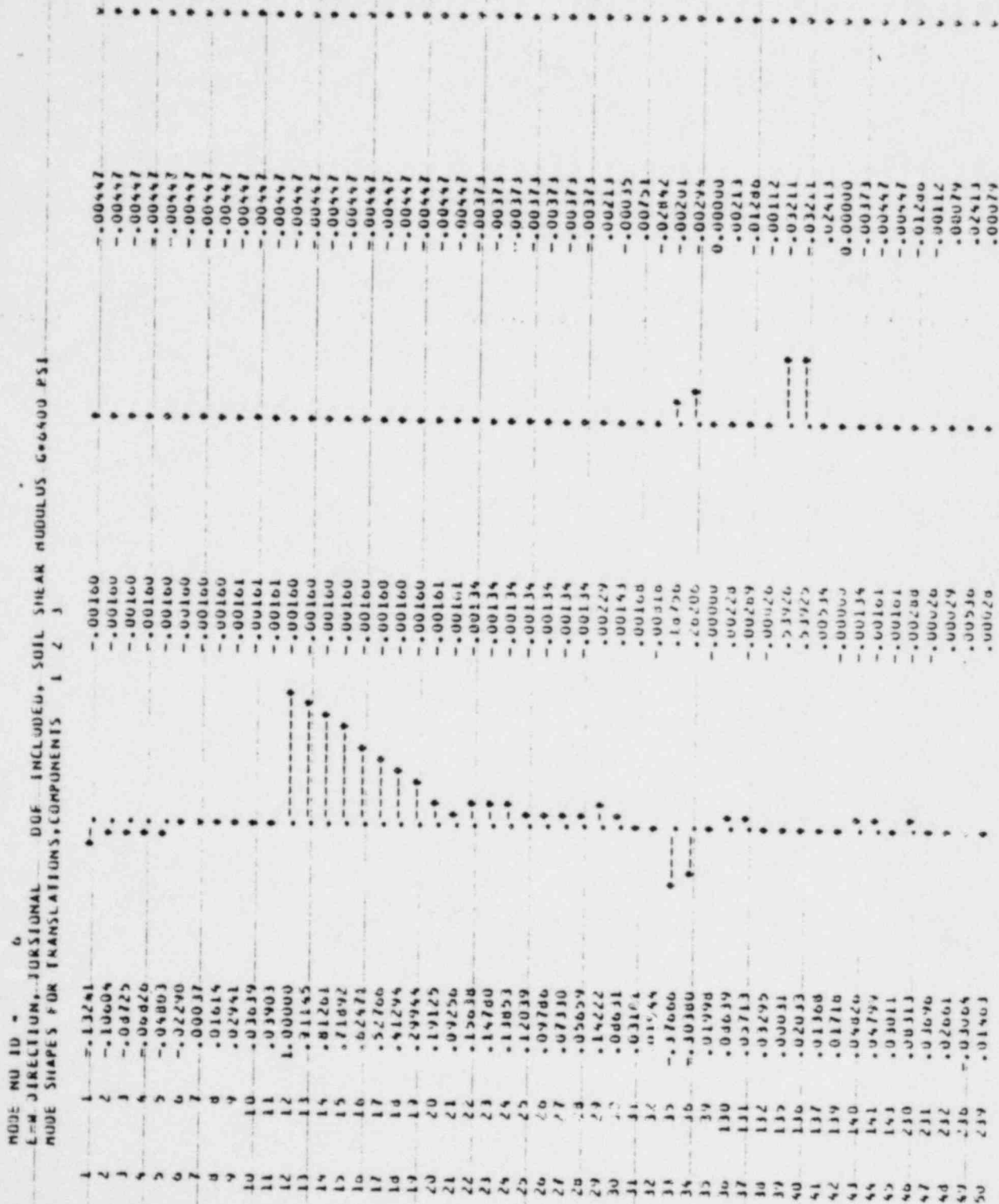
MODE SHAPES FOR TRANSLATIONS, COMPONENTS 1 2 1

[illegible]





# WATERFORD UNIT 3, DYNAMIC ANALYSIS, TORSIONAL EFFECT STUDIES, MODE SHAPE PLOTTINGS



# WATERFORD UNIT 3, DYNAMIC ANALYSIS, TORSIONAL EFFECT STUDIES, MODE SHAPE PLOTTINGS

MODE NO 10 -  
E-W DIRECTION, TORSIONAL - DUE TO INCLUDE, SOIL SHEAR MODULUS 64600 PSI  
MODE SHAPES FOR ROTATIONS, COMPONENTS 5 6

1	1	7.00000	0	0.00040	0	0.00043
2	2	7.00000	0	0.00038	0	0.00042
3	3	7.00000	0	0.00036	0	0.00039
4	4	7.00000	0	0.00032	0	0.00034
5	5	7.00000	0	0.00026	0	0.00027
6	6	7.00000	0	0.00016	0	0.00018
7	7	7.00000	0	0.00002	0	0.00007
8	8	7.00000	0	0.00012	0	0.00002
9	9	7.00000	0	0.00031	0	0.00011
10	10	7.00000	0	0.00049	0	0.00019
11	11	7.00000	0	0.00068	0	0.00026
12	12	7.00000	0	0.00325	0	0.00027
13	13	7.00000	0	0.00322	0	0.00027
14	14	7.00000	0	0.00315	0	0.00027
15	15	7.00000	0	0.00308	0	0.00027
16	16	7.00000	0	0.00296	0	0.00027
17	17	7.00000	0	0.00264	0	0.00027
18	18	7.00000	0	0.00258	0	0.00027
19	19	7.00000	0	0.00221	0	0.00027
20	20	7.00000	0	0.00172	0	0.00027
21	21	7.00000	0	0.00110	0	0.00027
22	22	7.00000	0	0.00108	0	0.00028
23	23	7.00000	0	0.00107	0	0.00028
24	24	7.00000	0	0.00106	0	0.00028
25	25	7.00000	0	0.00105	0	0.00028
26	26	7.00000	0	0.00101	0	0.00028
27	27	7.00000	0	0.00093	0	0.00028
28	28	7.00000	0	0.00082	0	0.00028
29	29	7.00000	0	0.00083	0	0.00028
30	30	7.00000	0	0.00076	0	0.00028
31	31	7.00000	0	0.00070	0	0.00028
32	32	7.00000	0	0.00072	0	0.00028
33	33	7.00000	0	0.00065	0	0.00021
34	34	7.00000	0	0.00066	0	0.00021
35	35	7.00000	0	0.00075	0	0.00023
36	36	7.00000	0	0.00076	0	0.00023
37	37	7.00000	0	0.00070	0	0.00026
38	38	7.00000	0	0.00072	0	0.00026
39	39	7.00000	0	0.00065	0	0.00021
40	40	7.00000	0	0.00066	0	0.00021
41	41	7.00000	0	0.00070	0	0.00023
42	42	7.00000	0	0.00075	0	0.00023
43	43	7.00000	0	0.00074	0	0.00027
44	44	7.00000	0	0.00074	0	0.00027
45	45	7.00000	0	0.00076	0	0.00027
46	46	7.00000	0	0.00070	0	0.00026
47	47	7.00000	0	0.00072	0	0.00026
48	48	7.00000	0	0.00066	0	0.00021
49	49	7.00000	0	0.00066	0	0.00021
50	50	7.00000	0	0.00074	0	0.00023
51	51	7.00000	0	0.00074	0	0.00023
52	52	7.00000	0	0.00076	0	0.00027
53	53	7.00000	0	0.00070	0	0.00026
54	54	7.00000	0	0.00072	0	0.00026
55	55	7.00000	0	0.00066	0	0.00021
56	56	7.00000	0	0.00066	0	0.00021
57	57	7.00000	0	0.00074	0	0.00023
58	58	7.00000	0	0.00074	0	0.00023
59	59	7.00000	0	0.00076	0	0.00027
60	60	7.00000	0	0.00070	0	0.00026
61	61	7.00000	0	0.00072	0	0.00026
62	62	7.00000	0	0.00066	0	0.00021
63	63	7.00000	0	0.00066	0	0.00021
64	64	7.00000	0	0.00074	0	0.00023
65	65	7.00000	0	0.00074	0	0.00023
66	66	7.00000	0	0.00076	0	0.00027
67	67	7.00000	0	0.00070	0	0.00026
68	68	7.00000	0	0.00072	0	0.00026
69	69	7.00000	0	0.00066	0	0.00021
70	70	7.00000	0	0.00066	0	0.00021
71	71	7.00000	0	0.00074	0	0.00023
72	72	7.00000	0	0.00074	0	0.00023
73	73	7.00000	0	0.00076	0	0.00027
74	74	7.00000	0	0.00070	0	0.00026
75	75	7.00000	0	0.00072	0	0.00026
76	76	7.00000	0	0.00066	0	0.00021
77	77	7.00000	0	0.00066	0	0.00021
78	78	7.00000	0	0.00074	0	0.00023
79	79	7.00000	0	0.00074	0	0.00023
80	80	7.00000	0	0.00076	0	0.00027
81	81	7.00000	0	0.00070	0	0.00026
82	82	7.00000	0	0.00072	0	0.00026
83	83	7.00000	0	0.00066	0	0.00021
84	84	7.00000	0	0.00066	0	0.00021
85	85	7.00000	0	0.00074	0	0.00023
86	86	7.00000	0	0.00074	0	0.00023
87	87	7.00000	0	0.00076	0	0.00027
88	88	7.00000	0	0.00070	0	0.00026
89	89	7.00000	0	0.00072	0	0.00026
90	90	7.00000	0	0.00066	0	0.00021
91	91	7.00000	0	0.00066	0	0.00021
92	92	7.00000	0	0.00074	0	0.00023
93	93	7.00000	0	0.00074	0	0.00023
94	94	7.00000	0	0.00076	0	0.00027
95	95	7.00000	0	0.00070	0	0.00026
96	96	7.00000	0	0.00072	0	0.00026
97	97	7.00000	0	0.00066	0	0.00021
98	98	7.00000	0	0.00066	0	0.00021
99	99	7.00000	0	0.00074	0	0.00023
100	100	7.00000	0	0.00074	0	0.00023

# WATERFORD UNIT 3, DYNAMIC ANALYSIS, TORSIONAL EFFECT STUDIES, MODE SHAPE PLOTTINGS

MODE NO ID =		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42	
E-W DIRECTION, TORSIONAL DOF NOT INCLUDED, SOIL SHEAR MODULUS G=6400 PSI		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42	
MODE SHAPES FOR TRANSLATIONS, COMPONENTS		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42	
Node Pt		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42	
X <sub>1</sub> (1-2)		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42	
X <sub>2</sub> (3-4)		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42	
X <sub>3</sub> (5-6)		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42	
X <sub>4</sub> (7-8)		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42	
X <sub>5</sub> (9-10)		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42	
X <sub>6</sub> (11-12)		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42	
X <sub>7</sub> (13-14)		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42	
X <sub>8</sub> (15-16)		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42	
X <sub>9</sub> (17-18)		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42	
X <sub>10</sub> (19-20)		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42	
X <sub>11</sub> (21-22)		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42	
X <sub>12</sub> (23-24)		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42	
X <sub>13</sub> (25-26)		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42	
X <sub>14</sub> (27-28)		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42	
X <sub>15</sub> (29-30)		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42	
X <sub>16</sub> (31-32)		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42	
X <sub>17</sub> (33-34)		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42	
X <sub>18</sub> (35-36)		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42	
X <sub>19</sub> (37-38)		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42	
X <sub>20</sub> (39-40)		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42	
X <sub>21</sub> (41-42)		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42	
X <sub>22</sub> (43-44)		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42	
X <sub>23</sub> (45-46)		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42	
X <sub>24</sub> (47-48)		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42	
X <sub>25</sub> (49-50)		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16																																																					



## WATERFORD UNIT 3, DYNAMIC ANALYSIS, TORSIONAL EFFECT STUDIES, MODE SHAPE PLOTTINGS

MODE NO 10 • 1  
 $f_1 = 1.071 \text{ Hz}$ 

E-W DIRECTION, TORSIONAL DOF NOT INCLUDED, SOIL SHEAR MODULUS G=6400 PSI

MODE SHAPES FOR ROTATIONS, COMPONENTS q 5 6

[illegible]

\*\* MAX MODAL ROTATIONAL DISPLACEMENT(USED FOR NORMALIZATION) = .165281E-02

# WATERFORD UNIT 3, DYNAMIC ANALYSIS, TORSIONAL EFFECT STUDIES, MODE SHAPE PLOTTINGS

MODE NO 10 \* 2  $f_n = 2.446 \text{ Hz}$

E-W DIRECTION, TORSIONAL DOF NOT INCLUDED, SOIL SHEAR MODULUS G=6000 PSI

MODE SHAPES FOR TRANSLATIONS, COMPONENTS 1 2 3

Node Pt	$X_1 (E-W)$	$X_2 (N-S)$	$X_3 (V-GR)$
1	1.00000	-.00001	-.01941
2	.85636	-.00001	-.01941
3	.74563	-.00001	-.01941
4	.64271	-.00001	-.01941
5	.53675	-.00001	-.01941
6	.40364	-.00001	-.01941
7	.27100	-.00001	-.01941
8	.16702	-.00001	-.01941
9	.05616	-.00000	-.01941
10	-.03563	-.00000	-.01941
11	-.11832	-.00000	-.01941
12	.63461	-.00001	-.01941
13	.55907	-.00001	-.01941
14	.48107	-.00001	-.01941
15	.40356	-.00001	-.01941
16	.32607	-.00001	-.01941
17	.24850	-.00001	-.01941
18	.16963	-.00001	-.01941
19	.09100	-.00001	-.01941
20	.01295	-.00000	-.01941
21	-.06417	-.00000	-.01941
22	.13235	-.00001	-.01618
23	.10846	-.00001	-.01618
24	.08504	-.00001	-.01618
25	.06498	-.00000	-.01618
26	.04906	-.00000	-.01618
27	.03675	-.00000	-.01618
28	-.07954	-.00000	-.01618
29	.23318	-.00009	-.05962
30	.08334	-.00009	-.05962
31	.00285	-.00001	-.03485
32	-.07938	-.00000	-.03485
33	.16397	-.00009	-.11202
34	.08725	-.00009	-.11202
35	-.16718	0.00000	0.00000
36	.00228	-.00009	-.05962
37	.00324	-.00009	-.11202
38	-.19930	0.00000	0.00000
39	-.10226	-.00000	-.01618
40	-.10226	-.00000	-.01941
41	-.17902	-.00000	-.01941
42	-.17992	-.00000	-.03485

\*\* MAX MU/L TRANSLATIONAL DISPT (USED FOR NORMALIZATION) = 1.00

WATERFORD UNIT 3, DYNAMIC ANALYSIS, TORSIONAL EFFECT STUDIES, MODE SHAPE PLOTTINGS

MODE NO	ID #	$f_n = 2.665 Hz$	$\chi_4$ (Rotation in N-S Direction)	$\chi_5$ (Rotation in E-W Direction)	$\chi_6$ (Torsion)
1	1	.0000	.0000	.0000	.0000
2	2	.0000	.0000	.0000	.0000
3	3	.0000	.0000	.0000	.0000
4	4	.0000	.0000	.0000	.0000
5	5	.0000	.0000	.0000	.0000
6	6	.0000	.0000	.0000	.0000
7	7	.0000	.0000	.0000	.0000
8	8	.0000	.0000	.0000	.0000
9	9	.0000	.0000	.0000	.0000
10	10	.0000	.0000	.0000	.0000
11	11	.0000	.0000	.0000	.0000
12	12	.0000	.0000	.0000	.0000
13	13	.0000	.0000	.0000	.0000
14	14	.0000	.0000	.0000	.0000
15	15	.0000	.0000	.0000	.0000
16	16	.0000	.0000	.0000	.0000
17	17	.0000	.0000	.0000	.0000
18	18	.0000	.0000	.0000	.0000
19	19	.0000	.0000	.0000	.0000
20	20	.0000	.0000	.0000	.0000
21	21	.0000	.0000	.0000	.0000
22	22	.0000	.0000	.0000	.0000
23	23	.0000	.0000	.0000	.0000
24	24	.0000	.0000	.0000	.0000
25	25	.0000	.0000	.0000	.0000
26	26	.0000	.0000	.0000	.0000
27	27	.0000	.0000	.0000	.0000
28	28	.0000	.0000	.0000	.0000
29	29	.0000	.0000	.0000	.0000
30	30	.0000	.0000	.0000	.0000
31	31	.0000	.0000	.0000	.0000
32	32	.0000	.0000	.0000	.0000
33	33	.0000	.0000	.0000	.0000
34	34	.0000	.0000	.0000	.0000
35	35	.0000	.0000	.0000	.0000
36	36	.0000	.0000	.0000	.0000
37	37	.0000	.0000	.0000	.0000
38	38	.0000	.0000	.0000	.0000
39	39	.0000	.0000	.0000	.0000
40	40	.0000	.0000	.0000	.0000
41	41	.0000	.0000	.0000	.0000
42	42	.0000	.0000	.0000	.0000

\*\* MAX MODAL ROTATIONAL DISPLACEMENT (USED FOR NORMALIZATION) = .459208E-02

## WATERFORD UNIT 3, DYNAMIC ANALYSIS, TORSIONAL EFFECT STUDIES, MODE SHAPE PLOTTINGS

MODE NO 10 0 1

E-W DIRECTION, TORSIONAL DOF NOT INCLUDED, SOIL SHEAR MODULUS G=8400 PSI  
MODE SHAPES FOR TRANSLATIONS, COMPONENTS 1 2 3

2 1

[illegible]

\*\* MAX MUJAL TRANSLATIONAL DISPMT (USED FOR NORMALIZATION) = 1.00

B5



WATERFORD UNIT 3, DYNAMIC ANALYSIS, TORSIONAL EFFECT STUDIES, MODE SHAPE PLOTTINGS

MODE NO 10 \*  
E-W DIRECTION, TORSIONAL DOF NOT INCLUDED, SOIL SHEAR MODULUS G=6400 PSI  
MODE SHAPES FOR ROTATIONS, COMPONENTS 4 5 6

1	.00000	.00248	.....	.....	.....
2	.00000	.00243	.....	.....	.....
3	.00000	.00234	.....	.....	.....
4	.00000	.00220	.....	.....	.....
5	.00000	.00198	.....	.....	.....
6	.00000	.00157	.....	.....	.....
7	.00000	.00099	.....	.....	.....
8	.00000	.00040	.....	.....	.....
9	.00000	.00039	.....	.....	.....
10	.00000	.00120	.....	.....	.....
11	.00000	.00208	.....	.....	.....
12	.00000	.00339	.....	.....	.....
13	.00000	.00338	.....	.....	.....
14	.00000	.00335	.....	.....	.....
15	.00000	.00332	.....	.....	.....
16	.00000	.00328	.....	.....	.....
17	.00000	.00323	.....	.....	.....
18	.00000	.00312	.....	.....	.....
19	.00000	.00297	.....	.....	.....
20	.00000	.00278	.....	.....	.....
21	.00000	.00254	.....	.....	.....
22	.00000	.00261	.....	.....	.....
23	.00000	.00261	.....	.....	.....
24	.00000	.00260	.....	.....	.....
25	.00000	.00259	.....	.....	.....
26	.00000	.00257	.....	.....	.....
27	.00000	.00251	.....	.....	.....
28	.00000	.00248	.....	.....	.....
29	.00000	.00257	.....	.....	.....
30	.00000	.00250	.....	.....	.....
31	.00000	.00243	.....	.....	.....
32	.00000	.00242	.....	.....	.....
33	.00000	.00285	.....	.....	.....
34	.00000	.00248	.....	.....	.....
35	.00000	.00240	.....	.....	.....
36	.00000	.00240	.....	.....	.....
37	.00000	.00283	.....	.....	.....
38	.00000	.00243	.....	.....	.....
39	.00000	.00240	.....	.....	.....
40	.00000	.00240	.....	.....	.....
41	.00000	.00240	.....	.....	.....
42	.00000	.00240	.....	.....	.....

\*\* MAX MODAL ROTATIONAL DISPLACEMENT (USED FOR NORMALIZATION) = -.139095E-02

# WATERFORD UNIT 3, 0V' C ANALYSIS, TORSIONAL EFFECT STUDIES, MODE SHAPE PLOTTINGS

MODE NO 10 8  
 E-W DIRECTION, TORS' AL DOF NOT INCLUDED, SOIL SHEAR MODULUS G=8400 PSI  
 MODE SHAPES FOR VIBRATIONS, COMPONENTS 1 2 3

1	1	.01	-.0000	-.00109	.
2	2	.002	-.0000	-.00109	.
3	3	.0090	-.0000	-.00109	.
4	4	.00876	-.0000	-.00109	.
5	5	.00740	-.0000	-.00109	.
6	6	.00559	-.0000	-.00109	.
7	7	.00340	-.0000	-.00109	.
8	8	.00261	-.0000	-.00109	.
9	9	.00171	-.0000	-.00109	.
10	10	.00137	-.0000	-.00109	.
11	11	.00152	-.0000	-.00109	.
12	12	1.00000	-.0000	-.00109	.
13	13	.90808	-.0000	-.00109	.
14	14	.80392	-.0000	-.00109	.
15	15	.70631	-.0000	-.00109	.
16	16	.60817	-.0000	-.00109	.
17	17	.50661	-.0000	-.00109	.
18	18	.38218	-.0000	-.00109	.
19	19	.25961	-.0000	-.00109	.
20	20	.14504	-.0000	-.00109	.
21	21	.04346	-.0000	-.00109	.
22	22	-.02350	-.0000	-.00091	.
23	23	-.02159	-.0000	-.00091	.
24	24	-.01955	-.0000	-.00091	.
25	25	-.01569	-.0000	-.00091	.
26	26	-.01100	-.0000	-.00091	.
27	27	-.00593	-.0000	-.00091	.
28	28	-.00243	-.0000	-.00091	.
29	29	-.06130	-.0048	-.00376	.
30	30	-.02297	-.00048	-.00376	.
31	31	-.01744	-.0001	-.00197	.
32	32	-.00752	-.00001	-.00197	.
33	33	-.04362	-.0040	-.00664	.
34	34	-.03336	-.00039	-.00664	.
35	35	-.00411	0.00000	0.00000	.
36	36	-.01483	-.00045	-.00376	.
37	37	-.01923	-.00039	-.00664	.
38	38	.00479	0.00000	0.00000	.
39	39	-.00067	-.00000	-.00091	.
40	40	-.00067	-.00000	-.00109	.
41	41	-.00370	-.00000	-.00109	.
42	42	.00367	-.00001	-.00197	.

\*\* MAX MODAL TRANSLATIONAL DISPHY (USED FOR NORMALIZATION) = 1.00

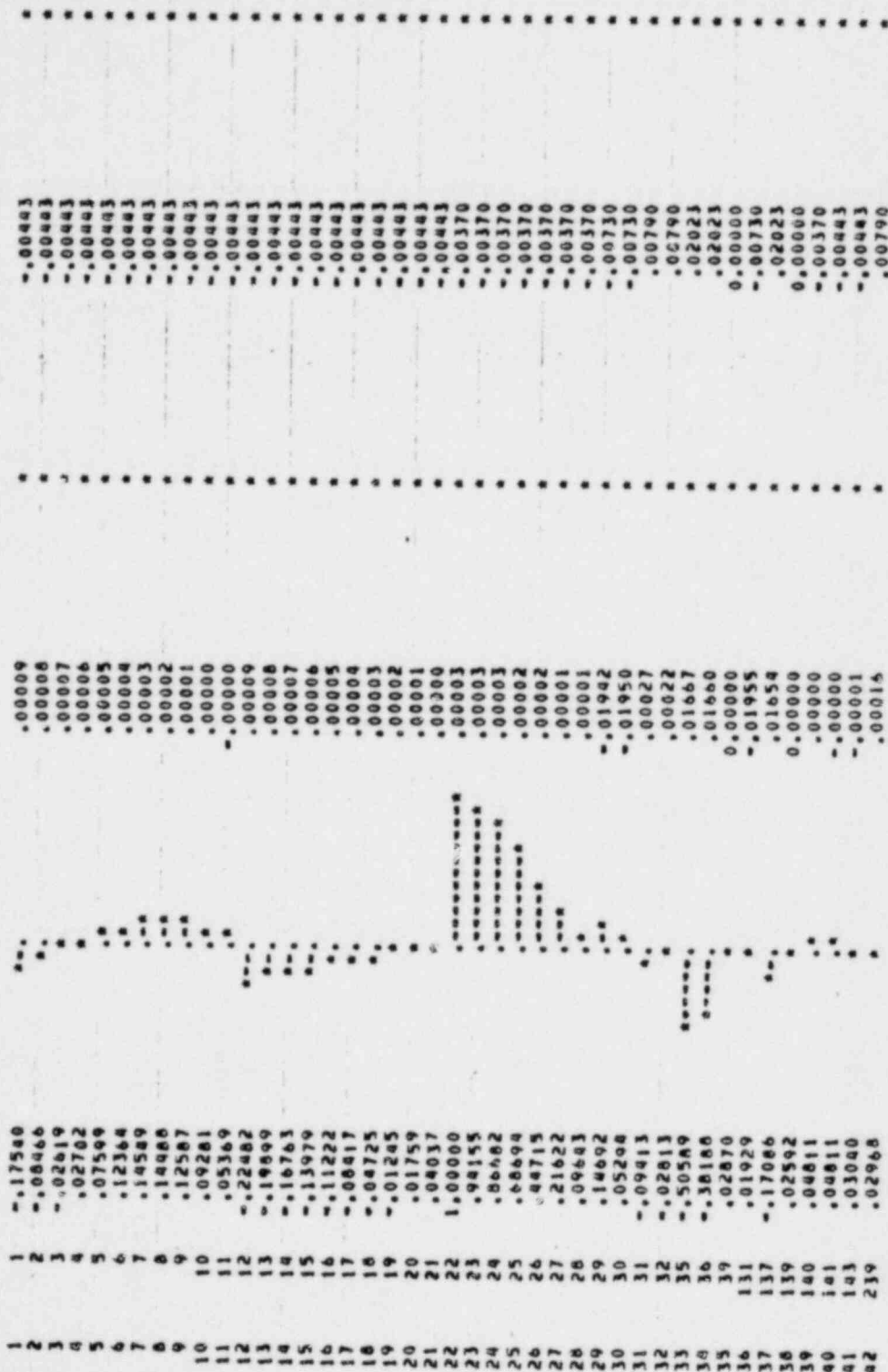
WATERFORD UNIT 3, DYNAMIC ANALYSIS, TORSIONAL EFFECT STUDIES, MODE SHAPE PLOTTINGS

MODE NO	ID	4	5	6
1	1	.00000	.00002	.00000
2	2	.00000	.00002	.00000
3	3	.00000	.00002	.00000
4	4	.00000	.00003	.00000
5	5	.00000	.00003	.00000
6	6	.00000	.00005	.00000
7	7	.00000	.00007	.00000
8	8	.00000	.00009	.00000
9	9	.00000	.00011	.00000
10	10	.00000	.00014	.00000
11	11	.00000	.00017	.00000
12	12	.00000	.00310	.00000
13	13	.00000	.00306	.00000
14	14	.00000	.00297	.00000
15	15	.00000	.00287	.00000
16	16	.00000	.00274	.00000
17	17	.00000	.00256	.00000
18	18	.00000	.00221	.00000
19	19	.00000	.00173	.00000
20	20	.00000	.00108	.00000
21	21	.00000	.00028	.00000
22	22	.00000	.00024	.00000
23	23	.00000	.00024	.00000
24	24	.00000	.00024	.00000
25	25	.00000	.00024	.00000
26	26	.00000	.00023	.00000
27	27	.00000	.00022	.00000
28	28	.00000	.00019	.00000
29	29	.00000	.00025	.00000
30	30	.00000	.00022	.00000
31	31	.00000	.00020	.00000
32	32	.00000	.00019	.00000
33	33	.00000	.00020	.00000
34	34	.00000	.00020	.00000
35	35	.00000	.00018	.00000
36	36	.00000	.00020	.00000
37	37	.00000	.00020	.00000
38	38	.00000	.00018	.00000
39	39	.00000	.00018	.00000
40	40	.00000	.00018	.00000
41	41	.00000	.00018	.00000
42	42	.00000	.00018	.00000
43	43	.00000	.00018	.00000
44	44	.00000	.00018	.00000
45	45	.00000	.00018	.00000
46	46	.00000	.00018	.00000
47	47	.00000	.00018	.00000
48	48	.00000	.00018	.00000
49	49	.00000	.00018	.00000
50	50	.00000	.00018	.00000
51	51	.00000	.00018	.00000
52	52	.00000	.00018	.00000
53	53	.00000	.00018	.00000
54	54	.00000	.00018	.00000
55	55	.00000	.00018	.00000
56	56	.00000	.00018	.00000
57	57	.00000	.00018	.00000
58	58	.00000	.00018	.00000
59	59	.00000	.00018	.00000
60	60	.00000	.00018	.00000
61	61	.00000	.00018	.00000
62	62	.00000	.00018	.00000
63	63	.00000	.00018	.00000
64	64	.00000	.00018	.00000
65	65	.00000	.00018	.00000
66	66	.00000	.00018	.00000
67	67	.00000	.00018	.00000
68	68	.00000	.00018	.00000
69	69	.00000	.00018	.00000
70	70	.00000	.00018	.00000
71	71	.00000	.00018	.00000
72	72	.00000	.00018	.00000
73	73	.00000	.00018	.00000
74	74	.00000	.00018	.00000
75	75	.00000	.00018	.00000
76	76	.00000	.00018	.00000
77	77	.00000	.00018	.00000
78	78	.00000	.00018	.00000
79	79	.00000	.00018	.00000
80	80	.00000	.00018	.00000
81	81	.00000	.00018	.00000
82	82	.00000	.00018	.00000
83	83	.00000	.00018	.00000
84	84	.00000	.00018	.00000
85	85	.00000	.00018	.00000
86	86	.00000	.00018	.00000
87	87	.00000	.00018	.00000
88	88	.00000	.00018	.00000
89	89	.00000	.00018	.00000
90	90	.00000	.00018	.00000
91	91	.00000	.00018	.00000
92	92	.00000	.00018	.00000
93	93	.00000	.00018	.00000
94	94	.00000	.00018	.00000
95	95	.00000	.00018	.00000
96	96	.00000	.00018	.00000
97	97	.00000	.00018	.00000
98	98	.00000	.00018	.00000
99	99	.00000	.00018	.00000
100	100	.00000	.00018	.00000

\*\* MAX MODAL ROTATIONAL DISPLACEMENT (USED FOR NORMALIZATION) = .310201E-02

WATERFORD UNIT 3, DYNAMIC ANALYSIS, TORSIONAL EFFECT STUDIES, MODE SHAPE PLOTTINGS

MODE NO 10 5  
E-W DIRECTION, TORSIONAL DOF NOT INCLUDED, SOIL SHEAR MODULUS 666000 PSI  
MODE SHAPES FOR TRANSLATIONS, COMPONENTS 1 2 3



\*\* MAX MODAL TRANSLATIONAL DISPLT (USED FOR NORMALIZATION) = 1.00



## WATERFORD UNIT 3, DYNAMIC ANALYSIS, TORSIONAL EFFECT STUDIES, MODE SHAPE PLOTTINGS

MOORE NO 10 5

E-W DIRECTION, TORSIONAL DOF NOT INCLUDED, SOIL SHEAR MODULUS G=6400 PSI  
MODE SHAPES FOR ROTATIONS, COMPONENTS 4 5 6

MODE SHAPES FOR ROTATIONS, COMPONENTS 4 5 6

1	00000	000000	000000
2	00000	000000	000000
3	00000	000000	000000
4	00000	000000	000000
5	00000	000000	000000
6	00000	000000	000000
7	00000	000000	000000
8	00000	000000	000000
9	00000	000000	000000
10	00000	000000	000000
11	00000	000000	000000
12	00000	000000	000000
13	00000	000000	000000
14	00000	000000	000000
15	00000	000000	000000
16	00000	000000	000000
17	00000	000000	000000
18	00000	000000	000000
19	00000	000000	000000
20	00000	000000	000000
21	00000	000000	000000
22	00000	000000	000000
23	00000	000000	000000
24	00000	000000	000000
25	00000	000000	000000
26	00000	000000	000000
27	00000	000000	000000
28	00000	000000	000000
29	00000	000000	000000
30	00000	000000	000000
31	00000	000000	000000
32	00000	000000	000000
33	00000	000000	000000
34	00000	000000	000000
35	00000	000000	000000
36	00000	000000	000000
37	00000	000000	000000
38	00000	000000	000000
39	00000	000000	000000
40	00000	000000	000000
41	00000	000000	000000
42	00000	000000	000000
43	00000	000000	000000
44	00000	000000	000000
45	00000	000000	000000
46	00000	000000	000000
47	00000	000000	000000
48	00000	000000	000000
49	00000	000000	000000
50	00000	000000	000000
51	00000	000000	000000
52	00000	000000	000000
53	00000	000000	000000
54	00000	000000	000000
55	00000	000000	000000
56	00000	000000	000000
57	00000	000000	000000
58	00000	000000	000000
59	00000	000000	000000
60	00000	000000	000000
61	00000	000000	000000
62	00000	000000	000000
63	00000	000000	000000
64	00000	000000	000000
65	00000	000000	000000
66	00000	000000	000000
67	00000	000000	000000
68	00000	000000	000000
69	00000	000000	000000
70	00000	000000	000000
71	00000	000000	000000
72	00000	000000	000000
73	00000	000000	000000
74	00000	000000	000000
75	00000	000000	000000
76	00000	000000	000000
77	00000	000000	000000
78	00000	000000	000000
79	00000	000000	000000
80	00000	000000	000000
81	00000	000000	000000
82	00000	000000	000000
83	00000	000000	000000
84	00000	000000	000000
85	00000	000000	000000
86	00000	000000	000000
87	00000	000000	000000
88	00000	000000	000000
89	00000	000000	000000
90	00000	000000	000000
91	00000	000000	000000
92	00000	000000	000000
93	00000	000000	000000
94	00000	000000	000000
95	00000	000000	000000
96	00000	000000	000000
97	00000	000000	000000
98	00000	000000	000000
99	00000	000000	000000
100	00000	000000	000000

\*\* MAX MODAL ROTATIONAL DISPLACEMENT(USED FOR NORMALIZATION) = .624901E-02

B 10

## WATERFORD UNIT 3, DYNAMIC ANALYSIS, TORSIONAL EFFECT STUDIES, MODE SHAPE PLOTTINGS

MODE NO ID ■ 6

E-W DIRECTION, TORSIONAL DOF NOT INCLUDED, SOIL SHEAR MODULUS G=8400 PSI  
MODE SHAPES FOR TRANSLATIONS, COMPONENTS 1 2 3

23

Iteration	Value	Value	Value
1	1.00000	0.00000	0.00000
2	0.37083	0.00005	0.00242
3	0.0207	0.00004	0.00242
4	0.03347	0.00004	0.00242
5	0.05729	0.00003	0.00242
6	0.09753	0.00002	0.00242
7	0.15404	0.00002	0.00242
8	0.26493	0.00001	0.00242
9	0.45213	0.00001	0.00242
10	0.7785	0.00000	0.00242
11	0.8957	0.00000	0.00242
12	0.95227	0.00005	0.00242
13	0.9817	0.00005	0.00242
14	0.99250	0.00005	0.00242
15	0.99774	0.00004	0.00242
16	0.99929	0.00005	0.00242
17	0.99954	0.00002	0.00242
18	0.9997	0.00002	0.00242
19	0.99993	0.00001	0.00242
20	0.99995	0.00001	0.00242
21	0.99999	0.00000	0.00242
22	0.99999	0.00002	0.00242
23	0.99999	0.00002	0.00242
24	0.99999	0.00002	0.00242
25	0.99999	0.00001	0.00242
26	0.99999	0.00001	0.00242
27	0.99999	0.00001	0.00242
28	0.99999	0.00000	0.00242
29	0.99999	0.00000	0.00242
30	0.99999	0.00000	0.00242
31	0.99999	0.00000	0.00242
32	0.99999	0.00000	0.00242
33	0.99999	0.00000	0.00242
34	0.99999	0.00000	0.00242
35	0.99999	0.00000	0.00242
36	0.99999	0.00000	0.00242
37	0.99999	0.00000	0.00242
38	0.99999	0.00000	0.00242
39	0.99999	0.00000	0.00242
40	0.99999	0.00000	0.00242
41	0.99999	0.00000	0.00242
42	0.99999	0.00000	0.00242

\*\* MAX MODAL TRANSLATIONAL DISPLT (USED FOR NORMALIZATION) = 1.00



WATERFORD UNIT 1, DYNAMIC ANALYSIS, TORSIONAL EFFECT STUDIES, MODE SHAPE PLOTTINGS

MODE NO 10 = 1  $f_1 = 1.082 \text{ Hz}$   
 N-S DIRECTION, TORSIONAL DOF INCLUDED, SOIL SHEAR MODULUS G=6400 PSI  
 MODE SHAPE FOR TRANSLATIONS, COMPONENTS 1 2 3

	MODE PT	$X_1 (E-W)$	$X_2 (E-W)$	$X_3 (N-S)$	$X_4 (N-S)$	$X_5 (VBR)$	$X_6 (VBR)$
	1	-.00686		1.00000			
	2	-.00686		.96219		-.02909	
	3	-.00686		.95703		-.02909	
SHIELD	4	-.00685		.90555		-.02909	
	5	-.00685		.87738		-.02909	
BLDG	6	-.00685		.84112		-.02909	
	7	-.00685		.80559		-.02909	
	8	-.00685		.77678		-.02909	
	9	-.00685		.74543		-.02909	
	10	-.00685		.71869		-.02909	
	11	-.00685		.69410		-.02909	
	12	-.00686		.91697		-.02909	
	13	-.00686		.89496		-.02909	
CONTAINER	14	-.00686		.87220		-.02909	
	15	-.00685		.84955		-.02909	
VKBL	16	-.00685		.82684		-.02909	
	17	-.00685		.80394		-.02909	
	18	-.00685		.78038		-.02909	
	19	-.00685		.75674		-.02909	
	20	-.00685		.73311		-.02909	
	21	-.00685		.70961		-.02909	
	22	-.00686		.76953		-.03001	
	23	-.00686		.76248		-.03001	
INT	24	-.00686		.75565		-.03001	
	25	-.00686		.74869		-.03001	
SHUT	26	-.00686		.73254		-.03001	
	27	-.00685		.71767		-.03001	
	28	-.00685		.70490		-.03001	
	29	-.03008		.80884		-.13521	
FHB	30	-.03002		.76085		-.13492	
	31	.00690		.73176		.03112	
	32	.01243		.71614		.05608	
	33	.01908		.79161		.09615	
RAB	34	.01776		.76754		.09424	
	35	.00000		.67250		.00000	
	36	.00000		.76025		-.13521	
	37	.02108		.73782		-.12340	
	38	.00102		.70821		.00415	
	39	.03255		.80418		.14271	
	40	.03255		.78019		.14271	
	41	.03023		.72681		.13508	
	42	.00000	MODE PT 139	.66903		-.00000	
	43	-.00685	RELATIVE CENTER	.69770		-.03001	
	44	-.00685		.69791		-.02909	
	45	-.00685		.67579		-.02909	
	46	.02778		.76388		-.12340	
	47	.00102		.73433		.00415	
	48	.00535		.70766		.02413	
	49	.03023		.75583		.13508	
	50	.00535		.67435		.02413	



## WATERFORD UNIT 3, DYNAMIC ANALYSIS, TORSIONAL EFFECT STUDIES, MODE SHAPE PLUTINGS

MODE NO 10 =		1	DOF INCLUDED, SOIL SHEAR MODULUS G=6400 PSI		X <sub>6</sub> (Torsion)		
N-S DIRECTION, TORSIONAL		MODE SHAPES FOR ROTATIONS		COMPONENTS		X <sub>5</sub> (Backward m E-W Direction)	
Mode No	1	2	3	4	5	6	
1	1	0.00125	0.00125	0.0000	0.0000	0.0000	0.0022
2	2	0.00124	0.00124	0.0000	0.0000	0.0000	0.0022
3	3	0.00123	0.00123	0.0000	0.0000	0.0000	0.0022
4	4	0.00123	0.00123	0.0000	0.0000	0.0000	0.0022
5	5	0.00122	0.00122	0.0000	0.0000	0.0000	0.0022
6	6	0.00119	0.00119	0.0000	0.0000	0.0000	0.0022
7	7	0.00116	0.00116	0.0000	0.0000	0.0000	0.0021
8	8	0.00112	0.00112	0.0000	0.0000	0.0000	0.0021
9	9	0.00106	0.00106	0.0000	0.0000	0.0000	0.0021
10	10	0.00101	0.00101	0.0000	0.0000	0.0000	0.0021
11	11	0.00095	0.00095	0.0000	0.0000	0.0000	0.0020
12	12	0.00100	0.00100	0.0000	0.0000	0.0000	0.0020
13	13	0.00100	0.00100	0.0000	0.0000	0.0000	0.0020
14	14	0.00100	0.00100	0.0000	0.0000	0.0000	0.0020
15	15	0.00100	0.00100	0.0000	0.0000	0.0000	0.0020
16	16	0.00099	0.00099	0.0000	0.0000	0.0000	0.0020
17	17	0.00099	0.00099	0.0000	0.0000	0.0000	0.0020
18	18	0.00098	0.00098	0.0000	0.0000	0.0000	0.0020
19	19	0.00097	0.00097	0.0000	0.0000	0.0000	0.0020
20	20	0.00095	0.00095	0.0000	0.0000	0.0000	0.0020
21	21	0.00093	0.00093	0.0000	0.0000	0.0000	0.0020
22	22	0.00096	0.00096	0.0000	0.0000	0.0000	0.0020
23	23	0.00096	0.00096	0.0000	0.0000	0.0000	0.0020
24	24	0.00096	0.00096	0.0000	0.0000	0.0000	0.0020
25	25	0.00096	0.00096	0.0000	0.0000	0.0000	0.0020
26	26	0.00095	0.00095	0.0000	0.0000	0.0000	0.0020
27	27	0.00094	0.00094	0.0000	0.0000	0.0000	0.0020
28	28	0.00093	0.00093	0.0000	0.0000	0.0000	0.0020
29	29	0.00097	0.00097	0.0000	0.0000	0.0000	0.0020
30	30	0.00095	0.00095	0.0000	0.0000	0.0000	0.0019
31	31	0.00093	0.00093	0.0000	0.0000	0.0000	0.0018
32	32	0.00092	0.00092	0.0000	0.0000	0.0000	0.0021
33	33	0.00093	0.00093	0.0000	0.0000	0.0000	0.0021
34	34	0.00093	0.00093	0.0000	0.0000	0.0000	0.0027
35	35	0.00092	0.00092	0.0000	0.0000	0.0000	0.0026
36	36	0.00095	0.00095	0.0000	0.0000	0.0000	0.0020
37	37	0.00093	0.00093	0.0000	0.0000	0.0000	0.0018
38	38	0.00092	0.00092	0.0000	0.0000	0.0000	0.0021
39	39	0.00093	0.00093	0.0000	0.0000	0.0000	0.0021
40	40	0.00093	0.00093	0.0000	0.0000	0.0000	0.0027
41	41	0.00093	0.00093	0.0000	0.0000	0.0000	0.0028
42	42	0.00092	0.00092	0.0000	0.0000	0.0000	0.0021
43	43	0.00092	0.00092	0.0000	0.0000	0.0000	0.0020
44	44	0.00092	0.00092	0.0000	0.0000	0.0000	0.0020
45	45	0.00092	0.00092	0.0000	0.0000	0.0000	0.0020
46	46	0.00095	0.00095	0.0000	0.0000	0.0000	0.0020
47	47	0.00093	0.00093	0.0000	0.0000	0.0000	0.0018
48	48	0.00092	0.00092	0.0000	0.0000	0.0000	0.0021
49	49	0.00093	0.00093	0.0000	0.0000	0.0000	0.0021
50	50	0.00092	0.00092	0.0000	0.0000	0.0000	0.0026

Backward Center  
Node 159

# WATERFORD UNIT 3, DYNAMIC ANALYSIS, TORSIONAL EFFECT STUDIES, MODE SHAPE PLOTTINGS

$$f_s = 1.87 \sqrt{K^2}$$

MODE NO ID = 2 N-S DIRECTION, TORSIONAL DOF INCLUDED, SOIL SHEAR MODULUS G=6400 P81  
 MODE SHAPES FOR TRANSLATIONS, COMPONENTS 1 2 3

		$X_1(\text{in})$	$X_2(\text{in})$	$X_3(\text{in})$	$X_4(\text{in})$	$X_5(\text{in})$	$X_6(\text{in})$
1	1	-.20117	..	-.05995	..	.00341	..
2	2	-.20118	..	-.05502	..	.00341	..
3	3	-.20118	..	-.05121	..	.00341	..
4	4	-.20118	..	-.04765	..	.00341	..
5	5	-.20119	..	-.04397	..	.00341	..
6	6	-.20119	..	-.03932	..	.00341	..
7	7	-.20119	..	-.03464	..	.00341	..
8	8	-.20120	..	-.03092	..	.00341	..
9	9	-.20120	..	-.02692	..	.00341	..
10	10	-.20120	..	-.02356	..	.00341	..
11	11	-.20120	..	-.02050	..	.00341	..
12	12	-.20117	..	-.01682	..	.00341	..
13	13	-.20118	..	-.01311	..	.00341	..
14	14	-.20118	..	-.00941	..	.00341	..
15	15	-.20118	..	-.00571	..	.00341	..
16	16	-.20119	..	-.00201	..	.00341	..
17	17	-.20119	..	..	..	.00341	..
18	18	-.20119	..	..	..	.00341	..
19	19	-.20120	..	..	..	.00341	..
20	20	-.20120	..	..	..	.00341	..
21	21	-.20120	..	..	..	.00341	..
22	22	-.20120	..	..	..	.00341	..
23	23	-.20120	..	..	..	.00341	..
24	24	-.20120	..	..	..	.00341	..
25	25	-.20120	..	..	..	.00341	..
26	26	-.20120	..	..	..	.00341	..
27	27	-.20120	..	..	..	.00341	..
28	28	-.20120	..	..	..	.00341	..
29	29	-.20120	..	..	..	.00341	..
30	30	-.20120	..	..	..	.00341	..
31	31	-.20120	..	..	..	.00341	..
32	32	-.20120	..	..	..	.00341	..
33	33	-.20120	..	..	..	.00341	..
34	34	-.20120	..	..	..	.00341	..
35	35	-.20120	..	..	..	.00341	..
36	36	-.20120	..	..	..	.00341	..
37	37	-.20120	..	..	..	.00341	..
38	38	-.20120	..	..	..	.00341	..
39	39	-.20120	..	..	..	.00341	..
40	40	-.20120	..	..	..	.00341	..
41	41	-.20120	..	..	..	.00341	..
42	42	-.20120	..	..	..	.00341	..
43	43	-.20120	..	..	..	.00341	..
44	44	-.20120	..	..	..	.00341	..
45	45	-.20120	..	..	..	.00341	..
46	46	-.20120	..	..	..	.00341	..
47	47	-.20120	..	..	..	.00341	..
48	48	-.20120	..	..	..	.00341	..
49	49	-.20120	..	..	..	.00341	..
50	50	-.20120	..	..	..	.00341	..

\*\* MAX MODAL TRANSLATIONAL DISPL (USED FOR NORMALIZATION) = 1.00

WATERFORD UNIT 3, DYNAMIC ANALYSIS, TORSIONAL EFFECT STUDIES, MODE SHAPE PLOTTINGS

$$f_n = 1.814 \text{ Hz}$$

MODE NO 10 = 2  
N-S DIRECTION, TORSIONAL DOF INCLUDED, SOIL SHEAR MODULUS G=6400 PSI

MODE SHAPES FOR ROTATIONS, COMPONENTS a 5 6  
MODE NO 10 = 2  
X<sub>6</sub> (Rotation in N-S Direction) X<sub>6</sub> (Rotation in E-W Direction) X<sub>6</sub> (Torsion)

1	.00016	.00000	.00781
2	.00016	.00000	.00780
3	.00016	.00000	.00775
4	.00016	.00000	.00768
5	.00015	.00000	.00758
6	.00015	.00000	.00743
7	.00014	.00000	.00723
8	.00014	.00000	.00706
9	.00013	.00000	.00683
10	.00012	.00000	.00662
11	.00011	.00000	.00640
12	.00012	.00000	.00637
13	.00012	.00000	.00637
14	.00012	.00000	.00637
15	.00012	.00000	.00637
16	.00012	.00000	.00637
17	.00012	.00000	.00637
18	.00012	.00000	.00637
19	.00011	.00000	.00637
20	.00011	.00000	.00637
21	.00011	.00000	.00637
22	.00011	.00000	.00639
23	.00011	.00000	.00639
24	.00011	.00000	.00639
25	.00011	.00000	.00639
26	.00011	.00000	.00639
27	.00011	.00000	.00639
28	.00011	.00000	.00639
29	.00012	.00000	.00557
30	.00012	.00000	.00553
31	.00011	.00000	.00648
32	.00011	.00000	.00648
33	.00011	.00000	.00648
34	.00011	.00000	.00697
35	.00011	.00000	.00689
36	.00012	.00000	.00637
37	.00011	.00000	.00653
38	.00011	.00000	.00648
39	.00011	.00000	.00648
40	.00011	.00000	.00697
41	.00011	.00000	.00689
42	.00011	.00000	.00648
43	.00011	.00000	.00637
44	.00011	.00000	.00637
45	.00011	.00000	.00637
46	.00012	.00000	.00653
47	.00011	.00000	.00648
48	.00011	.00000	.00648
49	.00011	.00000	.00689
50	.00011	.00000	.00637

# WATERFORD UNIT 3, DYNAMIC ANALYSIS, TORSIONAL EFFECT STUDIES, MODE SHAPE PLOTTINGS

MODE NO 10 = 3  
 N-S DIRECTION, TORSIONAL DOF INCLUDED, SOIL SHEAR MODULUS G=400 PSI  
 MODE SHAPES FOR TRANSLATIONS, COMPONENTS 1 2 3

1	1	-.00065	1.00000	-----	-.10037
2	2	-.00065	.85689	-----	-.10037
3	3	-.00065	.74661	-----	-.10037
4	4	-.00065	.68005	-----	-.10037
5	5	-.00065	.53841	-----	-.10037
6	6	-.00064	.80570	-----	-.10037
7	7	-.00064	.27344	-----	-.10037
8	8	-.00064	.16980	-----	-.10037
9	9	-.00064	.05937	-----	-.10037
10	10	-.00064	-.03198	-----	-.10037
11	11	-.00064	.11819	-----	-.10037
12	12	-.00065	.62691	-----	-.10037
13	13	-.00065	.55254	-----	-.10037
14	14	-.00065	.27574	-----	-.10037
15	15	-.00065	.39943	-----	-.10037
16	16	-.00065	.32314	-----	-.10037
17	17	-.00064	.24676	-----	-.10037
18	18	-.00064	.16907	-----	-.10037
19	19	-.00064	.09163	-----	-.10037
20	20	-.00064	-.01476	-----	-.10037
21	21	-.00064	-.06118	-----	-.10037
22	22	-.00066	.13038	-----	-.10355
23	23	-.00066	.10700	-----	-.10355
24	24	-.00066	.08452	-----	-.10355
25	25	-.00066	.04910	-----	-.10355
26	26	-.00066	.01039	-----	-.10355
27	27	-.00066	-.03630	-----	-.10355
28	28	-.00066	-.07636	-----	-.10355
29	29	-.00255	.23905	-----	-.46365
30	30	-.00255	.08642	-----	-.46268
31	31	.00068	.00443	-----	-.10715
32	32	.00119	-.07540	-----	.19315
33	33	.00016	.15426	-----	.33138
34	34	-.00078	.09160	-----	.32460
35	35	-.00000	.18222	-----	.00000
36	36	-.00254	.08644	-----	-.46365
37	37	-.00260	.00500	-----	-.42378
38	38	-.00006	-.07617	-----	.01406
39	39	.00357	.17144	-----	.49038
40	40	.00358	.09532	-----	.49038
41	41	.00289	.00396	-----	.46430
42	42	.00000	.19418	-----	.00000
43	43	-.00066	-.09869	-----	-.10355
44	44	-.00064	.09867	-----	-.10037
45	45	-.00064	-.17498	-----	-.42376
46	46	-.00260	.08635	-----	.01406
47	47	-.00007	.00467	-----	.08325
48	48	.00052	-.07622	-----	.46430
49	49	.00289	.08815	-----	.08325
50	50	.00053	.17512	-----	

\*\* MAX MODAL TRANSLATIONAL DISPLT (USED FOR NORMALIZATION) = 1.00



# WATERFORD UNIT 3, DYNAMIC ANALYSIS, TORSIONAL EFFECT STUDIES, MODE SHAPE PLOTTINGS

MODE NO ID = 3  
 N-S DIRECTION, TORSIONAL DUF INCLUDED, SOIL SHEAR MODULUS G=6400 PSI  
 MODE SHAPES FOR ROTATIONS, COMPONENTS 4 5 6

1	1	-.00456	-.00000	-.00003
2	2	-.00455	-.00000	-.00003
3	3	-.00452	-.00000	-.00003
4	4	-.00448	-.00000	-.00003
5	5	-.00442	-.00000	-.00003
6	6	-.00430	-.00000	-.00003
7	7	-.00413	-.00000	-.00003
8	8	-.00397	-.00000	-.00002
9	9	-.00374	-.00000	-.00002
10	10	-.00351	-.00000	-.00002
11	11	-.00327	-.00000	-.00002
12	12	-.00318	-.00000	-.00002
13	13	-.00318	-.00000	-.00002
14	14	-.00317	-.00000	-.00002
15	15	-.00317	-.00000	-.00002
16	16	-.00316	-.00000	-.00002
17	17	-.00315	-.00000	-.00002
18	18	-.00312	-.00000	-.00002
19	19	-.00329	-.00000	-.00002
20	20	-.00326	-.00000	-.00002
21	21	-.00321	-.00000	-.00002
22	22	-.00320	-.00000	-.00002
23	23	-.00320	-.00000	-.00002
24	24	-.00320	-.00000	-.00002
25	25	-.00320	-.00000	-.00002
26	26	-.00319	-.00000	-.00002
27	27	-.00319	-.00000	-.00002
28	28	-.00318	-.00000	-.00002
29	29	-.00325	-.00000	-.00000
30	30	-.00322	-.00000	-.00000
31	31	-.00318	-.00000	-.00002
32	32	-.00318	-.00000	-.00002
33	33	-.00319	-.00000	-.00007
34	34	-.00319	-.00000	-.00008
35	35	-.00318	-.00000	-.00008
36	36	-.00322	-.00000	-.00000
37	37	-.00318	-.00000	-.00002
38	38	-.00318	-.00000	-.00002
39	39	-.00319	-.00000	-.00007
40	40	-.00319	-.00000	-.00008
41	41	-.00318	-.00000	-.00002
42	42	-.00318	-.00000	-.00002
43	43	-.00318	-.00000	-.00002
44	44	-.00318	-.00000	-.00002
45	45	-.00318	-.00000	-.00002
46	46	-.00322	-.00000	-.00000
47	47	-.00318	-.00000	-.00002
48	48	-.00318	-.00000	-.00002
49	49	-.00319	-.00000	-.00008
50	50	-.00318	-.00000	-.00002

\*\* MAX MODAL ROTATIONAL DISPLACEMENT (USED FOR NORMALIZATION) = -.456201E-02



## WATERFORD UNIT 3, DYNAMIC ANALYSIS, TORSIONAL EFFECT STUDIES, MODE SHAPE PLOTTINGS

MODE	NU	ID	■	4
1	1	1	1	1
2	2	2	2	2
3	3	3	3	3
4	4	4	4	4
5	5	5	5	5
6	6	6	6	6
7	7	7	7	7
8	8	8	8	8
9	9	9	9	9
10	10	10	10	10
11	11	11	11	11
12	12	12	12	12
13	13	13	13	13
14	14	14	14	14
15	15	15	15	15
16	16	16	16	16
17	17	17	17	17
18	18	18	18	18
19	19	19	19	19
20	20	20	20	20
21	21	21	21	21
22	22	22	22	22
23	23	23	23	23
24	24	24	24	24
25	25	25	25	25
26	26	26	26	26
27	27	27	27	27
28	28	28	28	28
29	29	29	29	29
30	30	30	30	30
31	31	31	31	31
32	32	32	32	32
33	33	33	33	33
34	34	34	34	34
35	35	35	35	35
36	36	36	36	36
37	37	37	37	37
38	38	38	38	38
39	39	39	39	39
40	40	40	40	40
41	41	41	41	41
42	42	42	42	42
43	43	43	43	43
44	44	44	44	44
45	45	45	45	45
46	46	46	46	46
47	47	47	47	47
48	48	48	48	48
49	49	49	49	49
50	50	50	50	50
51	51	51	51	51
52	52	52	52	52
53	53	53	53	53
54	54	54	54	54
55	55	55	55	55
56	56	56	56	56
57	57	57	57	57
58	58	58	58	58
59	59	59	59	59
60	60	60	60	60
61	61	61	61	61
62	62	62	62	62
63	63	63	63	63
64	64	64	64	64
65	65	65	65	65
66	66	66	66	66
67	67	67	67	67
68	68	68	68	68
69	69	69	69	69
70	70	70	70	70
71	71	71	71	71
72	72	72	72	72
73	73	73	73	73
74	74	74	74	74
75	75	75	75	75
76	76	76	76	76
77	77	77	77	77
78	78	78	78	78
79	79	79	79	79
80	80	80	80	80
81	81	81	81	81
82	82	82	82	82
83	83	83	83	83
84	84	84	84	84
85	85	85	85	85
86	86	86	86	86
87	87	87	87	87

MODE NO. 12  
N-S DIRECTION, TORSIONAL DOF INCLUDED, SOIL SHEAR MODULUS G=400 PSI  
MODE SHAPES FOR TRANSLATIONS, COMPONENTS 1 2 3

MODE SHAPES FOR TRANSLATIONS, COMPONENTS 1 2 3

[illegible]

\*\* MAX MUJAL TRANSLATIONAL DISPMY (USED FOR NORMALIZATION) = 1.00



# WATERFORD UNIT 3, DYNAMIC ANALYSIS, TORSIONAL EFFECT STUDIES, MODE SHAPE PLOTTINGS

MODE NO ID # 5  
 N-S DIRECTION, TORSIONAL DOF INCLUDED, SOIL SHEAR MODULUS G=6400 PSI  
 MODE SHAPES FOR TRANSLATIONS, COMPONENTS 1 2 3

1	1	-.17496	..	.30952	----	.01996	*
2	2	-.17494	..	.26582	----	.01996	*
3	3	-.17493	..	.23351	----	.01996	*
4	4	-.17491	..	.20143	----	.01996	*
5	5	-.17490	..	.16714	----	.01996	*
6	6	-.17488	..	.12354	----	.01996	*
7	7	-.17486	..	.08050	----	.01996	*
8	8	-.17485	..	.04857	----	.01996	*
9	9	-.17483	..	.01748	----	.01996	*
10	10	-.17482	..	-.00486	----	.01996	*
11	11	-.17481	..	-.02125	----	.01996	*
12	12	-.17496	..	-.28457	----	.01996	*
13	13	-.17495	..	-.26022	----	.01996	*
14	14	-.17493	..	-.23410	----	.01996	*
15	15	-.17492	..	-.20871	----	.01996	*
16	16	-.17490	..	-.18324	----	.01996	*
17	17	-.17488	..	-.15730	----	.01996	*
18	18	-.17487	..	-.12869	----	.01996	*
19	19	-.17485	..	-.10019	----	.01996	*
20	20	-.17484	..	-.07240	----	.01996	*
21	21	-.17482	..	-.04590	----	.01996	*
22	22	-.18080	..	-.04579	----	.02059	*
23	23	-.18039	..	-.04052	----	.02059	*
24	24	-.18039	..	-.08529	----	.02059	*
25	25	-.18038	..	-.07664	----	.02059	*
26	26	-.18037	..	-.06684	----	.02059	*
27	27	-.18036	..	-.05473	----	.02059	*
28	28	-.18035	..	-.04454	----	.02059	*
29	29	-.93423	-----	-.18659	----	.09307	*
30	30	-.93219	-----	-.10560	----	.09286	*
31	31	.20094	-----	-.15309	----	.02127	*
32	32	.35319	-----	.17366	----	.03832	*
33	33	.46448	-----	.08795	----	.06664	*
34	34	.42148	-----	.15767	----	.06511	*
35	35	.00000	-----	.04994	----	.00000	*
36	130	-.93420	-----	-.12735	----	.09307	*
37	131	-.85120	-----	.03079	----	.08404	*
38	132	-.03925	-----	-.05606	----	.00277	*
39	135	.99998	-----	.64355	-----	.09707	*
40	136	1.00000	-----	.65242	-----	.09707	*
41	137	.90903	-----	-.30336	-----	.09210	*
42	139	-.00000	-----	-.04756	-----	.00000	*
43	140	-.18035	-----	-.03884	-----	.02059	*
44	141	-.17481	-----	-.03330	-----	.01996	*
45	143	-.17480	-----	-.01813	-----	.01996	*
46	230	-.85121	-----	.00409	-----	.08404	*
47	231	-.03927	-----	-.07514	-----	.00277	*
48	232	.14504	-----	-.07203	-----	.01654	*
49	236	.90901	-----	-.30050	-----	.09210	*
50	239	.14506	-----	-.05723	-----	.01654	*

\*\* MAX MODAL TRANSLATIONAL DISPLT (USED FOR NORMALIZATION) = 1.00

WATERFORD UNIT 3, DYNAMIC ANALYSIS, TORSIONAL EFFECT STUDIES, MODE SHAPE PLOTTINGS

MODE NO 10 = 5  
N-S DIRECTION, TORSIONAL DOF INCLUDED, JOIL SHEAR MODULUS Q=400 PSI  
MODE SHAPES FOR ROTATIONS, COMPONENTS 4 5 6

1	1	-.00091	1	-.00000	1	-.22622
2	2	-.00049	2	-.00000	2	-.22423
3	3	-.00046	3	-.00000	3	-.21420
4	4	-.00082	4	-.00000	4	-.20055
5	5	-.00075	5	-.00000	5	-.18255
6	6	-.00061	6	-.00000	6	-.15471
7	7	-.00043	7	-.00000	7	-.12183
8	8	-.00024	8	-.00000	8	-.09267
9	9	-.00001	9	-.00000	9	-.05838
10	10	-.00026	10	-.00000	10	-.02757
11	11	-.00053	11	-.00000	11	-.00209
12	12	-.00101	12	-.00000	12	-.00554
13	13	-.00100	13	-.00000	13	-.00554
14	14	-.00099	14	-.00000	14	-.00554
15	15	-.00098	15	-.00000	15	-.00554
16	16	-.00097	16	-.00000	16	-.00554
17	17	-.00095	17	-.00000	17	-.00554
18	18	-.00091	18	-.00000	18	-.00554
19	19	-.00085	19	-.00000	19	-.00554
20	20	-.00074	20	-.00000	20	-.00554
21	21	-.00069	21	-.00000	21	-.00554
22	22	-.00071	22	-.00000	22	-.00565
23	23	-.00071	23	-.00000	23	-.00565
24	24	-.00070	24	-.00000	24	-.00565
25	25	-.00070	25	-.00000	25	-.00565
26	26	-.00069	26	-.00000	26	-.00565
27	27	-.00067	27	-.00000	27	-.00565
28	28	-.00065	28	-.00000	28	-.00565
29	29	-.00062	29	-.00000	29	-.00565
30	30	-.00073	30	-.00000	30	-.00609
31	31	-.00063	31	-.00000	31	-.00631
32	32	-.00063	32	-.00000	32	-.00603
33	33	-.00061	33	-.00000	33	-.01195
34	34	-.00062	34	-.00000	34	-.01112
35	35	-.00063	35	-.00000	35	-.00554
36	36	-.00073	36	-.00000	36	-.00609
37	37	-.00063	37	-.00000	37	-.00631
38	38	-.00063	38	-.00000	38	-.00603
39	39	-.00061	39	-.00000	39	-.01195
40	40	-.00062	40	-.00000	40	-.01112
41	41	-.00063	41	-.00000	41	-.00631
42	42	-.00063	42	-.00000	42	-.00554
43	43	-.00063	43	-.00000	43	-.00554
44	44	-.00063	44	-.00000	44	-.00554
45	45	-.00063	45	-.00000	45	-.00554
46	46	-.00073	46	-.00000	46	-.00609
47	47	-.00063	47	-.00000	47	-.00631
48	48	-.00063	48	-.00000	48	-.00603
49	49	-.00062	49	-.00000	49	-.01112
50	50	-.00063	50	-.00000	50	-.00554

\*\* MAX MODAL ROTATIONAL DISPLACEMENT(USED FOR NORMALIZATION) = -.226221E+00



# WATERFORD UNIT 3, DYNAMIC ANALYSIS, TORSIONAL EFFECT STUDIES, MODE SHAPE PLOTTINGS

MODE NO 10 = 6  
 N-S DIRECTION, TORSIONAL DOF INCLUDED, SOIL SHEAR MODULUS G=6400 PSI  
 MODE SHAPES FOR TRANSLATIONS, COMPONENTS 1 2 3

1	1	-.02544	*	-.10345	*	-.01479	*
2	2	-.02544	*	-.07920	*	-.01479	*
3	3	-.02544	*	-.06190	*	-.01479	*
4	4	-.02544	*	-.04478	*	-.01479	*
5	5	-.02543	*	-.02683	*	-.01479	*
6	6	-.02543	*	-.00493	*	-.01479	*
7	7	-.02543	*	.01482	*	-.01479	*
8	8	-.02542	*	.02790	*	-.01479	*
9	9	-.02542	*	.03862	*	-.01479	*
10	10	-.02542	*	.04382	*	-.01479	*
11	11	-.02542	*	.04598	*	-.01479	*
12	12	-.02544	*	1.00000	-----*	-.01479	*
13	13	-.02544	*	.91247	-----*	-.01479	*
14	14	-.02544	*	.81411	-----*	-.01479	*
15	15	-.02544	*	.72123	-----*	-.01479	*
16	16	-.02543	*	.62778	-----*	-.01479	*
17	17	-.02543	*	.53125	-----*	-.01479	*
18	18	-.02543	*	.41579	-----*	-.01479	*
19	19	-.02542	*	.30161	-----*	-.01479	*
20	20	-.02542	*	.19308	-----*	-.01479	*
21	21	-.02542	*	.09469	-----*	-.01479	*
22	22	-.02623	*	.11303	-----*	-.01525	*
23	23	-.02623	*	.10797	-----*	-.01525	*
24	24	-.02623	*	.10268	-----*	-.01525	*
25	25	-.02623	*	.09330	-----*	-.01525	*
26	26	-.02623	*	.08213	-----*	-.01525	*
27	27	-.02622	*	.06795	-----*	-.01525	*
28	28	-.02622	*	.05631	-----*	-.01525	*
29	29	-.07008	*	.09366	-----*	-.06289	*
30	30	-.06994	*	.04386	-----*	-.06273	*
31	31	.01945	*	.01563	-----*	.01490	*
32	32	.04438	*	.05917	-----*	.02757	*
33	35	.46022	-----*	-.42412	-----*	.05208	*
34	36	.42622	-----*	-.44237	-----*	.04940	*
35	39	-.00000	*	.03347	-----*	0.00000	*
36	130	-.07008	*	.04233	-----*	-.06289	*
37	131	-.06425	*	.03026	-----*	-.05635	*
38	132	.00033	*	.03335	-----*	-.00137	*
39	135	.00966	*	-.04449	-----*	.06517	*
40	136	.00965	*	-.79860	-----*	.06517	*
41	137	.07515	*	.00379	-----*	.06273	*
42	139	-.00000	*	.03171	-----*	0.00000	*
43	140	-.02622	*	.04978	-----*	-.01525	*
44	141	-.02542	*	.05054	-----*	-.01479	*
45	143	-.02541	*	.03935	-----*	-.01479	*
46	230	-.06425	*	.05157	-----*	-.05635	*
47	231	.00034	*	.02183	-----*	-.00137	*
48	232	.02100	*	.03157	-----*	.01222	*
49	236	.07517	*	-.11245	-----*	.06273	*
50	239	.02100	*	.03366	-----*	.01222	*

\*\* MAX MODAL TRANSLATIONAL DISPLT (USED FOR NORMALIZATION) = 1.00

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## WATERFORD UNIT 3, DYNAMIC ANALYSIS, TORSIONAL EFFECT STUDIES, MODE SHAPE PLOTTINGS

MODE MC ID # 6

N-S DIRECTION, TORSIONAL

N-S DIRECTION, TORSIONAL

### N-S DIRECTION, TORSIONAL MODE SHAPE FOR ROTATIONS, COM

[illegible]

\*\* MAX RADIAL ROTATIONAL DISPLACEMENT(USED FOR NORMALIZATION) = -.903897E-02



## WATERFORD UNIT 3, DYNAMIC ANALYSIS, TORSIONAL EFFECT STUDIES, MODE SHAPE PLOTTINGS

MODE NO 10 = 1  
5-8 DIRECTION, TORSIONAL DOF NOT INCLUDED, SOIL SHEAR MODULUS 66400 PSI  
MODE SHAPES FOR ROTATIONS, COMPONENTS 4 5 6  
MODE PR  $\chi_4$  (BENDING IN 4-5 DIRECTION)  $\chi_5$  (BENDING IN 2-3 DIRECTION)

MODE	SHAPE	FOR	MUTATIONS	COMPONENTS	$\chi_4$ (Backward in $\theta$ - $\omega$ direction)	$\chi_5$ (Backward in $\theta$ - $\omega$ direction)	$\chi_6$ (Tension)
1	1	0.0125	0.0000	0.0000	0.0000	0.0000	0.0000
2	2	0.0125	0.0000	0.0000	0.0000	0.0000	0.0000
3	3	0.0125	0.0000	0.0000	0.0000	0.0000	0.0000
4	4	0.0125	0.0000	0.0000	0.0000	0.0000	0.0000
5	5	0.0125	0.0000	0.0000	0.0000	0.0000	0.0000
6	6	0.0119	0.0000	0.0000	0.0000	0.0000	0.0000
7	7	0.0116	0.0000	0.0000	0.0000	0.0000	0.0000
8	8	0.0112	0.0000	0.0000	0.0000	0.0000	0.0000
9	9	0.0107	0.0000	0.0000	0.0000	0.0000	0.0000
10	10	0.0101	0.0000	0.0000	0.0000	0.0000	0.0000
11	11	0.0095	0.0000	0.0000	0.0000	0.0000	0.0000
12	12	0.0100	0.0000	0.0000	0.0000	0.0000	0.0000
13	13	0.0100	0.0000	0.0000	0.0000	0.0000	0.0000
14	14	0.0100	0.0000	0.0000	0.0000	0.0000	0.0000
15	15	0.0100	0.0000	0.0000	0.0000	0.0000	0.0000
16	16	0.0100	0.0000	0.0000	0.0000	0.0000	0.0000
17	17	0.0099	0.0000	0.0000	0.0000	0.0000	0.0000
18	18	0.0098	0.0000	0.0000	0.0000	0.0000	0.0000
19	19	0.0097	0.0000	0.0000	0.0000	0.0000	0.0000
20	20	0.0096	0.0000	0.0000	0.0000	0.0000	0.0000
21	21	0.0093	0.0000	0.0000	0.0000	0.0000	0.0000
22	22	0.0096	0.0000	0.0000	0.0000	0.0000	0.0000
23	23	0.0096	0.0000	0.0000	0.0000	0.0000	0.0000
24	24	0.0096	0.0000	0.0000	0.0000	0.0000	0.0000
25	25	0.0096	0.0000	0.0000	0.0000	0.0000	0.0000
26	26	0.0095	0.0000	0.0000	0.0000	0.0000	0.0000
27	27	0.0094	0.0000	0.0000	0.0000	0.0000	0.0000
28	28	0.0093	0.0000	0.0000	0.0000	0.0000	0.0000
29	29	0.0097	0.0000	0.0000	0.0000	0.0000	0.0000
30	30	0.0095	0.0000	0.0000	0.0000	0.0000	0.0000
31	31	0.0093	0.0000	0.0000	0.0000	0.0000	0.0000
32	32	0.0093	0.0000	0.0000	0.0000	0.0000	0.0000
33	33	0.0093	0.0000	0.0000	0.0000	0.0000	0.0000
34	34	0.0093	0.0000	0.0000	0.0000	0.0000	0.0000
35	35	0.0092	0.0000	0.0000	0.0000	0.0000	0.0000
36	36	0.0093	0.0000	0.0000	0.0000	0.0000	0.0000
37	37	0.0093	0.0000	0.0000	0.0000	0.0000	0.0000
38	38	0.0092	0.0000	0.0000	0.0000	0.0000	0.0000
39	39	0.0092	0.0000	0.0000	0.0000	0.0000	0.0000
40	40	0.0092	0.0000	0.0000	0.0000	0.0000	0.0000
41	41	0.0092	0.0000	0.0000	0.0000	0.0000	0.0000
42	42	0.0092	0.0000	0.0000	0.0000	0.0000	0.0000

\*\* MAX MUDAL ROTATIONAL DISPLACEMENT(USED FOR NORMALIZATION) = -.124920E-02





WATERFORD UNIT 3, DYNAMIC ANALYSIS, TORSIONAL EFFECT STUDIES, MODE SHAPE PLOTTINGS

MODE NO 10 = 2  $f_1 = 2.468 \text{ Hz}$

S-S DIRECTION, TORSIONAL DOF NOT INCLUDED, SOIL SHEAR MODULUS GR4400 PSI

MODE SHAPES FOR ROTATIONS, COMPONENTS 4 5 6

Node #  $\theta_4$  (RADIANS IN N-S PLANE)

1	-.00456	-.00000	-.00000
2	-.00454	-.00000	-.00000
3	-.00452	-.00000	-.00000
4	-.00448	-.00000	-.00000
5	-.00441	-.00000	-.00000
6	-.00430	-.00000	-.00000
7	-.00413	-.00000	-.00000
8	-.00396	-.00000	-.00000
9	-.00374	-.00000	-.00000
10	-.00351	-.00000	-.00000
11	-.00326	-.00000	-.00000
12	-.00316	-.00000	-.00000
13	-.00310	-.00000	-.00000
14	-.00307	-.00000	-.00000
15	-.00306	-.00000	-.00000
16	-.00306	-.00000	-.00000
17	-.00306	-.00000	-.00000
18	-.00306	-.00000	-.00000
19	-.00306	-.00000	-.00000
20	-.00306	-.00000	-.00000
21	-.00306	-.00000	-.00000
22	-.00306	-.00000	-.00000
23	-.00306	-.00000	-.00000
24	-.00306	-.00000	-.00000
25	-.00306	-.00000	-.00000
26	-.00306	-.00000	-.00000
27	-.00306	-.00000	-.00000
28	-.00306	-.00000	-.00000
29	-.00306	-.00000	-.00000
30	-.00306	-.00000	-.00000
31	-.00306	-.00000	-.00000
32	-.00306	-.00000	-.00000
33	-.00306	-.00000	-.00000
34	-.00306	-.00000	-.00000
35	-.00306	-.00000	-.00000
36	-.00306	-.00000	-.00000
37	-.00306	-.00000	-.00000
38	-.00306	-.00000	-.00000
39	-.00306	-.00000	-.00000
40	-.00306	-.00000	-.00000
41	-.00306	-.00000	-.00000
42	-.00306	-.00000	-.00000

\*\* MAX MODAL ROTATIONAL DISPLACEMENT(USED FOR NORMALIZATION) = -.455958E-02





# WATERFORD UNIT 3, DYNAMIC ANALYSIS, TORSIONAL EFFECT STUDIES, MODE SHAPE PLOTTINGS

MODE NO 10 3  
 5-8 DIRECTION, TORSIONAL DOF NOT INCLUDED, SOIL SHEAR MODULUS 66600 PSI  
 MODE SHAPES FOR ROTATIONS, COMPONENTS 5 6

1	-.00264	.....	.....	.....	.....
2	-.00279	.....	.....	.....	.....
3	-.00271	.....	.....	.....	.....
4	-.00259	.....	.....	.....	.....
5	-.00239	.....	.....	.....	.....
6	-.00208	.....	.....	.....	.....
7	-.00153	.....	.....	.....	.....
8	-.00101	.....	.....	.....	.....
9	-.00032	.....	.....	.....	.....
10	-.00039	.....	.....	.....	.....
11	-.00115	.....	.....	.....	.....
12	-.00145	.....	.....	.....	.....
13	-.00194	.....	.....	.....	.....
14	-.00193	.....	.....	.....	.....
15	-.00191	.....	.....	.....	.....
16	-.00189	.....	.....	.....	.....
17	-.00186	.....	.....	.....	.....
18	-.00181	.....	.....	.....	.....
19	-.00173	.....	.....	.....	.....
20	-.00163	.....	.....	.....	.....
21	-.00150	.....	.....	.....	.....
22	-.00151	.....	.....	.....	.....
23	-.00151	.....	.....	.....	.....
24	-.00151	.....	.....	.....	.....
25	-.00151	.....	.....	.....	.....
26	-.00150	.....	.....	.....	.....
27	-.00148	.....	.....	.....	.....
28	-.00145	.....	.....	.....	.....
29	-.00164	.....	.....	.....	.....
30	-.00154	.....	.....	.....	.....
31	-.00144	.....	.....	.....	.....
32	-.00143	.....	.....	.....	.....
33	-.00147	.....	.....	.....	.....
34	-.00146	.....	.....	.....	.....
35	-.00143	.....	.....	.....	.....
36	-.00142	.....	.....	.....	.....
37	-.00140	.....	.....	.....	.....
38	-.00143	.....	.....	.....	.....
39	-.00143	.....	.....	.....	.....
40	-.00143	.....	.....	.....	.....
41	-.00143	.....	.....	.....	.....
42	-.00143	.....	.....	.....	.....

\*\* MAX MODAL ROTATIONAL DISPLACEMENT(USED FOR NORMALIZATION) = -.203528E-02



WATERFORD UNIT 3, DYNAMIC ANALYSIS, TORSIONAL EFFECT STUDIES, MODE SHAPE PLOTTINGS

MODE NO 10 4  
 S-S DIRECTION, TORSIONAL DOF NOT INCLUDED, SOIL SHEAR MODULUS 66600 PSI  
 MODE SHAPES FOR ROTATIONS, COMPONENTS 4 5 6

1	.0000	.0000	.0000
2	.0000	.0000	.0000
3	.0000	.0000	.0000
4	.0001	.0000	.0000
5	.0001	.0000	.0000
6	.0002	.0000	.0000
7	.0003	.0000	.0000
8	.0004	.0000	.0000
9	.0006	.0000	.0000
10	.0007	.0000	.0000
11	.0009	.0000	.0000
12	.0013	.0000	.0000
13	.0039	.0000	.0000
14	.0030	.0000	.0000
15	.0029	.0000	.0000
16	.0027	.0000	.0000
17	.0026	.0000	.0000
18	.0026	.0000	.0000
19	.0017	.0000	.0000
20	.0015	.0000	.0000
21	.0036	.0000	.0000
22	.0012	.0000	.0000
23	.0012	.0000	.0000
24	.0012	.0000	.0000
25	.0012	.0000	.0000
26	.0011	.0000	.0000
27	.0011	.0000	.0000
28	.0010	.0000	.0000
29	.0022	.0000	.0000
30	.0017	.0000	.0000
31	.0010	.0000	.0000
32	.0010	.0000	.0000
33	.0012	.0000	.0000
34	.0011	.0000	.0000
35	.0010	.0000	.0000
36	.0010	.0000	.0000
37	.0010	.0000	.0000
38	.0010	.0000	.0000
39	.0010	.0000	.0000
40	.0010	.0000	.0000
41	.0010	.0000	.0000
42	.0010	.0000	.0000

\*\* MAX MODAL ROTATIONAL DISPLACEMENT(USED FOR NORMALIZATION) = -.313366E-02

WATERFORD UNIT 3, DYNAMIC ANALYSIS, TORSIONAL EFFECT STUDIES, MODE SHAPE PLOTTINGS

MODE NO 10 5  
N-S DIRECTION, TORSIONAL DOF NOT INCLUDED, SOIL SHEAR MODULUS G=6400 PSI  
MODE SHAPES FOR TRANSLATIONS, COMPONENTS 1 2 3

1	-.00008	.06677	.00978
2	-.00004	.03552	.00973
3	-.00003	.01496	.00978
4	-.00003	.00808	.00978
5	-.00003	.02213	.00978
6	-.00002	.04069	.00978
7	-.00002	.05126	.00978
8	-.00002	.05375	.00978
9	-.00001	.05013	.00978
10	-.00001	.04090	.00978
11	-.00001	.02895	.00978
12	-.00004	.13535	.00978
13	-.00004	.11985	.00978
14	-.00004	.10138	.00978
15	-.00003	.08476	.00978
16	-.00003	.06827	.00978
17	-.00002	.05150	.00978
18	-.00002	.02499	.00978
19	-.00002	.00955	.00978
20	-.00001	.00883	.00978
21	-.00001	.02260	.00978
22	-.00002	.11719	.00978
23	-.00002	.11113	.01009
24	-.00002	.10430	.01009
25	-.00001	.09104	.01009
26	-.00001	.07448	.01009
27	-.00001	.05328	.01009
28	-.00001	.03675	.01009
29	-.00001	1.00000	.01009
30	-.00001	.21994	.01009
31	-.00004	.01037	.01009
32	-.00002	.00732	.01009
33	-.00002	.00253	.01009
34	-.00009	.00393	.01009
35	0.00000	.01966	.01009
36	-.00001	.01201	.01009
37	-.00001	.00906	.01009
38	0.00000	.01849	.01009
39	-.00001	.02777	.01009
40	-.00001	.02777	.01009
41	-.00000	.02034	.01009
42	-.00001	.02033	.01009

\*\* MAX MUCL TRANSLATIONAL DISPMY (USED FOR NORMALIZATION) = 1.00



# WATERFORD UNIT 3, DYNAMIC ANALYSIS, TORSIONAL EFFECT STUDIES, MODE SHAPE PLOTTINGS

MODE NO 10 5

5-3 DIRECTION, TORSIONAL DOF NOT INCLUDED, SOIL SHEAR MODULUS 66400 PSI  
MODE SHAPES FOR ROTATIONS, COMPONENTS 4 5 6

1	-.00044	..	..	..	..
2	-.00042	..	..	..	..
3	-.00039	..	..	..	..
4	..	..	..	..	..
5	-.00029	..	..	..	..
6	-.00019	..	..	..	..
7	-.00008	..	..	..	..
8	..	..	..	..	..
9	..	..	..	..	..
10	..	..	..	..	..
11	..	..	..	..	..
12	..	..	..	..	..
13	..	..	..	..	..
14	..	..	..	..	..
15	..	..	..	..	..
16	..	..	..	..	..
17	..	..	..	..	..
18	..	..	..	..	..
19	..	..	..	..	..
20	..	..	..	..	..
21	..	..	..	..	..
22	..	..	..	..	..
23	..	..	..	..	..
24	..	..	..	..	..
25	..	..	..	..	..
26	..	..	..	..	..
27	..	..	..	..	..
28	..	..	..	..	..
29	..	..	..	..	..
30	..	..	..	..	..
31	..	..	..	..	..
32	..	..	..	..	..
33	..	..	..	..	..
34	..	..	..	..	..
35	..	..	..	..	..
36	..	..	..	..	..
37	..	..	..	..	..
38	..	..	..	..	..
39	..	..	..	..	..
40	..	..	..	..	..
41	..	..	..	..	..
42	..	..	..	..	..

\*\* MAX MODAL ROTATIONAL DISPLACEMENT(USED FOR NORMALIZATION) = -.42E-02

# WATERFORD UNIT 3, DYNAMIC ANALYSIS, TORSIONAL EFFECT STUDIES, MODE SHAPE PLOTTINGS

MODE NO 10 \* 6  
N-S DIRECTION, TORSIONAL DOF NOT INCLUDED, SOIL SHEAR MODULUS G=6400 PSI  
MODE SHAPES FOR TRANSLATIONS, COMPONENTS 1 2 3

1	1	-.00024	*	.38618	.03206	*
2	2	-.00021	*	.18169	.03206	*
3	3	-.00019	*	.04911	.03206	*
4	4	-.00017	*	-.07086	.03206	*
5	5	-.00014	*	-.18100	.03206	*
6	6	-.00012	*	-.28824	.03206	*
7	7	-.00009	*	-.33808	.03206	*
8	8	-.00007	*	-.33802	.03206	*
9	9	-.00004	*	-.29763	.03206	*
10	10	-.00002	*	-.22589	.03206	*
11	11	.00000	*	-.14108	.03206	*
12	12	-.00024	*	.44117	.03206	*
13	13	-.00022	*	.38559	.03206	*
14	14	-.00019	*	.31947	.03206	*
15	15	-.00017	*	.26027	.03206	*
16	16	-.00014	*	.20192	.03206	*
17	17	-.00012	*	.14309	.03206	*
18	18	-.00009	*	.06950	.03206	*
19	19	-.00007	*	.00015	.03206	*
20	20	-.00004	*	-.05958	.03206	*
21	21	-.00002	*	-.10512	.03206	*
22	22	-.00008	*	-.53362	.03308	*
23	23	-.00007	*	-.50695	.03308	*
24	24	-.00007	*	-.47624	.03308	*
25	25	-.00006	*	-.41519	.03308	*
26	26	-.00004	*	-.33792	.03308	*
27	27	-.00003	*	-.23865	.03308	*
28	28	-.00001	*	-.16207	.03308	*
29	29	.04371	*	-.52702	.10028	*
30	30	.04386	*	-.03113	.10028	*
31	31	-.00043	*	.10111	-.03389	*
32	32	-.00034	*	-.00358	-.03389	*
33	33	-.03065	*	1.00000	-.12382	*
34	34	-.03054	*	.68336	-.12382	*
35	35	0.00000	*	-.09409	0.00000	*
36	131	.04394	*	.09334	.10028	*
37	137	-.03042	*	.10762	-.12382	*
38	139	0.00000	*	-.09026	0.00000	*
39	140	-.00001	*	-.12070	.03308	*
40	141	-.00001	*	-.12070	.03206	*
41	143	.00002	*	-.09633	.03206	*
42	239	-.00023	*	-.09618	-.03389	*

\*\* MAX MODAL TRANSLATIONAL DISPLT (USED FOR NORMALIZATION) = 1.00

