



LOUISIANA
POWER & LIGHT

142 DELARONDE STREET
P. O. BOX 8008 • NEW ORLEANS, LOUISIANA 70174 • (504) 386-2345

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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5/11

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

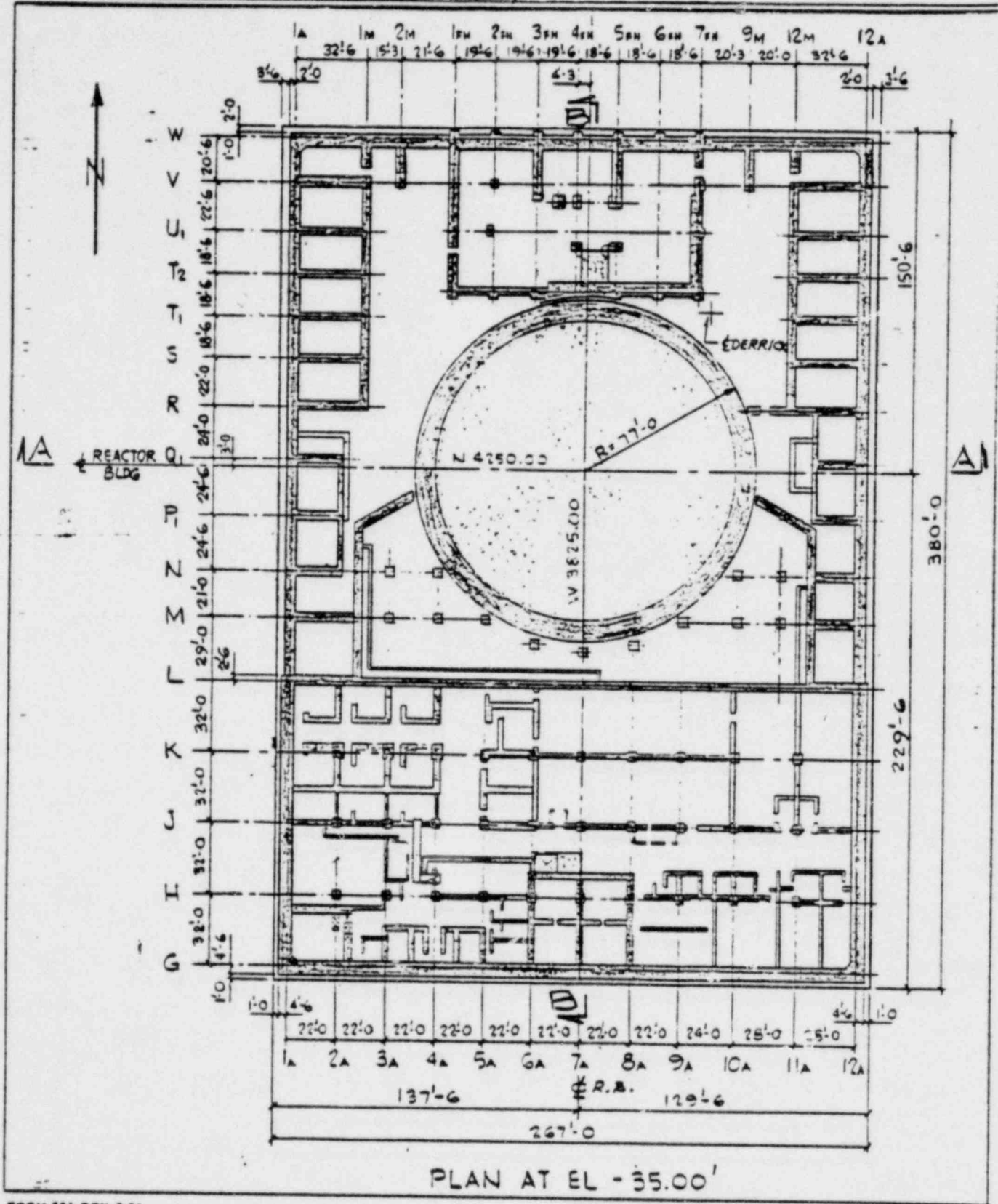
DEPT. NO. 350

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'



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BY J. CHEN DATE 6/4/81

NEW YORK

SHEET E2 OF

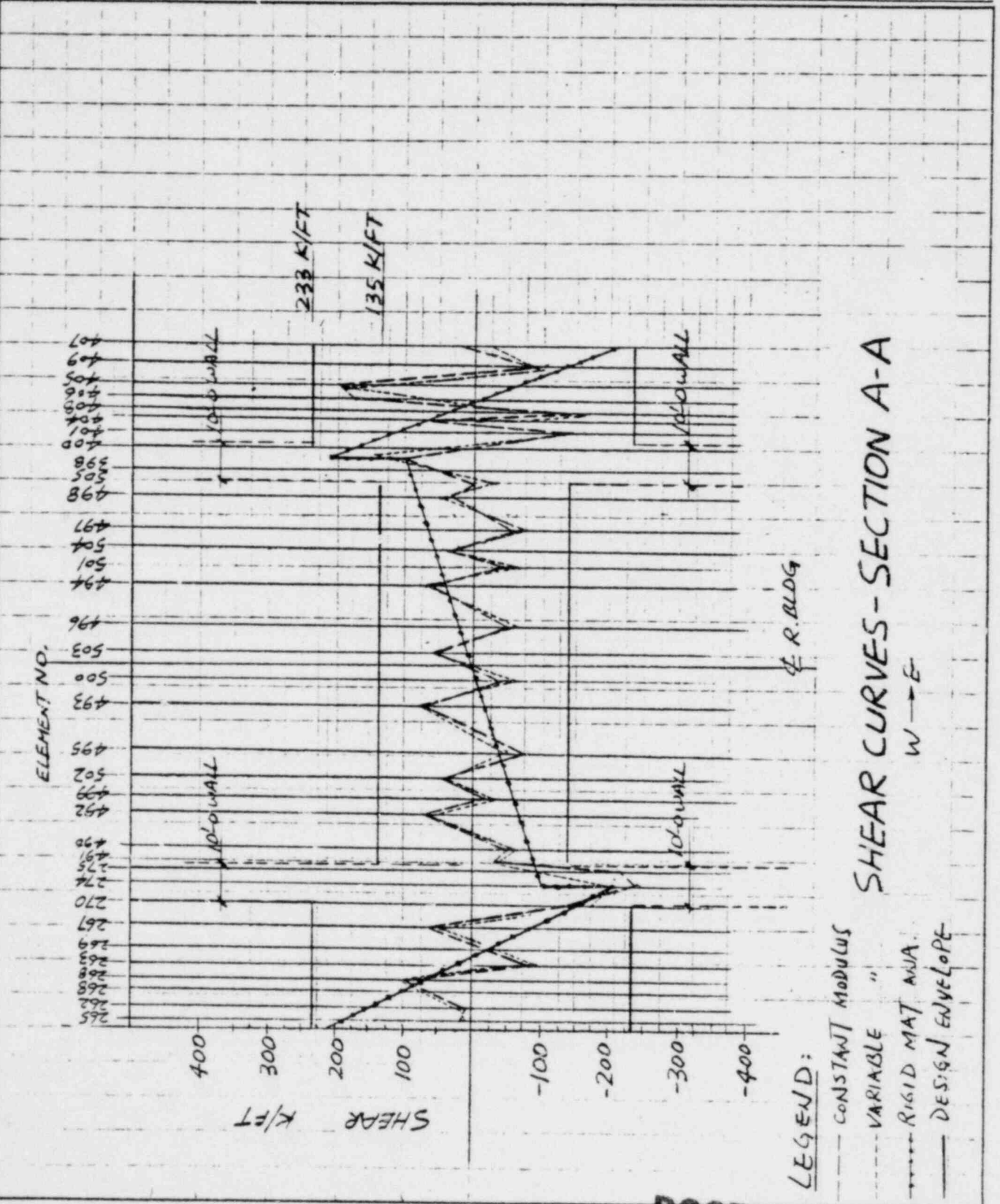
CHKD. BY J. YANG DATE 6/11/81

OPS NO. 5234.014 DEPT. NO. 550

CLIENT LOUISIANA POWER & LIGHT CO.

PROJECT WATERFORD STEAM ELECTRIC STATION

SUBJECT 1977 1165 MW INSTALLATION - UNIT 3



SHEAR CURVES - SECTION A-A

R. BLDG

LEGEND:
 - - - - - CONSTANT MODULUS
 - - - - - VARIABLE "
 ······ RIGID MAT
 ——— DESIGN ENVELOPE

W → E

POOR ORIGINAL

EBASCO SERVICES INCORPORATED

BY J. CHEN DATE 6/11/81

NEW YORK

SHEET E3 OF

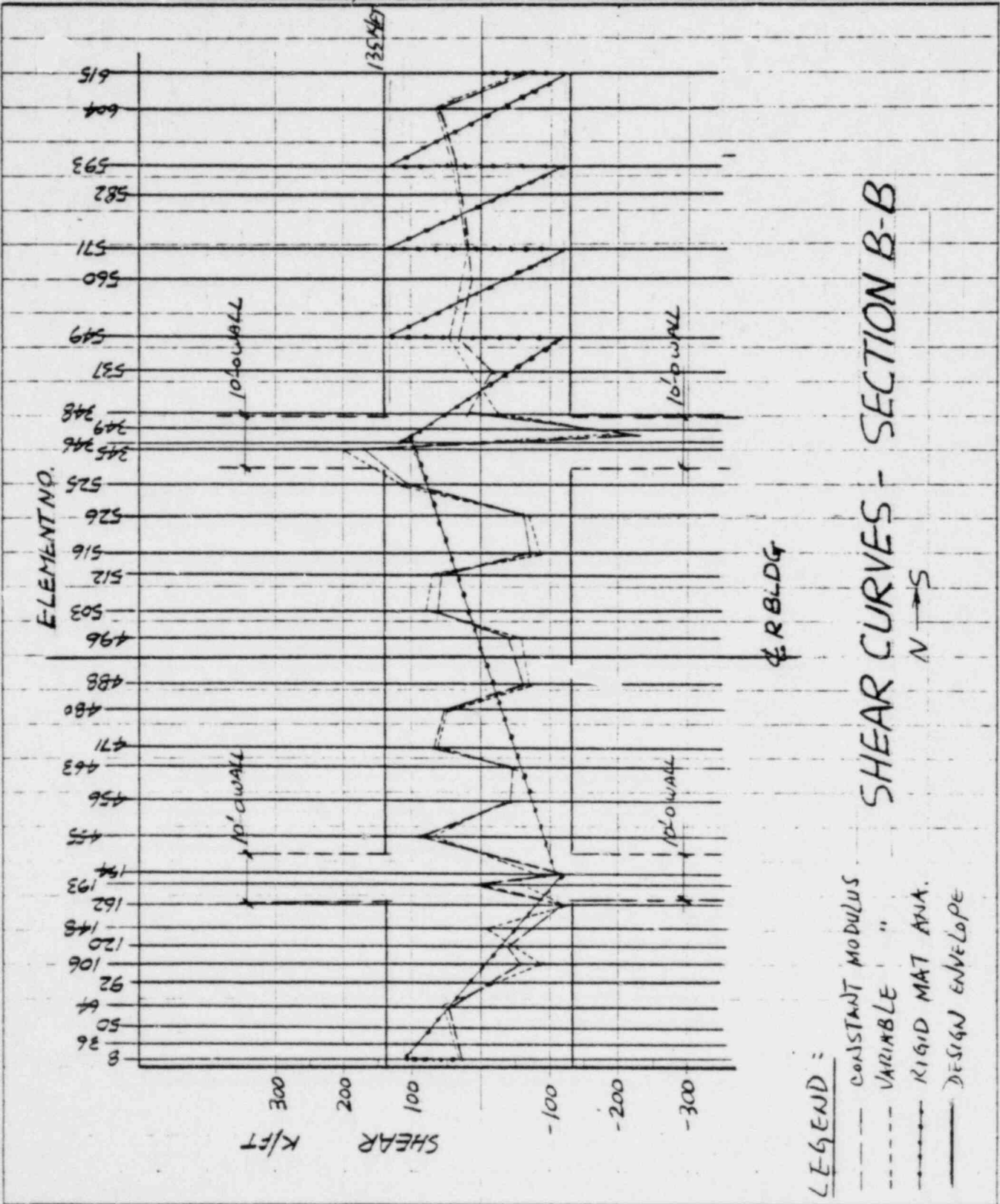
CHKD. BY J. YANG DATE 6/11/81

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



SHEAR CURVES - SECTION B-B
N → S
LEGEND =
— CONSTANT MODULUS
- - - VARIABLE MODULUS
... RIGID MAT ANA.
- · - DESIGN ENVELOPE

POOR ORIGINAL

EBASCO SERVICES INCORPORATED

BY J. CHEN DATE 6/11/81

NEW YORK

SHEET 64 OF _____

CHKD. BY J. YANG DATE 6/11/81

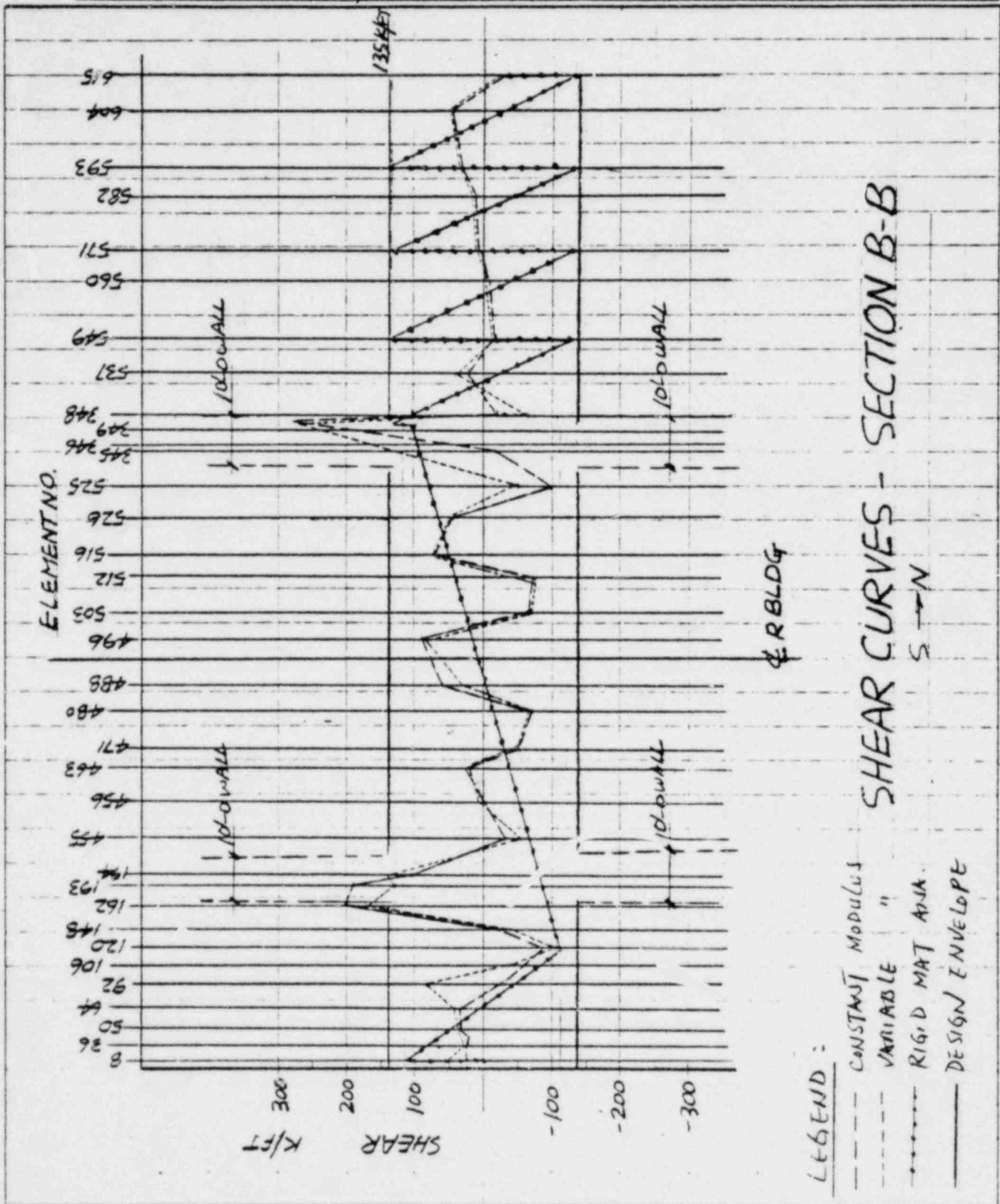
OFFS NO. 5234.014 DEPT. NO. 550

CLIENT LOUISIANA POWER & LIGHT CO.

PROJECT WATERFORD STEAM ELECTRIC STATION

PROJECT 1977 1165 MW INSTALLATION - UNIT 3

SUBJECT COMMON MAT ANALYSIS



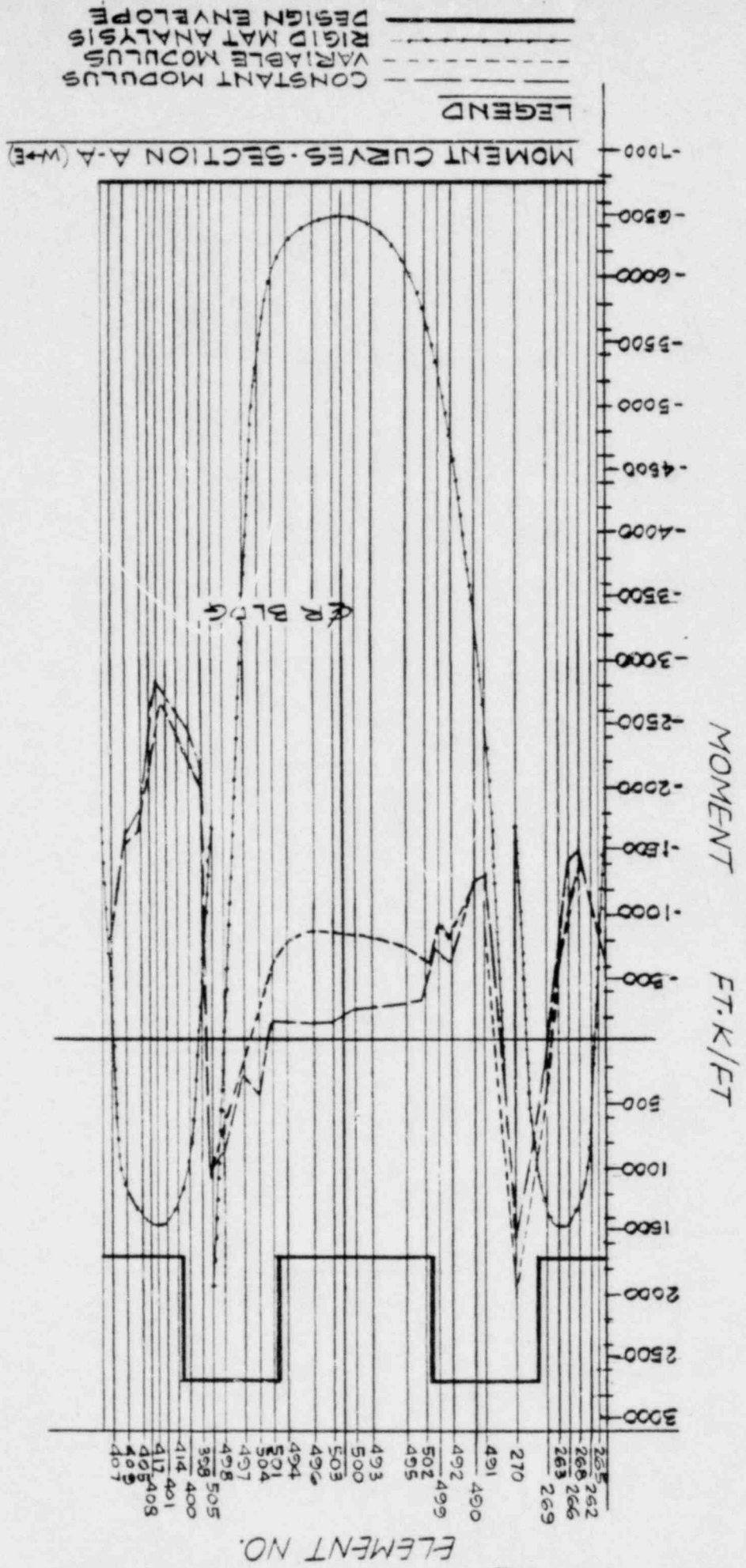
EBASCO SERVICES INCORPORATED

SHEET 55 OF

CLIENT: LOUISIANA POWER & LIGHT CO.
PROJECT: WATSFORD STEAM ELECTRIC STATION
SUBJECT: UNIT - UNIT 1
1677 1165 MB INSTALLATION

DWG NO. 5234-014
BY: D. DAURIO
CHECKED BY: J. CHEN

DEPT. NO. 550
DATE: 5/29/81
DATE: 5/27/81



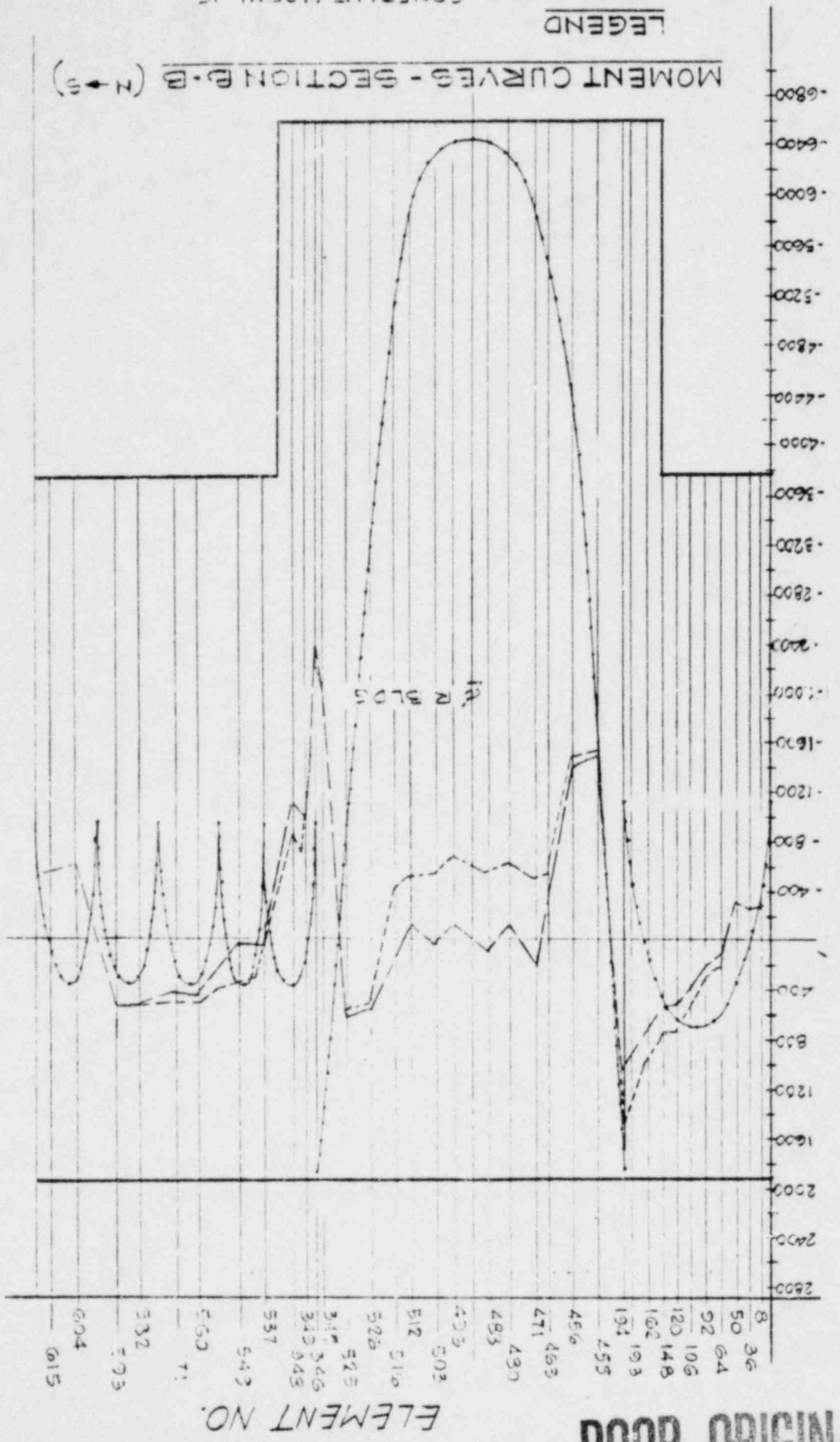
POOR ORIGINAL

EBAYCO SERVICES INCORPORATED

SHEET E6 OF

DESIGN NO. 5234-014 DEPT. NO. 550
 BY P. DAURIO DATE 5/20/81
 CHECKED BY J. CHEN DATE 5/27/81

LOUISIANA POWER & LIGHT CO.
 WATKINS STEEL REINFORCEMENT SECTION
 701 P.O. BOX 90000, NEW ORLEANS, LA 70109
 (504) 586-1000



ELEMENT NO.

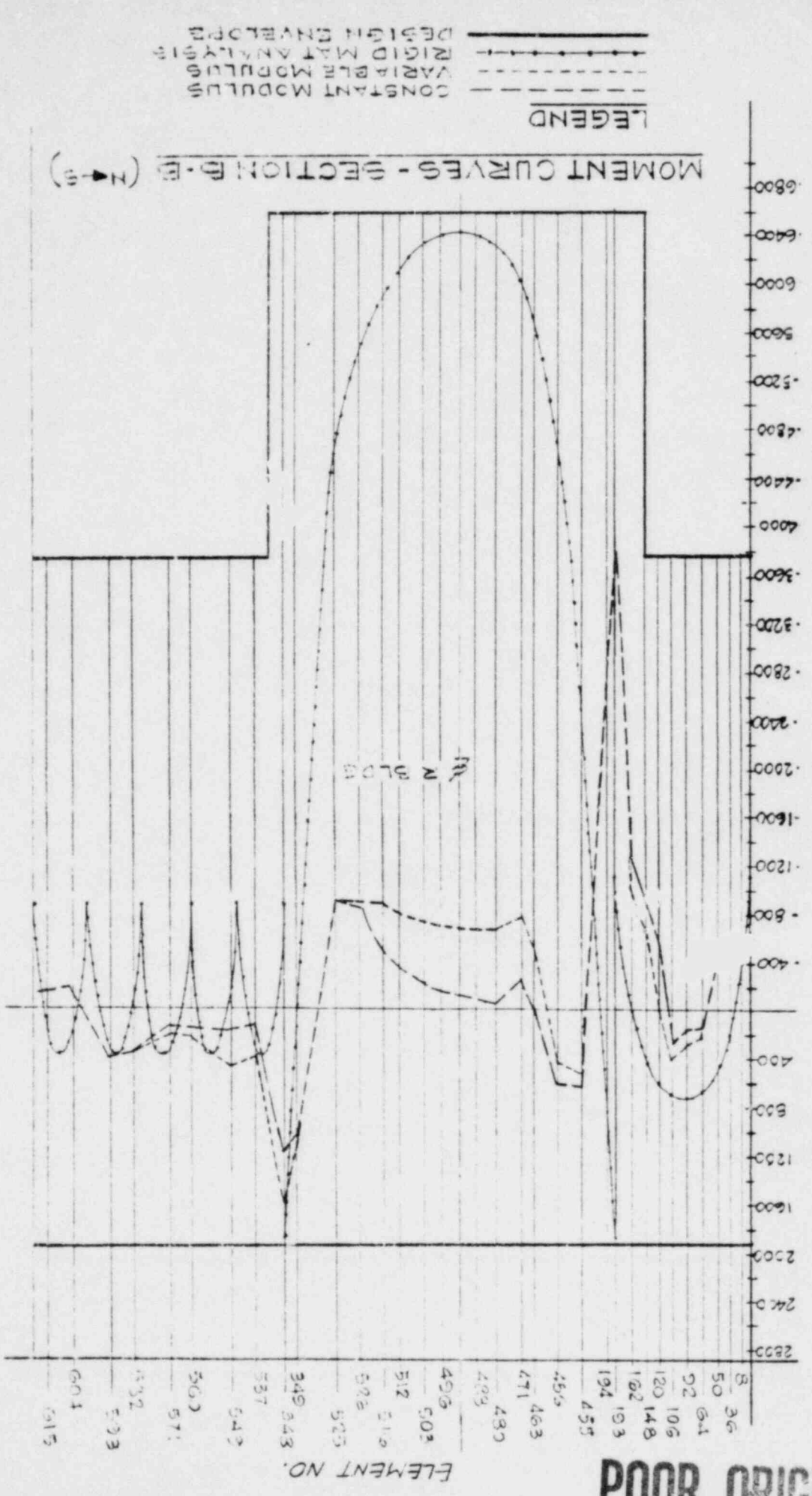
POOR ORIGINAL

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REV. 67 OF

PROJECT NO. 5234.014
DESIGN NO. 550
DATE 5/20/81
BY D. DAURIO
CHECKED BY I. CHEN
DATE 5/27/81

LOUISIANA POWER & LIGHT CO.
ALABAMA POWER SYSTEMS ACQUISITION
PROJECTS OR IMPROVEMENTS
SECTION 3
MEMORANDUM
SECTION 3
MEMORANDUM
SECTION 3



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EBASCO SERVICES INCORPORATED

BY J. CHEN DATE 6/4/81

NEW YORK

SHEET E8 OF

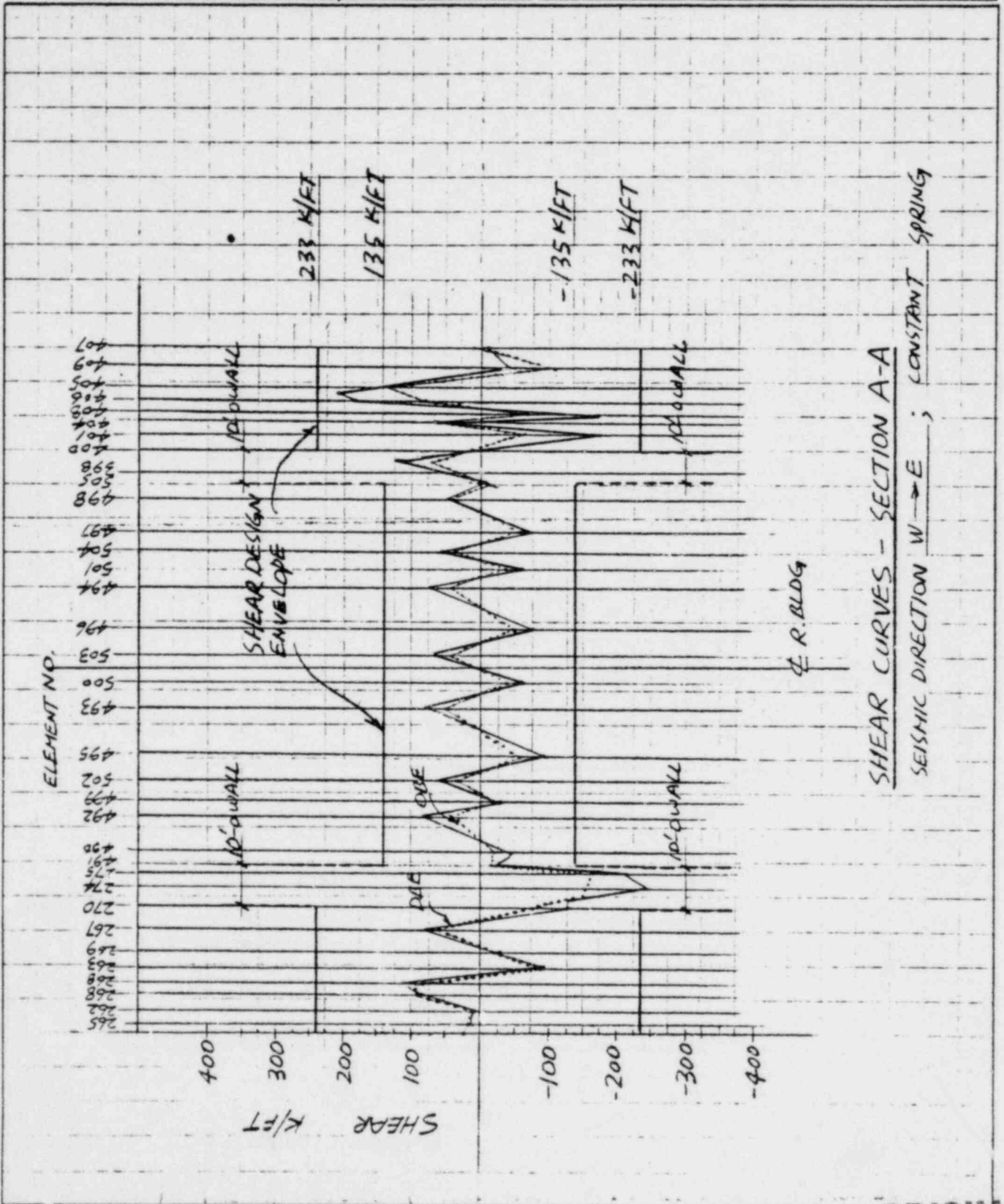
CHKD. BY J. YANG DATE 6/4/81

DEPT. NO. 550

CLIENT LOUISIANA POWER & LIGHT CO.
WATERFORD STEAM ELECTRIC STATION

PROJECT 1977 1165 MW INSTALLATION - UNIT 3

SUBJECT COMMON MAT ANALYSIS



POOR ORIGINAL

EBASCO SERVICES INCORPORATED

BY J. CHEN DATE 6/4/81

NEW YORK

SHEET E9 OF

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

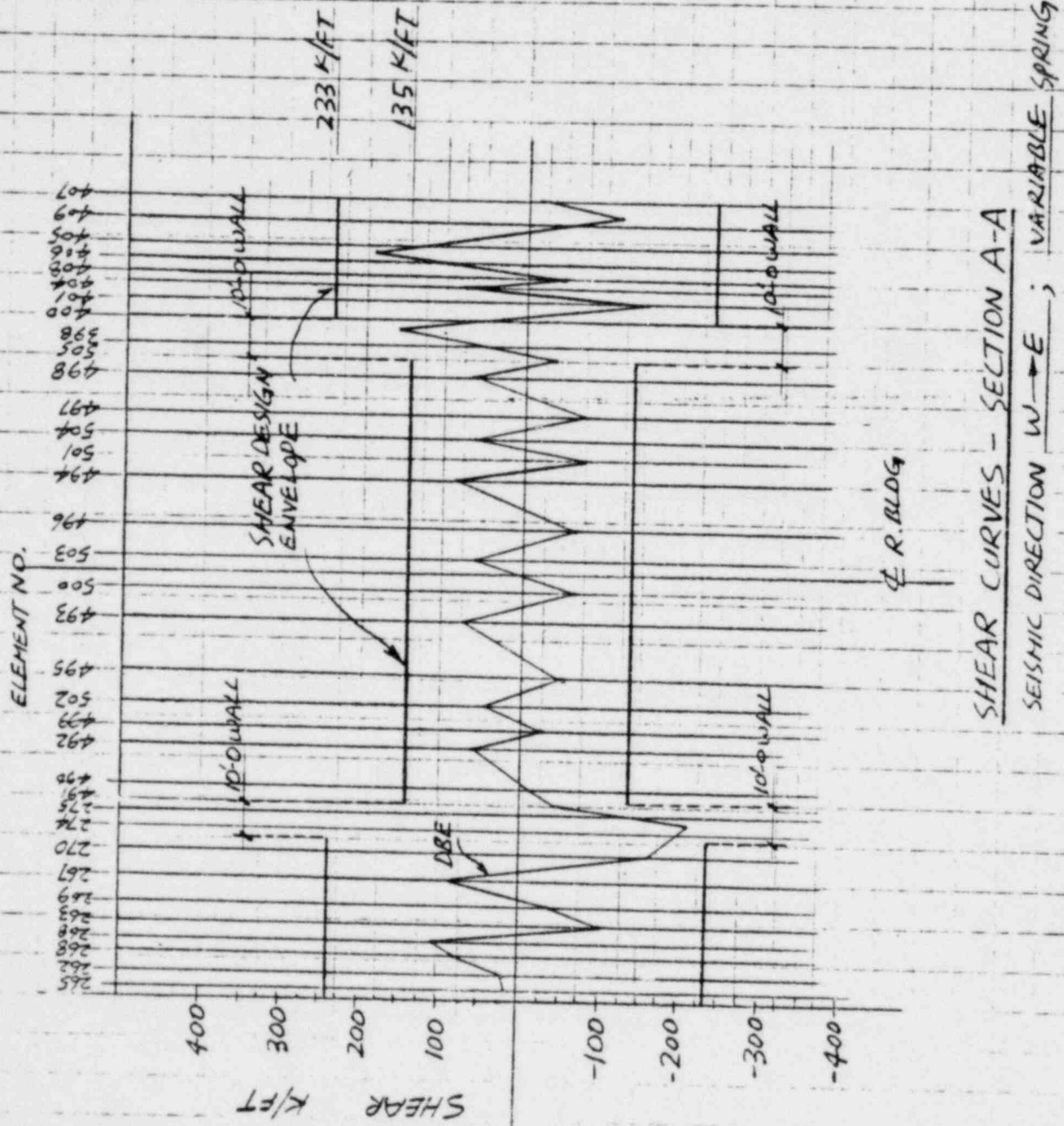
OFS NO. 5234.014 DEPT NO. 550

CLIENT LOUISIANA POWER & LIGHT CO.

PROJECT WATERFORD STEAM ELECTRIC STATION

1977 1165 MW INSTALLATION - UNIT 3

SUBJECT COMMON MAT ANALYSIS



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BY J. CHEN DATE 6/4/81

NEW YORK

SHEET E10 OF

CH'D. BY J. YANG DATE 6/2/81

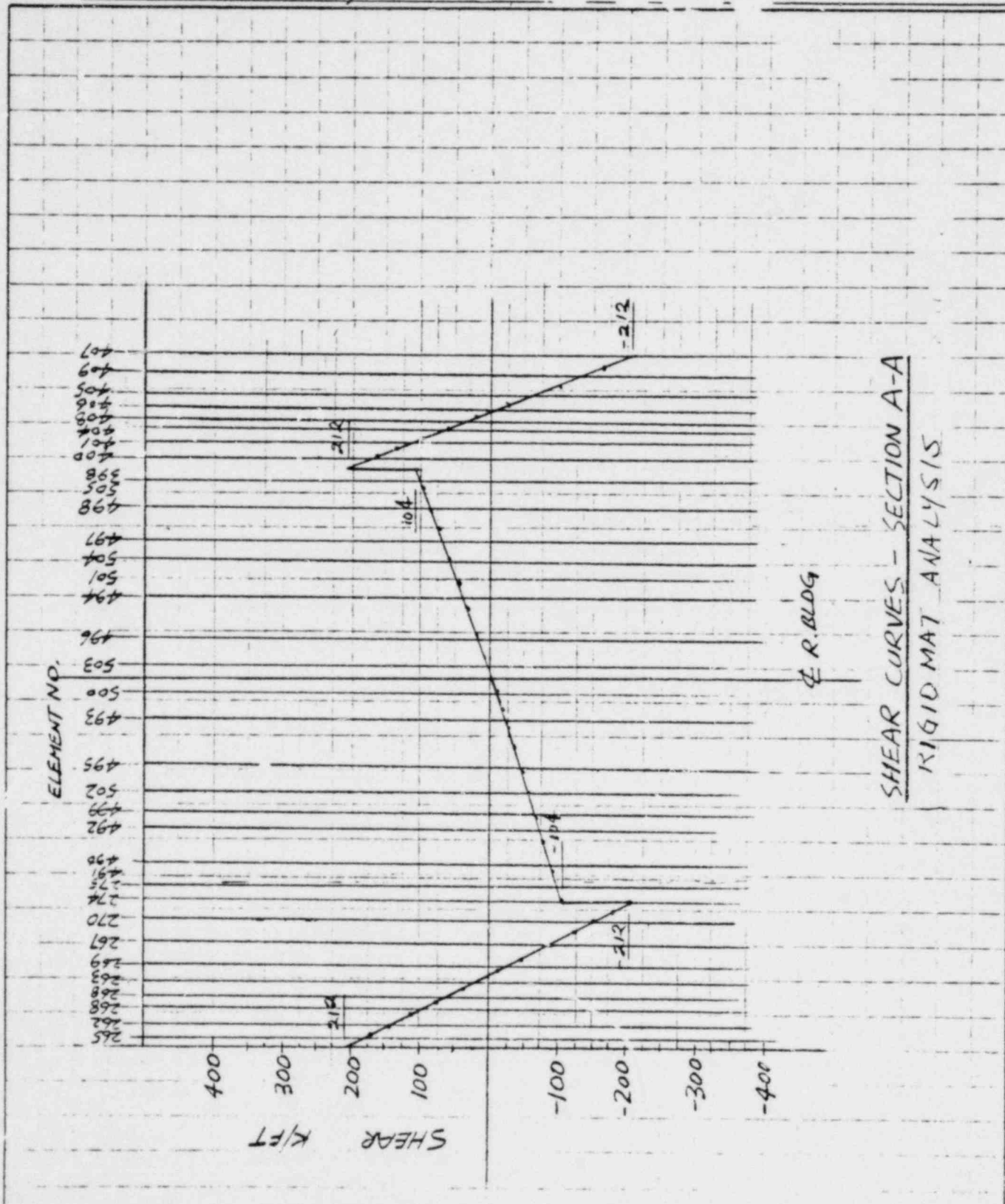
DEPT. NO. 550

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

CLIENT

PROJECT

SUBJECT COMMON MAT ANALYSIS



POOR ORIGINAL

EBASCO SERVICES INCORPORATED

BY F. ALEXANDER DATE 5-27-81

NEW YORK

SHEET 11 OF 11

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

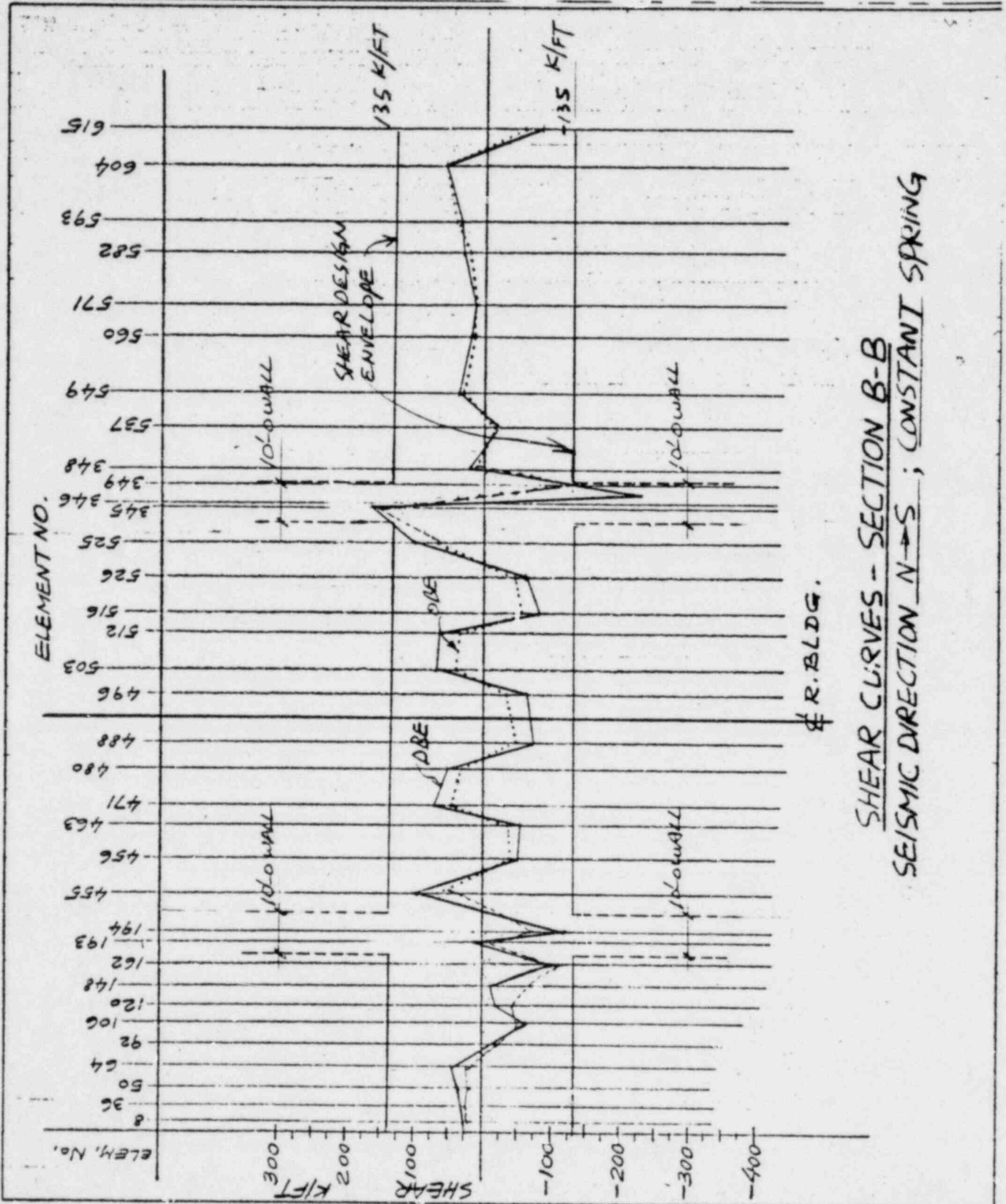
QFS NO. 5334.014

DEPT. NO. 550

CLIENT LOUISIANA POWER & LIGHT CO.
WATERFORD STEAM ELECTRIC STATION

PROJECT 1977 1165 MW INSTALLATION - UNIT 3

SUBJECT COMMON MAT ANALYSIS



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

EBASCO SERVICES INCORPORATED

NEW YORK

BY P. ALEXANDRESCU DATE 5-26-81

SHEET E/2 OF _____

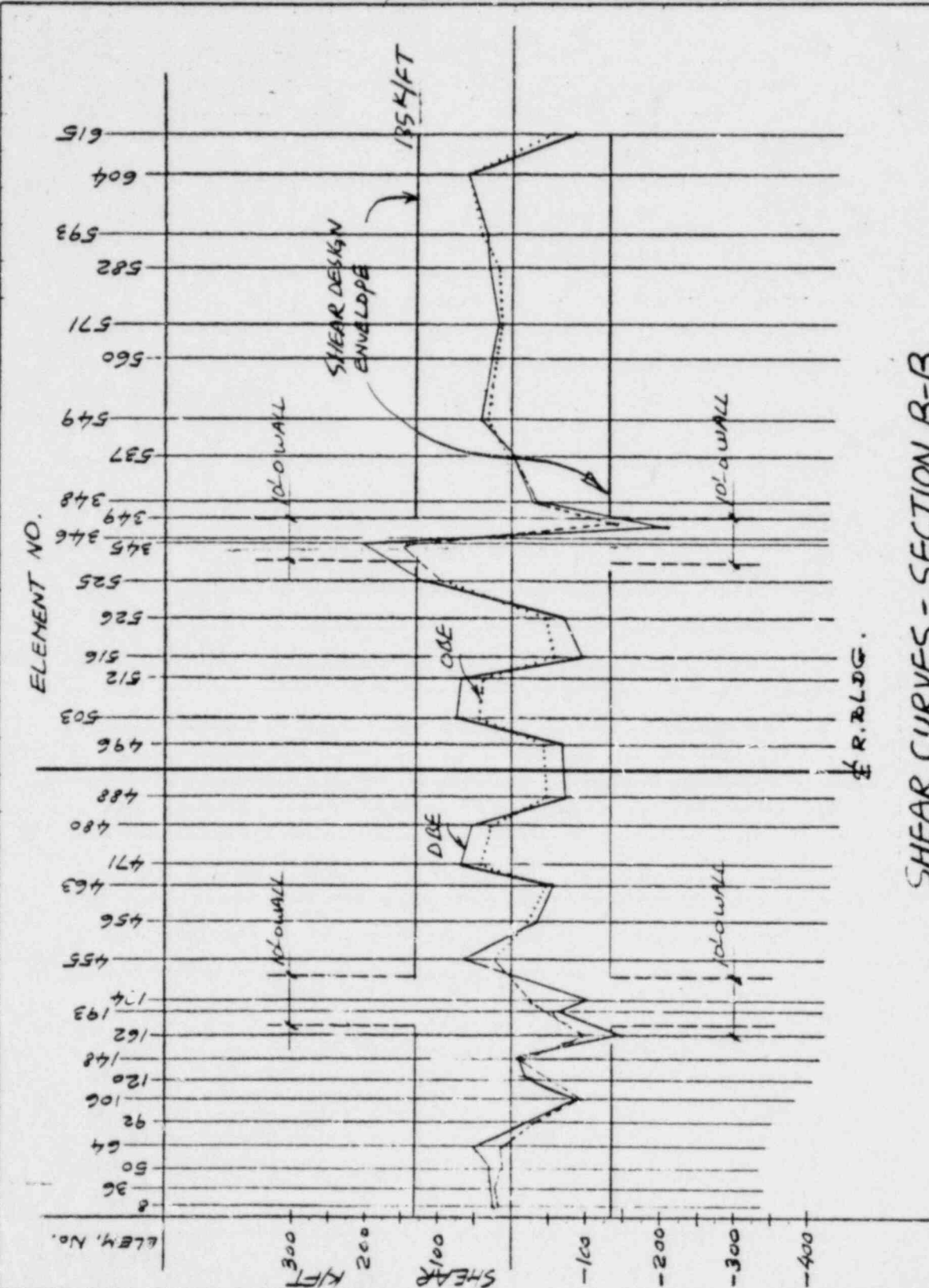
CHKD. BY V. CHEN DATE 5/27/81

OFS 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



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

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

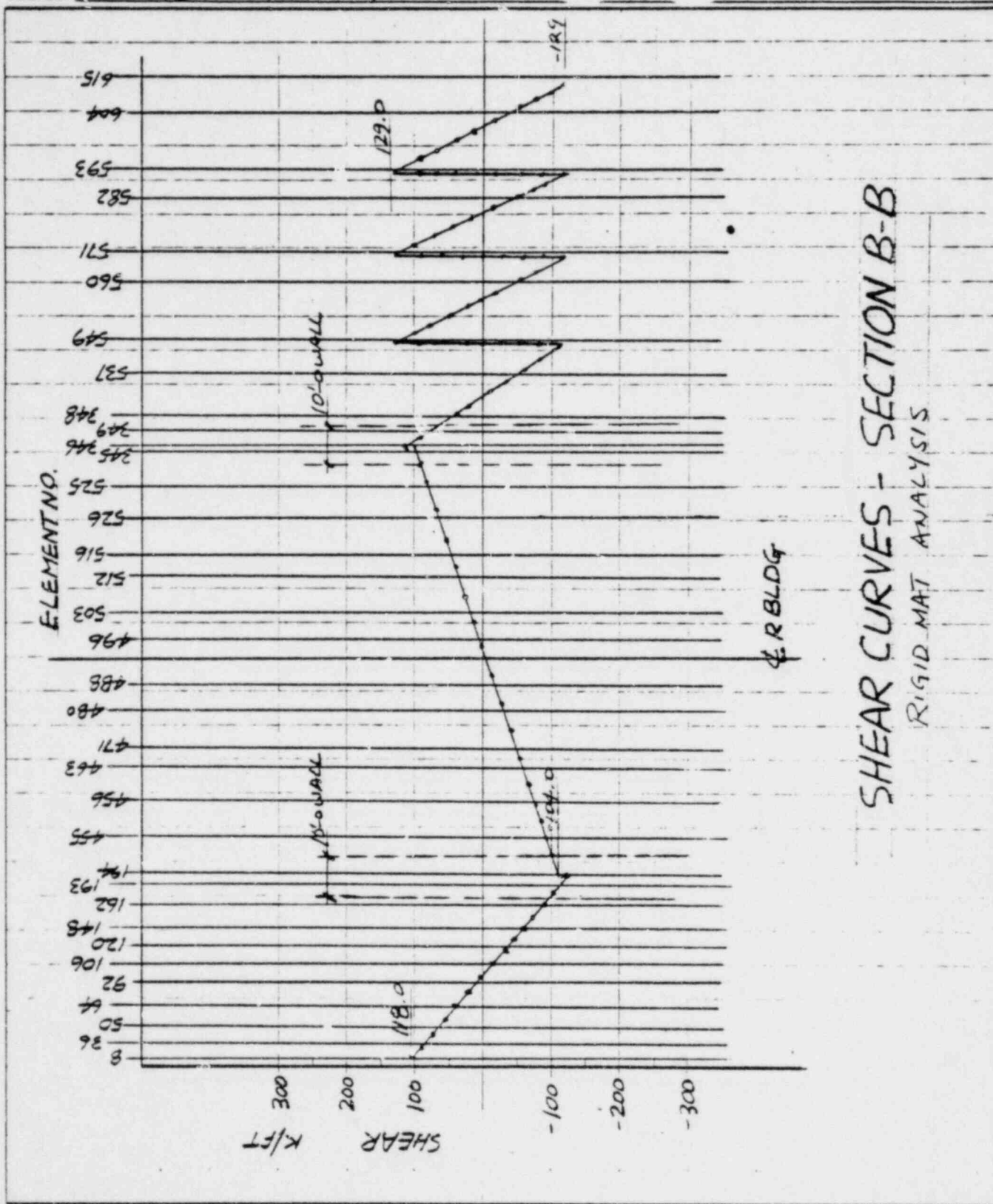
DEPT. NO. 550

CLIENT LOUISIANA POWER & LIGHT CO.

PROJECT WATERFORD STEAM ELECTRIC STATION

SUBJECT 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

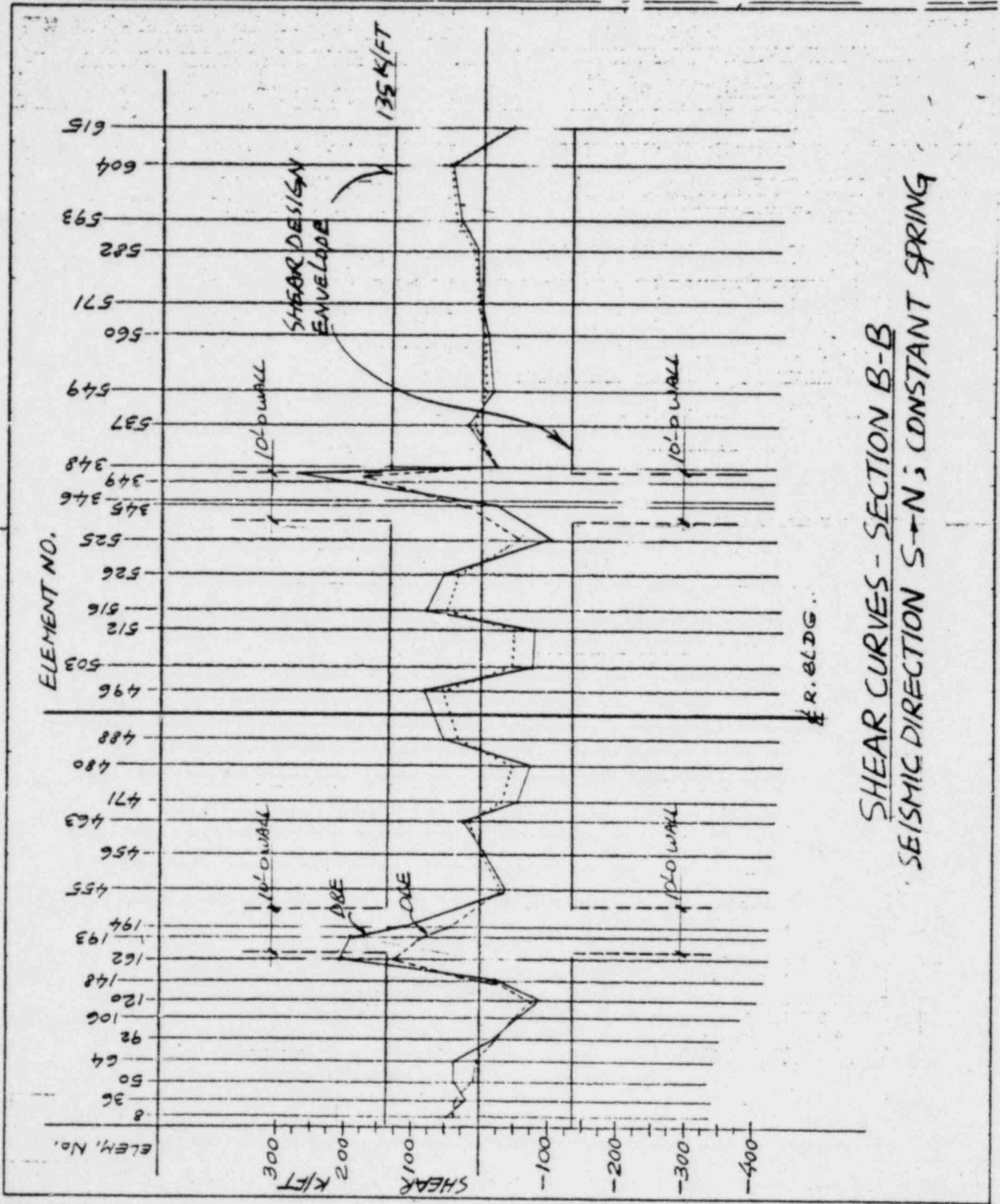
OPS NO. 5034.014

DEPT. NO. 550

CLIENT LOUISIANA POWER & LIGHT CO.
WATERFORD STEAM ELECTRIC STATION

PROJECT 1977 1165 MW INSTALLATION - UNIT 3

SUBJECT COMMON MAT ANALYSIS



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

EBASCO SERVICES INCORPORATED

BY F. ALEXANDREZ DATE 5-27-81

NEW YORK

SHEET E15 OF

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

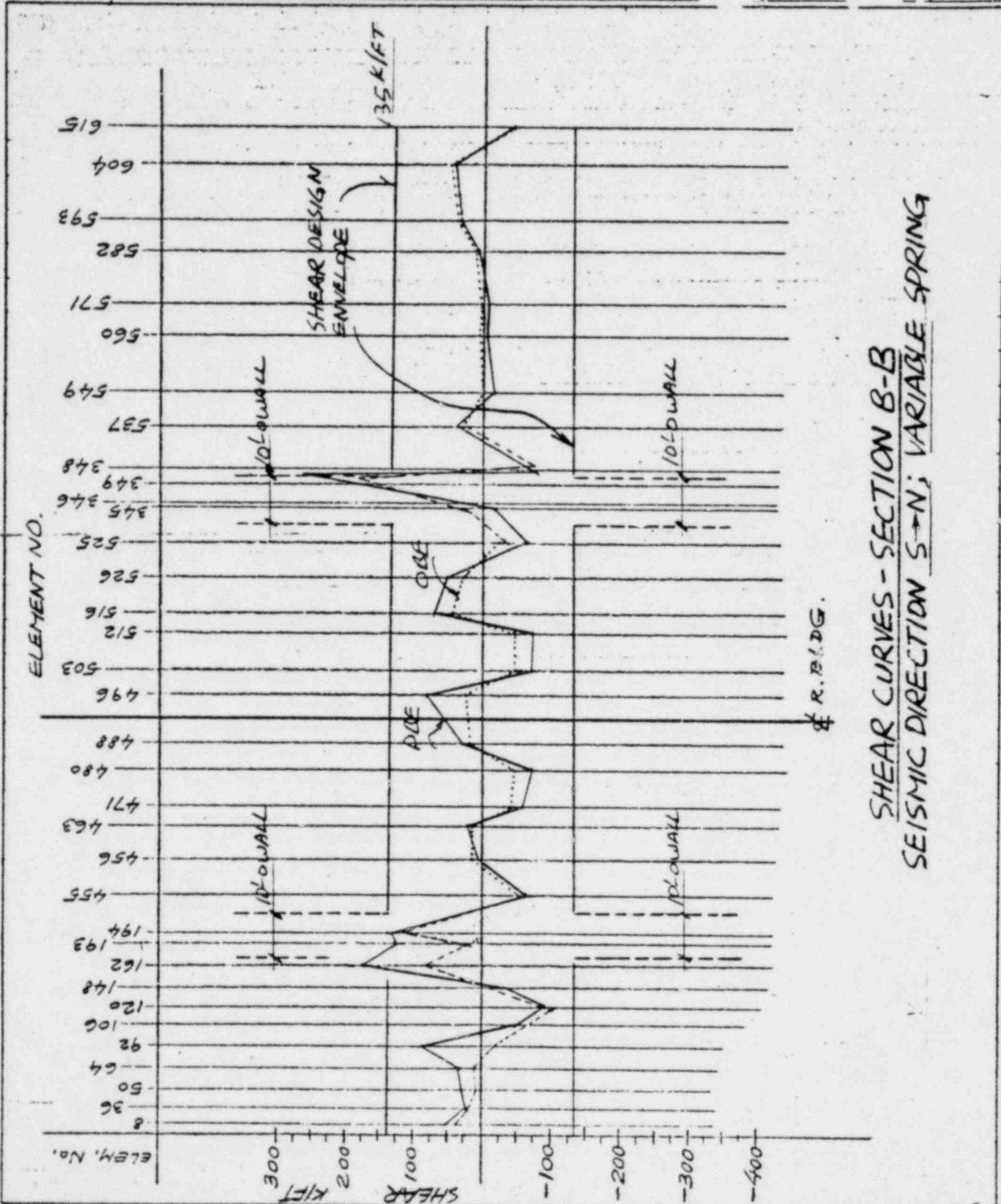
OFF. NO. 5334.014

DEPT. NO. 520

CLIENT LOUISIANA POWER & LIGHT CO.
WATERFORD STEAM ELECTRIC STATION

PROJECT 1977 1165 MW INSTALLATION - UNIT 3

SUBJECT COMMON MAT ANALYSIS



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

POOR ORIGINAL

EBASCO SERVICES INCORPORATED

NEW YORK

SHEET E16 OF _____

BY F. ALEXANDER DATE 5-7-81

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

OFFS NO. 5234-014

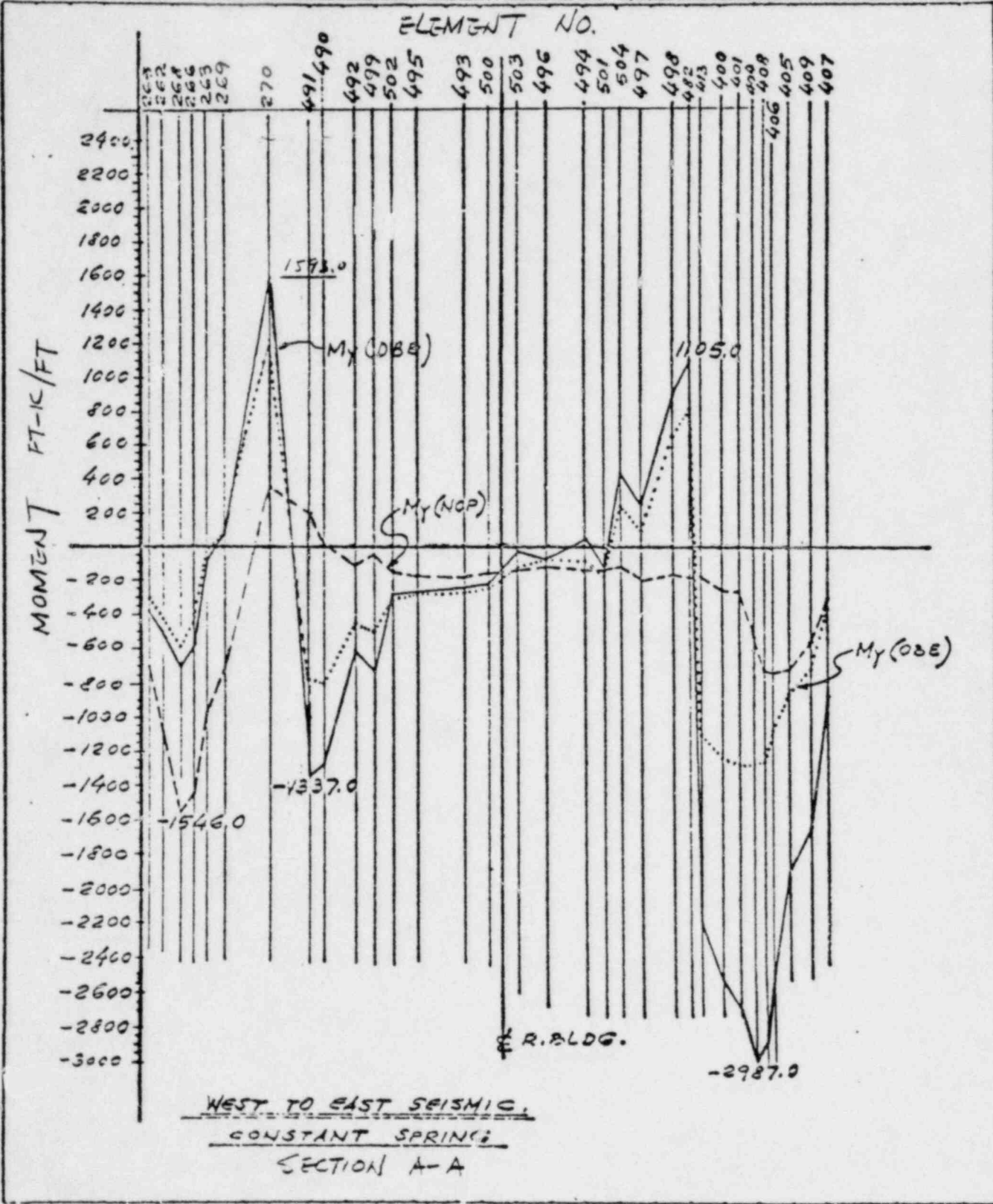
DEPT. NO. 550

CLIENT LOUISIANA POWER & LIGHT CO.

PROJECT WATERFORD STEAM ELECTRIC STATION

SUBJECT 1977 1165 MW INSTALLATION - UNIT 3

SUBJECT COMMON MAT ANALYSIS



POOR ORIGINAL

EBASCO SERVICES INCORPORATED

BY F. ALEXANDROSCU DATE 4-28-81

NEW YORK

SHEET E17 OF _____

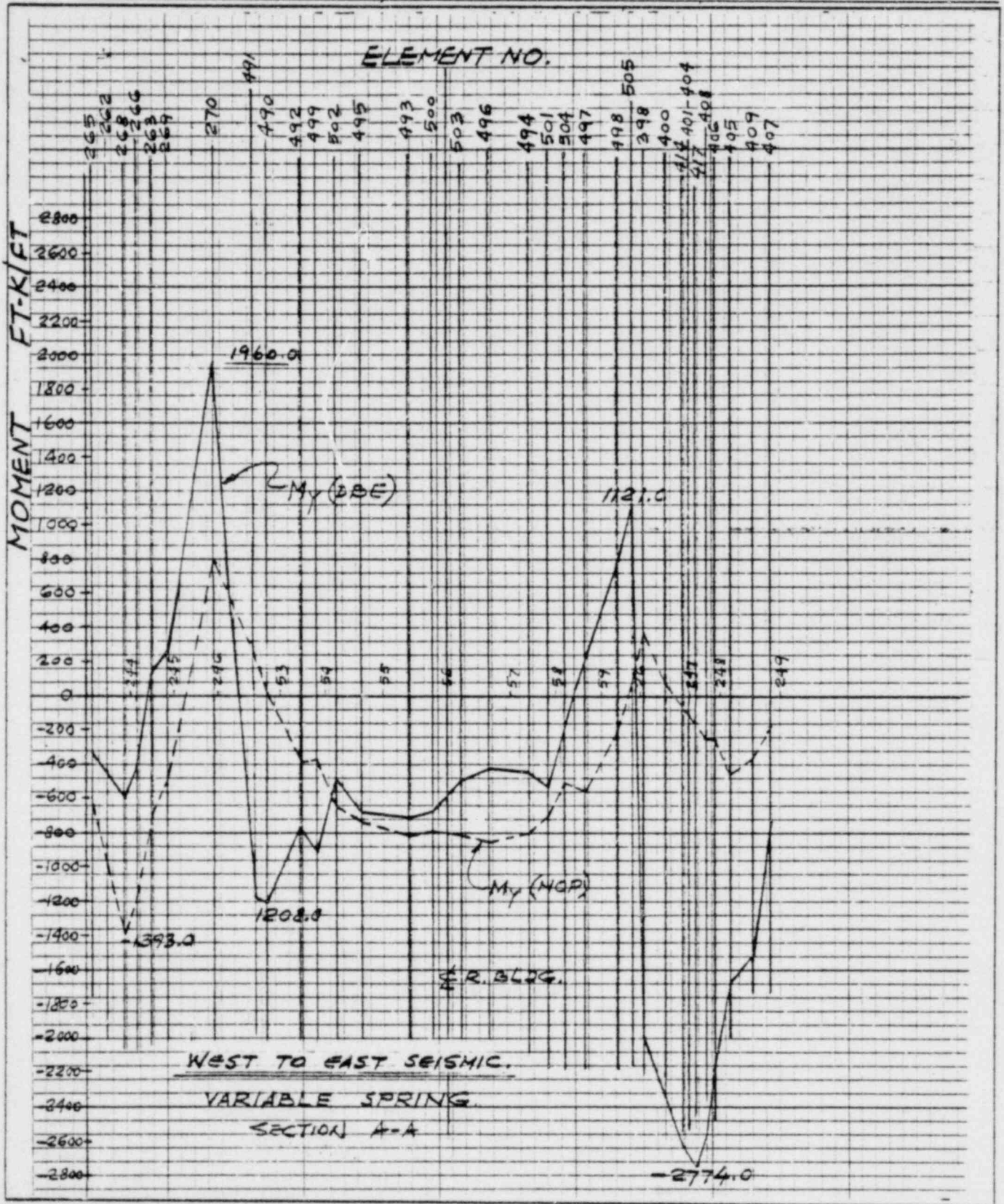
CHKD. BY J. CHEN DATE 5/6/81

OFS 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



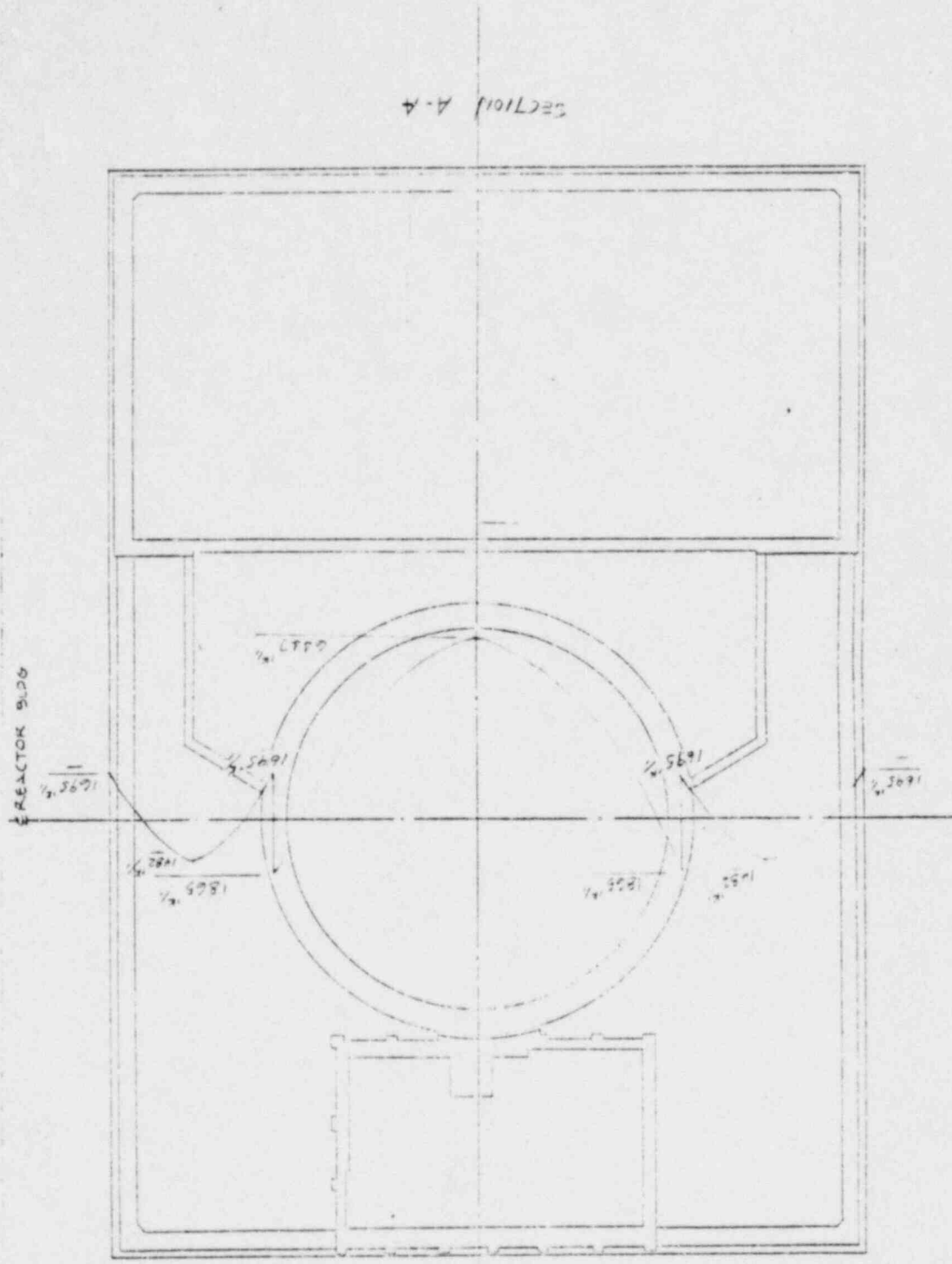
POOR ORIGINAL

EDASLU SERVICES INCORPORATED

REV. 6/8 UP

DEPT. NO. 550
DATE 5/25/81
CHECKED BY J. CHEN

CLIENT: LOUISIANA POWER & LIGHT CO
PROJECT: WATERFORD D.E.S. UNIT NO. 3
SUBJECT: COMMON PEN. MAT. - RIGID MAT. ANALYSIS



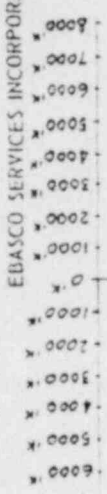
SECTION B-D

POOR ORIGINAL

DEPT. NO. 5234-044
BY T. YANG
CHECKED BY L. CHEN

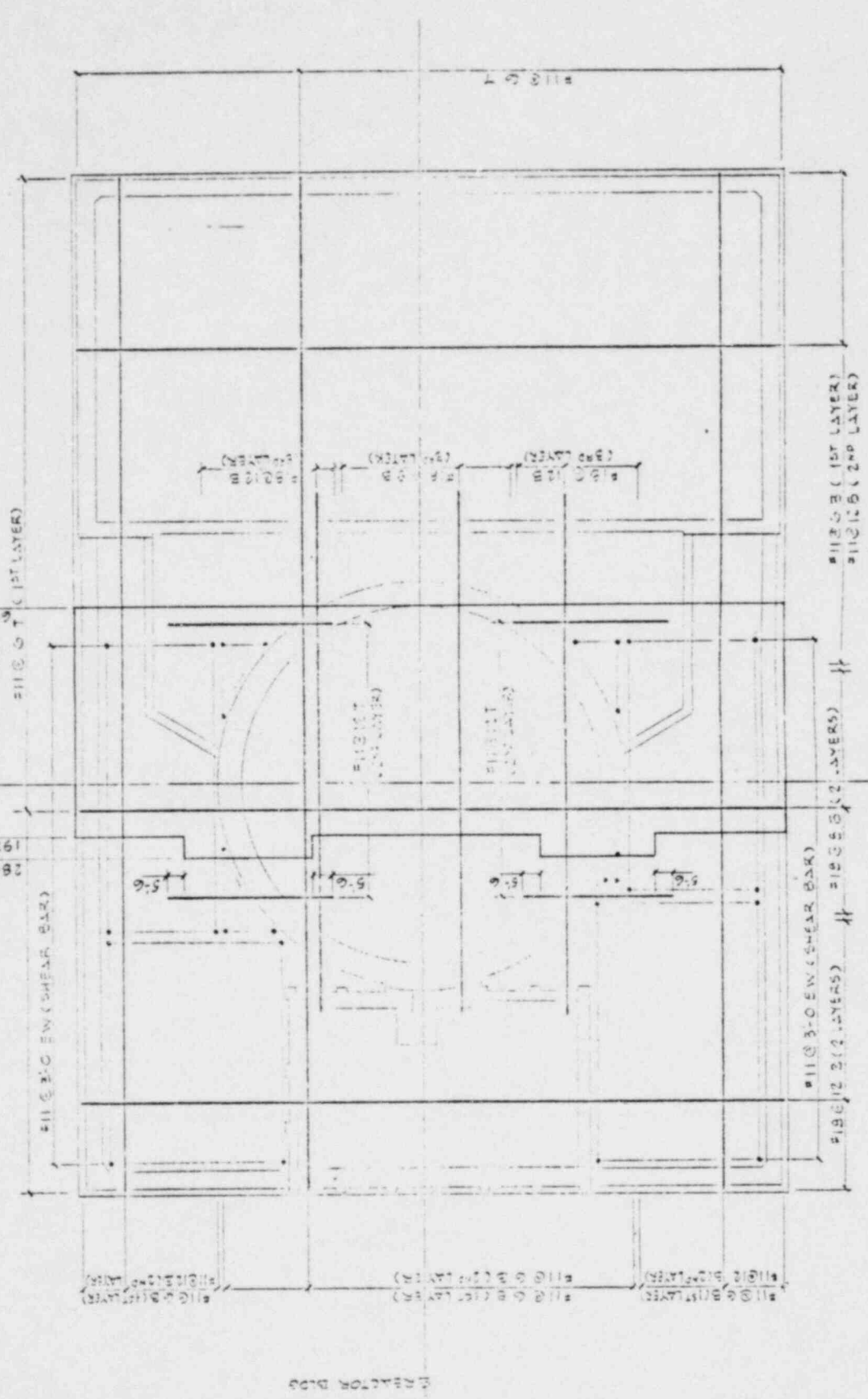
DEPT. NO. 550
DATE 5/10/81
DATE 5/10/81

EBASCO SERVICES INCORPORATED
B-W DIRECTION
TAB REINF
MOMENT CAPACITY
ENVELOPE CURVE
& REACTOR



FOR CALCULATION
SEE PAGE A3

CLIENT: LOUISIANA POWER & LIGHT CO
PROJECT: WATERFORD 5 E/S UNIT NO. 3
SUBJECT: COMMON EDN MAT. REINF -
MOMENT DESIGN ENVELOPE (SECTION A-A)



POOR ORIGINAL

EBASCO SERVICES INCORPORATED

BY F. ALEXANDROSCU DATE 5-20-81

NEW YORK

SHEET E20 OF

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

OPS NO. 5234.014

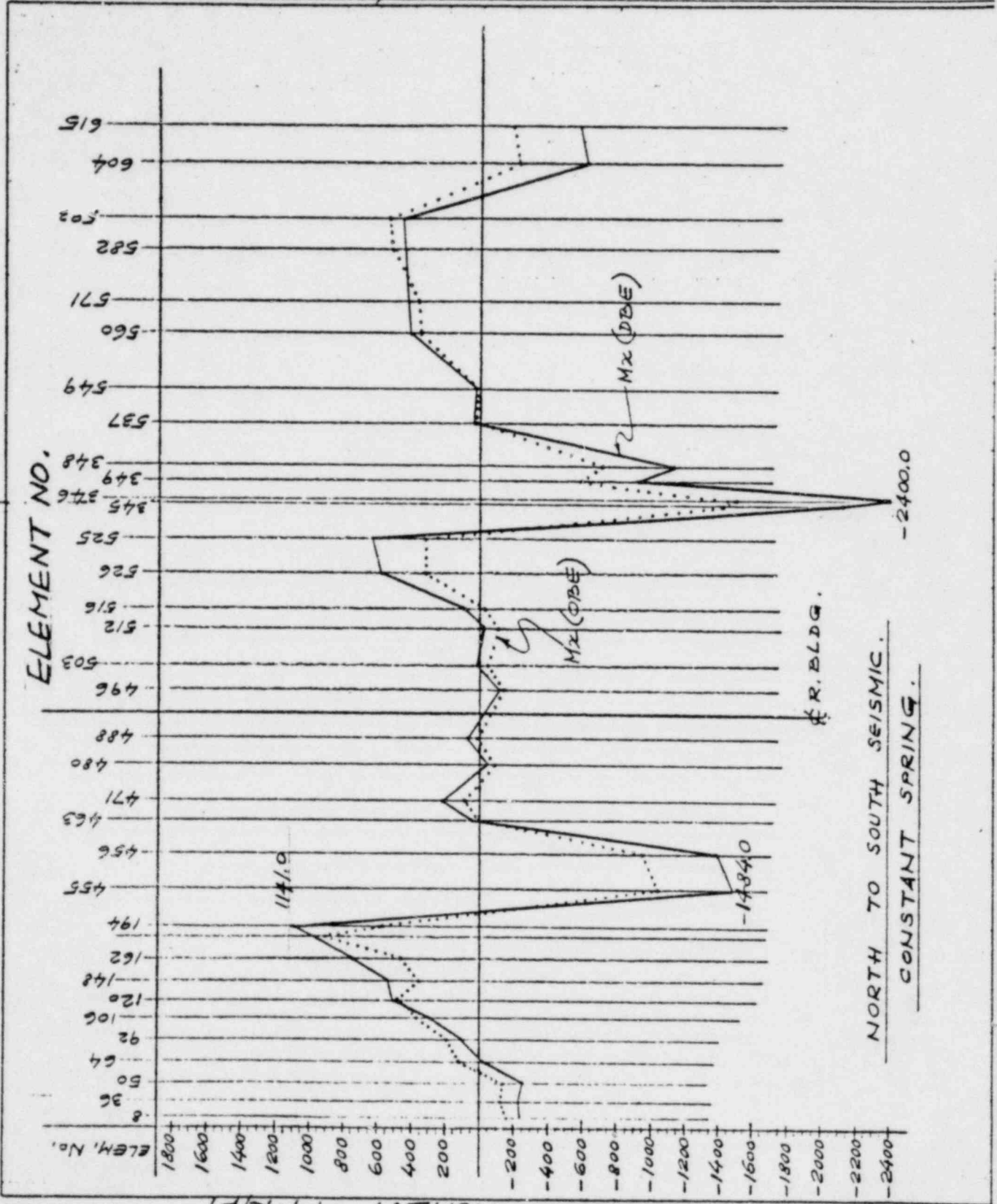
DEPT. NO. 550

CLIENT LOUISIANA POWER & LIGHT CO.

WATERFORD STEAM ELECTRIC STATION

PROJECT 1977 1165 MW INSTALLATION - UNIT 3

SUBJECT COMMON MAT ANALYSIS



EBASCO SERVICES INCORPORATED

NEW YORK

SHEET 521 OF

NO. 5834.014

OFF. NO. 5834.014

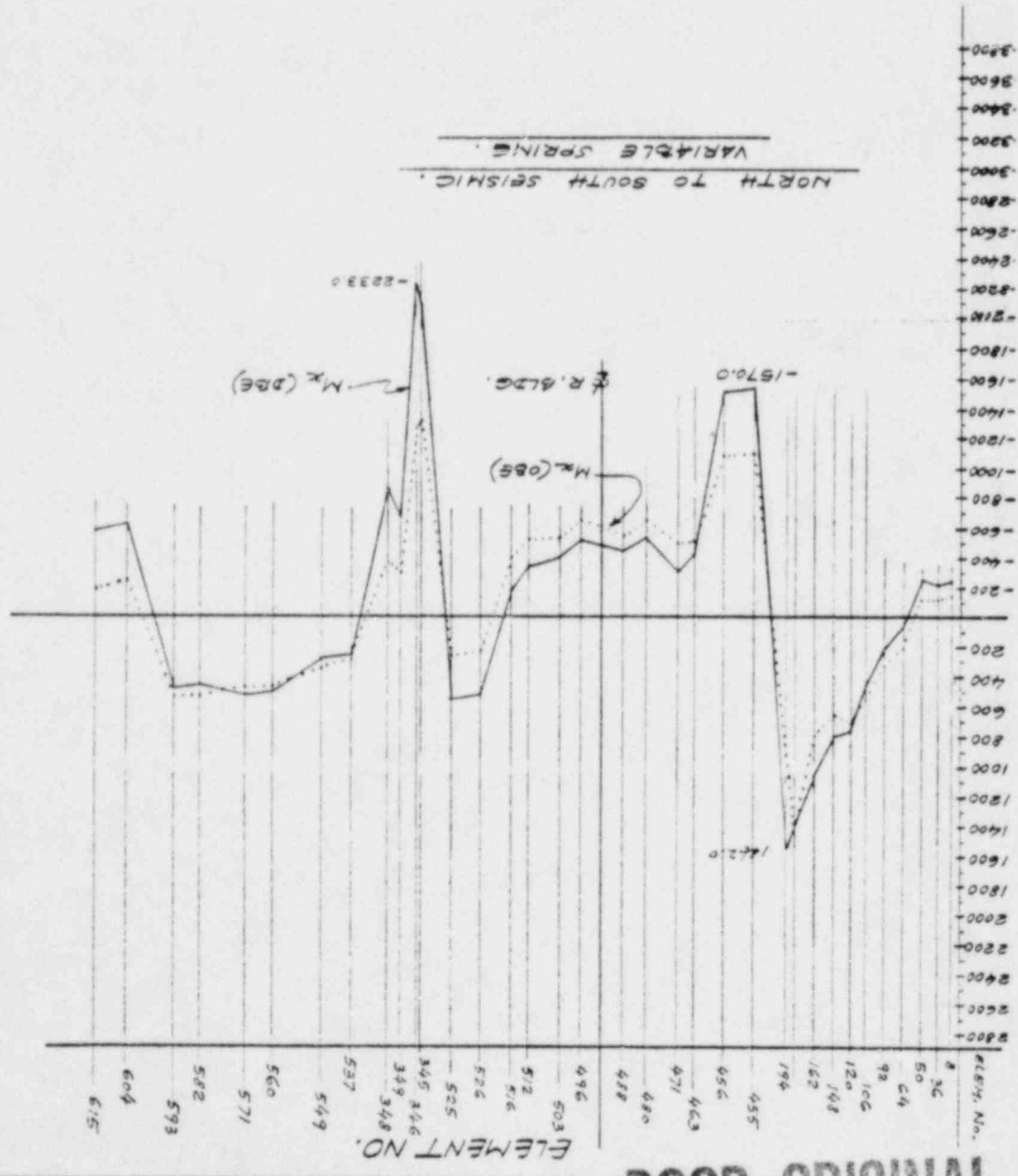
DEPT. NO. 520

LOUISIANA POWER & LIGHT CO.

WESTMOND STEAM ELECTRIC STATION

1977 1195 MW INSTALLATION - UNIT 3

SUBJECT: COMMON MAT ANALYSIS



POOR ORIGINAL

EBASCO SERVICES INCORPORATED

SHEET E23 OF _____

CLIENT LOUISIANA POWER & LIGHT CO

PROJECT WATERFORD 5.E5 UNIT NO.3

SUBJECT COMMON EN MAT - P.10.0 MAT ANALYSIS

OFFS NO. 5234 o1A

DEPT. NO. 550

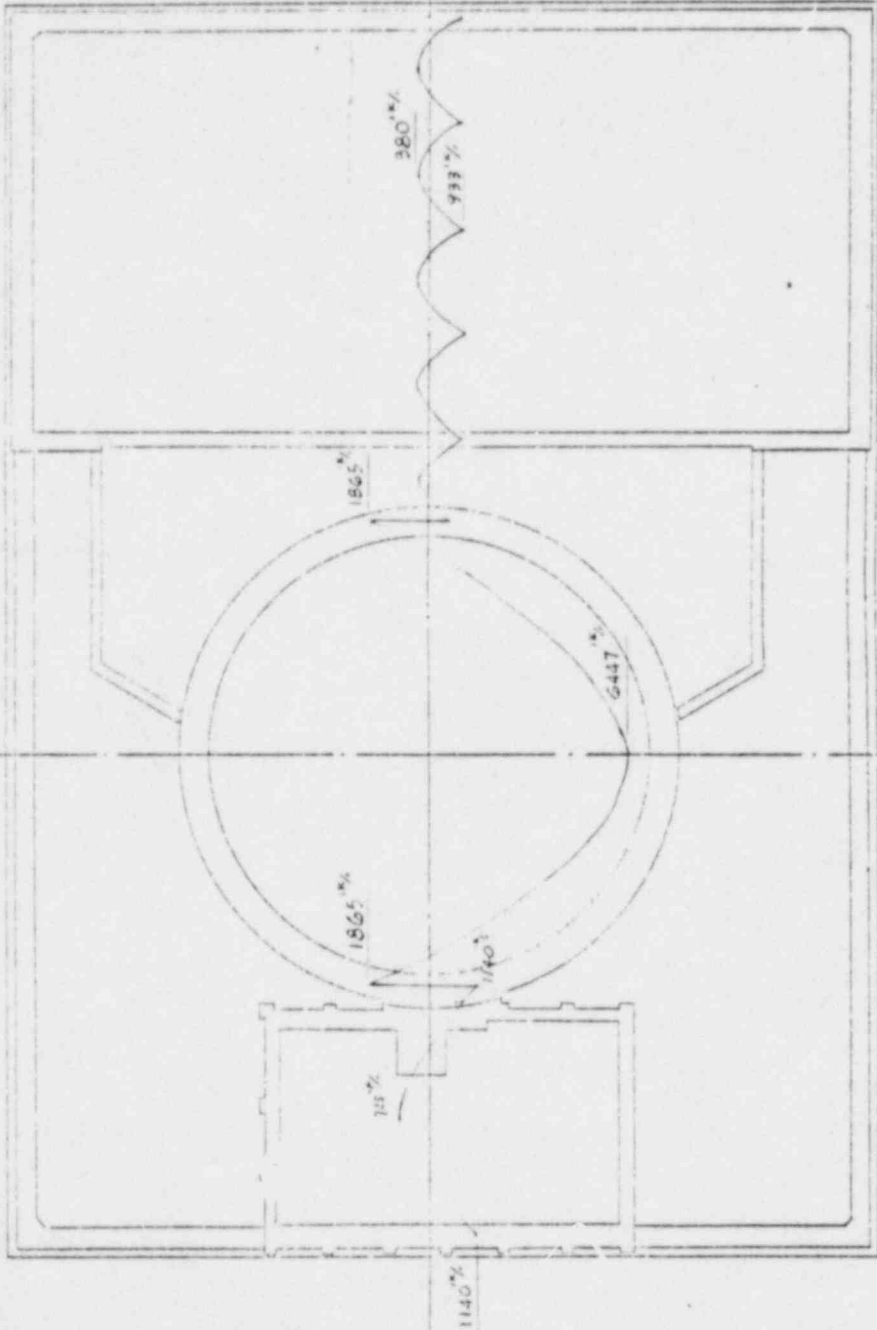
BY T. V. G.

ATE 5/25/81

CHECKED BY J. CHEM

DATE 5/25/81

REACTOR BLDG



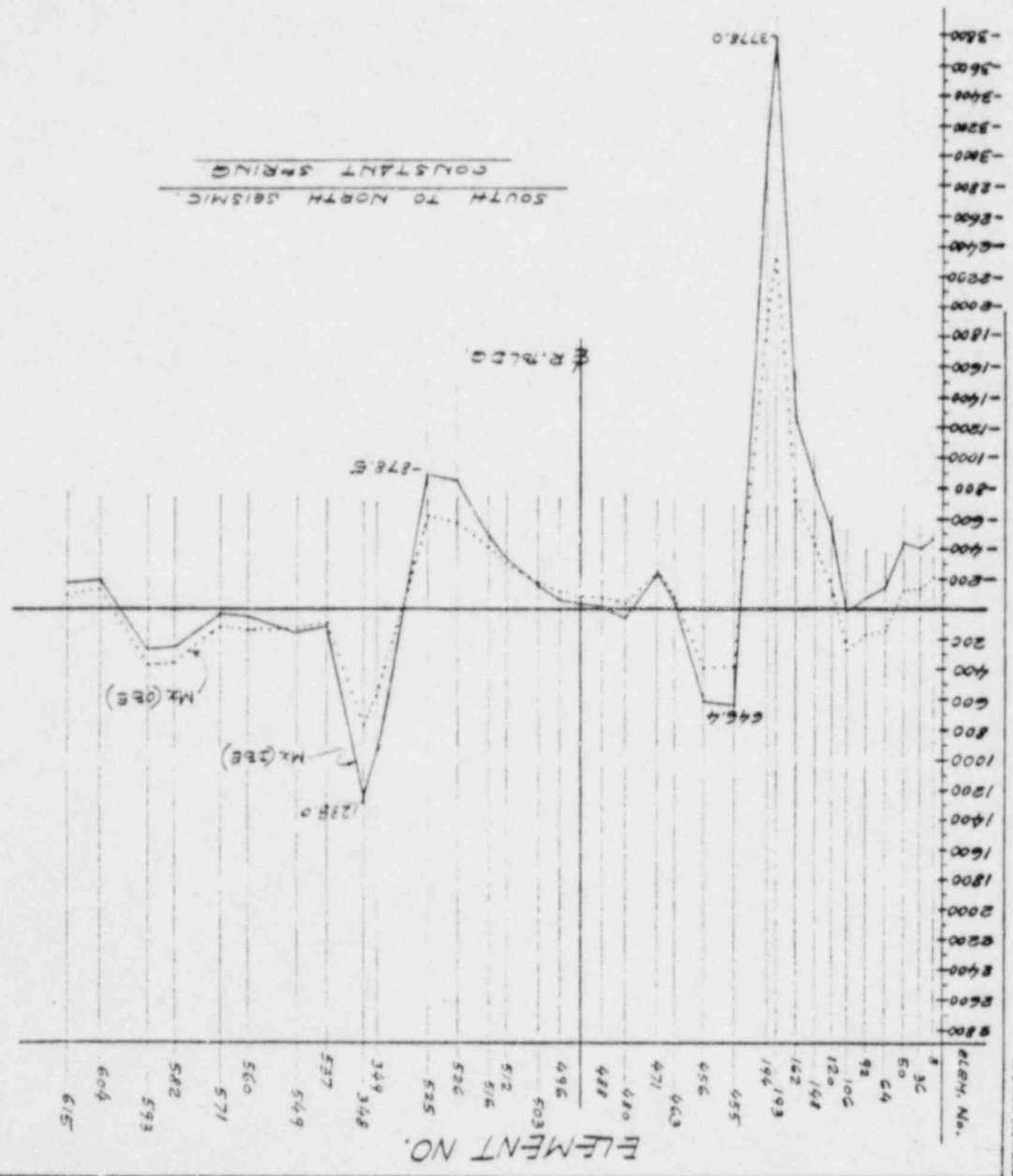
SECTION B-B

REACTOR BLDG

POOR ORIGINAL

EBASCO SERVICES INCORPORATED

NEW YORK SHEET 5-21 OF DEPT. NO. 550
 OPS. NO. 5234-014
 CLIENT: LOUISIANA POWER & LIGHT CO.
 WATERFORD STEAM ELECTRIC STATION
 PROJECT: 1972 1165 MR INSTALLATION - UNIT 3
 SUBJECT: SOMMISON MAT



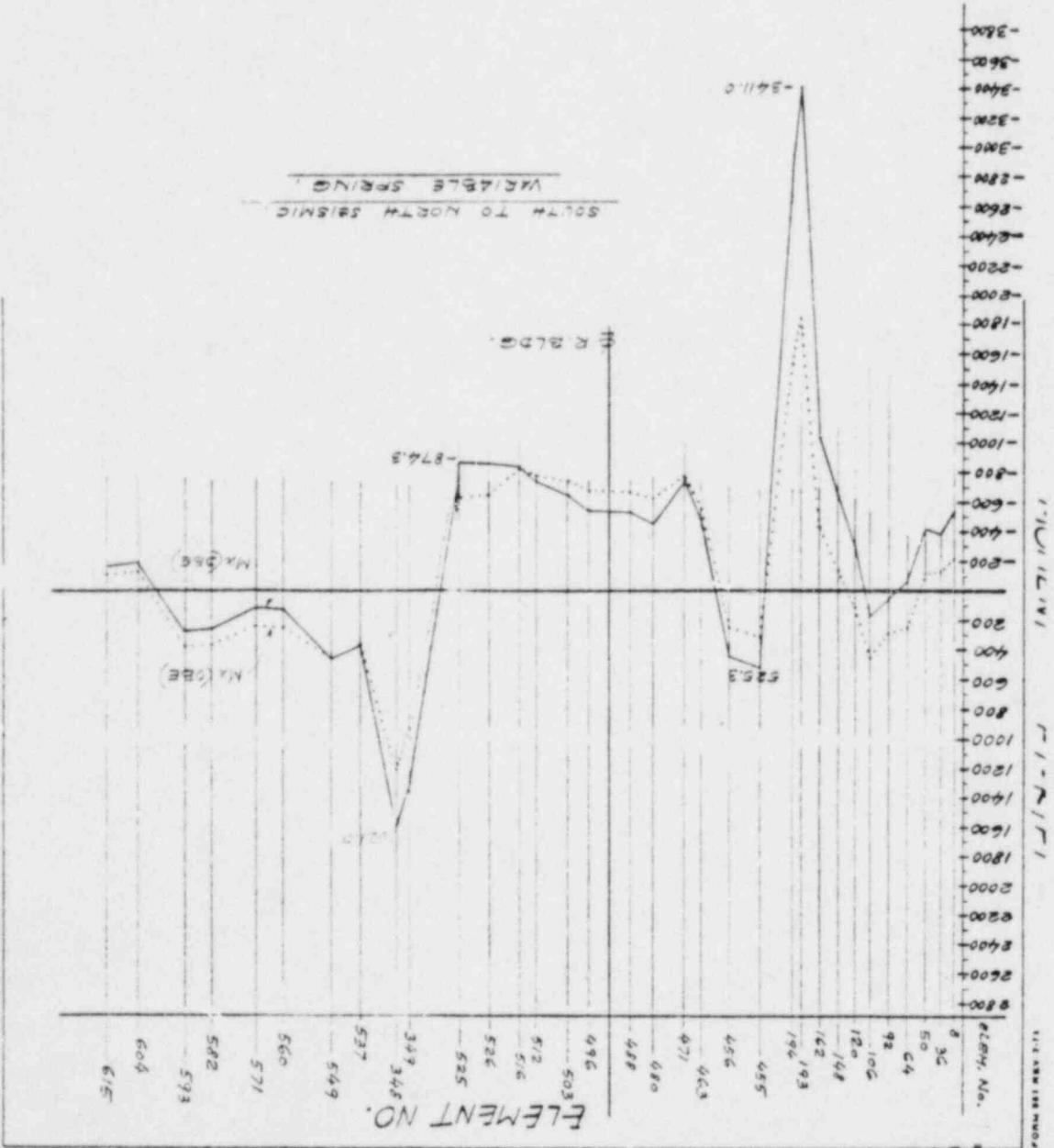
POOR ORIGINAL

EBASCO SERVICES INCORPORATED

NEW YORK SHEET 1.2 OF DEPT. NO. 550
 OFS NO. 5234-014

CLIENT: LOUISIANA POWER & LIGHT CO.
 WATERFORD STEAM ELECTRIC STATION
 PROJECT: 1577.1165 MR INSTALLATION - UNIT 3

SUBJECT: COMMON MAT



POOR ORIGINAL

FORM 801 REV 7-71 1 A 71 10 1

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.

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

$f_1 = 1.086 \text{ Hz}$

| MODE NO | 13 | 1 | $X_1(\text{ft-in})$ | $X_2(\text{ft-in})$ | $X_3(\text{ft-in})$ | $X_4(\text{in-c})$ | $X_5(\text{in-c})$ | $X_6(\text{in-c})$ | $X_7(\text{in-c})$ | $X_8(\text{in-c})$ |
|---------|----|---------|---------------------|---------------------|---------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| 1 | 1 | 1.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 2 | 2 | 0.95054 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 3 | 3 | 0.1207 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 4 | 4 | 0.7655 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 5 | 5 | 0.4002 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 6 | 6 | 0.79395 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 7 | 7 | 0.7477 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 8 | 8 | 0.71051 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 9 | 9 | 0.7003 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 10 | 10 | 0.3555 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 11 | 11 | 0.0367 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 12 | 12 | 0.1752 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 13 | 13 | 0.6640 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 14 | 14 | 0.5433 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 15 | 15 | 0.2236 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 16 | 16 | 0.7034 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 17 | 17 | 0.7815 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 18 | 18 | 0.7233 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 19 | 19 | 0.9254 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 20 | 20 | 0.5958 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 21 | 21 | 0.2686 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 22 | 22 | 0.7151 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 23 | 23 | 0.7842 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 24 | 24 | 0.6422 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 25 | 25 | 0.7801 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 26 | 26 | 0.5988 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 27 | 27 | 0.3823 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 28 | 28 | 0.2016 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 29 | 29 | 0.71286 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 30 | 30 | 0.6920 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 31 | 31 | 0.6668 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 32 | 32 | 0.66072 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 33 | 33 | 0.79017 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 34 | 34 | 0.7543 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 35 | 35 | 0.8761 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 36 | 36 | 0.6908 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 37 | 37 | 0.1923 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 38 | 38 | 0.3471 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 39 | 39 | 0.8630 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 40 | 40 | 0.7303 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 41 | 41 | 0.7246 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 42 | 42 | 0.8255 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 43 | 43 | 0.61017 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 44 | 44 | 0.1026 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 45 | 45 | 0.7822 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 46 | 46 | 0.5395 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 47 | 47 | 0.7143 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 48 | 48 | 0.6692 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 49 | 49 | 0.77026 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 50 | 50 | 0.00095 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |

Rotation Center
Node 139

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

| MODE NO | TO | 1 | f_n | 1.044 Hz | MODE SHAPE FOR ROTATIONS, COMPONENTS X, Y, Z | X_L (Rotation) | Y_L (Rotation) | Z_L (Rotation) |
|---------|----|--------|--------|----------|--|------------------|------------------|------------------|
| 1 | 1 | 0.0000 | 0.0000 | 0.0000 | 0.0167 | 0.0042 | 0.0000 | 0.0000 |
| 2 | 2 | 0.0000 | 0.0000 | 0.0000 | 0.0166 | 0.0042 | 0.0000 | 0.0000 |
| 3 | 3 | 0.0070 | 0.0000 | 0.0000 | 0.0166 | 0.0042 | 0.0000 | 0.0000 |
| 4 | 4 | 0.0000 | 0.0000 | 0.0000 | 0.0165 | 0.0042 | 0.0000 | 0.0000 |
| 5 | 5 | 0.0000 | 0.0000 | 0.0000 | 0.0164 | 0.0042 | 0.0000 | 0.0000 |
| 6 | 6 | 0.0000 | 0.0000 | 0.0000 | 0.0161 | 0.0041 | 0.0000 | 0.0000 |
| 7 | 7 | 0.0000 | 0.0000 | 0.0000 | 0.0158 | 0.0041 | 0.0000 | 0.0000 |
| 8 | 8 | 0.0000 | 0.0000 | 0.0000 | 0.0154 | 0.0040 | 0.0000 | 0.0000 |
| 9 | 9 | 0.0000 | 0.0000 | 0.0000 | 0.0149 | 0.0040 | 0.0000 | 0.0000 |
| 10 | 10 | 0.0000 | 0.0000 | 0.0000 | 0.0143 | 0.0039 | 0.0000 | 0.0000 |
| 11 | 11 | 0.0000 | 0.0000 | 0.0000 | 0.0143 | 0.0039 | 0.0000 | 0.0000 |
| 12 | 12 | 0.0000 | 0.0000 | 0.0000 | 0.0142 | 0.0039 | 0.0000 | 0.0000 |
| 13 | 13 | 0.0000 | 0.0000 | 0.0000 | 0.0142 | 0.0039 | 0.0000 | 0.0000 |
| 14 | 14 | 0.0000 | 0.0000 | 0.0000 | 0.0142 | 0.0039 | 0.0000 | 0.0000 |
| 15 | 15 | 0.0000 | 0.0000 | 0.0000 | 0.0142 | 0.0039 | 0.0000 | 0.0000 |
| 16 | 16 | 0.0000 | 0.0000 | 0.0000 | 0.0142 | 0.0039 | 0.0000 | 0.0000 |
| 17 | 17 | 0.0000 | 0.0000 | 0.0000 | 0.0141 | 0.0039 | 0.0000 | 0.0000 |
| 18 | 18 | 0.0000 | 0.0000 | 0.0000 | 0.0141 | 0.0039 | 0.0000 | 0.0000 |
| 19 | 19 | 0.0000 | 0.0000 | 0.0000 | 0.0140 | 0.0039 | 0.0000 | 0.0000 |
| 20 | 20 | 0.0000 | 0.0000 | 0.0000 | 0.0138 | 0.0039 | 0.0000 | 0.0000 |
| 21 | 21 | 0.0000 | 0.0000 | 0.0000 | 0.0136 | 0.0039 | 0.0000 | 0.0000 |
| 22 | 22 | 0.0000 | 0.0000 | 0.0000 | 0.0140 | 0.0039 | 0.0000 | 0.0000 |
| 23 | 23 | 0.0000 | 0.0000 | 0.0000 | 0.0140 | 0.0039 | 0.0000 | 0.0000 |
| 24 | 24 | 0.0000 | 0.0000 | 0.0000 | 0.0133 | 0.0039 | 0.0000 | 0.0000 |
| 25 | 25 | 0.0000 | 0.0000 | 0.0000 | 0.0139 | 0.0039 | 0.0000 | 0.0000 |
| 26 | 26 | 0.0000 | 0.0000 | 0.0000 | 0.0139 | 0.0039 | 0.0000 | 0.0000 |
| 27 | 27 | 0.0000 | 0.0000 | 0.0000 | 0.0138 | 0.0039 | 0.0000 | 0.0000 |
| 28 | 28 | 0.0000 | 0.0000 | 0.0000 | 0.0136 | 0.0039 | 0.0000 | 0.0000 |
| 29 | 29 | 0.0000 | 0.0000 | 0.0000 | 0.0137 | 0.0039 | 0.0000 | 0.0000 |
| 30 | 30 | 0.0000 | 0.0000 | 0.0000 | 0.0137 | 0.0039 | 0.0000 | 0.0000 |
| 31 | 31 | 0.0000 | 0.0000 | 0.0000 | 0.0136 | 0.0039 | 0.0000 | 0.0000 |
| 32 | 32 | 0.0000 | 0.0000 | 0.0000 | 0.0135 | 0.0039 | 0.0000 | 0.0000 |
| 33 | 33 | 0.0000 | 0.0000 | 0.0000 | 0.0136 | 0.0039 | 0.0000 | 0.0000 |
| 34 | 34 | 0.0000 | 0.0000 | 0.0000 | 0.0136 | 0.0039 | 0.0000 | 0.0000 |
| 35 | 35 | 0.0000 | 0.0000 | 0.0000 | 0.0135 | 0.0039 | 0.0000 | 0.0000 |
| 36 | 36 | 0.0000 | 0.0000 | 0.0000 | 0.0136 | 0.0039 | 0.0000 | 0.0000 |
| 37 | 37 | 0.0000 | 0.0000 | 0.0000 | 0.0135 | 0.0039 | 0.0000 | 0.0000 |
| 38 | 38 | 0.0000 | 0.0000 | 0.0000 | 0.0136 | 0.0039 | 0.0000 | 0.0000 |
| 39 | 39 | 0.0000 | 0.0000 | 0.0000 | 0.0136 | 0.0039 | 0.0000 | 0.0000 |
| 40 | 40 | 0.0000 | 0.0000 | 0.0000 | 0.0136 | 0.0039 | 0.0000 | 0.0000 |
| 41 | 41 | 0.0000 | 0.0000 | 0.0000 | 0.0136 | 0.0039 | 0.0000 | 0.0000 |
| 42 | 42 | 0.0000 | 0.0000 | 0.0000 | 0.0135 | 0.0039 | 0.0000 | 0.0000 |
| 43 | 43 | 0.0000 | 0.0000 | 0.0000 | 0.0135 | 0.0039 | 0.0000 | 0.0000 |
| 44 | 44 | 0.0000 | 0.0000 | 0.0000 | 0.0135 | 0.0039 | 0.0000 | 0.0000 |
| 45 | 45 | 0.0000 | 0.0000 | 0.0000 | 0.0135 | 0.0039 | 0.0000 | 0.0000 |
| 46 | 46 | 0.0000 | 0.0000 | 0.0000 | 0.0135 | 0.0039 | 0.0000 | 0.0000 |
| 47 | 47 | 0.0000 | 0.0000 | 0.0000 | 0.0135 | 0.0039 | 0.0000 | 0.0000 |
| 48 | 48 | 0.0000 | 0.0000 | 0.0000 | 0.0135 | 0.0039 | 0.0000 | 0.0000 |
| 49 | 49 | 0.0000 | 0.0000 | 0.0000 | 0.0135 | 0.0039 | 0.0000 | 0.0000 |
| 50 | 50 | 0.0000 | 0.0000 | 0.0000 | 0.0135 | 0.0039 | 0.0000 | 0.0000 |
| 51 | 51 | 0.0000 | 0.0000 | 0.0000 | 0.0135 | 0.0039 | 0.0000 | 0.0000 |

A2

MATEKUND UNIT 3, DYNAMIC ANALYSIS, TORSIONAL EFFECT STUDIES, RUDE SHAPE PLOTTINGS

$f_c = 1.684 \text{ Hz}$

| MODE NO | DIR | MODE SHAPE NO | $X_1(\text{cm})$ | $X_2(\text{cm})$ | $X_3(\text{cm})$ | $X_4(\text{cm})$ | $X_5(\text{cm})$ | $X_6(\text{cm})$ | $X_7(\text{cm})$ | $X_8(\text{cm})$ | $X_9(\text{cm})$ |
|---------|-----|---------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| 1 | | 1 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 2 | | 2 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 3 | | 3 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 4 | | 4 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 5 | | 5 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 6 | | 6 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 7 | | 7 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 8 | | 8 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 9 | | 9 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 10 | | 10 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 11 | | 11 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 12 | | 12 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 13 | | 13 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 14 | | 14 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 15 | | 15 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 16 | | 16 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 17 | | 17 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 18 | | 18 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 19 | | 19 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 20 | | 20 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 21 | | 21 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 22 | | 22 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 23 | | 23 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 24 | | 24 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 25 | | 25 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 26 | | 26 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 27 | | 27 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 28 | | 28 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 29 | | 29 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 30 | | 30 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 31 | | 31 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 32 | | 32 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 33 | | 33 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 34 | | 34 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 35 | | 35 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 36 | | 36 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 37 | | 37 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 38 | | 38 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 39 | | 39 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 40 | | 40 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 41 | | 41 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 42 | | 42 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 43 | | 43 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 44 | | 44 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 45 | | 45 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 46 | | 46 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 47 | | 47 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 48 | | 48 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 49 | | 49 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 50 | | 50 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

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$\lambda = 1.184 \text{ Hz}$

| MODE NO | MODE SHAPE | X_4 (Rotation in θ -S Direction) | X_5 (Rotation in E -W Direction) | X_6 (Translation) |
|---------|------------|---|--------------------------------------|---------------------|
| 1 | | 0.0000 | 0.0000 | -0.00613 |
| 2 | | -0.0000 | 0.0000 | -0.00672 |
| 3 | | -0.0000 | 0.0000 | -0.00608 |
| 4 | | -0.0000 | 0.0000 | -0.00603 |
| 5 | | -0.0000 | 0.0000 | -0.00620 |
| 6 | | -0.0000 | 0.0000 | -0.00644 |
| 7 | | -0.0000 | 0.0000 | -0.00630 |
| 8 | | -0.0000 | 0.0000 | -0.00617 |
| 9 | | -0.0000 | 0.0000 | -0.00600 |
| 10 | | -0.0000 | 0.0000 | -0.00584 |
| 11 | | -0.0000 | 0.0000 | -0.00568 |
| 12 | | -0.0000 | 0.0000 | -0.00552 |
| 13 | | -0.0000 | 0.0000 | -0.00536 |
| 14 | | -0.0000 | 0.0000 | -0.00520 |
| 15 | | -0.0000 | 0.0000 | -0.00504 |
| 16 | | -0.0000 | 0.0000 | -0.00488 |
| 17 | | -0.0000 | 0.0000 | -0.00472 |
| 18 | | -0.0000 | 0.0000 | -0.00456 |
| 19 | | -0.0000 | 0.0000 | -0.00440 |
| 20 | | -0.0000 | 0.0000 | -0.00424 |
| 21 | | -0.0000 | 0.0000 | -0.00408 |
| 22 | | -0.0000 | 0.0000 | -0.00392 |
| 23 | | -0.0000 | 0.0000 | -0.00376 |
| 24 | | -0.0000 | 0.0000 | -0.00360 |
| 25 | | -0.0000 | 0.0000 | -0.00344 |
| 26 | | -0.0000 | 0.0000 | -0.00328 |
| 27 | | -0.0000 | 0.0000 | -0.00312 |
| 28 | | -0.0000 | 0.0000 | -0.00296 |
| 29 | | -0.0000 | 0.0000 | -0.00280 |
| 30 | | -0.0000 | 0.0000 | -0.00264 |
| 31 | | -0.0000 | 0.0000 | -0.00248 |
| 32 | | -0.0000 | 0.0000 | -0.00232 |
| 33 | | -0.0000 | 0.0000 | -0.00216 |
| 34 | | -0.0000 | 0.0000 | -0.00200 |
| 35 | | -0.0000 | 0.0000 | -0.00184 |
| 36 | | -0.0000 | 0.0000 | -0.00168 |
| 37 | | -0.0000 | 0.0000 | -0.00152 |
| 38 | | -0.0000 | 0.0000 | -0.00136 |
| 39 | | -0.0000 | 0.0000 | -0.00120 |
| 40 | | -0.0000 | 0.0000 | -0.00104 |
| 41 | | -0.0000 | 0.0000 | -0.00088 |
| 42 | | -0.0000 | 0.0000 | -0.00072 |
| 43 | | -0.0000 | 0.0000 | -0.00056 |
| 44 | | -0.0000 | 0.0000 | -0.00040 |
| 45 | | -0.0000 | 0.0000 | -0.00024 |
| 46 | | -0.0000 | 0.0000 | -0.00008 |
| 47 | | -0.0000 | 0.0000 | 0.00008 |
| 48 | | -0.0000 | 0.0000 | 0.00024 |
| 49 | | -0.0000 | 0.0000 | 0.00040 |
| 50 | | -0.0000 | 0.0000 | 0.00056 |

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

MODE NO 10 3
 L-W DIRECTION, TORSIONAL UCF INCLUDED, SOIL SHEAR MODULUS G=6400 PSI
 MODE SHAPES FOR TRANSLATIONS, COMPONENTS 1 2 3

| MODE NO | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
|---------|---------|---|---|---------|---|---|---|---|---------|
| 1 | 1.00000 | | | -.00121 | | | | | -.01974 |
| 2 | -.02477 | | | -.00121 | | | | | -.01974 |
| 3 | -.74281 | | | -.00121 | | | | | -.01974 |
| 4 | -.03878 | | | -.00121 | | | | | -.01974 |
| 5 | -.53169 | | | -.00121 | | | | | -.01974 |
| 6 | -.39720 | | | -.00121 | | | | | -.01974 |
| 7 | -.26321 | | | -.00122 | | | | | -.01974 |
| 8 | -.12820 | | | -.00122 | | | | | -.01974 |
| 9 | -.04623 | | | -.00122 | | | | | -.01974 |
| 10 | -.04666 | | | -.00122 | | | | | -.01974 |
| 11 | -.12999 | | | -.00122 | | | | | -.01974 |
| 12 | -.63435 | | | -.00121 | | | | | -.01974 |
| 13 | -.55765 | | | -.00121 | | | | | -.01974 |
| 14 | -.47847 | | | -.00121 | | | | | -.01974 |
| 15 | -.39977 | | | -.00121 | | | | | -.01974 |
| 16 | -.32111 | | | -.00121 | | | | | -.01974 |
| 17 | -.24237 | | | -.00121 | | | | | -.01974 |
| 18 | -.16235 | | | -.00122 | | | | | -.01974 |
| 19 | -.08258 | | | -.00122 | | | | | -.01974 |
| 20 | -.00341 | | | -.00122 | | | | | -.01974 |
| 21 | -.07484 | | | -.00122 | | | | | -.01974 |
| 22 | -.12428 | | | -.00101 | | | | | -.01645 |
| 23 | -.10002 | | | -.1101 | | | | | -.01645 |
| 24 | -.07665 | | | -.00101 | | | | | -.01645 |
| 25 | -.03768 | | | -.00101 | | | | | -.01645 |
| 26 | -.00077 | | | -.00101 | | | | | -.01645 |
| 27 | -.04923 | | | -.00102 | | | | | -.01645 |
| 28 | -.09062 | | | -.00102 | | | | | -.01645 |
| 29 | -.24293 | | | -.00009 | | | | | -.00437 |
| 30 | -.02142 | | | -.00057 | | | | | -.00638 |
| 31 | -.00731 | | | -.00230 | | | | | -.03549 |
| 32 | -.07103 | | | -.00625 | | | | | -.13082 |
| 33 | -.18963 | | | -.00023 | | | | | -.01514 |
| 34 | -.11010 | | | -.00068 | | | | | -.02186 |
| 35 | -.14139 | | | -.00000 | | | | | -.00000 |
| 36 | -.05136 | | | -.00009 | | | | | -.00437 |
| 37 | -.02818 | | | -.00390 | | | | | -.06039 |
| 38 | -.08525 | | | -.00033 | | | | | -.00524 |
| 39 | -.14639 | | | -.00655 | | | | | -.16856 |
| 40 | -.11825 | | | -.00625 | | | | | -.16856 |
| 41 | -.03139 | | | -.00737 | | | | | -.11347 |
| 42 | -.20575 | | | -.00000 | | | | | -.00000 |
| 43 | -.11367 | | | -.00102 | | | | | -.01645 |
| 44 | -.11347 | | | -.00122 | | | | | -.01974 |
| 45 | -.11244 | | | -.00122 | | | | | -.01974 |
| 46 | -.05388 | | | -.00390 | | | | | -.06039 |
| 47 | -.00079 | | | -.00033 | | | | | -.00524 |
| 48 | -.07820 | | | -.00022 | | | | | -.00437 |
| 49 | -.11722 | | | -.00737 | | | | | -.11347 |
| 50 | -.18067 | | | -.00922 | | | | | -.00437 |

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

| MODE | NU | TO | E-M DIRECTION, TORSIONAL | DOF INCLUDED, SOIL SHEAR MODULUS G=4500 PSI | MODE SHAPES FOR ROTATIONS, COMPONENTS 4 5 6 | |
|------|----|--------|--------------------------|---|---|--------|
| 1 | 1 | .00000 | | .00409 | | .00030 |
| 2 | 2 | .00000 | | .00401 | | .00030 |
| 3 | 3 | .00000 | | .00401 | | .00030 |
| 4 | 4 | .00000 | | .00427 | | .00029 |
| 5 | 5 | .00000 | | .00450 | | .00029 |
| 6 | 6 | .00000 | | .00439 | | .00028 |
| 7 | 7 | .00000 | | .00423 | | .00028 |
| 8 | 8 | .00000 | | .00400 | | .00025 |
| 9 | 9 | .00000 | | .00384 | | .00023 |
| 10 | 10 | .00000 | | .00362 | | .00022 |
| 11 | 11 | .00000 | | .00338 | | .00021 |
| 12 | 12 | .00000 | | .00319 | | .00020 |
| 13 | 13 | .00000 | | .00299 | | .00020 |
| 14 | 14 | .00000 | | .00278 | | .00020 |
| 15 | 15 | .00000 | | .00258 | | .00020 |
| 16 | 16 | .00000 | | .00237 | | .00020 |
| 17 | 17 | .00000 | | .00216 | | .00020 |
| 18 | 18 | .00000 | | .00195 | | .00020 |
| 19 | 19 | .00000 | | .00174 | | .00020 |
| 20 | 20 | .00000 | | .00153 | | .00020 |
| 21 | 21 | .00000 | | .00132 | | .00020 |
| 22 | 22 | .00000 | | .00111 | | .00020 |
| 23 | 23 | .00000 | | .00090 | | .00020 |
| 24 | 24 | .00000 | | .00069 | | .00020 |
| 25 | 25 | .00000 | | .00048 | | .00020 |
| 26 | 26 | .00000 | | .00027 | | .00020 |
| 27 | 27 | .00000 | | .00006 | | .00020 |
| 28 | 28 | .00000 | | .00000 | | .00020 |
| 29 | 29 | .00000 | | .00000 | | .00020 |
| 30 | 30 | .00000 | | .00000 | | .00020 |
| 31 | 31 | .00000 | | .00000 | | .00020 |
| 32 | 32 | .00000 | | .00000 | | .00020 |
| 33 | 33 | .00000 | | .00000 | | .00020 |
| 34 | 34 | .00000 | | .00000 | | .00020 |
| 35 | 35 | .00000 | | .00000 | | .00020 |
| 36 | 36 | .00000 | | .00000 | | .00020 |
| 37 | 37 | .00000 | | .00000 | | .00020 |
| 38 | 38 | .00000 | | .00000 | | .00020 |
| 39 | 39 | .00000 | | .00000 | | .00020 |
| 40 | 40 | .00000 | | .00000 | | .00020 |
| 41 | 41 | .00000 | | .00000 | | .00020 |
| 42 | 42 | .00000 | | .00000 | | .00020 |
| 43 | 43 | .00000 | | .00000 | | .00020 |
| 44 | 44 | .00000 | | .00000 | | .00020 |
| 45 | 45 | .00000 | | .00000 | | .00020 |
| 46 | 46 | .00000 | | .00000 | | .00020 |
| 47 | 47 | .00000 | | .00000 | | .00020 |
| 48 | 48 | .00000 | | .00000 | | .00020 |
| 49 | 49 | .00000 | | .00000 | | .00020 |
| 50 | 50 | .00000 | | .00000 | | .00020 |

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 4, 5, 6

| MODE NO | 10 | 4 | 5 | 6 |
|---------|--------|--------|--------|--------|
| 1 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 2 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 3 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 4 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 5 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 6 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 7 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 8 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 9 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 10 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 11 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 12 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 13 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 14 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 15 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 16 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 17 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 18 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 19 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 20 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 21 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 22 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 23 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 24 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 25 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 26 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 27 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 28 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 29 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 30 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 31 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 32 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 33 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 34 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 35 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 36 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 37 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 38 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 39 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 40 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 41 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 42 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 43 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 44 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 45 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 46 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 47 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 48 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 49 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 50 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

A8

MATEFORD UNIT J, DYNAMIC ANALYSIS, TORSIONAL EFFECT STUDIES, MODE SHAPE PLOTTING

MODE NO 10

E-M JUNCTION, TORSIONAL MODE SHAPES FOR ROTATIONS, COMPONENTS X Y Z

MODE INCLINATION, SOIL SHEAR MODULUS G=6400 PSI

| MODE NO | X | Y | Z | ANGLE |
|---------|--------|--------|--------|--------|
| 1 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 2 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 3 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 4 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 5 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 6 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 7 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 8 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 9 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 10 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 11 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 12 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 13 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 14 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 15 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 16 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 17 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 18 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 19 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 20 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 21 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 22 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 23 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 24 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 25 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 26 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 27 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 28 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 29 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 30 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 31 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 32 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 33 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 34 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 35 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 36 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 37 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 38 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 39 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 40 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 41 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 42 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 43 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 44 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 45 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 46 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 47 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 48 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 49 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 50 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

MAX ROTATIONAL DISPLACEMENTS FOR NORMALIZATION

A 10

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

| MODE NO | MODE SHAPE | DEF INCL | SOIL SHEAR MODULUS G | MODE SHAPE PLOTTINGS |
|---------|------------|----------|----------------------|----------------------|
| 1 | 1.1241 | 0.0160 | 60000 | 0.0047 |
| 2 | 1.0604 | 0.0160 | 60000 | 0.0047 |
| 3 | 0.8725 | 0.0160 | 60000 | 0.0047 |
| 4 | 0.6826 | 0.0160 | 60000 | 0.0047 |
| 5 | 0.4803 | 0.0160 | 60000 | 0.0047 |
| 6 | 0.2290 | 0.0160 | 60000 | 0.0047 |
| 7 | 0.0037 | 0.0160 | 60000 | 0.0047 |
| 8 | 0.1614 | 0.0160 | 60000 | 0.0047 |
| 9 | 0.2941 | 0.0160 | 60000 | 0.0047 |
| 10 | 0.3639 | 0.0160 | 60000 | 0.0047 |
| 11 | 0.3903 | 0.0160 | 60000 | 0.0047 |
| 12 | 1.00000 | 0.0160 | 60000 | 0.0047 |
| 13 | 3.1155 | 0.0160 | 60000 | 0.0047 |
| 14 | 8.1261 | 0.0160 | 60000 | 0.0047 |
| 15 | 7.1692 | 0.0160 | 60000 | 0.0047 |
| 16 | 6.2471 | 0.0160 | 60000 | 0.0047 |
| 17 | 5.2766 | 0.0160 | 60000 | 0.0047 |
| 18 | 4.1294 | 0.0160 | 60000 | 0.0047 |
| 19 | 2.9944 | 0.0160 | 60000 | 0.0047 |
| 20 | 1.9125 | 0.0160 | 60000 | 0.0047 |
| 21 | 0.9256 | 0.0160 | 60000 | 0.0047 |
| 22 | 1.5638 | 0.0160 | 60000 | 0.0047 |
| 23 | 1.4700 | 0.0160 | 60000 | 0.0047 |
| 24 | 1.1853 | 0.0160 | 60000 | 0.0047 |
| 25 | 1.2039 | 0.0160 | 60000 | 0.0047 |
| 26 | 0.9786 | 0.0160 | 60000 | 0.0047 |
| 27 | 0.7330 | 0.0160 | 60000 | 0.0047 |
| 28 | 0.5659 | 0.0160 | 60000 | 0.0047 |
| 29 | 1.4272 | 0.0160 | 60000 | 0.0047 |
| 30 | 0.8631 | 0.0160 | 60000 | 0.0047 |
| 31 | 0.3174 | 0.0160 | 60000 | 0.0047 |
| 32 | 0.1554 | 0.0160 | 60000 | 0.0047 |
| 33 | 1.7666 | 0.0160 | 60000 | 0.0047 |
| 34 | 1.3080 | 0.0160 | 60000 | 0.0047 |
| 35 | 0.1998 | 0.0160 | 60000 | 0.0047 |
| 36 | 0.4639 | 0.0160 | 60000 | 0.0047 |
| 37 | 0.2713 | 0.0160 | 60000 | 0.0047 |
| 38 | 0.3295 | 0.0160 | 60000 | 0.0047 |
| 39 | 0.0031 | 0.0160 | 60000 | 0.0047 |
| 40 | 0.2033 | 0.0160 | 60000 | 0.0047 |
| 41 | 0.1368 | 0.0160 | 60000 | 0.0047 |
| 42 | 0.1718 | 0.0160 | 60000 | 0.0047 |
| 43 | 0.9826 | 0.0160 | 60000 | 0.0047 |
| 44 | 0.4794 | 0.0160 | 60000 | 0.0047 |
| 45 | 0.3011 | 0.0160 | 60000 | 0.0047 |
| 46 | 0.0313 | 0.0160 | 60000 | 0.0047 |
| 47 | 0.1696 | 0.0160 | 60000 | 0.0047 |
| 48 | 0.2661 | 0.0160 | 60000 | 0.0047 |
| 49 | 0.3064 | 0.0160 | 60000 | 0.0047 |
| 50 | 0.1403 | 0.0160 | 60000 | 0.0047 |

AM

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

MODE NO TO " 6
 E-W DIRECTION, TORSIONAL DUF INCLUDED, SOIL SHEAR MODULUS G=6400 PSI
 MODE SHAPES FOR ROTATIONS COMPONENTS 5 6

| MODE NO | TO | COMPONENT 5 | COMPONENT 6 | MODE SHAPE |
|---------|----|-------------|-------------|------------|
| 1 | 1 | 0.00000 | 0.00000 | 0.00000 |
| 2 | 2 | 0.00000 | 0.00000 | 0.00000 |
| 3 | 3 | 0.00000 | 0.00000 | 0.00000 |
| 4 | 4 | 0.00000 | 0.00000 | 0.00000 |
| 5 | 5 | 0.00000 | 0.00000 | 0.00000 |
| 6 | 6 | 0.00000 | 0.00000 | 0.00000 |
| 7 | 7 | 0.00000 | 0.00000 | 0.00000 |
| 8 | 8 | 0.00000 | 0.00000 | 0.00000 |
| 9 | 9 | 0.00000 | 0.00000 | 0.00000 |
| 10 | 10 | 0.00000 | 0.00000 | 0.00000 |
| 11 | 11 | 0.00000 | 0.00000 | 0.00000 |
| 12 | 12 | 0.00000 | 0.00000 | 0.00000 |
| 13 | 13 | 0.00000 | 0.00000 | 0.00000 |
| 14 | 14 | 0.00000 | 0.00000 | 0.00000 |
| 15 | 15 | 0.00000 | 0.00000 | 0.00000 |
| 16 | 16 | 0.00000 | 0.00000 | 0.00000 |
| 17 | 17 | 0.00000 | 0.00000 | 0.00000 |
| 18 | 18 | 0.00000 | 0.00000 | 0.00000 |
| 19 | 19 | 0.00000 | 0.00000 | 0.00000 |
| 20 | 20 | 0.00000 | 0.00000 | 0.00000 |
| 21 | 21 | 0.00000 | 0.00000 | 0.00000 |
| 22 | 22 | 0.00000 | 0.00000 | 0.00000 |
| 23 | 23 | 0.00000 | 0.00000 | 0.00000 |
| 24 | 24 | 0.00000 | 0.00000 | 0.00000 |
| 25 | 25 | 0.00000 | 0.00000 | 0.00000 |
| 26 | 26 | 0.00000 | 0.00000 | 0.00000 |
| 27 | 27 | 0.00000 | 0.00000 | 0.00000 |
| 28 | 28 | 0.00000 | 0.00000 | 0.00000 |
| 29 | 29 | 0.00000 | 0.00000 | 0.00000 |
| 30 | 30 | 0.00000 | 0.00000 | 0.00000 |
| 31 | 31 | 0.00000 | 0.00000 | 0.00000 |
| 32 | 32 | 0.00000 | 0.00000 | 0.00000 |
| 33 | 33 | 0.00000 | 0.00000 | 0.00000 |
| 34 | 34 | 0.00000 | 0.00000 | 0.00000 |
| 35 | 35 | 0.00000 | 0.00000 | 0.00000 |
| 36 | 36 | 0.00000 | 0.00000 | 0.00000 |
| 37 | 37 | 0.00000 | 0.00000 | 0.00000 |
| 38 | 38 | 0.00000 | 0.00000 | 0.00000 |
| 39 | 39 | 0.00000 | 0.00000 | 0.00000 |
| 40 | 40 | 0.00000 | 0.00000 | 0.00000 |
| 41 | 41 | 0.00000 | 0.00000 | 0.00000 |
| 42 | 42 | 0.00000 | 0.00000 | 0.00000 |
| 43 | 43 | 0.00000 | 0.00000 | 0.00000 |
| 44 | 44 | 0.00000 | 0.00000 | 0.00000 |
| 45 | 45 | 0.00000 | 0.00000 | 0.00000 |
| 46 | 46 | 0.00000 | 0.00000 | 0.00000 |
| 47 | 47 | 0.00000 | 0.00000 | 0.00000 |
| 48 | 48 | 0.00000 | 0.00000 | 0.00000 |
| 49 | 49 | 0.00000 | 0.00000 | 0.00000 |
| 50 | 50 | 0.00000 | 0.00000 | 0.00000 |

A/2

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

MODE NO 10 = 1
 E-W DIRECTION, TORSIONAL DOF NOT INCLUDED, SOIL SHEAR MODULUS G=6400 PSI
 MODE SHAPE FOR TRANSLATIONS, COMPONENTS 1 2 3
 $f_{nat} = 1.99 / \text{Hz}$

| Node PT | X ₁ (E-W) | X ₂ (N-S) | X ₃ (A-S) | X ₄ (A-S) | X ₅ (VERT) |
|---------|----------------------|----------------------|----------------------|----------------------|-----------------------|
| 1 | 1.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 2 | .95093 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 3 | .91276 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 4 | .87750 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 5 | .84124 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 6 | .80551 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 7 | .74935 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 8 | .71255 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 9 | .67246 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 10 | .63823 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 11 | .60955 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 12 | .91690 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 13 | .87614 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 14 | .85612 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 15 | .82281 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 16 | .79116 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 17 | .75933 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 18 | .72687 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 19 | .69433 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 20 | .66183 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 21 | .62906 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 22 | .71653 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 23 | .70637 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 24 | .69649 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 25 | .68045 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 26 | .66251 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 27 | .64108 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 28 | .62322 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 29 | .75966 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 30 | .69640 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 31 | .66292 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 32 | .62672 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 33 | .73308 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 34 | .70071 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 35 | .57803 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 36 | .66200 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 37 | .66355 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 38 | .57383 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 39 | .61334 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 40 | .61334 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 41 | .58141 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 42 | .58144 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |

** MAX NUDAL TRANSLATIONAL DISPT (USED FOR NORMALIZATION) = 1.00

Shale

Block

Combust

Vertical

Internal

Stone

FH8

RAG

Node 133
 Reflected Center

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

MODE NO ID # 1 $f_1 = 1.417 Hz$

E-W DIRECTION, TORSIONAL DOF NOT INCLUDED, SOIL SHEAR MODULUS 60000 PSI

MODE SHAPES FOR ROTATIONS, COMPONENTS a 5 b

| MODE NO | Y ₄ (Rotation in M-S Direction) | X ₄ (Rotation in T-W Direction) | X ₆ (Tension) |
|---------|--|--|--------------------------|
| 1 | .00000 | .00165 | .00000 |
| 2 | .00000 | .00165 | .00000 |
| 3 | .00000 | .00164 | .00000 |
| 4 | .00000 | .00168 | .00000 |
| 5 | .00000 | .00162 | .00000 |
| 6 | .00000 | .00160 | .00000 |
| 7 | .00000 | .00156 | .00000 |
| 8 | .00000 | .00152 | .00000 |
| 9 | .00000 | .00147 | .00000 |
| 10 | .00000 | .00141 | .00000 |
| 11 | .00000 | .00135 | .00000 |
| 12 | .00000 | .00141 | .00000 |
| 13 | .00000 | .00141 | .00000 |
| 14 | .00000 | .00141 | .00000 |
| 15 | .00000 | .00140 | .00000 |
| 16 | .00000 | .00140 | .00000 |
| 17 | .00000 | .00140 | .00000 |
| 18 | .00000 | .00139 | .00000 |
| 19 | .00000 | .00138 | .00000 |
| 20 | .00000 | .00136 | .00000 |
| 21 | .00000 | .00134 | .00000 |
| 22 | .00000 | .00138 | .00000 |
| 23 | .00000 | .00138 | .00000 |
| 24 | .00000 | .00136 | .00000 |
| 25 | .00000 | .00136 | .00000 |
| 26 | .00000 | .00137 | .00000 |
| 27 | .00000 | .00136 | .00000 |
| 28 | .00000 | .00134 | .00000 |
| 29 | .00000 | .00136 | .00001 |
| 30 | .00000 | .00135 | .00001 |
| 31 | .00000 | .00134 | .00001 |
| 32 | .00000 | .00134 | .00000 |
| 33 | .00000 | .00134 | .00001 |
| 34 | .00000 | .00134 | .00001 |
| 35 | .00000 | .00133 | 0.00000 |
| 36 | .00000 | .00134 | .00001 |
| 37 | .00000 | .00134 | .00001 |
| 38 | .00000 | .00133 | 0.00000 |
| 39 | .00000 | .00133 | .00000 |
| 40 | .00000 | .00133 | .00000 |
| 41 | .00000 | .00133 | .00000 |
| 42 | .00000 | .00133 | .00000 |

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

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

MODE NO 10 * 2 $f_n = 7.446 \text{ Hz}$

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

MODE SHAPES FOR TRANSLATIONS, COMPONENTS 1 2 3

| Node Pt | $X_1 (E-W)$ | $X_2 (N-S)$ | $X_3 (V-GR)$ | $X_1 (V-GR)$ | $X_2 (N-S)$ | $X_3 (E-W)$ |
|---------|-------------|-------------|--------------|--------------|-------------|-------------|
| 1 | 1.00000 | | | | | |
| 2 | .85636 | | | | | |
| 3 | .78563 | | | | | |
| 4 | .68271 | | | | | |
| 5 | .53675 | | | | | |
| 6 | .40364 | | | | | |
| 7 | .27100 | | | | | |
| 8 | .16702 | | | | | |
| 9 | .05616 | | | | | |
| 10 | -.03563 | | | | | |
| 11 | -.11832 | | | | | |
| 12 | .63461 | | | | | |
| 13 | .55907 | | | | | |
| 14 | .48107 | | | | | |
| 15 | .40356 | | | | | |
| 16 | .32607 | | | | | |
| 17 | .24850 | | | | | |
| 18 | .16963 | | | | | |
| 19 | .09100 | | | | | |
| 20 | .01295 | | | | | |
| 21 | -.06417 | | | | | |
| 22 | .13235 | | | | | |
| 23 | .10846 | | | | | |
| 24 | .08544 | | | | | |
| 25 | .06498 | | | | | |
| 26 | .04906 | | | | | |
| 27 | .03675 | | | | | |
| 28 | -.07954 | | | | | |
| 29 | .23318 | | | | | |
| 30 | .08334 | | | | | |
| 31 | .02265 | | | | | |
| 32 | -.07938 | | | | | |
| 33 | .16397 | | | | | |
| 34 | .08725 | | | | | |
| 35 | -.16718 | | | | | |
| 36 | .00228 | | | | | |
| 37 | .00324 | | | | | |
| 38 | -.19938 | | | | | |
| 39 | -.10226 | | | | | |
| 40 | .10226 | | | | | |
| 41 | -.17992 | | | | | |
| 42 | -.17992 | | | | | |

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

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

| MODE NO | ID # | $f_n = 2.66f_{Hz}$ | χ_4 (Rad/Sec in N-S Direction) | χ_5 (Rad/Sec in E-W Direction) | χ_6 (Torsion) |
|---------|------|--------------------|-------------------------------------|-------------------------------------|--------------------|
| 1 | 1 | .00000 | .00000 | .00000 | .00000 |
| 2 | 2 | .00000 | .00000 | .00000 | .00000 |
| 3 | 3 | .00000 | .00000 | .00000 | .00000 |
| 4 | 4 | .00000 | .00000 | .00000 | .00000 |
| 5 | 5 | .00000 | .00000 | .00000 | .00000 |
| 6 | 6 | .00000 | .00000 | .00000 | .00000 |
| 7 | 7 | .00000 | .00000 | .00000 | .00000 |
| 8 | 8 | .00000 | .00000 | .00000 | .00000 |
| 9 | 9 | .00000 | .00000 | .00000 | .00000 |
| 10 | 10 | .00000 | .00000 | .00000 | .00000 |
| 11 | 11 | .00000 | .00000 | .00000 | .00000 |
| 12 | 12 | .00000 | .00000 | .00000 | .00000 |
| 13 | 13 | .00000 | .00000 | .00000 | .00000 |
| 14 | 14 | .00000 | .00000 | .00000 | .00000 |
| 15 | 15 | .00000 | .00000 | .00000 | .00000 |
| 16 | 16 | .00000 | .00000 | .00000 | .00000 |
| 17 | 17 | .00000 | .00000 | .00000 | .00000 |
| 18 | 18 | .00000 | .00000 | .00000 | .00000 |
| 19 | 19 | .00000 | .00000 | .00000 | .00000 |
| 20 | 20 | .00000 | .00000 | .00000 | .00000 |
| 21 | 21 | .00000 | .00000 | .00000 | .00000 |
| 22 | 22 | .00000 | .00000 | .00000 | .00000 |
| 23 | 23 | .00000 | .00000 | .00000 | .00000 |
| 24 | 24 | .00000 | .00000 | .00000 | .00000 |
| 25 | 25 | .00000 | .00000 | .00000 | .00000 |
| 26 | 26 | .00000 | .00000 | .00000 | .00000 |
| 27 | 27 | .00000 | .00000 | .00000 | .00000 |
| 28 | 28 | .00000 | .00000 | .00000 | .00000 |
| 29 | 29 | .00000 | .00000 | .00000 | .00000 |
| 30 | 30 | .00000 | .00000 | .00000 | .00000 |
| 31 | 31 | .00000 | .00000 | .00000 | .00000 |
| 32 | 32 | .00000 | .00000 | .00000 | .00000 |
| 33 | 33 | .00000 | .00000 | .00000 | .00000 |
| 34 | 34 | .00000 | .00000 | .00000 | .00000 |
| 35 | 35 | .00000 | .00000 | .00000 | .00000 |
| 36 | 36 | .00000 | .00000 | .00000 | .00000 |
| 37 | 37 | .00000 | .00000 | .00000 | .00000 |
| 38 | 38 | .00000 | .00000 | .00000 | .00000 |
| 39 | 39 | .00000 | .00000 | .00000 | .00000 |
| 40 | 40 | .00000 | .00000 | .00000 | .00000 |
| 41 | 41 | .00000 | .00000 | .00000 | .00000 |
| 42 | 42 | .00000 | .00000 | .00000 | .00000 |

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

BS

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

MODE NO ID # 3
 E-W DIRECTION, TORSIONAL DOF NOT INCLUDED, SOIL SHEAR MODULUS G=6600 PSI
 MODE SHAPES FOR TRANSLATIONS, COMPONENTS 1 2 3

| MODE NO | ID # | 1 | 2 | 3 |
|---------|------|---------|---------|---------|
| 1 | 1 | .00000 | ..00001 | ..01438 |
| 2 | 2 | .07486 | ..00001 | ..01438 |
| 3 | 3 | .76171 | ..00001 | ..01438 |
| 4 | 4 | .68871 | ..00001 | ..01438 |
| 5 | 5 | .56853 | ..00001 | ..01438 |
| 6 | 6 | .46023 | ..00001 | ..01438 |
| 7 | 7 | .33230 | ..00001 | ..01438 |
| 8 | 8 | .23684 | ..00000 | ..01438 |
| 9 | 9 | .14347 | ..00000 | ..01438 |
| 10 | 10 | .07572 | ..00000 | ..01438 |
| 11 | 11 | .02607 | ..00000 | ..01438 |
| 12 | 12 | -.83176 | ..00001 | ..01438 |
| 13 | 13 | -.75129 | ..00001 | ..01438 |
| 14 | 14 | -.66565 | ..00001 | ..01438 |
| 15 | 15 | -.58213 | ..00001 | ..01438 |
| 16 | 16 | -.49847 | ..00001 | ..01438 |
| 17 | 17 | -.41383 | ..00001 | ..01438 |
| 18 | 18 | -.32230 | ..00001 | ..01438 |
| 19 | 19 | -.23136 | ..00000 | ..01438 |
| 20 | 20 | -.14260 | ..00000 | ..01438 |
| 21 | 21 | -.05768 | ..00000 | ..01438 |
| 22 | 22 | -.22267 | ..00000 | ..01198 |
| 23 | 23 | -.20314 | ..00000 | ..01198 |
| 24 | 24 | -.18371 | ..00000 | ..01198 |
| 25 | 25 | -.15089 | ..00000 | ..01198 |
| 26 | 26 | -.11343 | ..00000 | ..01198 |
| 27 | 27 | -.07011 | ..00000 | ..01198 |
| 28 | 28 | -.03571 | ..00000 | ..01198 |
| 29 | 29 | -.32006 | ..00083 | ..04503 |
| 30 | 30 | -.18466 | ..00084 | ..04505 |
| 31 | 31 | -.12050 | ..00003 | ..02581 |
| 32 | 32 | -.04747 | ..00002 | ..02581 |
| 33 | 33 | -.27446 | ..00076 | ..08369 |
| 34 | 34 | -.20574 | ..00076 | ..08369 |
| 35 | 35 | .04570 | 0.00000 | 0.00000 |
| 36 | 36 | -.11552 | ..00085 | ..04505 |
| 37 | 37 | -.12393 | ..00075 | ..08369 |
| 38 | 38 | .05471 | 0.00000 | 0.00000 |
| 39 | 39 | -.01716 | ..00000 | ..01198 |
| 40 | 40 | -.01716 | ..00000 | ..01438 |
| 41 | 41 | .04033 | ..00000 | ..01438 |
| 42 | 42 | -.04026 | ..00001 | ..02581 |

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

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

MODE NO 10 1
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 | .00245 | ..... | ..... | ..... |
| 34 | .00000 | .00244 | ..... | ..... | ..... |
| 35 | .00000 | .00240 | ..... | ..... | ..... |
| 36 | .00000 | .00243 | ..... | ..... | ..... |
| 37 | .00000 | .00243 | ..... | ..... | ..... |
| 38 | .00000 | .00240 | ..... | ..... | ..... |
| 39 | .00000 | .00240 | ..... | ..... | ..... |
| 40 | .00000 | .00240 | ..... | ..... | ..... |
| 41 | .00000 | .00240 | ..... | ..... | ..... |
| 42 | .00000 | .00240 | ..... | ..... | ..... |

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

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

| MODE NO | ID | E-W DIRECTION, TORQ | AL DOF NOT INCLUDED, SOIL SHEAR MODULUS G=6400 PSI | RELATIONS, COMPONENTS | 1 | 2 | 3 |
|---------|----|---------------------|--|-----------------------|---|---|---------|
| 1 | 1 | .01 | -.0000 | | | | .00109 |
| 2 | 2 | | -.0000 | | | | .00109 |
| 3 | 3 | .0090 | -.0000 | | | | .00109 |
| 4 | 4 | .00876 | -.0000 | | | | .00109 |
| 5 | 5 | .00740 | -.0000 | | | | .00109 |
| 6 | 6 | .00559 | -.0000 | | | | .00109 |
| 7 | 7 | .00380 | -.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 | -.08130 | -.00048 | | | | .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 | -.01481 | -.00645 | | | | .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 10 5
E-W DIRECTION, TORSIONAL DOF NOT INCLUDED, SOIL SHEAR MODULUS 666000 PSI
MODE SHAPES FOR TRANSLATIONS, COMPONENTS 1 2 3

| MODE NO | 10 | 5 | 1 | 2 | 3 |
|---------|---------|---------|---------|---------|---------|
| 1 | -.17540 | -.00009 | -.00009 | -.00009 | -.00443 |
| 2 | -.08466 | -.00007 | -.00007 | -.00007 | -.00443 |
| 3 | -.02619 | -.00007 | -.00007 | -.00007 | -.00443 |
| 4 | .02702 | -.00006 | -.00006 | -.00006 | -.00443 |
| 5 | .07599 | -.00005 | -.00005 | -.00005 | -.00443 |
| 6 | .12364 | -.00004 | -.00004 | -.00004 | -.00443 |
| 7 | .14589 | -.00003 | -.00003 | -.00003 | -.00443 |
| 8 | .14968 | -.00002 | -.00002 | -.00002 | -.00443 |
| 9 | .12587 | -.00001 | -.00001 | -.00001 | -.00443 |
| 10 | .09281 | -.00000 | -.00000 | -.00000 | -.00443 |
| 11 | .05369 | -.00000 | -.00000 | -.00000 | -.00443 |
| 12 | -.22482 | -.00009 | -.00009 | -.00009 | -.00443 |
| 13 | -.19699 | -.00008 | -.00008 | -.00008 | -.00443 |
| 14 | -.16763 | -.00007 | -.00007 | -.00007 | -.00443 |
| 15 | -.13979 | -.00006 | -.00006 | -.00006 | -.00443 |
| 16 | -.11222 | -.00005 | -.00005 | -.00005 | -.00443 |
| 17 | -.08417 | -.00004 | -.00004 | -.00004 | -.00443 |
| 18 | -.04725 | -.00003 | -.00003 | -.00003 | -.00443 |
| 19 | -.01245 | -.00002 | -.00002 | -.00002 | -.00443 |
| 20 | -.01759 | -.00001 | -.00001 | -.00001 | -.00443 |
| 21 | .04037 | -.00000 | -.00000 | -.00000 | -.00443 |
| 22 | 1.00000 | -.00003 | -.00003 | -.00003 | -.00370 |
| 23 | .94155 | -.00003 | -.00003 | -.00003 | -.00370 |
| 24 | .86482 | -.00003 | -.00003 | -.00003 | -.00370 |
| 25 | .68694 | -.00002 | -.00002 | -.00002 | -.00370 |
| 26 | .44715 | -.00001 | -.00001 | -.00001 | -.00370 |
| 27 | .21622 | -.00001 | -.00001 | -.00001 | -.00370 |
| 28 | .08543 | -.00001 | -.00001 | -.00001 | -.00370 |
| 29 | .14692 | -.01942 | -.01942 | -.01942 | -.00730 |
| 30 | .05298 | -.01950 | -.01950 | -.01950 | -.00730 |
| 31 | -.09413 | -.00027 | -.00027 | -.00027 | -.00790 |
| 32 | -.02813 | -.00022 | -.00022 | -.00022 | -.00790 |
| 33 | -.50589 | -.01667 | -.01667 | -.01667 | -.02023 |
| 34 | -.38186 | -.01660 | -.01660 | -.01660 | -.02023 |
| 35 | .02870 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 36 | .01929 | -.01955 | -.01955 | -.01955 | -.00730 |
| 37 | -.17086 | -.01654 | -.01654 | -.01654 | -.02023 |
| 38 | .02592 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 39 | .04811 | -.00000 | -.00000 | -.00000 | -.00370 |
| 40 | .04811 | -.00000 | -.00000 | -.00000 | -.00443 |
| 41 | .03040 | -.00001 | -.00001 | -.00001 | -.00443 |
| 42 | .02968 | -.00015 | -.00015 | -.00015 | -.00790 |

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

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

| MODE NO | ID # | 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 | 1 | -.00000 | -.00121 | -.00000 |
| 2 | 2 | -.00000 | -.00116 | -.00000 |
| 3 | 3 | -.00000 | -.00108 | -.00000 |
| 4 | 4 | -.00000 | -.00096 | -.00000 |
| 5 | 5 | -.00000 | -.00076 | -.00000 |
| 6 | 6 | -.00000 | -.00051 | -.00000 |
| 7 | 7 | -.00000 | -.00020 | -.00000 |
| 8 | 8 | -.00000 | -.00006 | -.00000 |
| 9 | 9 | -.00000 | -.00033 | -.00000 |
| 10 | 10 | -.00000 | -.00054 | -.00000 |
| 11 | 11 | -.00000 | -.00070 | -.00000 |
| 12 | 12 | -.00000 | -.00065 | -.00000 |
| 13 | 13 | -.00000 | -.00063 | -.00000 |
| 14 | 14 | -.00000 | -.00059 | -.00000 |
| 15 | 15 | -.00000 | -.00055 | -.00000 |
| 16 | 16 | -.00000 | -.00049 | -.00000 |
| 17 | 17 | -.00000 | -.00041 | -.00000 |
| 18 | 18 | -.00000 | -.00025 | -.00000 |
| 19 | 19 | -.00000 | -.00005 | -.00000 |
| 20 | 20 | -.00000 | -.00022 | -.00000 |
| 21 | 21 | -.00000 | -.00055 | -.00000 |
| 22 | 22 | -.00000 | -.00625 | -.00000 |
| 23 | 23 | -.00000 | -.00620 | -.00000 |
| 24 | 24 | -.00000 | -.05377 | -.00000 |
| 25 | 25 | -.00000 | -.05776 | -.00000 |
| 26 | 26 | -.00000 | -.05315 | -.00000 |
| 27 | 27 | -.00000 | -.03776 | -.00000 |
| 28 | 28 | -.00000 | -.01888 | -.00000 |
| 29 | 29 | -.00000 | -.00087 | -.00000 |
| 30 | 30 | -.00000 | -.00069 | -.00000 |
| 31 | 31 | -.00000 | -.00051 | -.00000 |
| 32 | 32 | -.00000 | -.00059 | -.00000 |
| 33 | 33 | -.00000 | -.00033 | -.00000 |
| 34 | 34 | -.00000 | -.00036 | -.00000 |
| 35 | 35 | 0.00000 | -.00074 | 0.00000 |
| 36 | 36 | -.00000 | -.00051 | -.00000 |
| 37 | 37 | -.00000 | -.00050 | -.00000 |
| 38 | 38 | 0.00000 | -.00074 | 0.00000 |
| 39 | 39 | -.00000 | -.00074 | -.00000 |
| 40 | 40 | -.00000 | -.00074 | -.00000 |
| 41 | 41 | -.00000 | -.00074 | -.00000 |
| 42 | 42 | -.00000 | -.00073 | -.00000 |
| 239 | 239 | -.00000 | -.00073 | -.00000 |

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

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

MODE NO ID #
 E-W DIRECTION, TORSIONAL DOF NOT INCLUDED, SOIL SHEAR MODULUS G=6400 PSI
 MODE SHAPES FOR TRANSLATIONS, COMPONENTS 1 2 3

| MODE NO | ID # | 1 | 2 | 3 |
|---------|------|---------|---------|---------|
| 1 | 1 | 1.00000 | -.00005 | .00242 |
| 2 | 2 | .37083 | -.00005 | .00242 |
| 3 | 3 | -.02207 | -.00004 | .00242 |
| 4 | 4 | -.36347 | -.00004 | .00242 |
| 5 | 5 | -.65729 | -.00003 | .00242 |
| 6 | 6 | -.90753 | -.00002 | .00242 |
| 7 | 7 | -.95404 | -.00002 | .00242 |
| 8 | 8 | -.86493 | -.00001 | .00242 |
| 9 | 9 | -.65213 | -.00001 | .00242 |
| 10 | 10 | -.37765 | -.00000 | .00242 |
| 11 | 11 | -.08957 | -.00000 | .00242 |
| 12 | 12 | .05227 | -.00005 | .00242 |
| 13 | 13 | .04817 | -.00005 | .00242 |
| 14 | 14 | .04250 | -.00005 | .00242 |
| 15 | 15 | .03774 | -.00004 | .00242 |
| 16 | 16 | .03269 | -.00005 | .00242 |
| 17 | 17 | .02754 | -.00002 | .00242 |
| 18 | 18 | .01907 | -.00001 | .00242 |
| 19 | 19 | .01093 | -.00001 | .00242 |
| 20 | 20 | .00395 | -.00001 | .00242 |
| 21 | 21 | -.00109 | -.00000 | .00242 |
| 22 | 22 | .56845 | -.00002 | .00202 |
| 23 | 23 | .53569 | -.00002 | .00202 |
| 24 | 24 | .49152 | -.00002 | .00202 |
| 25 | 25 | .37970 | -.00001 | .00202 |
| 26 | 26 | .22691 | -.00001 | .00202 |
| 27 | 27 | .08841 | -.00001 | .00202 |
| 28 | 28 | .02197 | -.00000 | .00202 |
| 29 | 29 | -.86401 | -.01119 | .00744 |
| 30 | 30 | -.17593 | .01320 | .00744 |
| 31 | 31 | -.00863 | -.00006 | -.00433 |
| 32 | 32 | -.00243 | -.00007 | -.01391 |
| 33 | 33 | .15034 | -.01093 | -.01391 |
| 34 | 34 | .11121 | -.01092 | 0.00000 |
| 35 | 35 | .00791 | 0.00000 | .00744 |
| 36 | 36 | -.08440 | -.01320 | -.01391 |
| 37 | 37 | .04243 | -.01091 | 0.00000 |
| 38 | 38 | .00943 | 0.00000 | .00202 |
| 39 | 39 | -.00244 | -.00000 | .00242 |
| 40 | 40 | -.00263 | -.00000 | .00242 |
| 41 | 41 | .00647 | -.00001 | -.00242 |
| 42 | 42 | .00724 | -.00006 | -.00433 |

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

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

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

| | | | | |
|----|--------|--------|-------|--------|
| 1 | .00000 | .00389 | ..... | .00000 |
| 2 | .00000 | .00623 | ..... | .00000 |
| 3 | .00000 | .00769 | ..... | .00000 |
| 4 | .00000 | .00690 | ..... | .00000 |
| 5 | .00000 | .00763 | ..... | .00000 |
| 6 | .00000 | .00423 | ..... | .00000 |
| 7 | .00000 | .00254 | ..... | .00000 |
| 8 | .00000 | .00131 | ..... | .00000 |
| 9 | .00000 | .00025 | ..... | .00000 |
| 10 | .00000 | .00031 | ..... | .00000 |
| 11 | .00000 | .00047 | ..... | .00000 |
| 12 | .00000 | .00004 | ..... | .00000 |
| 13 | .00000 | .00003 | ..... | .00000 |
| 14 | .00000 | .00002 | ..... | .00000 |
| 15 | .00000 | .00001 | ..... | .00000 |
| 16 | .00000 | .00001 | ..... | .00000 |
| 17 | .00000 | .00003 | ..... | .00000 |
| 18 | .00000 | .00008 | ..... | .00000 |
| 19 | .00000 | .00015 | ..... | .00000 |
| 20 | .00000 | .00023 | ..... | .00000 |
| 21 | .00000 | .00034 | ..... | .00000 |
| 22 | .00000 | .00329 | ..... | .00000 |
| 23 | .00000 | .00325 | ..... | .00000 |
| 24 | .00000 | .00310 | ..... | .00000 |
| 25 | .00000 | .00296 | ..... | .00000 |
| 26 | .00000 | .00254 | ..... | .00000 |
| 27 | .00000 | .00161 | ..... | .00000 |
| 28 | .00000 | .00036 | ..... | .00000 |
| 29 | .00000 | .00178 | ..... | .00000 |
| 30 | .00000 | .00108 | ..... | .00000 |
| 31 | .00000 | .00040 | ..... | .00000 |
| 32 | .00000 | .00040 | ..... | .00000 |
| 33 | .00000 | .00034 | ..... | .00000 |
| 34 | .00000 | .00035 | ..... | .00000 |
| 35 | .00000 | .00040 | ..... | .00000 |
| 36 | .00000 | .00041 | ..... | .00000 |
| 37 | .00000 | .00040 | ..... | .00000 |
| 38 | .00000 | .00040 | ..... | .00000 |
| 39 | .00000 | .00040 | ..... | .00000 |
| 40 | .00000 | .00040 | ..... | .00000 |
| 41 | .00000 | .00040 | ..... | .00000 |
| 42 | .00000 | .00040 | ..... | .00001 |

** MAX MODAL ROTATIONAL DISPLACEMENT(USED FOR NORMALIZATION) = .659054E-02

WATERFORD UNIT 3, 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 SHAPES 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 | -.00666 | * | 1.00000 | ..... | -.02909 | * |
| | 2 | -.00666 | * | .96219 | ..... | -.02909 | * |
| | 3 | -.00666 | * | .95703 | ..... | -.02909 | * |
| SHED | 4 | -.00665 | * | .90555 | ..... | -.02909 | * |
| | 5 | -.00665 | * | .87738 | ..... | -.02909 | * |
| BLDG | 6 | -.00665 | * | .84172 | ..... | -.02909 | * |
| | 7 | -.00665 | * | .80559 | ..... | -.02909 | * |
| | 8 | -.00665 | * | .77678 | ..... | -.02909 | * |
| | 9 | -.00665 | * | .74543 | ..... | -.02909 | * |
| | 10 | -.00665 | * | .71869 | ..... | -.02909 | * |
| | 11 | -.00665 | * | .69410 | ..... | -.02909 | * |
| | 12 | -.00666 | * | .91697 | ..... | -.02909 | * |
| | 13 | -.00666 | * | .89496 | ..... | -.02909 | * |
| CONTAIN | 14 | -.00666 | * | .87220 | ..... | -.02909 | * |
| | 15 | -.00665 | * | .84955 | ..... | -.02909 | * |
| VCELL | 16 | -.00665 | * | .82694 | ..... | -.02909 | * |
| | 17 | -.00665 | * | .80394 | ..... | -.02909 | * |
| | 18 | -.00665 | * | .78038 | ..... | -.02909 | * |
| | 19 | -.00665 | * | .75674 | ..... | -.02909 | * |
| | 20 | -.00665 | * | .73311 | ..... | -.02909 | * |
| | 21 | -.00665 | * | .70961 | ..... | -.02909 | * |
| | 22 | -.00666 | * | .76953 | ..... | -.03001 | * |
| | 23 | -.00666 | * | .76248 | ..... | -.03001 | * |
| JUT | 24 | -.00666 | * | .75565 | ..... | -.03001 | * |
| | 25 | -.00666 | * | .74869 | ..... | -.03001 | * |
| Sheet | 26 | -.00665 | * | .73254 | ..... | -.03001 | * |
| | 27 | -.00665 | * | .71767 | ..... | -.03001 | * |
| | 28 | -.00665 | * | .70490 | ..... | -.03001 | * |
| | 29 | -.03008 | * | .80884 | ..... | -.13521 | ** |
| FHB | 30 | -.05002 | * | .76085 | ..... | -.13492 | ** |
| | 31 | .00690 | * | .73176 | ..... | .03112 | ** |
| | 32 | .01243 | * | .71614 | ..... | .05608 | ** |
| | 33 | .01908 | * | .79161 | ..... | .09615 | ** |
| RAB | 34 | .01776 | * | .76754 | ..... | .09424 | ** |
| | 35 | .00000 | * | .67250 | ..... | -.00000 | ** |
| | 36 | 130 | -.00000 | .76025 | ..... | -.13521 | ** |
| | 37 | 131 | -.02008 | .73782 | ..... | -.12340 | ** |
| | 38 | 132 | -.00102 | .70821 | ..... | -.00415 | ** |
| | 39 | 135 | .03255 | .80418 | ..... | .14271 | ** |
| | 40 | 136 | .03255 | .78019 | ..... | .14271 | ** |
| | 41 | 137 | .03023 | .72681 | ..... | .13508 | ** |
| | 42 | 139 | -.00000 | .66903 | ..... | -.00000 | ** |
| | 43 | 140 | -.00665 | .69770 | ..... | -.03001 | ** |
| | 44 | 141 | -.00665 | .69791 | ..... | -.02909 | ** |
| | 45 | 143 | -.00665 | .57579 | ..... | -.02909 | ** |
| | 46 | 230 | -.02778 | .76388 | ..... | -.12340 | ** |
| | 47 | 231 | -.00102 | .73433 | ..... | -.00415 | ** |
| | 48 | 232 | .00535 | .70766 | ..... | .02413 | ** |
| | 49 | 236 | .03023 | .75583 | ..... | .13508 | ** |
| | 50 | 239 | .00535 | .67435 | ..... | .02413 | ** |

MODE PT 139
 Relative Center

** MAX NODAL TRANSLATION OCCURS AT THIS POINT

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

$f_s = 1.87f_{N2}$

| MODE NO | ID # | N-S DIRECTION | TORSIONAL | DOF INCLUDED | SOIL SHEAR MODULUS | MODE SHAPE PLOTTINGS |
|--|------------|---------------|------------|--------------|--------------------|----------------------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| MODE SHAPES FOR TRANSLATIONS, COMPONENTS 1 2 3 | | | | | | |
| | $X_1(U-W)$ | $X_2(U-W)$ | $X_3(U-W)$ | $X_4(U-W)$ | $X_5(U-W)$ | $X_6(U-W)$ |
| 1 | -.20117 | .. | .. | .. | .. | .. |
| 2 | -.20118 | .. | .. | .. | .. | .. |
| 3 | -.20118 | .. | .. | .. | .. | .. |
| 4 | -.20118 | .. | .. | .. | .. | .. |
| 5 | -.20119 | .. | .. | .. | .. | .. |
| 6 | -.20119 | .. | .. | .. | .. | .. |
| 7 | -.20119 | .. | .. | .. | .. | .. |
| 8 | -.20120 | .. | .. | .. | .. | .. |
| 9 | -.20120 | .. | .. | .. | .. | .. |
| 10 | -.20120 | .. | .. | .. | .. | .. |
| 11 | -.20120 | .. | .. | .. | .. | .. |
| 12 | -.20117 | .. | .. | .. | .. | .. |
| 13 | -.20118 | .. | .. | .. | .. | .. |
| 14 | -.20118 | .. | .. | .. | .. | .. |
| 15 | -.20118 | .. | .. | .. | .. | .. |
| 16 | -.20119 | .. | .. | .. | .. | .. |
| 17 | -.20119 | .. | .. | .. | .. | .. |
| 18 | -.20119 | .. | .. | .. | .. | .. |
| 19 | -.20120 | .. | .. | .. | .. | .. |
| 20 | -.20120 | .. | .. | .. | .. | .. |
| 21 | -.20120 | .. | .. | .. | .. | .. |
| 22 | -.20757 | .. | .. | .. | .. | .. |
| 23 | -.20757 | .. | .. | .. | .. | .. |
| 24 | -.20757 | .. | .. | .. | .. | .. |
| 25 | -.20757 | .. | .. | .. | .. | .. |
| 26 | -.20757 | .. | .. | .. | .. | .. |
| 27 | -.20757 | .. | .. | .. | .. | .. |
| 28 | -.20758 | .. | .. | .. | .. | .. |
| 29 | -.94510 | .. | .. | .. | .. | .. |
| 30 | -.94315 | .. | .. | .. | .. | .. |
| 31 | -.21657 | .. | .. | .. | .. | .. |
| 32 | -.38948 | .. | .. | .. | .. | .. |
| 33 | -.6250 | .. | .. | .. | .. | .. |
| 34 | -.64149 | .. | .. | .. | .. | .. |
| 35 | -.00000 | .. | .. | .. | .. | .. |
| 36 | -.94511 | .. | .. | .. | .. | .. |
| 37 | -.86417 | .. | .. | .. | .. | .. |
| 38 | -.03016 | .. | .. | .. | .. | .. |
| 39 | -.00000 | .. | .. | .. | .. | .. |
| 40 | 1.00000 | .. | .. | .. | .. | .. |
| 41 | -.94361 | .. | .. | .. | .. | .. |
| 42 | -.00000 | .. | .. | .. | .. | .. |
| 43 | -.20758 | .. | .. | .. | .. | .. |
| 44 | -.20120 | .. | .. | .. | .. | .. |
| 45 | -.20121 | .. | .. | .. | .. | .. |
| 46 | -.86417 | .. | .. | .. | .. | .. |
| 47 | -.03015 | .. | .. | .. | .. | .. |
| 48 | -.16691 | .. | .. | .. | .. | .. |
| 49 | -.94361 | .. | .. | .. | .. | .. |
| 50 | -.16690 | .. | .. | .. | .. | .. |

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

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

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 # X₄ (Rocking in N-S Direction) X₆ (Rocking in E-W Direction) X₇ (Twisting)

| MODE # | X ₄ (Rocking in N-S Direction) | X ₆ (Rocking in E-W Direction) | X ₇ (Twisting) |
|--------|---|---|---------------------------|
| 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 | .00657 |
| 30 | .00012 | .00000 | .00653 |
| 31 | .00011 | .00000 | .00648 |
| 32 | .00011 | .00000 | .00648 |
| 33 | .00011 | .00000 | .00648 |
| 34 | .00011 | .00000 | .00648 |
| 35 | .00011 | .00000 | .00648 |
| 36 | .00011 | .00000 | .00648 |
| 37 | .00011 | .00000 | .00648 |
| 38 | .00011 | .00000 | .00648 |
| 39 | .00011 | .00000 | .00648 |
| 40 | .00011 | .00000 | .00648 |
| 41 | .00011 | .00000 | .00648 |
| 42 | .00011 | .00000 | .00648 |
| 43 | .00011 | .00000 | .00648 |
| 44 | .00011 | .00000 | .00648 |
| 45 | .00011 | .00000 | .00648 |
| 46 | .00012 | .00000 | .00648 |
| 47 | .00011 | .00000 | .00648 |
| 48 | .00011 | .00000 | .00648 |
| 49 | .00011 | .00000 | .00648 |
| 50 | .00011 | .00000 | .00648 |

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

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

| MODE NO | ID | COMPONENT 4 | COMPONENT 5 | COMPONENT 6 | MAX DISPLACEMENT |
|---------|-----|-------------|-------------|-------------|------------------|
| 1 | 1 | -.00283 | -.00000 | -.00000 | .00025 |
| 2 | 2 | -.00279 | -.00000 | -.00000 | .00024 |
| 3 | 3 | -.00271 | -.00000 | -.00000 | .00023 |
| 4 | 4 | -.00259 | -.00000 | -.00000 | .00022 |
| 5 | 5 | -.00240 | -.00000 | -.00000 | .00021 |
| 6 | 6 | -.00204 | -.00000 | -.00000 | .00018 |
| 7 | 7 | -.00154 | -.00000 | -.00000 | .00015 |
| 8 | 8 | -.00102 | -.00000 | -.00000 | .00012 |
| 9 | 9 | -.00033 | -.00000 | -.00000 | .00009 |
| 10 | 10 | .00037 | -.00000 | -.00000 | .00006 |
| 11 | 11 | .00113 | -.00000 | -.00000 | .00003 |
| 12 | 12 | .00192 | -.00000 | -.00000 | .00003 |
| 13 | 13 | .00191 | -.00000 | -.00000 | .00003 |
| 14 | 14 | .00190 | -.00000 | -.00000 | .00003 |
| 15 | 15 | .00189 | -.00000 | -.00000 | .00003 |
| 16 | 16 | .00187 | -.00000 | -.00000 | .00003 |
| 17 | 17 | .00184 | -.00000 | -.00000 | .00003 |
| 18 | 18 | .00176 | -.00000 | -.00000 | .00003 |
| 19 | 19 | .00171 | -.00000 | -.00000 | .00003 |
| 20 | 20 | .00161 | -.00000 | -.00000 | .00003 |
| 21 | 21 | .00148 | -.00000 | -.00000 | .00003 |
| 22 | 22 | .00149 | -.00000 | -.00000 | .00003 |
| 23 | 23 | .00149 | -.00000 | -.00000 | .00003 |
| 24 | 24 | .00149 | -.00000 | -.00000 | .00003 |
| 25 | 25 | .00149 | -.00000 | -.00000 | .00003 |
| 26 | 26 | .00148 | -.00000 | -.00000 | .00003 |
| 27 | 27 | .00146 | -.00000 | -.00000 | .00003 |
| 28 | 28 | .00143 | -.00000 | -.00000 | .00003 |
| 29 | 29 | .00162 | -.00000 | -.00000 | .00011 |
| 30 | 30 | .00153 | -.00000 | -.00000 | .00011 |
| 31 | 31 | .00162 | -.00000 | -.00000 | .00002 |
| 32 | 32 | .00162 | -.00000 | -.00000 | .00002 |
| 33 | 33 | .00145 | -.00000 | -.00000 | .00028 |
| 34 | 34 | .00144 | -.00000 | -.00000 | .00033 |
| 35 | 35 | .00141 | 0.00000 | -.00000 | .00003 |
| 36 | 130 | .00153 | -.00000 | -.00000 | .00011 |
| 37 | 131 | .00162 | -.00000 | -.00000 | .00002 |
| 38 | 132 | .00162 | -.00000 | -.00000 | .00002 |
| 39 | 135 | .00145 | -.00000 | -.00000 | .00028 |
| 40 | 136 | .00144 | -.00000 | -.00000 | .00033 |
| 41 | 137 | .00142 | -.00000 | -.00000 | .00002 |
| 42 | 139 | .00141 | 0.00000 | -.00000 | .00003 |
| 43 | 140 | .00141 | -.00000 | -.00000 | .00003 |
| 44 | 141 | .00141 | -.00000 | -.00000 | .00003 |
| 45 | 143 | .00141 | -.00000 | -.00000 | .00003 |
| 46 | 230 | .00153 | -.00000 | -.00000 | .00011 |
| 47 | 231 | .00142 | -.00000 | -.00000 | .00002 |
| 48 | 232 | .00142 | -.00000 | -.00000 | .00002 |
| 49 | 236 | .00144 | -.00000 | -.00000 | .00033 |
| 50 | 239 | .00141 | -.00000 | -.00000 | .00003 |

** MAX MODAL ROTATIONAL DISPLACEMENT (USED FOR NORMALIZATION) = .283482E-02

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 | -.17482 | .. | -.07240 | ---- | .01996 | * |
| 21 | 21 | -.17482 | .. | -.04590 | ---- | .01996 | * |
| 22 | 22 | -.18040 | .. | -.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

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

MODE NO ID # 5
 N-S DIRECTION, TORSIONAL DOF INCLUDED, JAIL SHEAR MODULUS Q=600 PSI
 MODE SHAPES FOR ROTATIONS, COMPONENTS 4 5 6

| MODE NO | ID # | COMPONENT 4 | COMPONENT 5 | COMPONENT 6 |
|---------|------|-------------|-------------|-------------|
| 1 | 1 | -.0001 | -.0000 | -.22622 |
| 2 | 2 | -.0000 | -.0000 | -.22423 |
| 3 | 3 | -.0006 | -.0000 | -.21420 |
| 4 | 4 | -.0002 | -.0000 | -.20055 |
| 5 | 5 | -.0075 | -.0000 | -.18255 |
| 6 | 6 | -.0061 | -.0000 | -.15471 |
| 7 | 7 | -.0043 | -.0000 | -.12183 |
| 8 | 8 | -.0024 | -.0000 | -.09267 |
| 9 | 9 | -.0001 | -.0000 | -.05838 |
| 10 | 10 | -.0026 | -.0000 | -.02757 |
| 11 | 11 | -.0053 | -.0000 | -.00209 |
| 12 | 12 | -.0101 | -.0000 | -.00554 |
| 13 | 13 | -.0100 | -.0000 | -.00554 |
| 14 | 14 | -.0098 | -.0000 | -.00554 |
| 15 | 15 | -.0098 | -.0000 | -.00554 |
| 16 | 16 | -.0097 | -.0000 | -.00554 |
| 17 | 17 | -.0095 | -.0000 | -.00554 |
| 18 | 18 | -.0091 | -.0000 | -.00554 |
| 19 | 19 | -.0085 | -.0000 | -.00554 |
| 20 | 20 | -.0078 | -.0000 | -.00554 |
| 21 | 21 | -.0069 | -.0000 | -.00554 |
| 22 | 22 | -.0071 | -.0000 | -.00565 |
| 23 | 23 | -.0071 | -.0000 | -.00565 |
| 24 | 24 | -.0070 | -.0000 | -.00565 |
| 25 | 25 | -.0070 | -.0000 | -.00565 |
| 26 | 26 | -.0069 | -.0000 | -.00565 |
| 27 | 27 | -.0067 | -.0000 | -.00565 |
| 28 | 28 | -.0065 | -.0000 | -.00565 |
| 29 | 29 | -.0062 | -.0000 | -.00565 |
| 30 | 30 | -.0073 | -.0000 | -.00603 |
| 31 | 31 | -.0063 | -.0000 | -.00603 |
| 32 | 32 | -.0063 | -.0000 | -.00603 |
| 33 | 33 | -.0061 | -.0000 | -.00603 |
| 34 | 34 | -.0062 | -.0000 | -.00603 |
| 35 | 35 | -.0063 | -.0000 | -.00603 |
| 36 | 36 | -.0062 | -.0000 | -.00603 |
| 37 | 37 | -.0073 | -.0000 | -.00603 |
| 38 | 38 | -.0063 | -.0000 | -.00603 |
| 39 | 39 | -.0063 | -.0000 | -.00603 |
| 40 | 40 | -.0062 | -.0000 | -.00603 |
| 41 | 41 | -.0061 | -.0000 | -.00603 |
| 42 | 42 | -.0062 | -.0000 | -.00603 |
| 43 | 43 | -.0063 | -.0000 | -.00603 |
| 44 | 44 | -.0063 | -.0000 | -.00603 |
| 45 | 45 | -.0063 | -.0000 | -.00603 |
| 46 | 46 | -.0063 | -.0000 | -.00603 |
| 47 | 47 | -.0063 | -.0000 | -.00603 |
| 48 | 48 | -.0063 | -.0000 | -.00603 |
| 49 | 49 | -.0062 | -.0000 | -.00603 |
| 50 | 50 | -.0063 | -.0000 | -.00603 |

** 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 | * | .30151 |* | -.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 | * | -.84449 |* | .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

CU

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

MODE NO. ID. #
 N-S DIRECTION, TORSIONAL DOF INCLUDED, SOIL SHEAR MODULUS G=6600 PSI
 MODE SHAPES FOR ROTATIONS, COMPONENTS # 5

| MODE NO. | ID. # | COMPONENT 1 | COMPONENT 2 | COMPONENT 3 | COMPONENT 4 | COMPONENT 5 |
|----------|-------|-------------|-------------|-------------|-------------|-------------|
| 1 | 00041 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 2 | 00040 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 3 | 00036 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 4 | 00035 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 5 | 00030 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 6 | 00022 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 7 | 00011 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 8 | 00000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 9 | 00014 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 10 | 00028 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 11 | 00042 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 12 | 00315 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 13 | 00311 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 14 | 00304 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 15 | 00276 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 16 | 00286 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 17 | 00271 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 18 | 00203 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 19 | 00203 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 20 | 00151 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 21 | 00065 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 22 | 00066 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 23 | 00045 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 24 | 00065 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 25 | 00064 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 26 | 00042 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 27 | 00058 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 28 | 00051 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 29 | 00042 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 30 | 00053 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 31 | 00043 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 32 | 00044 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 33 | 00026 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 34 | 00030 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 35 | 00047 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 36 | 00053 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 37 | 00043 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 38 | 00044 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 39 | 00026 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 40 | 00030 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 41 | 00043 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 42 | 00047 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 43 | 00047 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 44 | 00047 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 45 | 00047 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 46 | 00053 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 47 | 00043 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 48 | 00044 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 49 | 00030 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 50 | 00047 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

** MAX MODAL ROTATIONAL DISPLACEMENT (USED FOR NORMALIZATION) = .903697E-02

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

| MODE NO | MODE FR | X_4 (Rotation in N-S Direction) | X_5 (Rotation in E-W Direction) | X_6 (Torsion) |
|---------|---------|-----------------------------------|-----------------------------------|-----------------|
| 1 | 1 | -.00125 | -.00000 | -.00000 |
| 2 | 2 | -.00125 | -.00000 | -.00000 |
| 3 | 3 | -.00124 | -.00000 | -.00000 |
| 4 | 4 | -.00123 | -.00000 | -.00000 |
| 5 | 5 | -.00122 | -.00000 | -.00000 |
| 6 | 6 | -.00119 | -.00000 | -.00000 |
| 7 | 7 | -.00116 | -.00000 | -.00000 |
| 8 | 8 | -.00112 | -.00000 | -.00000 |
| 9 | 9 | -.00107 | -.00000 | -.00000 |
| 10 | 10 | -.00101 | -.00000 | -.00000 |
| 11 | 11 | -.00095 | -.00000 | -.00000 |
| 12 | 12 | -.00100 | -.00000 | -.00000 |
| 13 | 13 | -.00100 | -.00000 | -.00000 |
| 14 | 14 | -.00100 | -.00000 | -.00000 |
| 15 | 15 | -.00100 | -.00000 | -.00000 |
| 16 | 16 | -.00100 | -.00000 | -.00000 |
| 17 | 17 | -.00099 | -.00000 | -.00000 |
| 18 | 18 | -.00098 | -.00000 | -.00000 |
| 19 | 19 | -.00097 | -.00000 | -.00000 |
| 20 | 20 | -.00096 | -.00000 | -.00000 |
| 21 | 21 | -.00093 | -.00000 | -.00000 |
| 22 | 22 | -.00096 | -.00000 | -.00000 |
| 23 | 23 | -.00096 | -.00000 | -.00000 |
| 24 | 24 | -.00096 | -.00000 | -.00000 |
| 25 | 25 | -.00096 | -.00000 | -.00000 |
| 26 | 26 | -.00095 | -.00000 | -.00000 |
| 27 | 27 | -.00094 | -.00000 | -.00000 |
| 28 | 28 | -.00093 | -.00000 | -.00000 |
| 29 | 29 | -.00097 | -.00000 | -.00000 |
| 30 | 30 | -.00093 | -.00000 | -.00000 |
| 31 | 31 | -.00093 | -.00000 | -.00000 |
| 32 | 32 | -.00093 | -.00000 | -.00000 |
| 33 | 33 | -.00093 | -.00000 | -.00000 |
| 34 | 34 | -.00093 | -.00000 | -.00000 |
| 35 | 35 | -.00092 | -.00000 | -.00000 |
| 36 | 36 | -.00093 | -.00000 | -.00000 |
| 37 | 37 | -.00093 | -.00000 | -.00000 |
| 38 | 38 | -.00092 | -.00000 | -.00000 |
| 39 | 39 | -.00092 | -.00000 | -.00000 |
| 40 | 40 | -.00092 | -.00000 | -.00000 |
| 41 | 41 | -.00092 | -.00000 | -.00000 |
| 42 | 42 | -.00092 | -.00000 | -.00000 |

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

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

| MODE NO | ID # | f_n | $X_1(N-C)$ | $X_2(N-C)$ | $X_3(N-C)$ | $X_4(N-C)$ | $X_5(N-C)$ |
|---------|------|--------|------------|------------|------------|------------|------------|
| 1 | 1 | 1.0000 | 1.0000 | | | | |
| 2 | 2 | .6596 | .6596 | | | | |
| 3 | 3 | .7467 | .7467 | | | | |
| 4 | 4 | .6420 | .6420 | | | | |
| 5 | 5 | .5361 | .5361 | | | | |
| 6 | 6 | .4055 | .4055 | | | | |
| 7 | 7 | .2737 | .2737 | | | | |
| 8 | 8 | .1701 | .1701 | | | | |
| 9 | 9 | .0597 | .0597 | | | | |
| 10 | 10 | .0315 | .0315 | | | | |
| 11 | 11 | .1137 | .1137 | | | | |
| 12 | 12 | .6276 | .6276 | | | | |
| 13 | 13 | .5524 | .5524 | | | | |
| 14 | 14 | .4751 | .4751 | | | | |
| 15 | 15 | .3946 | .3946 | | | | |
| 16 | 16 | .3232 | .3232 | | | | |
| 17 | 17 | .2491 | .2491 | | | | |
| 18 | 18 | .1630 | .1630 | | | | |
| 19 | 19 | .0919 | .0919 | | | | |
| 20 | 20 | .0151 | .0151 | | | | |
| 21 | 21 | .0676 | .0676 | | | | |
| 22 | 22 | .1364 | .1364 | | | | |
| 23 | 23 | .1072 | .1072 | | | | |
| 24 | 24 | .0843 | .0843 | | | | |
| 25 | 25 | .0494 | .0494 | | | | |
| 26 | 26 | .0176 | .0176 | | | | |
| 27 | 27 | .0359 | .0359 | | | | |
| 28 | 28 | .0752 | .0752 | | | | |
| 29 | 29 | .2379 | .2379 | | | | |
| 30 | 30 | .0832 | .0832 | | | | |
| 31 | 31 | .0057 | .0057 | | | | |
| 32 | 32 | .0756 | .0756 | | | | |
| 33 | 33 | .1651 | .1651 | | | | |
| 34 | 34 | .0891 | .0891 | | | | |
| 35 | 35 | .1815 | .1815 | | | | |
| 36 | 36 | .0054 | .0054 | | | | |
| 37 | 37 | .0059 | .0059 | | | | |
| 38 | 38 | .1935 | .1935 | | | | |
| 39 | 39 | .0923 | .0923 | | | | |
| 40 | 40 | .0923 | .0923 | | | | |
| 41 | 41 | .1747 | .1747 | | | | |
| 42 | 42 | .1747 | .1747 | | | | |

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

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 $G=6400 \text{ PSI}$
 MODE SHAPES FOR ROTATIONS, COMPONENTS 4 5 6
 NAME FR X_4 (Rotations in N-S direction)

| MODE NO | FR | X_4 | 5 | 6 |
|---------|---------|---------|---------|---------|
| 1 | -.00456 | -.00000 | -.00000 | -.00000 |
| 2 | -.00454 | -.00000 | -.00000 | -.00000 |
| 3 | -.00452 | -.00000 | -.00000 | -.00000 |
| 4 | -.00448 | -.00000 | -.00000 | -.00000 |
| 5 | -.00441 | -.00000 | -.00000 | -.00000 |
| 6 | -.00430 | -.00000 | -.00000 | -.00000 |
| 7 | -.00413 | -.00000 | -.00000 | -.00000 |
| 8 | -.00396 | -.00000 | -.00000 | -.00000 |
| 9 | -.00374 | -.00000 | -.00000 | -.00000 |
| 10 | -.00351 | -.00000 | -.00000 | -.00000 |
| 11 | -.00326 | -.00000 | -.00000 | -.00000 |
| 12 | -.00316 | -.00000 | -.00000 | -.00000 |
| 13 | -.00310 | -.00000 | -.00000 | -.00000 |
| 14 | -.00310 | -.00000 | -.00000 | -.00000 |
| 15 | -.00310 | -.00000 | -.00000 | -.00000 |
| 16 | -.00316 | -.00000 | -.00000 | -.00000 |
| 17 | -.00314 | -.00000 | -.00000 | -.00000 |
| 18 | -.00312 | -.00000 | -.00000 | -.00000 |
| 19 | -.00329 | -.00000 | -.00000 | -.00000 |
| 20 | -.00325 | -.00000 | -.00000 | -.00000 |
| 21 | -.00320 | -.00000 | -.00000 | -.00000 |
| 22 | -.00319 | -.00000 | -.00000 | -.00000 |
| 23 | -.00319 | -.00000 | -.00000 | -.00000 |
| 24 | -.00319 | -.00000 | -.00000 | -.00000 |
| 25 | -.00319 | -.00000 | -.00000 | -.00000 |
| 26 | -.00319 | -.00000 | -.00000 | -.00000 |
| 27 | -.00319 | -.00000 | -.00000 | -.00000 |
| 28 | -.00318 | -.00000 | -.00000 | -.00000 |
| 29 | -.00324 | -.00000 | -.00000 | -.00000 |
| 30 | -.00321 | -.00000 | -.00000 | -.00000 |
| 31 | -.00318 | -.00000 | -.00000 | -.00000 |
| 32 | -.00318 | -.00000 | -.00000 | -.00000 |
| 33 | -.00319 | -.00000 | -.00000 | -.00000 |
| 34 | -.00318 | -.00000 | -.00000 | -.00000 |
| 35 | -.00318 | -.00000 | -.00000 | -.00000 |
| 36 | -.00318 | -.00000 | -.00000 | -.00000 |
| 37 | -.00318 | -.00000 | -.00000 | -.00000 |
| 38 | -.00318 | -.00000 | -.00000 | -.00000 |
| 39 | -.00318 | -.00000 | -.00000 | -.00000 |
| 40 | -.00318 | -.00000 | -.00000 | -.00000 |
| 41 | -.00318 | -.00000 | -.00000 | -.00000 |
| 42 | -.00318 | -.00000 | -.00000 | -.00000 |

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

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

MODE NO ID # 3
N-S DIRECTION, TORSIONAL DOF NOT INCLUDED, SOIL SHEAR MODULUS 666400 PSI
MODE SHAPES FOR TRANSLATIONS, COMPONENTS 1 2 3

| | | | | |
|----|---------|---------|--------|---------|
| 1 | -.00002 | 1.00000 |* | .04503 |
| 2 | -.00002 | .07156 |* | .04503 |
| 3 | -.00001 | .77592 |* | .04503 |
| 4 | -.00001 | .68143 |* | .04503 |
| 5 | -.00001 | .58053 |* | .04503 |
| 6 | -.00001 | .45181 |* | .04503 |
| 7 | -.00001 | .32357 |* | .04503 |
| 8 | -.00001 | .22709 |* | .04503 |
| 9 | -.00000 | .13125 |* | .04503 |
| 10 | -.00000 | .05990 |* | .04503 |
| 11 | -.00000 | .00510 |* | .04503 |
| 12 | -.00002 | -.49152 |* | .04503 |
| 13 | -.00002 | -.44566 |* | .04503 |
| 14 | -.00001 | -.39702 |* | .04503 |
| 15 | -.00001 | -.34947 |* | .04503 |
| 16 | -.00001 | -.30182 |* | .04503 |
| 17 | -.00001 | -.25361 |* | .04503 |
| 18 | -.00001 | -.20173 |* | .04503 |
| 19 | -.00001 | -.15011 |* | .04503 |
| 20 | -.00000 | -.09958 |* | .04503 |
| 21 | -.00000 | -.05098 |* | .04503 |
| 22 | -.00001 | -.14286 |* | .04646 |
| 23 | -.00001 | -.13168 |* | .04646 |
| 24 | -.00001 | -.12074 |* | .04646 |
| 25 | -.00001 | -.10306 |* | .04646 |
| 26 | -.00001 | -.08336 |* | .04646 |
| 27 | -.00000 | -.05934 |* | .04646 |
| 28 | -.00000 | -.03899 |* | .04646 |
| 29 | -.00071 | -.23490 |* | .04646 |
| 30 | -.00072 | -.13810 |* | .19207 |
| 31 | -.00001 | -.09096 |* | .19207 |
| 32 | -.00001 | -.04723 |* | -.04805 |
| 33 | -.00052 | -.16896 |* | -.04805 |
| 34 | -.00052 | -.14594 |* | -.20958 |
| 35 | 0.00000 | -.00976 |* | -.20958 |
| 36 | -.00072 | -.09084 |* | 0.00000 |
| 37 | -.00052 | -.09107 |* | -.19207 |
| 38 | 0.00000 | -.01513 |* | -.20958 |
| 39 | -.00000 | -.02766 |* | 0.00000 |
| 40 | -.00000 | -.02766 |* | -.04646 |
| 41 | -.00000 | -.00657 |* | -.04503 |
| 42 | -.00001 | -.00656 |* | -.04805 |

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

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

MODE NO ID # 4
N-S DIRECTION, TORSIONAL DOF NOT INCLUDED, SOIL SHEAR MODULUS G=6400 PSI
MODE SHAPES FOR TRANSLATIONS, COMPONENTS 1 2 3

| | | | | | |
|----|---------|---|---|---------|---------|
| 1 | -.00001 | . | . | .00769 | .00304 |
| 2 | -.00000 | . | . | .00654 | .00304 |
| 3 | -.00000 | . | . | .00575 | .00304 |
| 4 | -.00000 | . | . | .00407 | .00304 |
| 5 | -.00000 | . | . | .00387 | .00304 |
| 6 | -.00000 | . | . | .00258 | .00304 |
| 7 | -.00000 | . | . | .00136 | .00304 |
| 8 | -.00000 | . | . | .00057 | .00304 |
| 9 | -.00000 | . | . | -.00001 | .00304 |
| 10 | -.00000 | . | . | -.00025 | .00304 |
| 11 | -.00000 | . | . | -.00016 | .00304 |
| 12 | -.00001 | . | . | 1.00000 | .00304 |
| 13 | -.00000 | . | . | .90819 | .00304 |
| 14 | -.00000 | . | . | .80352 | .00304 |
| 15 | -.00000 | . | . | .70569 | .00304 |
| 16 | -.00000 | . | . | .60734 | .00304 |
| 17 | -.00000 | . | . | .50565 | .00304 |
| 18 | -.00000 | . | . | .38148 | .00304 |
| 19 | -.00000 | . | . | .25935 | .00304 |
| 20 | -.00000 | . | . | .14869 | .00304 |
| 21 | -.00000 | . | . | .04300 | .00304 |
| 22 | -.00000 | . | . | -.01133 | .00313 |
| 23 | -.00000 | . | . | -.01044 | .00313 |
| 24 | -.00000 | . | . | -.00954 | .00313 |
| 25 | -.00000 | . | . | -.00801 | .00313 |
| 26 | -.00000 | . | . | -.00623 | .00313 |
| 27 | -.00000 | . | . | -.00405 | .00313 |
| 28 | -.00000 | . | . | -.00226 | .00313 |
| 29 | -.00039 | . | . | -.04730 | .01395 |
| 30 | -.00040 | . | . | -.02263 | .01395 |
| 31 | -.00001 | . | . | -.01338 | -.00324 |
| 32 | -.00001 | . | . | -.00679 | -.00324 |
| 33 | -.00029 | . | . | -.03442 | -.01481 |
| 34 | -.00029 | . | . | -.02653 | -.01481 |
| 35 | 0.00000 | . | . | .00123 | 0.00000 |
| 36 | -.00040 | . | . | -.01331 | -.01395 |
| 37 | -.00029 | . | . | -.01304 | -.01481 |
| 38 | 0.00000 | . | . | .00159 | 0.00000 |
| 39 | -.00000 | . | . | -.00128 | .00313 |
| 40 | -.00000 | . | . | -.00128 | .00304 |
| 41 | -.00000 | . | . | .00102 | .00304 |
| 42 | .00000 | . | . | .00101 | -.00324 |

** 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 NOT INCLUDED, SOIL SHEAR MODULUS G=6400 PBI
MODE SHAPES FOR TRANSLATIONS, COMPONENTS 1 2 3

| | | | |
|----|---------|---------|--------|
| 1 | -.00008 | .06677 | .00978 |
| 2 | -.00004 | .03552 | .00978 |
| 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 | .02999 | .00978 |
| 19 | -.00002 | .00955 | .00978 |
| 20 | -.00001 | .00883 | .00978 |
| 21 | -.00001 | .02260 | .00978 |
| 22 | -.00002 | .11719 | .00978 |
| 23 | -.00002 | .11113 | .00978 |
| 24 | -.00002 | .10430 | .00978 |
| 25 | -.00001 | .09104 | .00978 |
| 26 | -.00001 | .07448 | .00978 |
| 27 | -.00001 | .05328 | .00978 |
| 28 | -.00001 | .03675 | .00978 |
| 29 | -.00001 | .00000 | .00978 |
| 30 | -.00001 | .21994 | .00978 |
| 31 | -.00008 | .01037 | .00978 |
| 32 | -.00002 | .00732 | .00978 |
| 33 | .00407 | .02253 | .00978 |
| 34 | .00609 | .03393 | .00978 |
| 35 | 0.00000 | .01966 | .00978 |
| 36 | -.00924 | .01201 | .00978 |
| 37 | .00611 | .00906 | .00978 |
| 38 | 0.00000 | .01849 | .00978 |
| 39 | -.00001 | .02777 | .00978 |
| 40 | -.00001 | .02777 | .00978 |
| 41 | -.00000 | -.02034 | .00978 |
| 42 | -.00001 | -.02033 | .00978 |

** MAX MUSCAL TRANSLATIONAL DISPMY (USED FOR NORMALIZATION) = 1.00

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

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

| MODE NO | ID | Component 1 | Component 2 | Component 3 | Frequency |
|---------|-----|-------------|-------------|-------------|-----------|
| 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 | .00003 | * | .10111 | -.03389 |
| 32 | 32 | .00034 | * | .00358 | -.03389 |
| 33 | 35 | -.03065 | * | 1.00000 | -.12382 |
| 34 | 36 | -.03054 | * | .60336 | -.12382 |
| 35 | 39 | 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

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

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

| Mode No | Component 4 | Component 5 | Component 6 |
|---------|-------------|-------------|-------------|
| 1 | -.00298 | -.00000 | -.00000 |
| 2 | -.00283 | -.00000 | -.00000 |
| 3 | -.00265 | -.00000 | -.00000 |
| 4 | -.00240 | -.00000 | -.00000 |
| 5 | -.00203 | -.00000 | -.00000 |
| 6 | -.00166 | -.00000 | -.00000 |
| 7 | -.00080 | -.00000 | -.00000 |
| 8 | -.00027 | -.00000 | -.00000 |
| 9 | -.00027 | -.00000 | -.00000 |
| 10 | -.00067 | -.00000 | -.00000 |
| 11 | -.00096 | -.00000 | -.00000 |
| 12 | -.00154 | -.00000 | -.00000 |
| 13 | -.00150 | -.00000 | -.00000 |
| 14 | -.00182 | -.00000 | -.00000 |
| 15 | -.00133 | -.00000 | -.00000 |
| 16 | -.00122 | -.00000 | -.00000 |
| 17 | -.00107 | -.00000 | -.00000 |
| 18 | -.00079 | -.00000 | -.00000 |
| 19 | -.00040 | -.00000 | -.00000 |
| 20 | -.00009 | -.00000 | -.00000 |
| 21 | -.00068 | -.00000 | -.00000 |
| 22 | -.00316 | -.00000 | -.00000 |
| 23 | -.00317 | -.00000 | -.00000 |
| 24 | -.00313 | -.00000 | -.00000 |
| 25 | -.00305 | -.00000 | -.00000 |
| 26 | -.00290 | -.00000 | -.00000 |
| 27 | -.00275 | -.00000 | -.00000 |
| 28 | -.00158 | -.00000 | -.00000 |
| 29 | -.00340 | -.00000 | -.00000 |
| 30 | -.00209 | -.00000 | -.00000 |
| 31 | -.00080 | -.00000 | -.00000 |
| 32 | -.00088 | -.00000 | -.00000 |
| 33 | -.00008 | -.00000 | -.00000 |
| 34 | -.00016 | -.00000 | -.00000 |
| 35 | -.00102 | -.00000 | -.00000 |
| 36 | -.00060 | -.00000 | -.00000 |
| 37 | -.00080 | -.00000 | -.00000 |
| 38 | -.00102 | -.00000 | -.00000 |
| 39 | -.00101 | -.00000 | -.00000 |
| 40 | -.00101 | -.00000 | -.00000 |
| 41 | -.00101 | -.00000 | -.00000 |
| 42 | -.00101 | -.00000 | -.00000 |

** MAX MODAL ROTATIONAL DISPLACEMENT(USED FOR NORMALIZATION) = .339685E-02