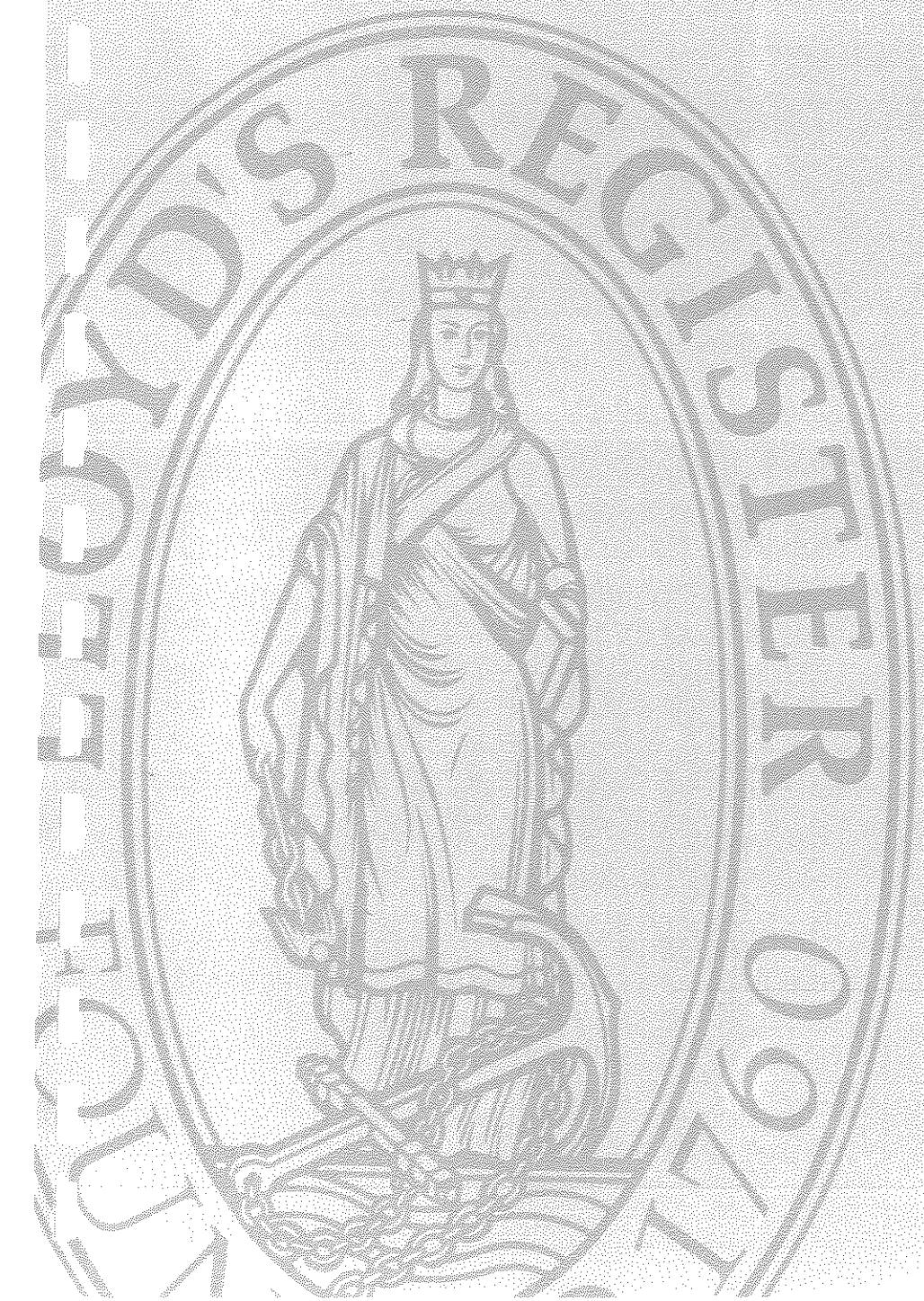
Lloyd's Register



10th Jan 1994

SUPPLEMENT TO PRELIMINARY REPORT (dated 9th Dec 1993)
OD/TR/93017

STUDY INTO THE STRENGTH RELIABILITY OF OFFSHORE STRUCTURES

PLATFORM No 3 a LIFTED PLATFORM in SHALLOW WATER

OD/TR/94001

CONTENTS

INTRODUCTION

This supplementary report comprises two more deterministic collapse analyses of the lifted shallow water platform (see Section 3c of the proposed study document dated May 1993). The first analysis has a leading diagonal member restricted at end two to an interaction ratio of 0.5. The final analysis for this structure has been performed with a major horizontal member fully released at end 1.

These analyses, together with those in the preliminary report, demonstrate the effect of undetected member failures for this structure.

RESULTS OF THE DETERMINISTIC COLLAPSE ANALYSES

The following analyses uses the same combined case which is detailed in the preliminary report.

The following deterministic collapse analyses have been performed with

d) member 65 with yielding set to give an interaction ratio of 0.5 at end 2 ie node 53.

e) member 144, a major horizontal member, fully released at end 1 ie node 87.

and the results of these are presented in the next two sections.

The analyses were terminated when a leg member reached an interaction ratio of approximately unity.

d) Results of collapse analysis

member 65 with yielding set to give an interaction ratio of 0.5 at end 2 ie node 53

i) Figure d.1: the lines and arrows in red indicate the axial and moments yield paths respectively.
An arrow indicates that a bending moment has reached yield at the member end. It does not differentiate between rotation about member local y or z or both. This information is available in Table d.1

ii) Table d.1 lists the displacements and forces along the Yield Paths at member ends. Appendix B (see preliminary report) gives the member local y axis thus identifying the bending moments ROTY AND ROTZ. (Member local x direction is always along the length of the member).

iii) Plots of undeformed and deformed structure at varying factors of

Figure d.2: wave and wind loading * 1.20

Figure d.3: " " " * 1.50

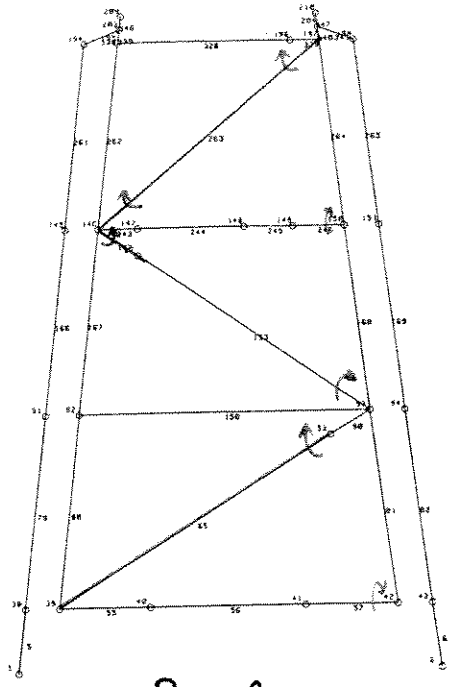
Figure d.4: " " " * 1.85

Figure d.5: " " " * 2.220

The deformations have been magnified by 40

iv) Table d.2: Member strength result at wave and wind * 2.220

v) Table d.3: Joint strength result at wave and wind * 2.220



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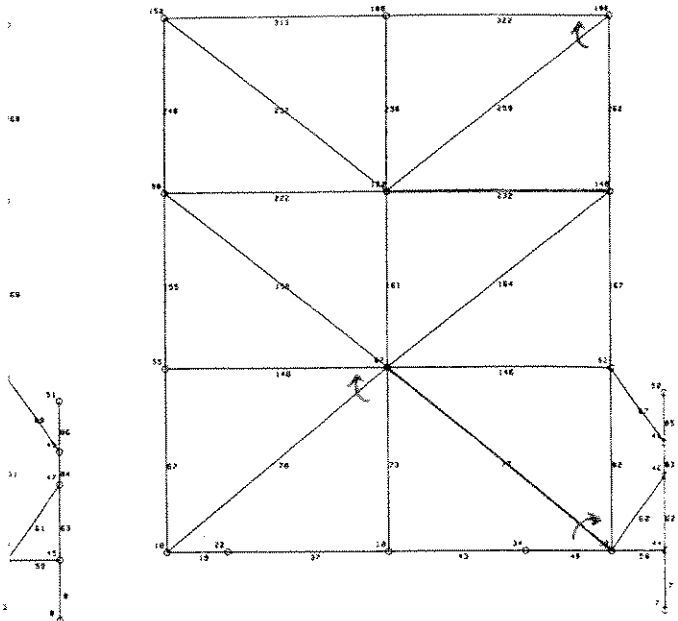

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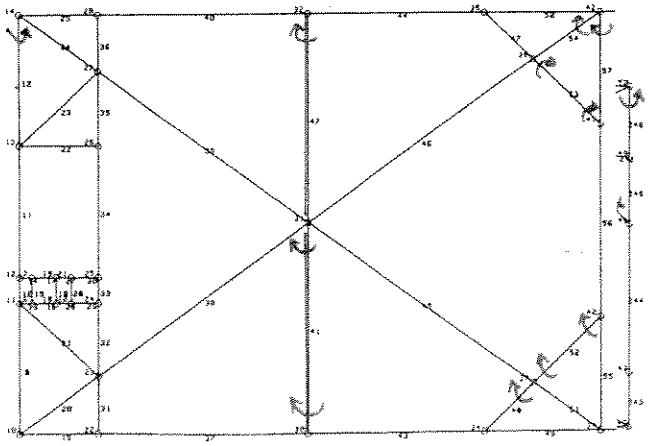
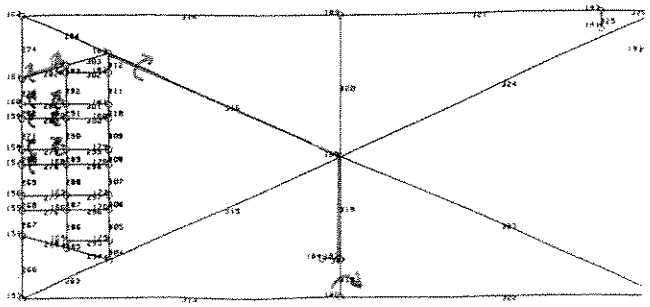


El. -36.6



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MODEL NAME: UM2PS1_14 Date: 6-JAN-94 Page No: 1

- DAMAGED STRUCTURE STRESS ANALYSIS -

Details of damage in file name: N37
Loading from Combination load file name: N36$D
Card title: 310 DEGREE EXTREME STORM - WIND & WAVE * 2.22

DISPLACEMENTS AND FORCES ALONG YIELD PATHS AT MEMBER ENDS

*** against stress indicates accuracy of 5 sig figs not obtained
*** against deflections indicates that plastic yielding direction is suspect

	Member No	Node No	Dof	Displacement or rotation Joint	Member end	Force or Moment Required	Achieved
	65	53	DISPX	-0.3430E+00	-0.1346E+00	-0.4050E+04	-0.4050E+04
	65	53	ROTY	-0.1330E-01	0.3502E-02	0.4160E+03	0.4160E+03
	65	53	ROTZ	0.9160E-02	0.5344E-03	0.3240E+03	0.3240E+03
	282	161	DISPX	0.4966E-01	0.3995E-01	-0.1108E+04	-0.1108E+04
***	282	161	ROTY	0.3270E-02	-0.8699E-02	0.0000E+00	0.1094E-04***
	282	161	ROTZ	-0.4265E-02	-0.5799E-02	0.0000E+00	-0.5081E-05
	282	173	ROTY	0.1876E-02	-0.3515E-03	-0.5360E+03	-0.5360E+03
	241	148	ROTY	0.4315E-01	0.4407E-01	0.1300E+03	0.1300E+03
	148	88	ROTY	0.7600E-03	-0.1220E-01	0.1800E+03	0.1800E+03
***	148	93	ROTZ	0.6334E-02	0.1936E-02	0.0000E+00	0.1954E-04***
	42	32	DISPX	-0.1678E+00	-0.1561E+00	-0.3573E+04	-0.3573E+04
	42	32	ROTY	-0.1517E-01	-0.1512E-02	0.9500E+02	0.9500E+02
	225	129	DISPX	0.4164E+00	0.4084E+00	-0.1217E+04	-0.1217E+04
	225	129	ROTZ	-0.8148E-02	-0.1309E-02	0.1500E+02	0.1500E+02
***	225	134	ROTY	-0.4893E-03	0.1536E-02	0.0000E+00	0.1940E-04***
	231	134	ROTY	-0.4893E-03	-0.2377E-01	0.4040E+03	0.4040E+03
	231	139	ROTY	0.5770E-01	-0.8246E-02	-0.1500E+03	-0.1500E+03
	144	87	DISPX	-0.3250E+00	-0.3675E+00	-0.2200E+04	-0.2200E+04
	144	87	ROTY	-0.1487E-01	-0.2641E-02	-0.2700E+03	-0.2700E+03
	144	88	ROTY	0.2353E-02	0.3642E-02	0.1300E+03	0.1300E+03
	244	147	ROTY	-0.7088E-02	0.6861E-02	-0.1513E+03	-0.1513E+03
	244	147	ROTZ	-0.5832E-02	-0.4586E-01	-0.2520E+03	-0.2520E+03
	244	148	ROTZ	0.4315E-01	-0.4158E-01	0.2990E+03	0.2990E+03
	78	42	DISPX	-0.4998E-01	-0.8522E-01	-0.6120E+04	-0.6120E+04
***	78	42	ROTY	0.5152E-02	0.3642E-02	0.0000E+00	-0.1488E-04***
***	78	42	ROTZ	-0.1875E-01	-0.1598E-01	0.0000E+00	-0.2164E-04***
	54	42	ROTZ	-0.1042E-01	-0.8347E-02	-0.7300E+03	-0.7300E+03
	77	39	DISPX	-0.8977E-01	-0.1288E+00	-0.7060E+04	-0.7060E+04
***	77	39	ROTY	0.3855E-02	0.1333E-02	0.0000E+00	-0.6454E-04***
	281	160	ROTY	0.4913E-02	-0.2275E-02	0.1730E+03	0.1730E+03
	281	171	ROTY	0.5029E-02	0.1558E-03	-0.1870E+03	-0.1870E+03
	53	36	ROTY	-0.6847E-02	-0.5417E-02	-0.1370E+03	-0.1370E+03
	53	41	ROTZ	-0.3967E-02	-0.6262E-02	0.1500E+03	0.1500E+03
	64	10	ROTY	-0.1627E-01	-0.8758E-02	-0.6080E+03	-0.6080E+03
	64	52	DISPX	-0.3258E+00	-0.1554E+00	-0.8660E+04	-0.8660E+04
	64	52	ROTY	-0.1202E-01	-0.3196E-02	0.4780E+03	0.4780E+03
	152	87	DISPX	-0.2768E+00	-0.4459E+00	-0.7000E+04	-0.7000E+04
***	152	87	ROTY	-0.1487E-01	-0.4194E-02	0.0000E+00	-0.1116E-03***
	152	96	ROTY	-0.6335E-02	-0.3047E-02	0.3600E+03	0.3600E+03
	316	183	DISPX	0.4481E+00	0.4440E+00	-0.1000E+04	-0.1000E+04
	316	183	ROTZ	-0.4569E-02	0.1899E-03	0.1000E+02	0.1000E+02
	263	146	DISPX	-0.3944E+00	-0.5284E+00	-0.4775E+04	-0.4775E+04
	263	146	ROTY	-0.9016E-02	-0.3837E-02	-0.1500E+03	-0.1500E+03
	263	197	ROTY	-0.5273E-02	-0.4552E-02	0.1338E+04	0.1338E+04
	280	159	ROTY	0.4594E-02	-0.1108E-02	0.1983E+03	0.1983E+03
	280	170	ROTY	0.4149E-02	0.6648E-03	-0.2040E+03	-0.2040E+03
	232	132	DISPX	0.1908E+00	0.1780E+00	-0.4230E+04	-0.4230E+04
***	41	30	ROTY	-0.1425E-01	-0.4202E-02	0.0000E+00	0.2243E-04***
	41	31	DISPX	-0.1469E+00	-0.1253E+00	-0.3305E+04	-0.3305E+04
	41	31	ROTY	0.1096E-03	-0.1640E-02	-0.8500E+02	-0.8500E+02

MODEL NAME: UM2PS1_14 Date: 6-JAN-94 Page No: 2

- DAMAGED STRUCTURE STRESS ANALYSIS -

Details of damage in file name: N37
Loading from Combination load file name: N36$D
Card title: 310 DEGREE EXTREME STORM - WIND & WAVE * 2.22

DISPLACEMENTS AND FORCES ALONG YIELD PATHS AT MEMBER ENDS

*** against stress indicates accuracy of 5 sig figs not obtained
*** against deflections indicates that plastic yielding direction is suspect

	Member No	Node No	Dof	Displacement or rotation Joint	Member end	Force or Moment Required	Achieved
	172	146	DISPX	0.4517E+00	0.3193E+00	0.9132E+04	0.9132E+04
***	172	146	ROTY	-0.9016E-02	0.2459E-02	0.0000E+00	0.2398E-03***
***	172	146	ROTZ	-0.3002E-03	0.7899E-02	0.0000E+00	-0.2266E-03***
	143	85	DISPX	0.3356E+00	0.3212E+00	-0.1000E+04	-0.1000E+04
	143	85	ROTZ	-0.7853E-02	-0.2023E-02	0.0000E+00	0.1951E-05
	143	88	ROTZ	0.1933E-02	0.1923E-02	0.2300E+02	0.2300E+02
	246	150	ROTY	-0.8425E-02	0.1729E-03	0.2000E+03	0.2000E+03
	246	150	ROTZ	0.1385E-01	0.4451E-01	-0.4290E+03	-0.4290E+03
	230	134	ROTZ	0.4419E-02	0.6975E-02	0.4200E+02	0.4200E+02
	230	137	DISPX	0.3951E+00	0.4043E+00	-0.1350E+04	-0.1350E+04
	230	137	ROTZ	0.8626E-03	0.7509E-02	-0.6700E+02	-0.6700E+02
	279	158	ROTY	0.1958E-02	-0.1912E-02	0.1795E+03	0.1795E+03
	279	169	ROTY	0.1366E-02	0.1102E-02	-0.2000E+03	-0.2000E+03
	249	99	DISPX	-0.3857E+00	-0.4908E+00	-0.6321E+04	-0.6321E+04
	249	99	ROTY	-0.7524E-02	-0.2619E-02	-0.3900E+03	-0.3900E+03
	74	32	DISPX	0.1471E+00	0.2459E+00	0.1143E+05	0.1143E+05
	74	32	ROTY	-0.1517E-01	-0.6258E-02	-0.5010E+03	-0.5010E+03
	74	87	ROTY	-0.1487E-01	-0.9843E-02	0.1290E+04	0.1290E+04
	52	37	ROTY	-0.8168E-02	-0.4720E-02	-0.1065E+03	-0.1065E+03
	52	40	ROTY	0.2478E-02	0.1981E-02	-0.9400E+02	-0.9400E+02
	52	40	ROTZ	-0.2104E-02	-0.1166E-02	-0.1216E+03	-0.1216E+03
	256	135	ROTY	-0.8639E-02	-0.4933E-02	-0.2500E+02	-0.2500E+02
	256	186	DISPX	0.4934E+00	0.3975E+00	0.8460E+04	0.8460E+04
	256	186	ROTY	-0.4540E-02	0.2816E-02	0.3920E+03	0.3920E+03
	151	64	DISPX	0.3297E+00	0.4320E+00	0.1085E+05	0.1085E+05
***	151	64	ROTY	-0.1360E-01	-0.4345E-02	0.0000E+00	-0.5281E-04***
	151	95	ROTY	-0.4427E-02	-0.5468E-03	0.4290E+03	0.4290E+03
	151	95	ROTZ	0.2117E-02	0.1602E-02	0.2400E+02	0.2400E+02
	70	87	ROTZ	-0.9939E-02	-0.6224E-02	-0.3700E+03	-0.3700E+03
***	153	93	ROTY	-0.1506E-01	-0.5194E-02	0.0000E+00	0.3637E-03***
	233	150	ROTZ	0.1365E-01	0.7773E-02	0.6100E+02	0.6100E+02
	147	92	ROTZ	-0.8401E-02	-0.7818E-02	-0.5690E+03	-0.5690E+03
	173	99	ROTY	-0.7524E-02	-0.7958E-03	-0.8850E+03	-0.8850E+03
	278	157	ROTY	0.2493E-03	-0.3254E-03	0.2008E+03	0.2008E+03
	318	186	ROTY	-0.4540E-02	0.1102E-02	-0.6800E+03	-0.6800E+03
	57	42	ROTY	-0.1757E-01	-0.1480E-01	0.8430E+03	0.8430E+03
	227	132	ROTY	-0.1008E-01	-0.6416E-02	-0.1120E+04	-0.1120E+04
	12	14	ROTY	0.1733E-01	0.1654E-01	-0.8710E+03	-0.8710E+03
	259	195	ROTZ	-0.3419E-02	-0.2973E-02	-0.4730E+03	-0.4730E+03
	48	37	ROTY	-0.8168E-02	-0.8216E-02	-0.1137E+03	-0.1137E+03
	319	187	DISPX	-0.6123E+00	-0.6169E+00	-0.3700E+04	-0.3700E+04
	145	89	ROTY	-0.1295E-01	-0.1040E-01	0.3100E+03	0.3100E+03

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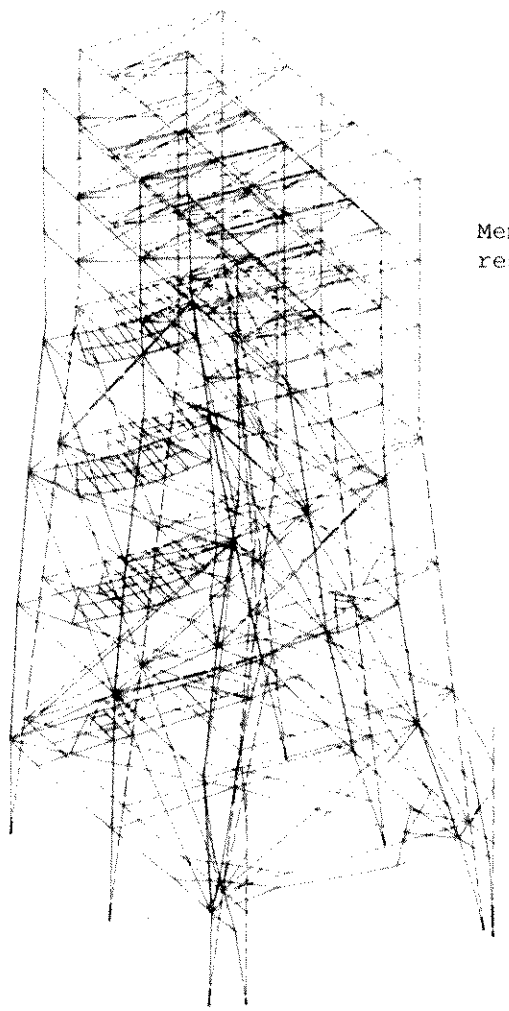
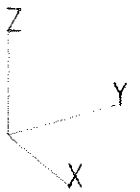


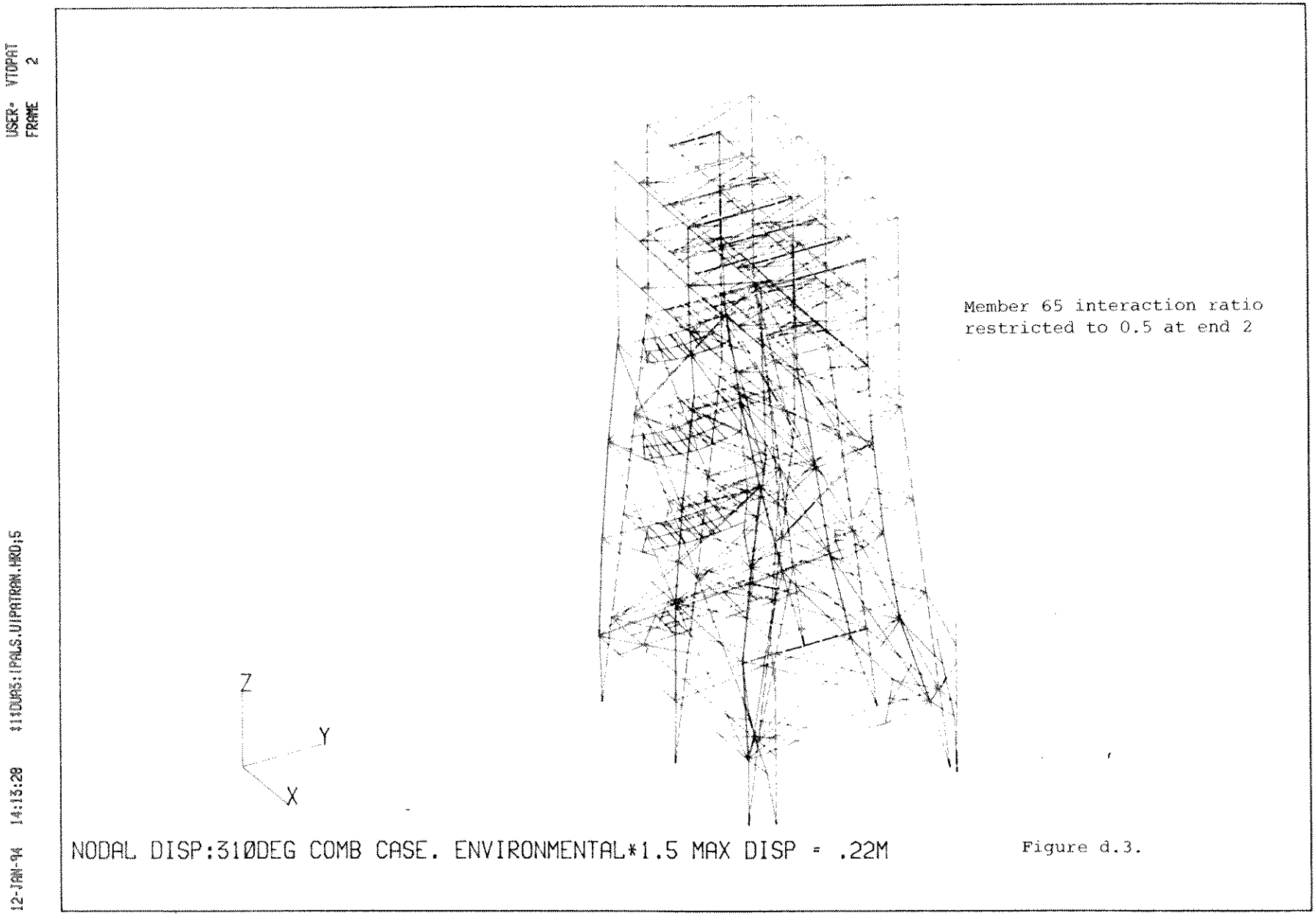
Member 65 interaction ratio
restricted to 0.5 at end 2



NODAL DISP:310DEG COMB CASE. ENVIRONMENTAL*1.2 MAX DISP = .19M

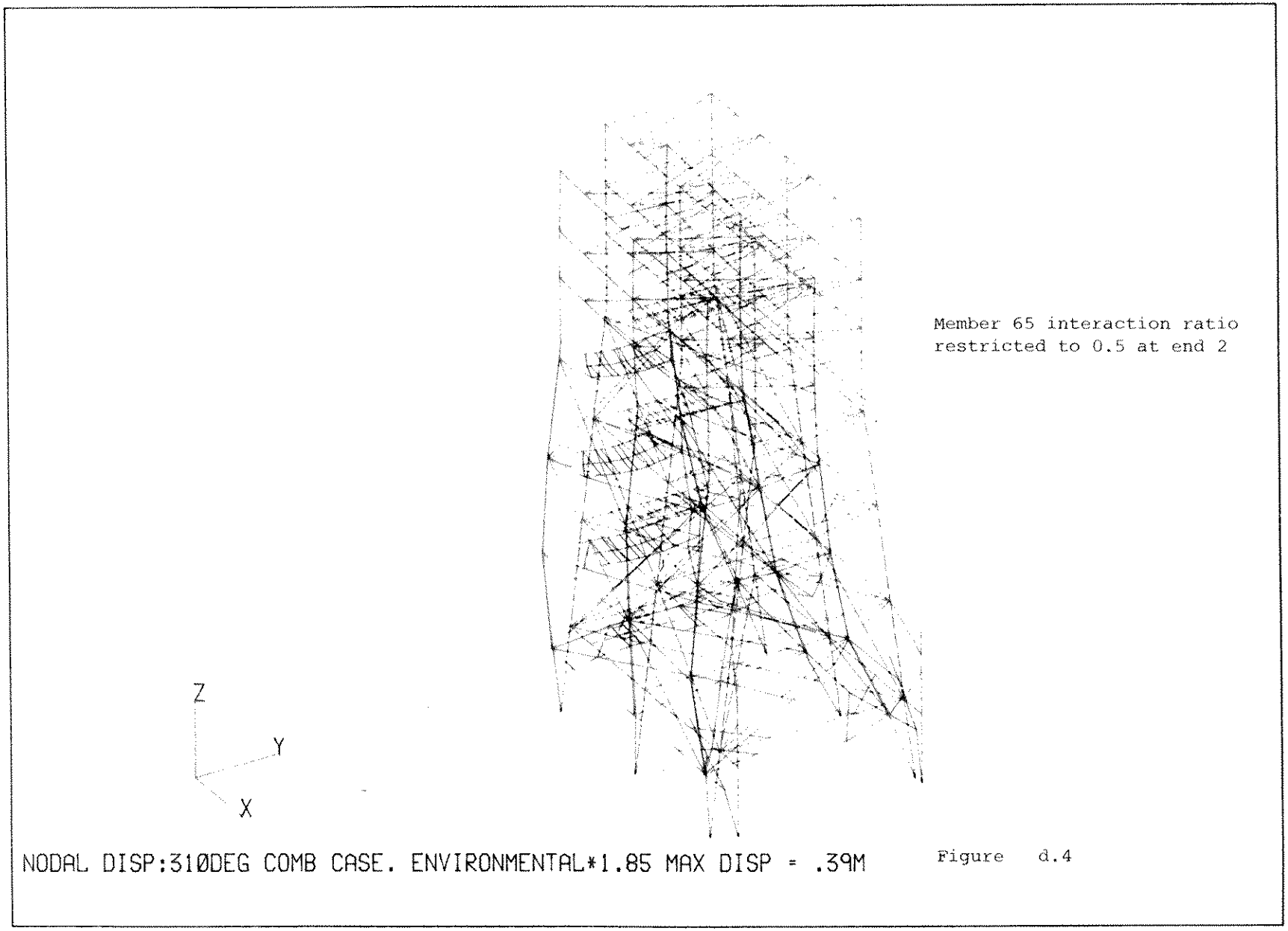
Figure d.2.

12-JAN-94 14:13:14 11DUA3:[PALS.UJPATRAN.HRD]5



Member 65 interaction ratio
restricted to 0.5 at end 2

Figure d.3.



Member 65 interaction ratio
restricted to 0.5 at end 2

Figure d.4

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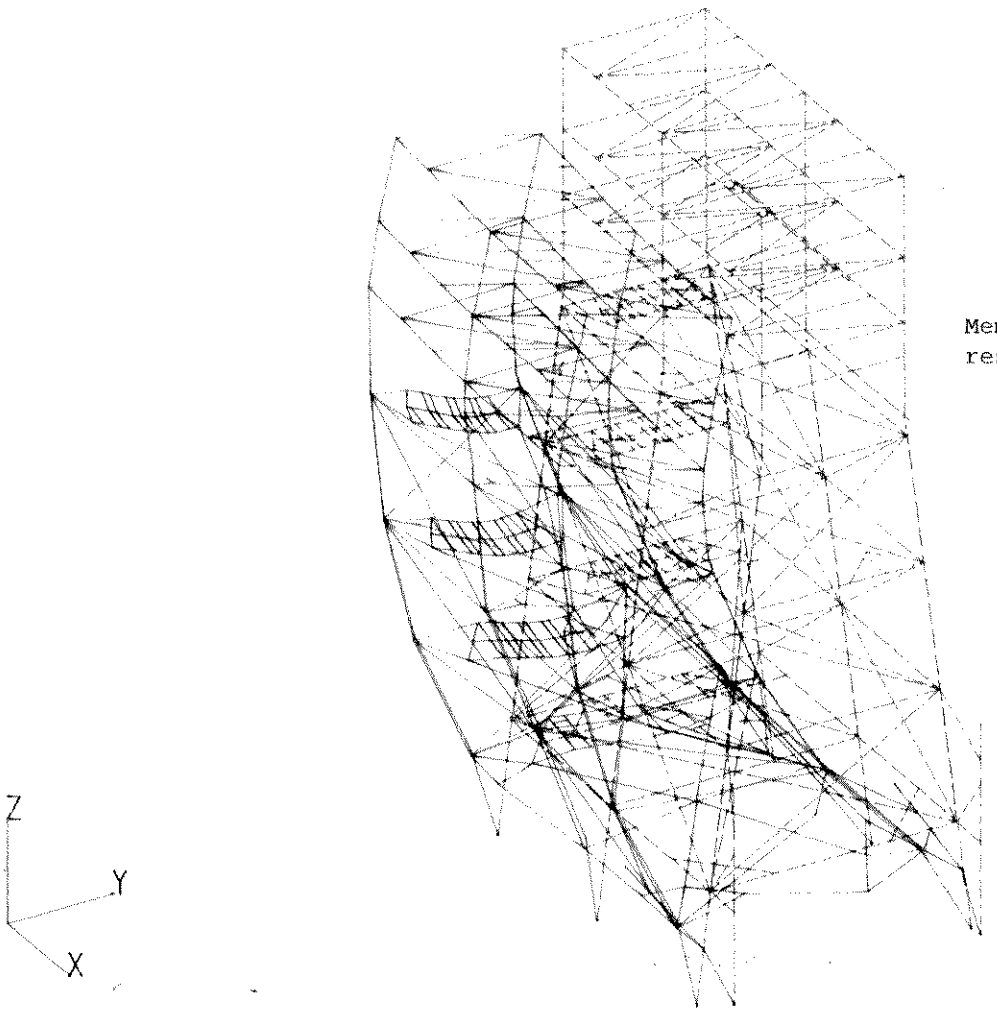


Member 65 interaction ratio
restricted to 0.5 at end 2

NODAL DISP:310DEG COMB CASE. ENVIRONMENTAL*2.22 MAX DISP = .78M

Figure d.5

12-JAN-94 14:14:01 $18DUA3:[PALS.UIPATRAN.HRD]5

AISC Check Summary

TABLE d.2

MEMBER No.	STATION POSITION	CASE No.	INTERACTION RATIO		C-T FLAG	
147	0.75	101	1.004	*	(C)	
256	1.00	101	1.002	*	(T)	
263	0.75	101	1.002	*	(C)	
230	0.00	101	1.002	*	(C)	
145	0.75	101	1.002	*	(C)	
153	0.50	101	1.001	*	(T)	
280	1.00	101	1.001	*	(T)	
42	0.75	101	1.001	*	(C)	
64	0.25	101	1.000	*	(C)	
232	0.50	101	1.000	*	(C)	
152	1.00	101	1.000	*	(C)	
12	1.00	101	1.000	*	(T)	
57	1.00	101	1.000		(T)	
156	0.25	101	1.000		(C)	<---
143	0.50	101	0.999		(C)	
279	1.00	101	0.999		(T)	
70	1.00	101	0.999		(T)	
233	0.75	101	0.999		(C)	
225	0.50	101	0.999		(C)	
151	1.00	101	0.999		(T)	
144	0.25	101	0.998		(C)	
259	1.00	101	0.998		(T)	
77	0.50	101	0.997		(C)	
41	1.00	101	0.997		(C)	
74	1.00	101	0.997		(T)	
173	0.25	101	0.996		(C)	
87	0.00	101	0.995		(C)	
278	0.00	101	0.995		(T)	
78	0.50	101	0.994		(C)	
164	1.00	101	0.993		(T)	
150	1.00	101	0.992		(C)	
249	0.25	101	0.991		(C)	
324	0.00	101	0.986		(C)	
159	0.50	101	0.983		(C)	
9	0.00	101	0.980		(T)	
282	1.00	101	0.978		(C)	
227	0.25	101	0.975		(C)	
244	1.00	101	0.967		(C)	
165	0.00	101	0.966		(T)	
54	1.00	101	0.964		(T)	

leg ---> member

MEMBER STRENGTH RESULTS FOR DAMAGED STRUCTURE
ENVIRONMENTAL LOADING * 2.22
MEMBER 65 Restricted to an
Interaction Ratio of 0.5

API Check Summary : 19th Edition Results. TABLE d.3

JOINT NO.	BRACE NO.	CASE NO.	CLASSIFICATION %K	%X	%YT	INTERACTION RATIO BENDING	OVERALL
37	48	101	0.0	100.0	0.0	0.972	1.005 **
161	282	101	0.0	0.0	100.0	0.000	1.003 **
40	52	101	0.0	0.0	100.0	0.804	1.002 **
32	74	101	39.4	0.0	60.6	0.021	1.000 **
36	53	101	0.0	0.0	100.0	0.875	0.996
158	279	101	0.0	0.0	100.0	0.936	0.996
157	278	101	0.0	0.0	100.0	0.992	0.993
41	53	101	0.0	0.0	100.0	0.823	0.986
37	52	101	0.0	39.0	61.0	0.785	0.979
89	71	101	73.2	7.3	19.5	0.009	0.970
135	171	101	67.6	0.0	32.4	0.044	0.958
89	165	101	90.9	9.1	0.0	0.066	0.957
159	280	101	0.0	0.0	100.0	0.906	0.901
186	256	101	53.9	0.0	46.1	0.038	0.861
87	74	101	71.0	0.0	29.0	0.023	0.826
10	64	101	26.2	0.0	73.8	0.015	0.821
10	70	101	42.1	0.0	57.9	0.002	0.812
183	312	101	79.9	0.0	20.1	0.364	0.800
135	256	101	100.0	0.0	0.0	0.013	0.772
14	71	101	48.6	0.0	51.4	0.002	0.768
162	249	101	47.3	0.0	52.7	0.073	0.758
195	259	101	51.8	0.0	48.2	0.046	0.753
64	151	101	92.0	0.0	8.0	0.006	0.741
186	322	101	0.0	30.3	69.7	0.131	0.739
89	78	101	100.0	0.0	0.0	0.015	0.736
89	159	101	100.0	0.0	0.0	0.025	0.731
46	60	101	0.0	0.0	100.0	0.023	0.722
160	281	101	0.0	0.0	100.0	0.729	0.706
99	170	101	86.1	0.0	13.9	0.013	0.702
197	263	101	14.7	0.0	85.3	0.088	0.701
189	320	101	0.0	0.0	100.0	0.122	0.701
30	37	101	0.0	0.0	100.0	0.068	0.689
64	89	101	100.0	0.0	0.0	0.013	0.686
32	40	101	0.0	4.4	95.6	0.014	0.653
142	239	101	0.0	0.0	100.0	0.588	0.629
173	293	101	0.0	0.0	100.0	0.658	0.624
87	70	101	72.9	0.0	27.1	0.008	0.614
48	87	101	0.0	0.0	100.0	0.140	0.607
87	164	101	100.0	0.0	0.0	0.009	0.596

JOINT STRENGTH RESULTS FOR DAMAGED STRUCTURE.
ENVIRONMENTAL LOADING * 2.22
MEMBER 65 Restricted to an
Interaction Ratio of 0.5

e) Results of collapse analysis with

member 144 completely released at end 1 at node 87

i) Figure e.1: the lines and arrows in red indicate the axial and moments yield paths respectively.
An arrow indicates that a bending moment has reached yield at the member end. It does not differentiate between rotation about member local y or z or both. This information is available in Table e.1

ii) Table e.1 lists the displacements and forces along the Yield Paths at member ends. Appendix B (see preliminary report) gives the member local y axis thus identifying the bending moments ROTY AND ROTZ. (Member local x direction is always along the length of the member).

iii) Plots of undeformed and deformed structure at varying factors of

Figure e.2: wave and wind loading * 1.25

Figure e.3: " " " * 1.75

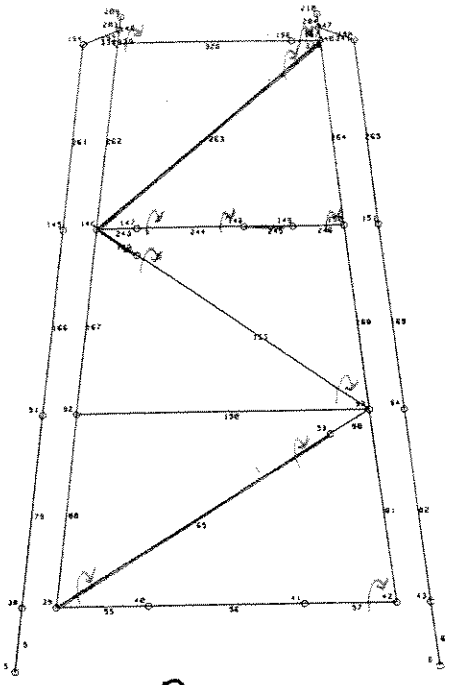
Figure e.4: " " " * 2.00

Figure e.5: " " " * 2.235

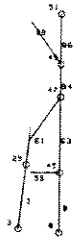
The deformations have been magnified by 40

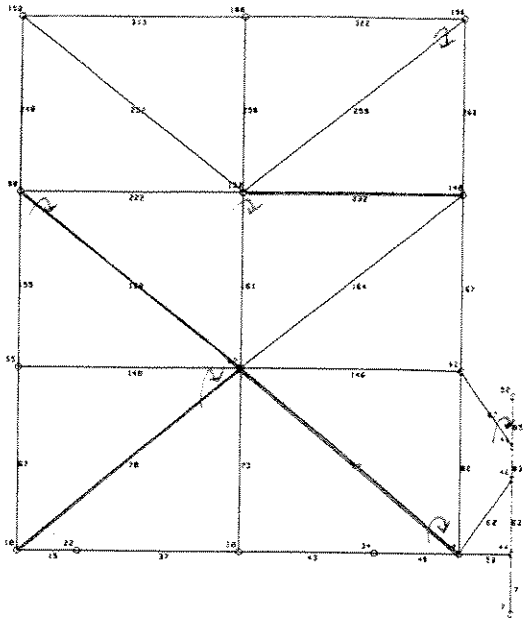
iv) Table e.2: Member strength result at wave and wind * 2.235

v) Table e.3: Joint strength result at wave and wind * 2.235

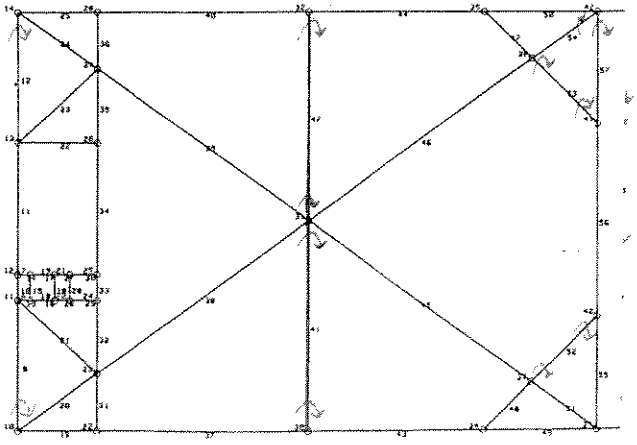


Row A

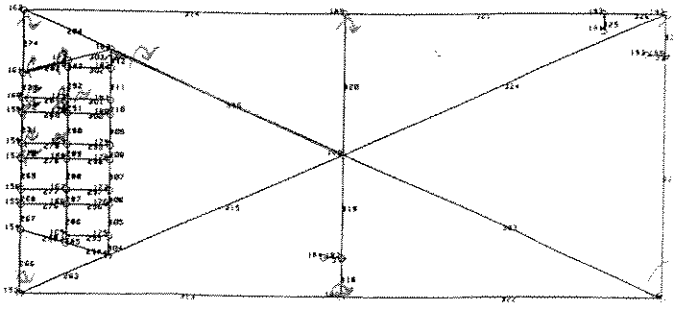




Row 2



El. -36·6



El. +6·0

MODEL NAME: UM2PS1_16 Date: 22-DEC-93 Page No: 1

- DAMAGED STRUCTURE STRESS ANALYSIS -

Details of damage in file name: Y55
Loading from Combination load file name: Y54$D
Card title: 310 DEG STORM WAVE & WIND * 2.235

DISPLACEMENTS AND FORCES ALONG YIELD PATHS AT MEMBER ENDS

*** against stress indicates accuracy of 5 sig figs not obtained
*** against deflections indicates that plastic yielding direction is suspect

	Member No	Node No	Dof	Displacement or rotation Joint	Member end	Force or Moment Required	Achieved
***	144	87	DISPX	-0.3062E+00	-0.4107E+00	0.0000E+00	-0.1254E-02***
	144	87	DISPY	-0.1595E+00	-0.2323E+00	0.0000E+00	-0.6155E-05
***	144	87	DISPZ	-0.1443E-01	-0.2257E+00	0.0000E+00	0.3033E-04***
	144	87	ROTX	0.4021E-02	0.4401E-02	0.0000E+00	-0.2876E-06
***	144	87	ROTY	-0.1795E-01	-0.6282E-02	0.0000E+00	0.5993E-04***
***	144	87	ROTZ	-0.8556E-03	0.7606E-02	0.0000E+00	-0.1379E-04***
	241	148	ROTY	0.2213E-01	0.3320E-01	0.2000E+02	0.2000E+02
	282	161	DISPX	0.2398E-01	0.9858E-02	-0.7600E+03	-0.7600E+03
	282	161	ROTY	0.4268E-02	-0.7273E-02	0.9500E+02	0.9500E+02
	282	173	ROTY	0.3710E-02	-0.3027E-03	-0.5600E+03	-0.5600E+03
	225	129	DISPX	0.4569E+00	0.4455E+00	-0.1170E+04	-0.1170E+04
	225	129	ROTZ	-0.8467E-02	-0.2796E-02	0.1500E+02	0.1500E+02
	77	39	DISPX	-0.9480E-01	-0.1376E+00	-0.7220E+04	-0.7220E+04
	77	39	ROTY	0.4177E-02	0.1665E-02	0.5000E+01	0.5000E+01
	77	39	ROTZ	-0.9513E-02	-0.8738E-02	0.2000E+02	0.2000E+02
	87	48	ROTZ	-0.1494E-01	-0.1350E-01	0.3440E+04	0.3440E+04
	78	42	DISPX	-0.4715E-01	-0.8527E-01	-0.5955E+04	-0.5955E+04
	78	89	ROTZ	-0.1017E-01	-0.7177E-02	-0.9000E+02	-0.9000E+02
	64	10	DISPX	-0.1457E+00	-0.3388E+00	-0.9530E+04	-0.9530E+04
	64	10	ROTY	-0.1783E-01	-0.5389E-02	-0.7000E+02	-0.7000E+02
	64	52	ROTY	-0.1592E-01	-0.2003E-02	0.7000E+02	0.7000E+02
	65	39	DISPX	-0.1314E+00	-0.3074E+00	-0.8830E+04	-0.8830E+04
	65	39	ROTY	-0.1571E-01	-0.4723E-02	-0.5000E+02	-0.5000E+02
	65	53	ROTY	-0.1559E-01	0.7945E-03	0.5000E+02	0.5000E+02
	65	53	ROTZ	0.8890E-02	0.9749E-04	0.7500E+02	0.7500E+02
	147	88	DISPX	0.3561E+00	0.3245E+00	-0.1065E+04	-0.1065E+04
	147	88	ROTZ	-0.7272E-02	0.5320E-02	0.5000E+02	0.5000E+02
	147	92	ROTZ	-0.9066E-02	0.8479E-02	-0.5000E+02	-0.5000E+02
	281	160	ROTY	0.5774E-02	-0.2131E-02	0.1750E+03	0.1750E+03
	281	171	ROTY	0.6885E-02	-0.3580E-03	-0.1800E+03	-0.1800E+03
	152	87	DISPX	-0.2616E+00	-0.5073E+00	-0.6005E+04	-0.6005E+04
	152	87	ROTY	-0.1795E-01	-0.1270E-01	-0.5250E+03	-0.5250E+03
	152	96	ROTY	-0.1029E-01	0.1446E-02	0.9500E+02	0.9500E+02
	244	147	ROTY	-0.8099E-02	0.7496E-02	-0.3450E+03	-0.3450E+03
	244	147	ROTZ	-0.6969E-02	-0.2499E-01	-0.2900E+03	-0.2900E+03
	244	148	ROTZ	0.2213E-01	-0.1998E-01	0.3650E+03	0.3650E+03
	263	146	DISPX	-0.4187E+00	-0.6089E+00	-0.4180E+04	-0.4180E+04
	263	197	ROTY	-0.8781E-02	-0.2412E-02	0.1375E+04	0.1375E+04
	280	159	ROTY	0.5639E-02	-0.1317E-02	0.1950E+03	0.1950E+03
	280	170	ROTY	0.5440E-02	0.4498E-03	-0.2000E+03	-0.2000E+03
	316	183	DISPX	0.5007E+00	0.4981E+00	-0.1150E+04	-0.1150E+04
	316	183	ROTZ	-0.3418E-02	0.7987E-03	0.3000E+02	0.3000E+02
	41	30	DISPX	-0.9596E-01	-0.1458E+00	-0.3150E+04	-0.3150E+04
	41	30	ROTY	-0.1301E-01	-0.6263E-02	-0.7000E+02	-0.7000E+02
	41	31	ROTY	-0.4024E-03	-0.1176E-02	-0.1150E+03	-0.1150E+03
	230	134	DISPX	0.4433E+00	0.4251E+00	-0.1055E+04	-0.1055E+04
	54	42	ROTZ	-0.9964E-02	-0.8566E-02	-0.7350E+03	-0.7350E+03
	42	31	DISPX	-0.1539E+00	-0.1608E+00	-0.3900E+04	-0.3900E+04
	42	31	ROTY	-0.4024E-03	0.3937E-03	-0.5000E+01	-0.5000E+01
	42	32	ROTY	-0.1693E-01	0.3537E-03	0.3000E+02	0.3000E+02

MODEL NAME: UM2PS1_16 Date: 22-DEC-93 Page No: 2

- DAMAGED STRUCTURE STRESS ANALYSIS -

Details of damage in file name: Y55
Loading from Combination load file name: Y54$D
Card title: 310 DEG STORM WAVE & WIND * 2.235

DISPLACEMENTS AND FORCES ALONG YIELD PATHS AT MEMBER ENDS

*** against stress indicates accuracy of 5 sig figs not obtained
*** against deflections indicates that plastic yielding direction is suspect

	Member No	Node No	Dof	Displacement or rotation Joint	Member end	Force or Moment Required	Achieved	
	249	99	DISPX	-0.4439E+00	-0.5997E+00	-0.6190E+04	-0.6190E+04	
	249	99	ROTY	-0.1097E-01	-0.2977E-02	-0.4500E+03	-0.4500E+03	
	249	162	ROTY	-0.6935E-02	-0.5918E-02	0.8050E+03	0.8050E+03	
	172	97	DISPX	0.2977E+00	0.4806E+00	0.7020E+04	0.7020E+04	
	279	158	ROTY	0.3015E-02	-0.2432E-02	0.1700E+03	0.1700E+03	
	279	169	ROTY	0.2354E-02	0.1007E-02	-0.1950E+03	-0.1950E+03	
	232	132	DISPX	0.2080E+00	0.1926E+00	-0.4305E+04	-0.4305E+04	
	246	150	ROTY	-0.1311E-01	-0.7466E-02	0.5250E+03	0.5250E+03	
	246	150	ROTZ	0.1221E-01	0.2552E-01	-0.4800E+03	-0.4800E+03	
	70	10	DISPX	0.6039E-01	0.6522E-01	0.9830E+04	0.9830E+04	
	70	87	ROTY	0.4096E-02	0.2555E-02	-0.3050E+03	-0.3050E+03	
	70	87	ROTZ	-0.1164E-01	-0.3071E-02	-0.2750E+03	-0.2750E+03	
	52	37	ROTY	-0.8052E-02	-0.5336E-02	-0.9500E+02	-0.9500E+02	
	52	37	ROTZ	-0.1684E-02	-0.1412E-02	0.1550E+03	0.1550E+03	
	52	40	ROTY	0.1005E-02	0.6822E-03	-0.8500E+02	-0.8500E+02	
	52	40	ROTZ	-0.1935E-02	-0.1005E-02	-0.1100E+03	-0.1100E+03	
	256	135	DISPX	0.4240E+00	0.5802E+00	0.7225E+04	0.7225E+04	
	256	186	ROTY	-0.7186E-02	0.5574E-02	0.3250E+03	0.3250E+03	
	256	186	ROTZ	-0.5235E-03	0.2063E-03	-0.4100E+03	-0.4100E+03	
	233	135	DISPX	0.1976E+00	0.1907E+00	-0.3690E+04	-0.3690E+04	
	233	150	ROTZ	0.1195E-01	0.8633E-02	0.1500E+02	0.1500E+02	
	53	36	ROTY	-0.5671E-02	-0.1635E-02	-0.1300E+03	-0.1300E+03	
	53	41	ROTZ	-0.4328E-02	-0.5898E-02	0.1450E+03	0.1450E+03	
	151	64	DISPX	0.3549E+00	0.5116E+00	0.9475E+04	0.9475E+04	
	151	64	ROTY	-0.1625E-01	-0.1013E-01	-0.6050E+03	-0.6050E+03	
	151	95	ROTY	-0.6165E-02	-0.4819E-03	0.7300E+03	0.7300E+03	
	259	195	ROTZ	-0.5609E-02	-0.4152E-02	-0.5150E+03	-0.5150E+03	
	74	32	DISPX	0.1482E+00	0.2307E+00	0.1081E+05	0.1081E+05	
	74	32	ROTY	-0.1693E-01	-0.1443E-01	-0.1395E+04	-0.1395E+04	
	74	87	ROTY	-0.1795E-01	-0.5467E-02	0.1310E+04	0.1310E+04	
	227	132	ROTY	-0.1555E-01	0.6081E-02	-0.4800E+03	-0.4800E+03	
	231	134	ROTY	-0.1704E-02	-0.8693E-02	0.1090E+04	0.1090E+04	
	231	139	ROTY	0.2664E-01	0.1393E-01	-0.1090E+04	-0.1090E+04	
	57	42	ROTY	-0.1579E-01	-0.8704E-02	0.5600E+03	0.5600E+03	
	158	87	DISPX	-0.1575E+00	-0.1602E+00	-0.5405E+04	-0.5405E+04	
***	158	99	ROTZ	-0.5304E-02	-0.8694E-02	0.5000E+01	0.5000E+01	***
	161	132	ROTZ	-0.1555E-01	-0.1629E-01	0.9605E+04	0.9605E+04	
	173	99	ROTY	-0.1097E-01	0.6059E-03	-0.9550E+03	-0.9550E+03	
	228	134	ROTZ	-0.1704E-02	0.9809E-03	-0.3400E+03	-0.3400E+03	
	278	157	ROTY	0.1199E-02	-0.1489E-02	0.1850E+03	0.1850E+03	
	318	186	ROTY	-0.7186E-02	0.1410E-02	-0.8550E+03	-0.8550E+03	
	245	148	DISPX	-0.5665E+00	-0.5695E+00	-0.1260E+04	-0.1260E+04	
	153	93	ROTY	-0.1605E-01	-0.1122E-01	-0.1150E+04	-0.1150E+04	
	153	97	ROTY	-0.5689E-02	-0.5131E-02	0.1260E+04	0.1260E+04	
	12	14	ROTY	0.1865E-01	0.1589E-01	-0.8300E+03	-0.8300E+03	
	320	189	ROTY	-0.8278E-02	-0.4805E-02	0.1220E+04	0.1220E+04	
	312	183	ROTY	0.5374E-03	0.1338E-02	0.4750E+03	0.4750E+03	
	329	197	ROTY	-0.8781E-02	-0.4757E-02	0.1600E+04	0.1600E+04	
	9	10	ROTY	0.1783E-01	0.1616E-01	0.8850E+03	0.8850E+03	
	159	89	DISPX	-0.1028E+00	-0.1047E+00	-0.5500E+04	-0.5500E+04	

MODEL NAME: UM2PS1_16 Date: 22-DEC-93 Page No: 3

- DAMAGED STRUCTURE STRESS ANALYSIS -

Details of damage in file name: Y55
Loading from Combination load file name: Y54$D
Card title: 310 DEG STORM WAVE & WIND * 2.235

DISPLACEMENTS AND FORCES ALONG YIELD PATHS AT MEMBER ENDS

*** against stress indicates accuracy of 5 sig figs not obtained
*** against deflections indicates that plastic yielding direction is suspect

Member No	Node No	Dof	Displacement or rotation Joint	Member end	Force or Moment Required	Achieved
266	153	ROTY	-0.7178E-02	-0.5787E-02	-0.1640E+04	-0.1640E+04
274	162	ROTY	-0.6935E-02	-0.5672E-02	0.1150E+04	0.1150E+04
301	171	ROTY	0.6885E-02	0.6456E-02	0.1900E+03	0.1900E+03
328	195	ROTY	-0.9257E-02	-0.8990E-02	-0.1570E+04	-0.1570E+04

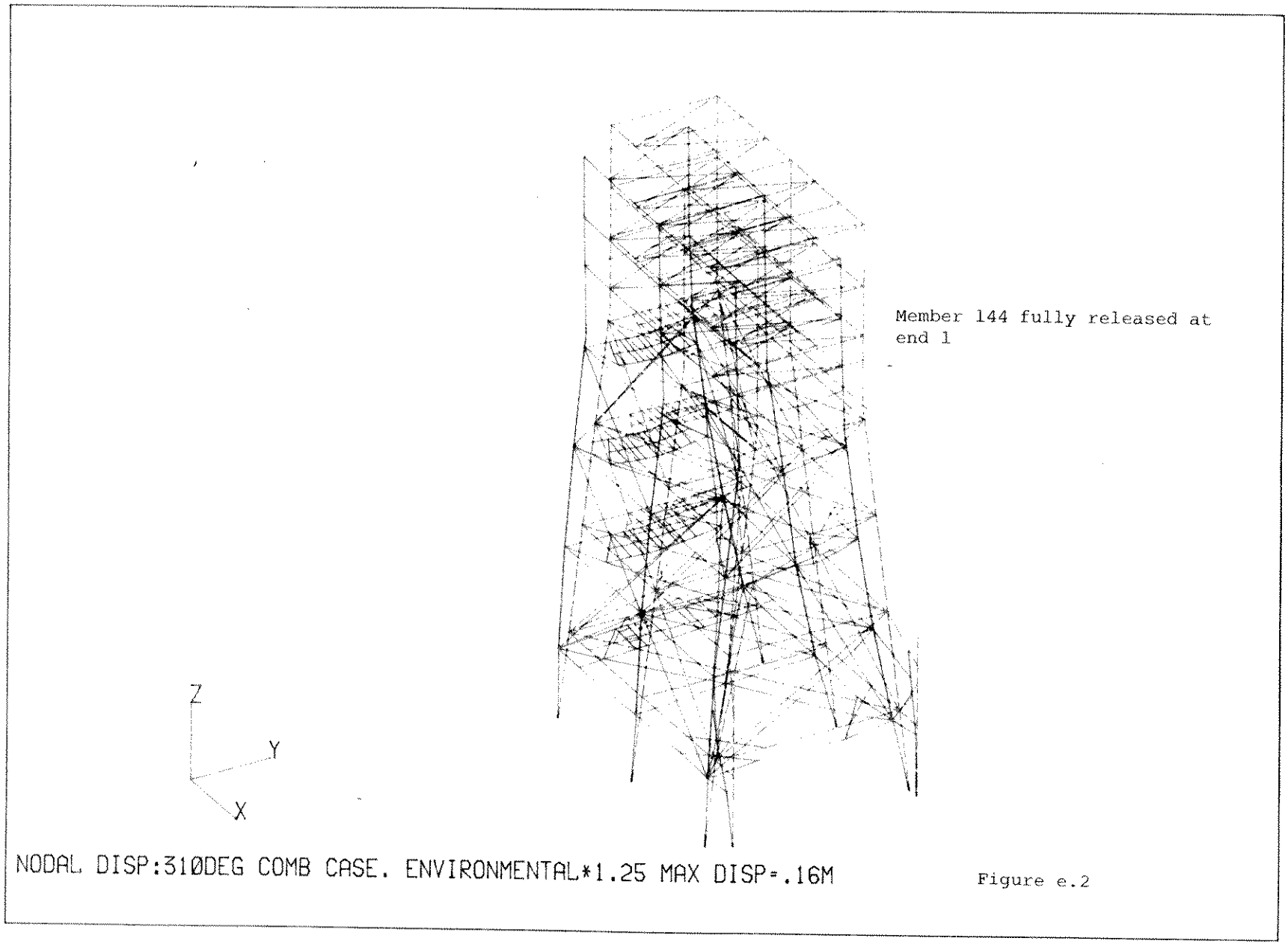
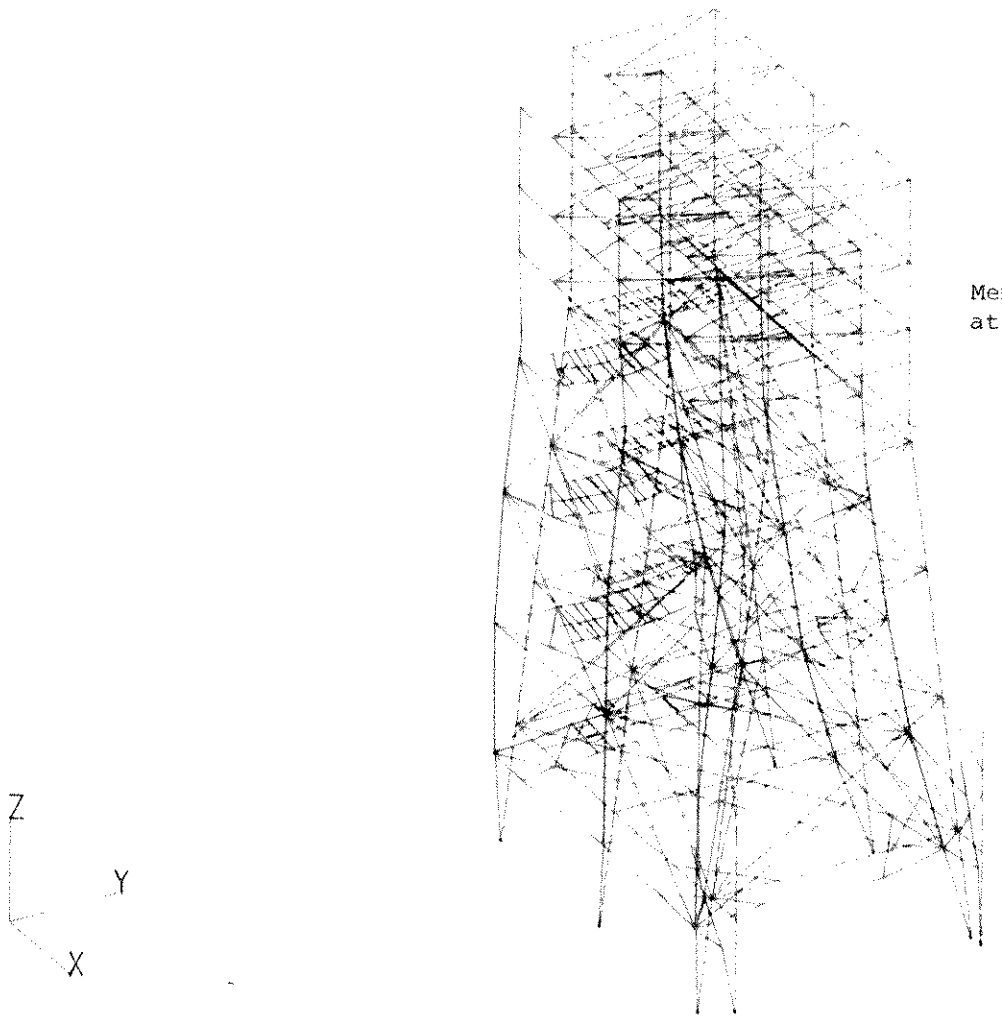

USER- VTOPAT
FRAME 1
22-DEC-93 09:56:39 \\DUA3:[PALS.UI]PATRAN.HRD;4
Member 144 fully released at end 1
Z
Y
X
NODAL DISP:310DEG COMB CASE. ENVIRONMENTAL*1.25 MAX DISP=.16M

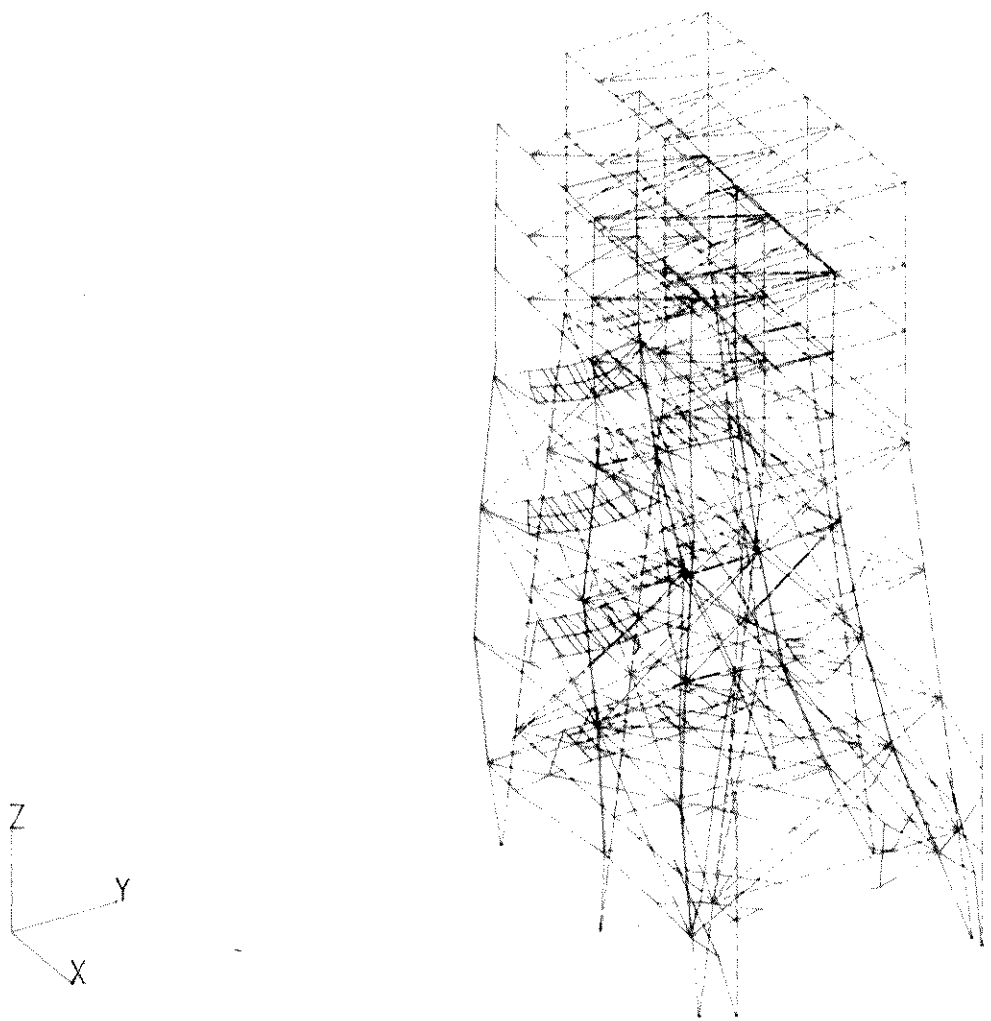
Figure e.2



Member 144 fully released
at end 1

NODAL DISP:310DEG COMB CASE. ENVIRONMENTAL*1.75 MAX DISP=.25M

Figure e.3



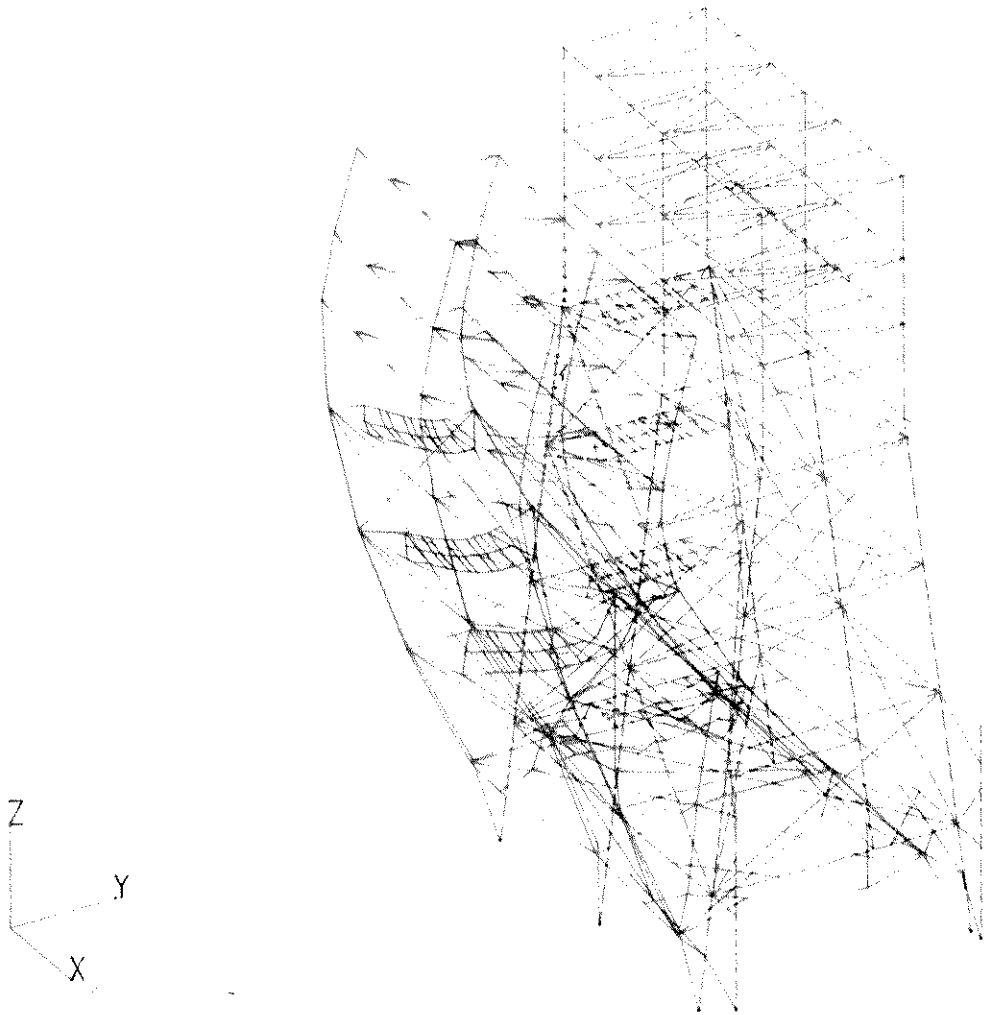
NODAL DISP:310DEG COMB CASE. ENVIRONMENTAL*2.0 MAX DISP=.35M

Member 144 fully released
at end 1

Figure e.4

USER* VTOPAT
FRAME 4

22-DEC-93 09:57:25 $21DUA3:[PALS.U]PATRAN.HRD;4



NODAL DISP:310DEG COMB CASE. ENVIRONMENTAL*2.235 MAX DISP=.79M

Member 144 fully released
at end 1

Figure e.5

AISC Check Summary TABLE e.2

MEMBER No.	STATION POSITION	CASE No.	INTERACTION RATIO	C-T FLAG	
70	0.50	101	1.005 *	(T)	
57	1.00	101	1.005 *	(T)	
312	1.00	101	1.004 *	(T)	
152	0.50	101	1.004 *	(C)	
151	0.00	101	1.003 *	(T)	
87	0.00	101	1.003 *	(C)	
164	1.00	101	1.003 *	(T)	
233	0.50	101	1.002 *	(C)	
232	0.50	101	1.002 *	(C)	
54	1.00	101	1.002 *	(T)	
250	0.50	101	1.002 *	(C)	<---
256	0.50	101	1.002 *	(T)	
328	0.00	101	1.001 *	(C)	
77	0.25	101	1.001 *	(C)	
266	0.00	101	1.000 *	(T)	
41	1.00	101	0.999	(C)	
78	0.50	101	0.999	(C)	
153	1.00	101	0.999	(T)	
65	0.50	101	0.999	(C)	
231	1.00	101	0.999	(C)	
274	1.00	101	0.999	(T)	
263	0.25	101	0.999	(C)	
64	0.50	101	0.999	(C)	
42	0.50	101	0.998	(C)	
280	0.00	101	0.997	(T)	
245	1.00	101	0.997	(C)	
9	0.00	101	0.995	(T)	
161	1.00	101	0.995	(T)	
259	1.00	101	0.994	(T)	
12	1.00	101	0.993	(T)	
249	0.75	101	0.993	(C)	
55	0.00	101	0.993	(T)	
159	0.50	101	0.993	(C)	
74	0.00	101	0.991	(T)	
279	1.00	101	0.988	(T)	
158	0.50	101	0.988	(C)	
225	0.50	101	0.987	(C)	
281	1.00	101	0.985	(C)	
230	0.00	101	0.985	(C)	

leg ---> member

MEMBER STRENGTH RESULTS FOR DAMAGED STRUCTURE.
ENVIRONMENTAL LOADING * 2.235
MEMBER 144 fully released at end 1.

API Check Summary : 19th Edition Results. TABLE e.3

JOINT NO.	BRACE NO.	CASE NO.	CLASSIFICATION %K	%X	%YT	INTERACTION RATIO BENDING	OVERALL
146	172	101	67.7	0.0	32.3	0.169	1.003 **
40	52	101	0.0	0.0	100.0	0.826	0.998
161	282	101	0.0	0.0	100.0	0.195	0.995
36	53	101	0.0	0.0	100.0	0.921	0.992
37	52	101	0.0	0.0	100.0	0.852	0.992
32	74	101	45.5	0.0	54.5	0.060	0.990
41	53	101	0.0	0.0	100.0	0.889	0.990
158	279	101	0.0	0.0	100.0	0.888	0.984
159	280	101	0.0	0.0	100.0	0.935	0.979
160	281	101	0.0	0.0	100.0	0.865	0.970
87	74	101	45.5	0.0	54.5	0.025	0.899
173	293	101	0.0	0.0	100.0	0.946	0.898
37	48	101	0.0	0.0	100.0	0.919	0.884
183	312	101	76.4	0.0	23.6	0.484	0.875
10	64	101	27.0	0.0	73.0	0.007	0.859
89	71	101	90.0	0.0	10.0	0.005	0.847
10	70	101	42.3	0.0	57.7	0.000	0.840
157	278	101	0.0	0.0	100.0	0.888	0.837
135	171	101	41.1	0.0	58.9	0.032	0.820
30	37	101	0.0	0.0	100.0	0.149	0.809
46	60	101	0.0	0.0	100.0	0.033	0.795
142	239	101	0.0	0.0	100.0	0.803	0.787
146	164	101	63.2	0.0	36.8	0.014	0.786
89	165	101	100.0	0.0	0.0	0.040	0.786
172	302	101	0.0	0.0	100.0	0.607	0.769
162	249	101	49.4	0.0	50.6	0.086	0.756
195	259	101	51.0	0.0	49.0	0.054	0.754
186	256	101	50.3	0.0	49.7	0.027	0.750
32	40	101	0.0	16.1	83.9	0.015	0.733
89	159	101	100.0	0.0	0.0	0.021	0.730
14	71	101	56.3	0.0	43.7	0.005	0.720
64	89	101	91.9	0.0	8.1	0.007	0.702
89	78	101	80.6	0.0	19.4	0.008	0.699
186	322	101	0.0	27.1	72.9	0.105	0.686
171	281	101	0.0	53.6	46.4	0.422	0.673
64	151	101	100.0	0.0	0.0	0.011	0.669
197	263	101	6.9	0.0	93.1	0.086	0.659
99	170	101	93.0	0.0	7.0	0.025	0.647
189	320	101	0.0	0.0	100.0	0.168	0.644

JOINT STRENGTH RESULTS FOR DAMAGED STRUCTURE.
ENVIRONMENTAL LOADING * 2.235
MEMBER 144 fully released at end 1.

OBSERVATIONS ON PLATFORM No 3

The deterministic collapse analyses performed on this platform have involved over 120 axial and moment restrictions.

Applying the stated criteria, the final factor on the environmental loading for all the cases examined are:

Analysis	Environmental Loading Factor
All members fully effective	2.245
member 65 restricted at end 2 to 0.75	2.235
member 65 restricted at end 2 to 0.50	2.220
member 65 fully released at end 1	2.175
member 144 fully released at end 1	2.235

Member 65 is a leading diagonal in Row A whilst member 144 is a horizontal member on plan EL. -22.0.