INVESTIGATION OF THE JUNE 6, 1994 COLLAPSE OF A RADIO TOWER IN SELMA, ALABAMA

U.S. Department of Labor
Occupational Safety and Health Administration

October 1994

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October 1994

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INTRODUCTION

A 350' high guyed radio transmission tower collapsed during the final phases of its construction on June 6, 1994 at approximately 9:00 AM in Selma, Alabama. The tower structure consisted of twenty-five pre-fabricated steel sections, each 10 or 20 ft in height. The erection of the tower sections started on May 20 and was completed on May 23, 1994. A masonry building was then constructed about 10 ft north of the tower to house the electrical equipment needed for the radio transmission. On June 3, 1994, three FM antennas were hoisted and fastened to the top sections of the tower using a new position of the snatch block located above the roof of the electrical equipment building. Prior to the construction of the electrical equipment building, the snatch block was positioned at the base of the structure during the erection of the tower sections. On the morning of June 6, two workers positioned near the top section of the tower, having completed the fastening of the coaxial cable to the top section of the tower, were beginning to lower the erection gin pole from the top section of the tower to the ground. The gin pole suddenly dropped and struck the coaxial cable, followed by the collapse of the tower structure. See Figure 1.4. Both workers, who were tied to the collapsing tower, fell to the ground. The accident resulted in the death of one worker and serious injuries to the other.

The compliance officer from the Occupational Safety And Health Administration (OSHA)'s Mobile Area Office arrived at the construction site on the following morning to gather information relating to the activities preceding the accident. The compliance officer took photographs of the accident site and the collapsed tower sections, interviewed workers and the owners of the tower erection company and the radio station. The Office of Construction and Engineering, OSHA National Office in Washington DC, was requested by the OSHA Regional Office, Atlanta, GA to provide assistance to the Area Office in the investigation of the accident. Structural Engineers from the Office of Construction and Engineering visited the accident site on June 8, 9, and on June 26, 1994 to examine the collapsed structure, take necessary measurements of the tower sections, obtain pertinent information about the fabrication and design of the tower section and to interview the personnel of the tower erection company.

The OSHA investigation included eyewitness accounts, interviews of the construction workers, review of the tower erection procedure, observation of the collapsed structure and engineering calculations. Throughout the course of the investigation, the Office of Construction and Engineering worked together with the Mobile Area Office, whose contributions are hereby acknowledged.

1.0 DESCRIPTION OF THE PROJECT AND THE ACCIDENT

The structure under construction in Selma, Alabama was a 350 feet high guyed radio transmission tower. A tower company (hereafter called the contractor) was contracted by the owner of the radio station to furnish and erect the tower. The contractor proposed to use fifteen new 10' high sections bought from a nationally known tower manufacturing company and ten old sections salvaged from two towers demolished earlier at other locations. The new and used tower sections were delivered to the job site on May 17, 1994.

The contractor also furnished other construction materials, e.g. gin poles, guywires, anchors, lighting kits, beacons, and sidelights [see Appendix A- Contract Agreement]. The contractor stated that the radio tower structure was not designed by a professional engineer. He, however, claimed that the assembly of the tower was accomplished as per construction details contained in the ROHN's commercial product catalog for a 350' high tower.

The bottom 80 ft of the tower consisted of four 20' high tower sections salvaged from a 330' high old tower demolished sometime back by the contractor at a different location. The vertical and horizontal members consisted of steel pipes. The diagonals were square solid bars. The tower sections were triangular in plan, each side equal to 18".

The middle 120 ft of the tower consisted of six 20' high tower sections, also salvaged from an old radio tower which was acquired by the contractor in November 1993. All members of the section consisted of solid square bars. See Figure 1.1. The middle sections were also triangular in plan, each side being 18".

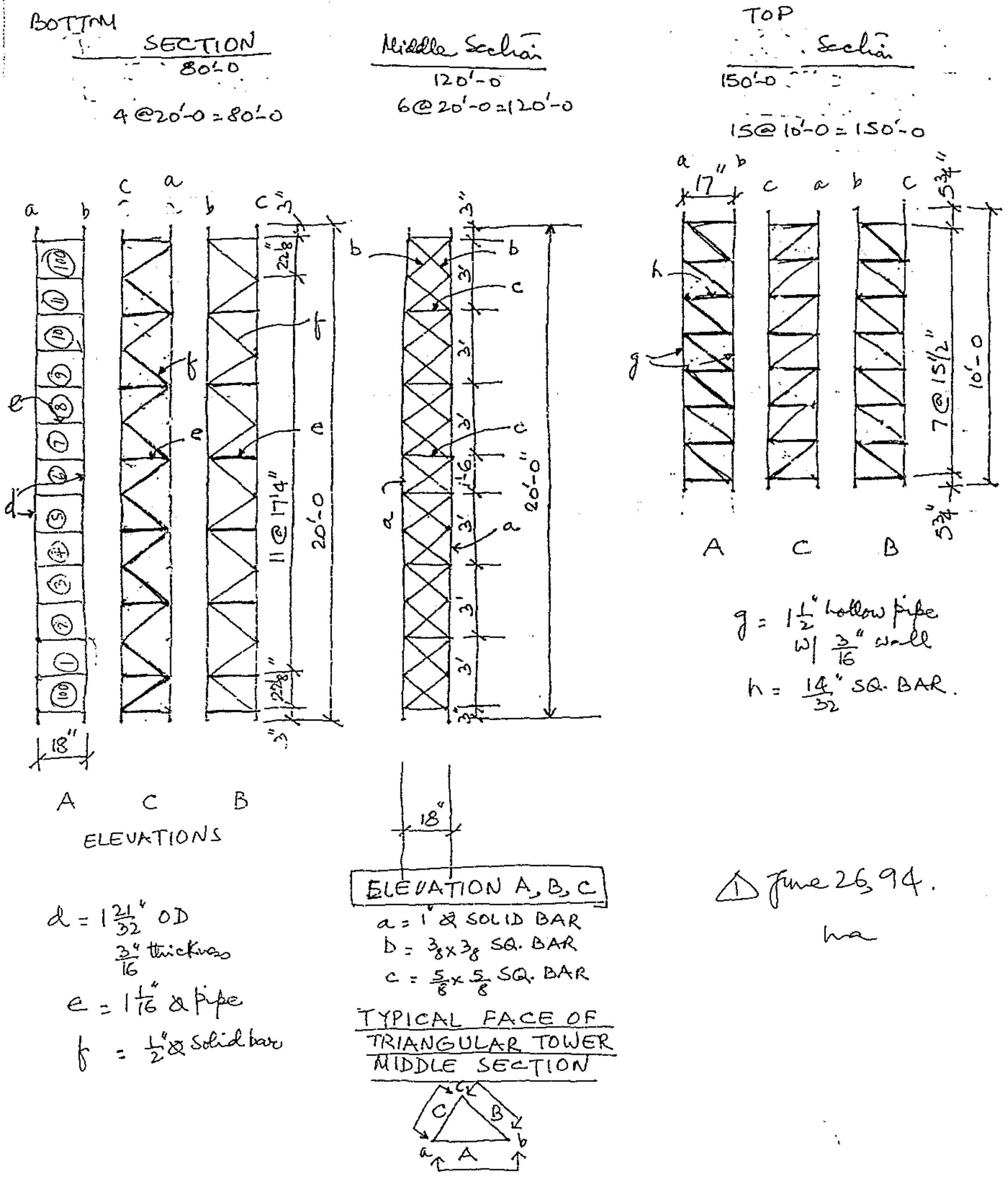
The upper 150 ft of the tower consisted of fifteen new 10' high sections manufactured by ROHN CO. The vertical members consisted of steel pipe sections, while the horizontal and diagonal members were solid square bars. The ROHN tower sections were also triangular in plan, each side being equal to 17". See Figure 1.1.

The tower was guyed at eight levels at approximate elevations of 50', 75', 100', 150', 200', 250', 290', and 350' above the base. At each level, there were three guy wires, 120 degrees apart. The guywire cables at the upper four levels were 5/16" in diameter and were anchored to a steel plate/rod assembly embedded in a concrete foundation located approximately 280 ft from the tower base (identified as the outer anchor). The guywire cables at the lower four levels were 1/4" in diameter and were attached to a similar steel plate/rod assembly anchored into a concrete foundation located at about 100 feet from the base (identified as the inner anchor). See Figure 1.2. Field observation of the failed tower structure confirmed the location of the guywire cables at the approximate elevations mentioned above. The inground anchor locations were also verified by a survey company.

See Figure 1.3. A local engineering firm, contracted by the Mobile Area Office, conducted the site survey a few days after the accident. See Figure 1.4 for the collapsed tower structure.

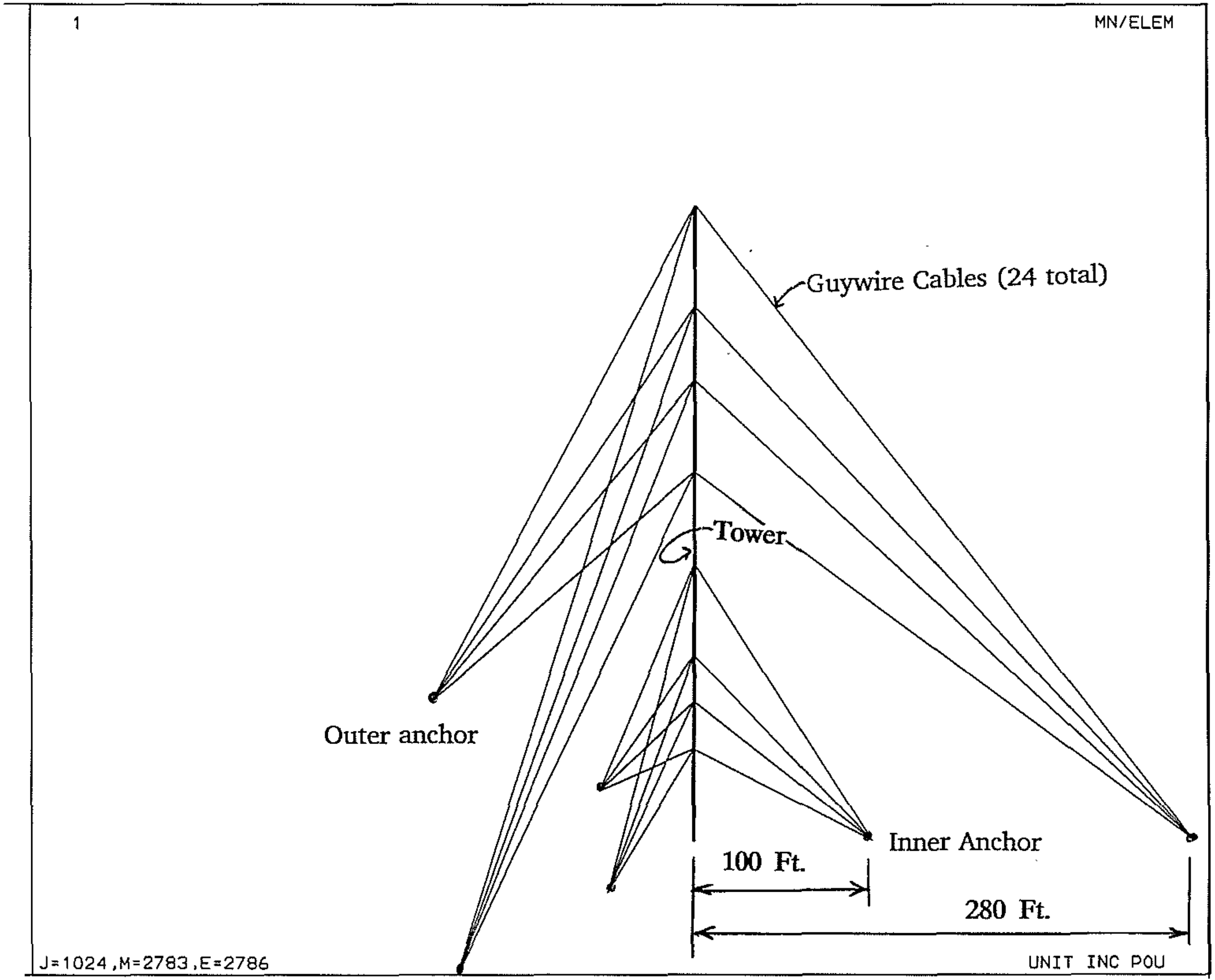
The tower section was erected employing a gin pole and double drum hoists system. This erection method is commonly used by the construction companies for these types of towers. The lower 80 ft of the tower was assembled on the ground and positioned on the concrete slab foundation by a crane. The guywire cables were installed and tensioned. A gin pole was then raised to the top of the structure by a hoist line from the winch truck through a snatch block located near the bottom of the tower. The winch truck was located at the north of the tower structure. After being hoisted to the proper elevation, the gin pole was fastened to the tower legs with wire rope/hook at its middle and bottom locations. Guided with a tag line, each tower section was then raised and placed atop of the previously erected section using the winch truck's second hoist line through the tower base snatch block. Figure 1.5 is a schematic view of the erection procedure. Two workers at the top of the tower aligned and bolted the newly placed tower section to the lower one. The gin pole was then detached, hoisted to the next higher elevation, and re-fastened to the tower for setting the next section. The above erection procedure was followed until the tower was completed. Guywires were installed at the specified locations and were tensioned to approximately 10 percent of their ultimate breaking strength.

The erection of the tower sections began on May 20 and was completed on May 23, 1994. Following the completion of the tower, a masonry building 10' X 11' in plan was constructed to house the electrical equipment approximately 10 ft north of the tower. When the work on the tower resumed on June 3, 1994, the foreman decided to reposition the snatch block at an elevation of approximately 22 feet above the base to clear the height of the equipment building. The snatch block was needed to hoist the antennas and co-axial cable. The antennas were then hoisted and placed in position and fastened to the tower. On the morning of June 6, 1994, two workers climbed to the tower top, made final adjustments to the antenna, and completed the hoisting of approximately 350 ft coaxial cable to the top. After tieing the top end of the cable to the tower leg, the workers were beginning to lower the gin pole. It was reported that the gin pole then suddenly slipped approximately 3 ft downward, struck the coaxial cable, and then the tower collapsed. The accident resulted in the death of one worker and serious injuries to the other.

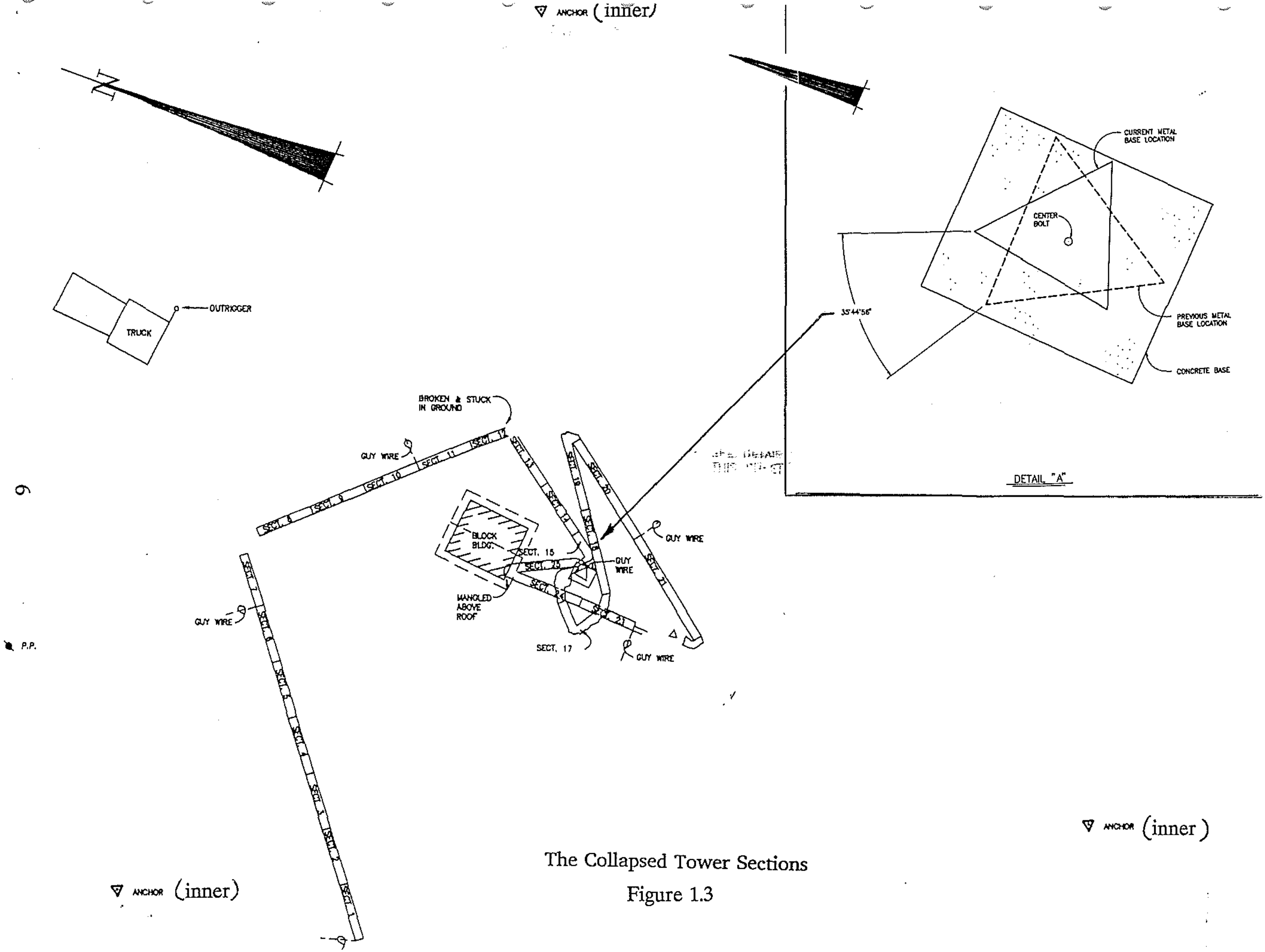


Tower Section Measurements

Figure 1.1

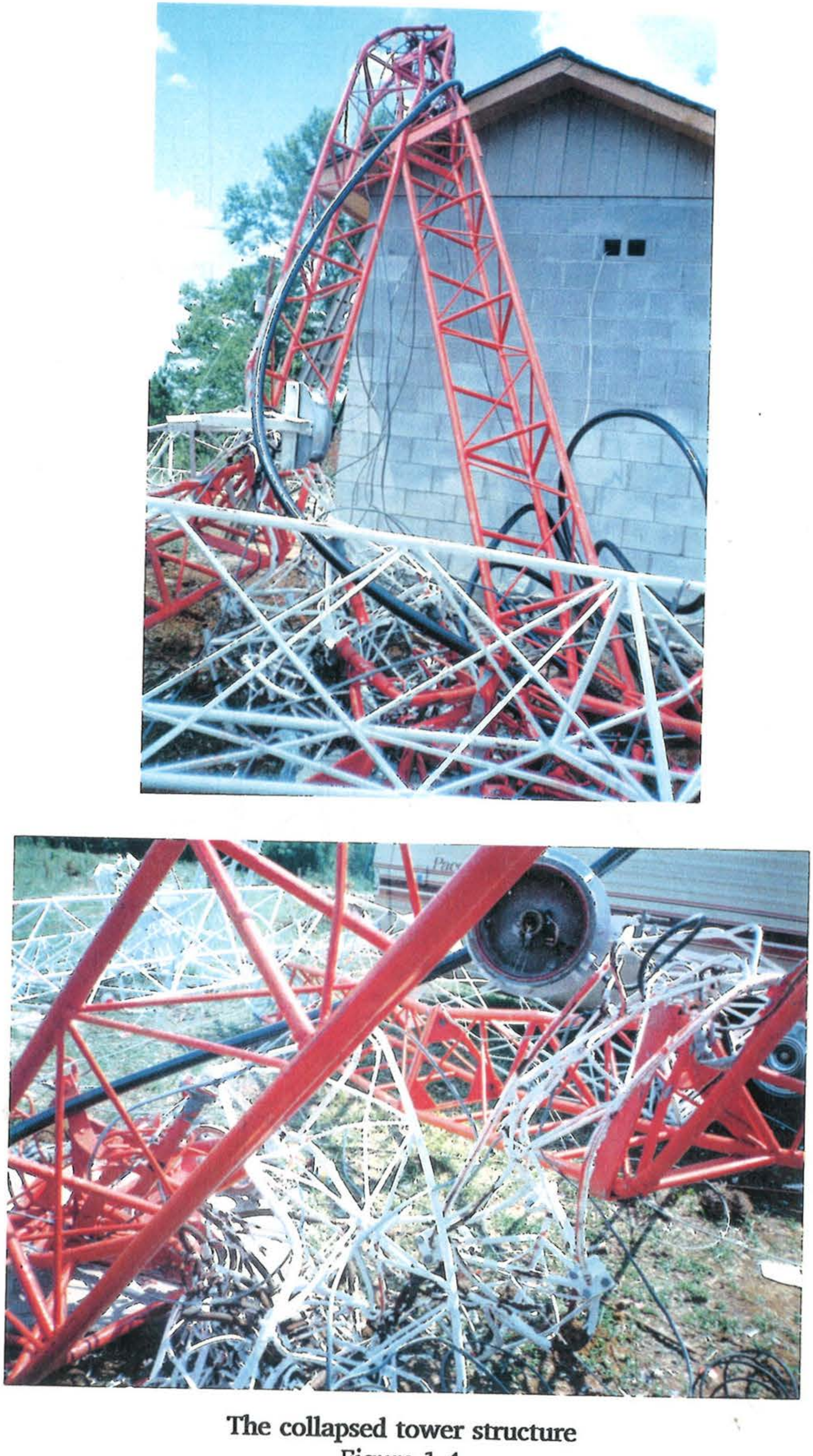


Tower Structure-Computer Model
Figure 1.2



The Collapsed Tower Sections

Figure 1.3



The collapsed tower structure
Figure 1.4

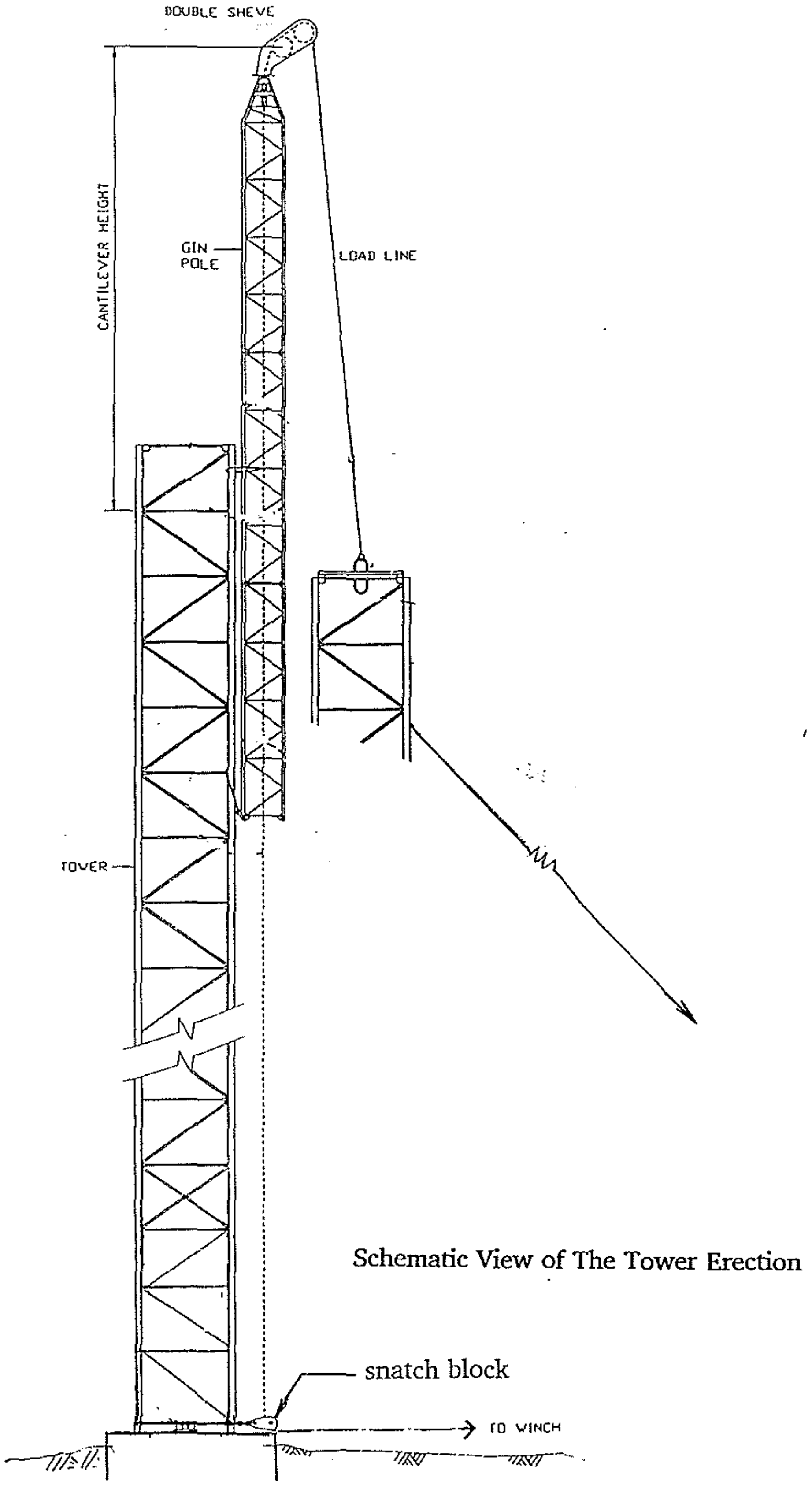

DOUBLE SHEVE
CANTILEVER HEIGHT
GIN POLE
LOAD LINE
TOWER
Schematic View of The Tower Erection
snatch block
TO WINCH

Figure 1.5

2.0 FIELD OBSERVATION OF THE FAILED STRUCTURE

The upper 15 new tower sections (identified as Section 1 thru Section 15 in Figure 1.3) fell to the ground in two straight pieces and appeared to be intact. The gin pole, antennas, and the top seven sections of the tower remained connected to each other and landed approximately 60 ft to the north-west of the tower base. Section 7 and Section 8 were separated at the bolted splice joint. Section 8 thru Section 12 remained connected and landed at approximately 30 feet east of the base.

The middle tower portion comprising of six previously used tower sections, identified as Section 16 thru 21 in Figure 1.3, landed in pieces at different locations. Section 16 was buckled and twisted, and landed near the tower base. See Figure 2.1. Section 17 remained connected to Section 16 and 18 at each end, but suffered a 90 degree bend at the mid-location. Its members were severely damaged. Sections 18 and 19 and Sections 20 and 21 fell in two straight segments, disengaging near the bottom of Section 19.

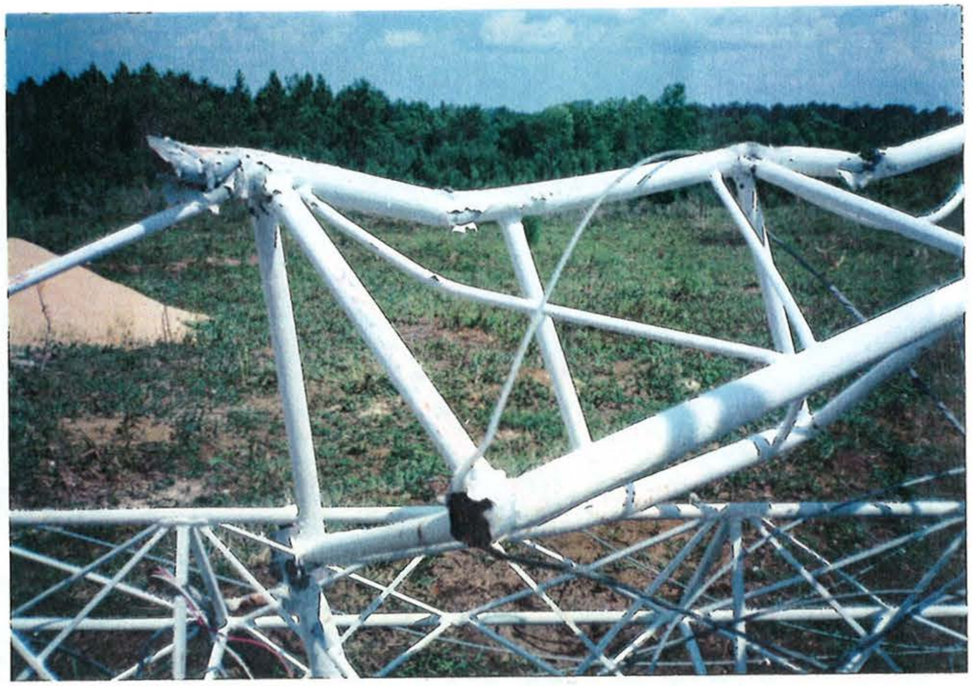
The lower 80 ft of the tower was comprised of four previously used sections, identified as Section 22 thru 25 in Figure 1.3. The vertical and horizontal members of this used tower section were steel pipes whereas the diagonal members were solid steel bars. Sections 22 and 23 were observed to be fractured at several places. At their fractured locations, the steel pipes were observed to be extensively rusted on the inside and were clogged with dirt and debris. See Figure 2.2. Wall thicknesses of the rusted pipe sections were measured to be 1/8" to 1/16" according to the CSHO of the Mobile Area Office. A representative of the Insurance Company indicated that due to the corrosive damage, the pipe wall was reduced to 0.001" [Ref. Engineer Report 94258-Tower Failure, By Cerny & Ivby Engineer, Inc]. Section 24 failed and bent at the location of snatch block attachment. The bottom of this section with the snatch block connected to Section 25 fell towards the direction of the winch truck with the top end resting on the equipment building roof. See Figure 2.3. The upper portion of Section 24 and Section 23 fell in one piece and landed to the west side of the tower base. Longitudinal splits at several places of the lower tower sections were also observed.

The tower's base plate was observed to have rotated from its original position. It was determined, by the surveyor, that the rotation was approximately 35.5° counter-clockwise. The tower's triangular-shaped steel base plate bent upward at one of its apexes. See Figure 2.1. All guywires were observed to have been installed close to their intended locations at the tower legs. The connection details of the guywire to the tower leg, however, varied from location to location. Guy brackets normally used for this type of connection were not used at any guywire/tower locations.

The inner concrete anchors for the lower four guywires were located approximately 120° apart at 100 ft from the tower base. The inner anchor steel plates were provided with only three holes for attachment of three guywires only. As there were four guy wires instead of three, the fourth guywire was fastened to the middle hole's eye bolts (ie. two guywires shared the same hole, see Figure 2.4) at two anchor plate locations. At the third anchor location, an additional hole was provided to one side of the plate for fastening of the fourth guywire. See Figure 2.4. The inner anchor steel rods were embedded into the ground and appeared to remain undisturbed. The outer anchors, also 120° apart, were located at a distance of approximately 280 ft from the tower base. The steel plates with four guywires attached appeared undamaged. However, a substantial length of the steel anchor rods was exposed. See Figure 2.5. The anchor rods for this type of guywire attachment are generally intended to be embedded a minimum of four feet into the ground, see ROHN's construction details - Figure 2.6 . Information contained in the ROHN's Commercial Product catalog referred by the contractor indicates that towers of this height would normally be braced with eight tension guywires in each tower leg, five of the upper guywires to be attached to the outer plate anchored at approximately 180 ft from the tower, and the lower three guywires to be tied to the inner plate and anchored at approximately 100 ft from the tower base. See Figure 2.7. The gin pole was attached to to the tower legs with wire rope/hook. The upper hook had a safety latch that was defective, and the lower snatch block had the safety latch removed.

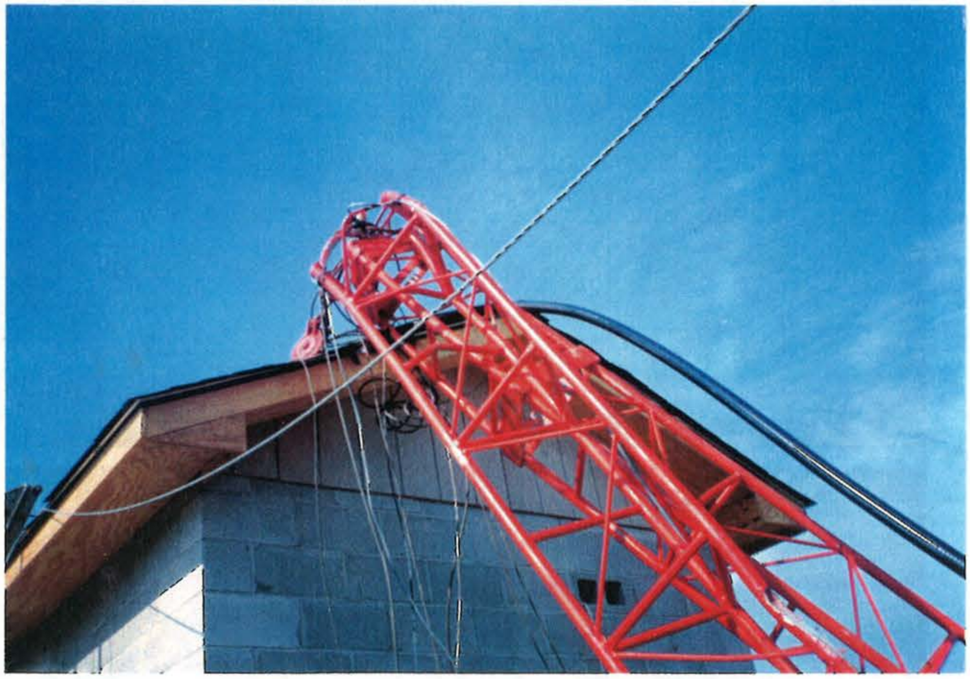
The Buckled Middle Tower (Section 16)-top photo
The Rotated/Bent[illegible] Tower Base Plate- bottom photo

Figure 2.1



The Corroded Lower Tower Members (Sections 22 and 23)

Figure 2.2



Snatch Block and Tower Sections 24/25 Rested On Top of The Building

Figure 2.3

Three inner anchors

Figure 2.4

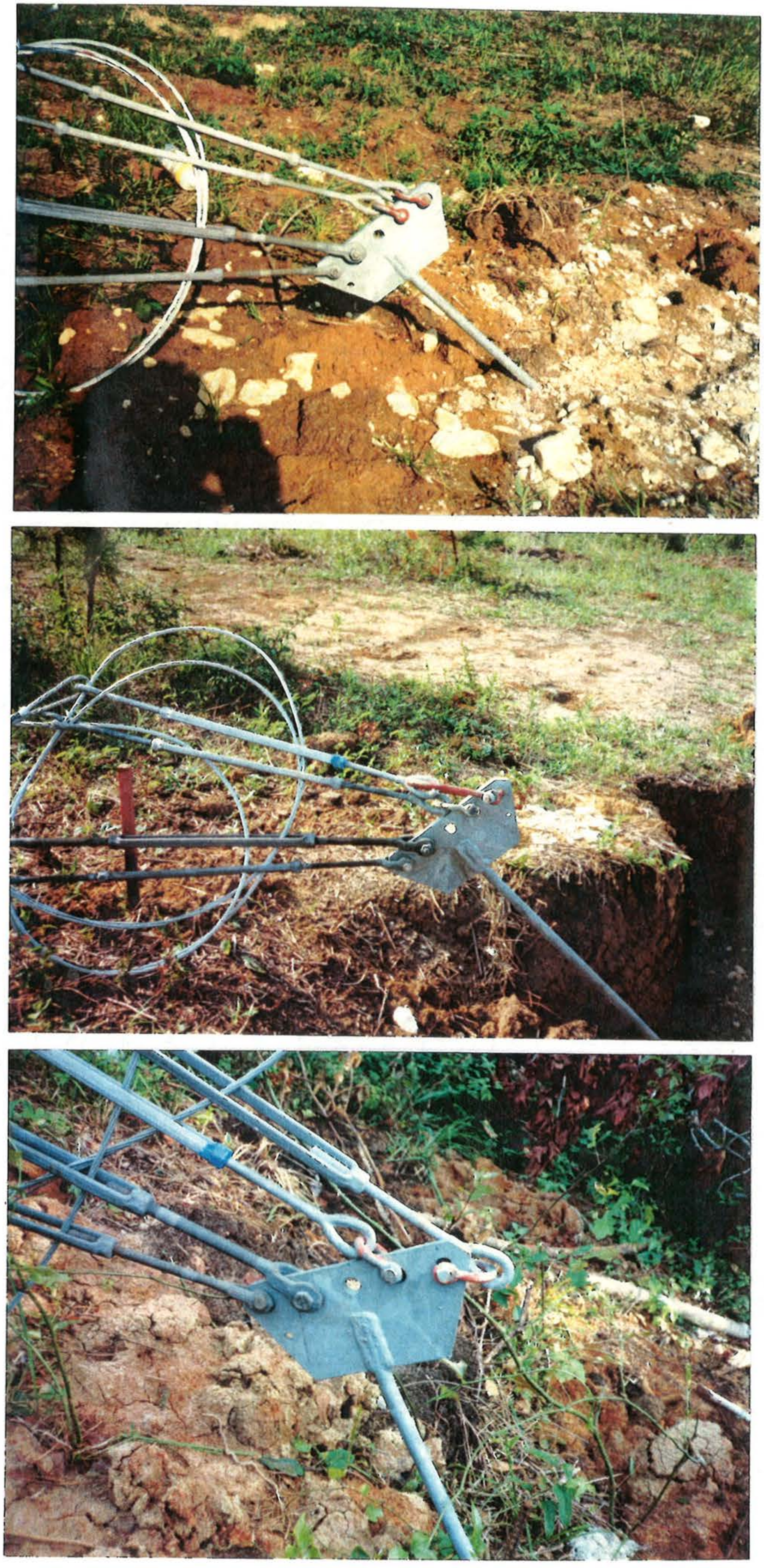
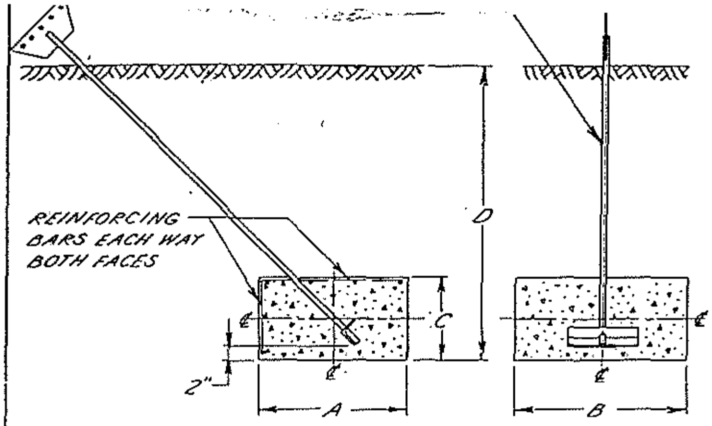
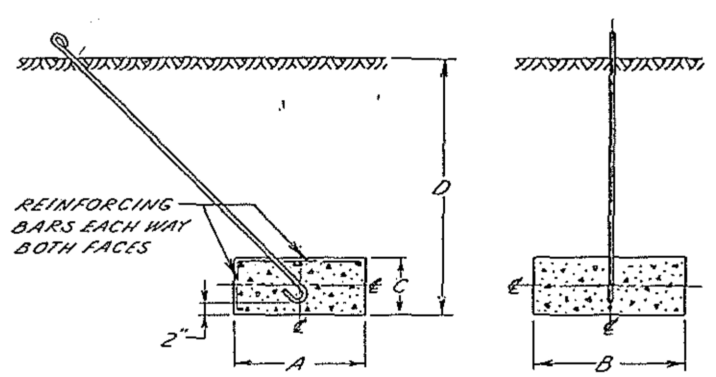


Figure 2.5

Three outer anchors-showing exposed steel rods



ANCHOR DETAIL FOR GAC 34, 56, 57, & 58
SHOWN ON DWG. NO. C 660415



ANCHOR DETAIL FOR GAC 30.

R9 NOTE: DUE TO VARIABLES INVOLVED IN ROOF AND OTHER INSTALLATIONS, IT SHALL BE THE CUSTOMER'S OR INSTALLER'S RESPONSIBILITY TO PROVIDE STRUCTURALLY ADEQUATE SUPPORTS FOR PIER & ANCHOR CONNECTIONS. IT MAY ALSO BE NECESSARY FOR THE CUSTOMER OR INSTALLER TO SECURE THE SERVICE OF A LOCAL ENGINEER TO DETERMINE THAT INSTALLATION COMPLIES WITH LOCAL BUILDING CODES.

GENERAL NOTES

FOR REQUIRED MATERIAL SPECIFICATIONS, INSTALLATION NOTES AND TOLERANCES SEE DRAWING NUMBER B841300.

1. MINIMUM ½" DIAMETER REINFORCING BARS IN ALL ANCHORS WITH MAXIMUM SPACING OF 12" EXCEPT NO. 10 BLOCK MAXIMUM SPACING OF 6".

CONCRETE ANCHOR DATA

DEPTH, D (FT.)	ROD NO.	BLOCK NO.	ANCHOR DIMENSIONS (FT.) A	B	C	WEIGHT CONCRETE (LBS)	CONCRETE (CU. YDS.)	UPLIFT * CAPACITY (LBS)	LATERAL CAPACITY (LBS)
3	GAC 30	3a	1.5	1.5	1	310	.08	900	1,500
		3b	2	2	1	560	.15	1,320	2,000
		3c	2.5	2.5	1	870	.23	1,810	2,500
		3d	3	3	1	1,260	.33	2,535	3,000
		3e	3	4	1	1,680	.44	3,020	4,000
4	GAC 30 OR GAC 34	4a	3	3	1.5	1,890	.50	3,490	5,850
		4b	3	4	1.5	2,520	.67	4,360	7,800
		4c	3	5	1.5	3,150	.84	4,985	9,750
		4d	3	6	1.5	3,780	1.00	6,090	11,700
		4e	4	6	1.5	5,050	1.33	7,660	11,700
6	GAC 56	6a	3	4	1.5	2,520	.67	10,035	12,600
		6b	3	5	1.5	3,150	.84	11,600	15,750
		6c	3	6	1.5	3,780	1.00	13,150	18,900
		6d	4	6	1.5	5,050	1.33	15,850	18,900
8	GAC 57	8a	3	5	1.5	3,150	.84	22,150	21,750
		8b	3	6	1.5	3,780	1.00	24,700	26,100
		8c	4	6	1.5	5,050	1.33	28,500	26,100
		8d	6	6	2.0	10,800	2.67	33,380	33,600
10	GAC 58	10a	3	6	2.0	5,040	1.33	37,450	43,200
		10b	4	6	2.0	6,720	1.78	42,700	43,200
		10c	4	7	2.0	7,840	2.07	46,800	50,400
		10d	5	7	2.0	9,800	2.59	52,350	50,400
		10e	5	9	2.0	12,600	3.33	61,700	64,800

* INCLUDES SAFETY FACTOR OF 2

* * NORMAL SOIL IS A COHESIVE TYPE SOIL WITH A HORIZONTAL BEARING CAPACITY OF 400 POUNDS PER SQUARE FOOT PER LINEAL FOOT OF DEPTH. ROCK, NON-COHESIVE SOILS, OR SATURATED OR SUBMERGED SOILS ARE NOT TO BE CONSIDERED AS NORMAL.

NO.	DESCRIPTION	DATE	BY
R13	INCREASED ROD LENGTHS; PART NO. GAC30 WAS GAC25	6-30-88	
R12	REV GEN NOTE & ADDED 'B841300' NOTE	1-9-85	RKB
R11	REVISED ANCHOR DETAIL DWG. NO.	8-18-77	RLH
R10	REMOVED RS-222-B FROM GEN. NOTE NO. 1	3/7/77	GLS
R9	ADDED NOTE	7-6-76	OH
R8	REVISE DESIGN NOTE 1.	1-14-75	
R7	REVISE DESIGN NOTE 1 & TITLE BLOCK	11-21-74	
R6	GAC-25 WAS GA-25	12-7-73	JER
R5	REVISED FOR EIA RS-222-B	4/4/73	GLS

REVISIONS

ROHN® MANUFACTURING
DIVISION OF UNR

TITLE: STANDARD CONCRETE ANCHORS

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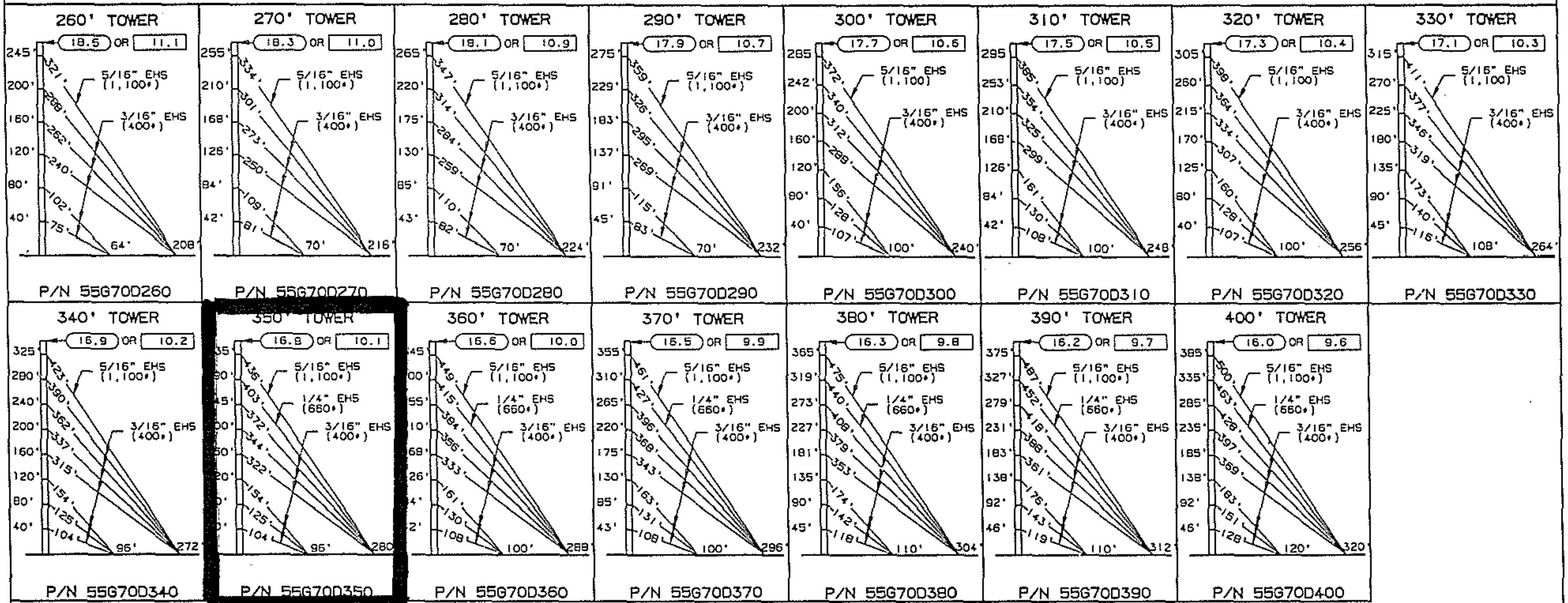
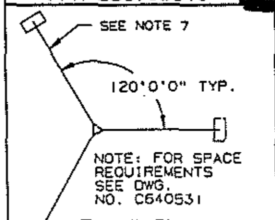
FILE NO.
SCALE: NONE
DRN. BY: GLS — DATE: 4/4/73
4-4-73
7-6-73
UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE GIVEN IN INCHES.
TOLERANCES: DEC ± FRAC ± ANGLES ±
DWG. NO. C 620643 R13

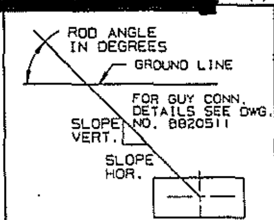
Concrete Anchor Details-from ROHN'sCatalog
Figure 2.6

Tower Guywire location as per ROHN's Product Catalog





TOWER PLAN TYPICAL



ANCHOR ROD SLOPE

GENERAL NOTES

1. TOWER DESIGN IN ACCORDANCE WITH APPROVED NATIONAL STANDARD ANSI/EIA-222-E-1991 (NO ICE)
2. ⊂⊃ALLOWABLE PROJ. AREA (SQ. FT.) FOR ROUND MEMBER ANTENNAS. □ALLOWABLE PROJ. AREA (SQ. FT.) FOR FLAT MEMBER ANTENNAS.
3. EQUIVALENT FLAT-PLATE ANTENNA AREAS, BASED ON EIA RS-222-C, MUST NOT EXCEED THE AREAS SHOWN FOR FLAT MEMBERS ANTENNAS.
4. TOWER DESIGNS INCLUDE THREE SIDE ARMS, SYMMETRICALLY PLACED, HAVING A TOTAL EFFECTIVE PROJECTED AREA EQUAL TO 8.0 SQUARE FEET. FOR SIDE ARM DETAILS (P/N SA253UA). SEE DWG. C821662 LATEST REVISION.
5. DESIGN ASSUME TWO 7/8" DIA. LINES ON EACH TOWER FACE.
6. TOWER DESIGNS, 200 FEET AND OVER, INCLUDE 2.0 SQUARE FEET OF EFFECTIVE PROJECTED AREA FOR A BEACON (DEDUCT ONE 7/8" LINE FOR BEACON.)
7. ANCHOR RADIUS IS FROM TOWER BASE TO INTERSECTION OF ROD WITH GROUND.
8. TOWER DESIGNS AND GUY CHORD LENGTHS SHOWN ARE BASED ON LEVEL GROUND. ADD 6 PERCENT TO CHORD LENGTHS (FOR SAG AND CONNECTIONS) FOR FINAL CUT LENGTHS. ( ) INDICATES INITIAL TENSION FOR GUY WIRES IN POUNDS AT 60 DEGREES FAHRENHEIT.
9. DO NOT INSTALL OR DISMANTLE TOWERS WITHIN FALLING DISTANCE OF ELECTRICAL AND/OR TELEPHONE LINES.
10. TOWER ERECTION AND DISMANTLING MUST BE BY QUALIFIED AND EXPERIENCED PERSONNEL.
11. TEMPORARY STEEL GUYS, WHEN REQUIRED DURING ERECTION OR DISMANTLING, MUST BE SUPPLIED AND INSTALLED BY THE ERECTOR.
12. INSTALL WARNING PLATE (P/N ACWS) IN A HIGHLY VISIBLE LOCATION.
13. ALL ANTENNA INSTALLATIONS MUST BE GROUNDED IN ACCORDANCE WITH LOCAL AND NATIONAL CODES.
14. EXTRA CABLE CLAMPS HAVE BEEN PROVIDED FOR TURNBUCKLE SAFETY REQUIREMENTS. FOR DETAILS SEE DWG. B680324 LATEST REVISION.
15. FOR GUY HARDWARE INSTALLATION DETAILS SEE DWG. A871382.

TOWER HT.	BASE PIER REF. DWG. C610621		ANCHOR DATA REF. DWG.: BLOCK-C620643; ROD-C660415							ANCHOR DATA REF. DWG.: BLOCK-C620643; ROD-C660415						
	NO.	REAC. LBS.	BLOCK NO.	ROD NO.	ROD ANGLE	SLOPE HOR.	SLOPE VERT.	REAC. LBS. HOR.	REAC. LBS. VERT.	BLOCK NO.	ROD NO.	ROD ANGLE	SLOPE HOR.	SLOPE VERT.	REAC. LBS. HOR.	REAC. LBS. VERT.
260'	CB2	14,940	4A	GAC303	42.6	12	11	1,350	1,250	4D	GAC345501	42.7	12	11.1	5,470	5,040
270'	CB2	15,330	4A	GAC303	41.5	12	10.6	1,410	1,250	4D	GAC345501	42.7	12	11.1	5,610	5,170
280'	CB2	15,800	4A	GAC303	42.2	12	10.9	1,420	1,280	4D	GAC345501	42.6	12	11.0	5,780	5,320
290'	CB2	16,460	4A	GAC303	43.7	12	11.5	1,450	1,390	4D	GAC345501	42.7	12	11.1	5,950	5,480
300'	CB2	17,590	4A	GAC303	38.5	12	9.5	2,250	1,790	4D	GAC345501	43.5	12	11.4	5,930	5,620
310'	CB2	18,240	4A	GAC303	39.9	12	10	2,300	1,920	4D	GAC345501	43.6	12	11.4	6,060	5,760
320'	CB2	18,650	4A	GAC303	39.5	12	9.9	2,320	1,910	4D	GAC345501	43.4	12	11.3	6,260	5,910
330'	CB2	19,190	4A	GAC303	39.7	12	10	2,420	2,010	4D	GAC345501	43.6	12	11.4	6,360	6,040
340'	CB2	20,110	4A	GAC303	39.6	12	9.9	2,200	1,830	4E	GAC345501	42.2	12	10.9	7,410	6,730
350'	CB3	21,100	4A	GAC303	39.6	12	9.9	2,190	1,810	4E	GAC345501	42.1	12	10.8	7,990	7,200
360'	CB3	21,650	4A	GAC303	39.6	12	9.9	2,300	1,900	4E	GAC345501	42.2	12	10.9	8,130	7,360
370'	CB3	22,430	4A	GAC303	40.5	12	10.3	2,350	2,010	4E	GAC345501	42.3	12	10.9	8,330	7,580
380'	CB3	22,750	4A	GAC303	38.9	12	9.7	2,440	1,970	6A	GAC565501	42.3	12	10.9	8,500	7,730
390'	CB3	23,210	4A	GAC303	39.4	12	9.9	2,440	2,010	6A	GAC565501	42.2	12	10.9	8,700	7,880
400'	CB3	23,400	4A	GAC303	37.0	12	9.1	2,490	1,880	6A	GAC565501	42	12	10.8	8,940	8,060

No.	Revision Description	Date	Rev By	Ckd By	Appd By
R1	REV'D EIA-222-D TO EIA-222-E	10-15-91	RKB		TS

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Scale: NONE	By	Date
Drawn:	BFY/KJ	9-1-87
Checked:	WF/KJ	9-30-87
App. Eng.:	RAM	10-1-87
App. Sales:	AE	2-12-88

Title: GUYING DETAILS FOR 260'-400' 55G TOWERS 70 MPH BASIC WIND SPEED (NO ICE)

ENG. FILE:

DRAWING NO.: C870491 R1

Figure 2.7

3.0 STRUCTURAL ANALYSIS AND DISCUSSION

Structural analyses were performed to determine the internal member stresses of the tower for the various loads experienced by the structure since the completion of the tower and the application of tensioning forces in the guywire cables. Based on the field measured dimensions, erection details provided by the contractor, and ROHN's catalog obtained from the manufacturer, a three dimensional model of the tower structure was developed and used for the structural analyses. See Figures 3.1 thru 3.7. This computer model consisting of 1024 joints and 2783 member elements represented the structure consisting of the combination of three different constructions; the bottom 80 ft of steel pipe construction, the middle 120 ft of solid pipe sections, and the upper 150 ft of new sections manufactured by ROHN.

Three guywires were modelled at each of the eight levels, the guywire cables were defined as tension members in the model and were subjected to tension forces only. The horizonal and diagonal members were assumed to be rigidly connected as they were welded to the main vertical legs of the tower.

The lower tower sections had extensive corrosive damage as discussed earlier. Wall thickness of the steel pipe member, as result of the corrosive damage, was decreased from its original 3/16" to 1/16" - 0.01". The most severe corrosion occurred between tower sections #22 and #23 at elevation approximately 50 ft to 80 ft above the base. Several analyses were performed with varying wall thicknesses in this area. Longitudinal split at some locations was also observed at the lower tower sections, but was not included in the structural evaluation. Laboratory testing to determine the material properties of the tower sections were not conducted and the analysis was based on the yield strength of the steel to be 50,000 psi. The weights of three antennas and two construction workers near the top of the tower were deemed insignificant and therefore were not considered in the analysis. The structure was then analyzed for the following conditions.

Case 1: The tower structure was analyzed based upon its original member sectional properties. Loads imposed to the structure included the tower's dead weights and the guywire tensioning forces. The guywires were assumed to have been tensioned to approximately 10% of their ultimate strength based upon the contractor's statement. Lateral forces such as wind load and other side load were not considered. Under this loading condition, the maximum combined stress (axial stress plus stress due to flexure about both principal axes) of the column members at the lower section of the tower was determined to be approximately 10,300 psi. The maximum stress at the middle solid pipe section and upper ROHN section were 11,400 psi and 8,600 psi respectively.

These stresses were considered to be within the allowable values providing an adequate factor of safety based on the yield strength of 50,000 psi of the tower members.

Case 2: The corrosive damage of the lower sections of the tower was included in this Case. The extent and locations of the corrosive damage to the lower sections were based upon the field observation of the collapsed structure which indicated that the most severe corrosion occurred at Sections #22 and #23 (between elevations 50' to 80' above the base). The steel pipe wall thickness was measured to have been reduced to 1/16" to 0.001" from the original 3/16". To account for the effects of the various degrees of corrosive damage, several analyses were performed using different wall thicknesses of vertical leg members between the elevation of 50' to 80' above the base. Loads on the structure included tower dead weight and guywire pre-tension without any lateral load. A wall thickness of 0.06" (1/16") resulted in the combined stresses of several vertical members of the lower section to be either close to or in excess of the AISC (American Institute of Steel Construction) permissible values. The interaction value of the axial compression and bending stresses was determined to be either approaching or exceeding 1.0 based on the AISC equation H1-1.

Case 3: The wall thickness of the leg members at the these elevations was further reduced to 0.03" (1/32") in this Case. The analysis determined that several members of the lower tower structure had a compressive stress greater than the permissible buckling stress, and a combined stress close to its yield strength. When checked against the AISC Equation H1-1 requirements, the interaction of axial compression and flexural bending exceeded 1.0, (for example at member 35, the interaction value was 2.08 instead of 1.0). It is, therefore, believed that some local buckling could occur if the thickness of the lower tower column was assumed to reduce to 1/32". In which case, the structure would have marginal factor of safety against failure. It was further determined that a wall thickness of 0.01" resulted in a maximum member stresses well beyond the metal yield strength. A comparison of the lower section column member stresses is presented for various wall thicknesses at selected locations in Table 1.

Case 4: The lateral forces imposed on the tower at the snatch block used to hoist the coaxial cables were considered in this Case to examine their effects on the tower structure. A lateral force of 200 lbs applied at 22 ft above the tower base resulted in additional stresses to the various part of the tower. These additional stresses were, however, considered to be small, and the lateral displacement of the tower along its' height was also determined to be insignificant.

Case 5: An applied lateral force of 1000 lbs at the location of the snatch block was considered in this Case. The stresses of some tower members increased by approximately 20 percent. The lateral displacement of the tower also increased. This higher lateral load of 1000 lbs was considered to simulate the increased horizontal load at the snatch block due to the reported sudden quick downward movement of the gin pole. The effect of the increased lateral load at the snatch block was considered significant. A tower structure of this type, in general, is not designed for any concentrated lateral load applied at locations other than the guywires or the tower base. See Table 2 for the comparison of member stresses due to lateral loads of 200 lbs and 1,000 lbs applied at approximately 22 ft above the base.

The construction details observed in the project site after the accident indicated that the tower construction was of poor quality. The following as-built conditions had significant adverse impact on the behavior of the tower structure:

1. Re-using of severely corroded tower sections without proper evaluation.

2. Attaching four guywire cables to an anchor plate that was proportioned and intended for three guywires only.

3. Exposing outer anchor steel rods at all three anchor locations resulting in inadequate embedment.

4. Connecting guywire cables to the tower structure without the appropriate connection brackets.

5. Positioning the snatch block at locations other than the guywires or the tower base.

For conclusions, see Page 30.

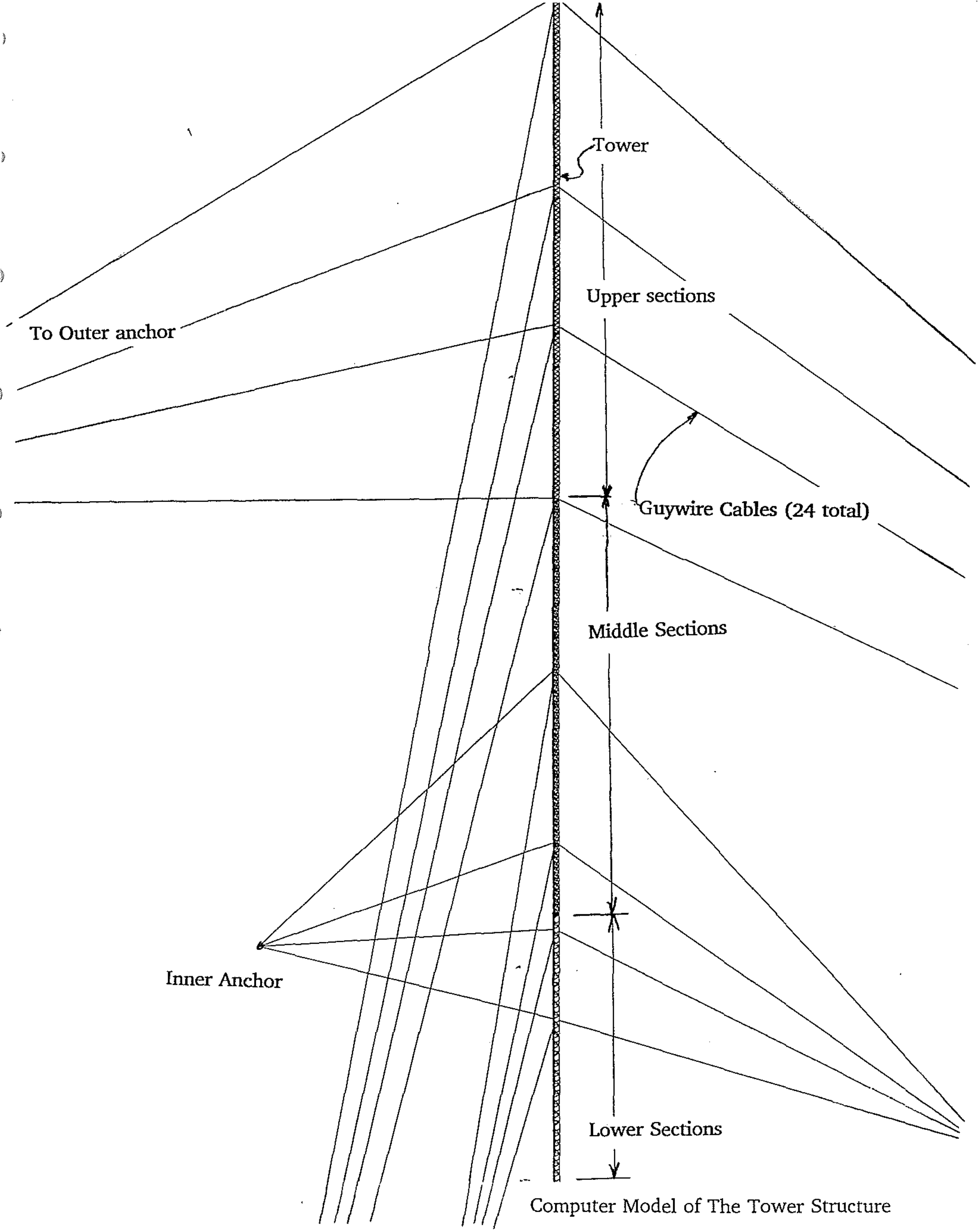

Tower
Upper sections
To Outer anchor
Guywire Cables (24 total)
Middle Sections
Inner Anchor
Lower Sections
Computer Model of The Tower Structure

Figure 3.1

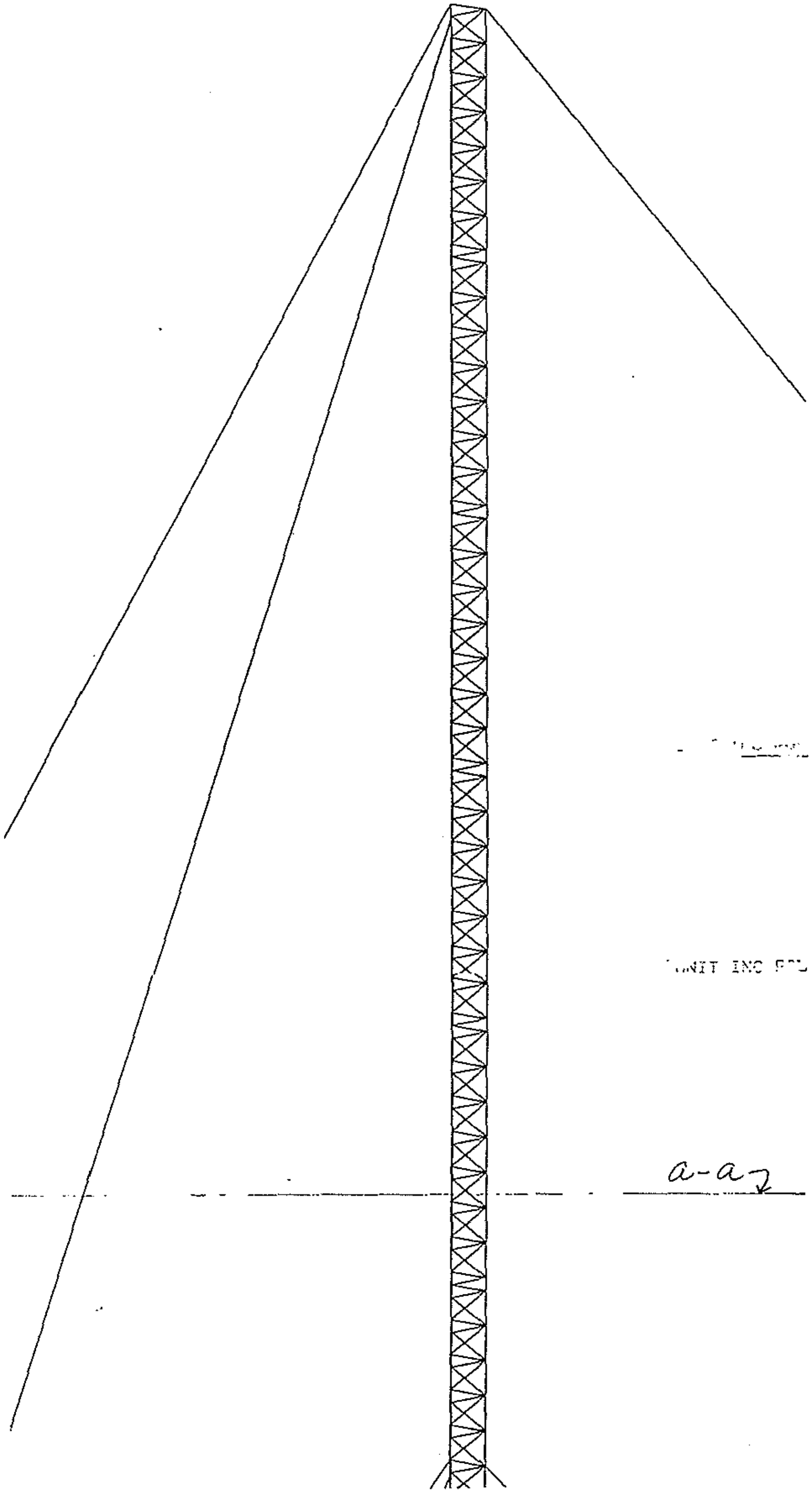


Figure 3.2

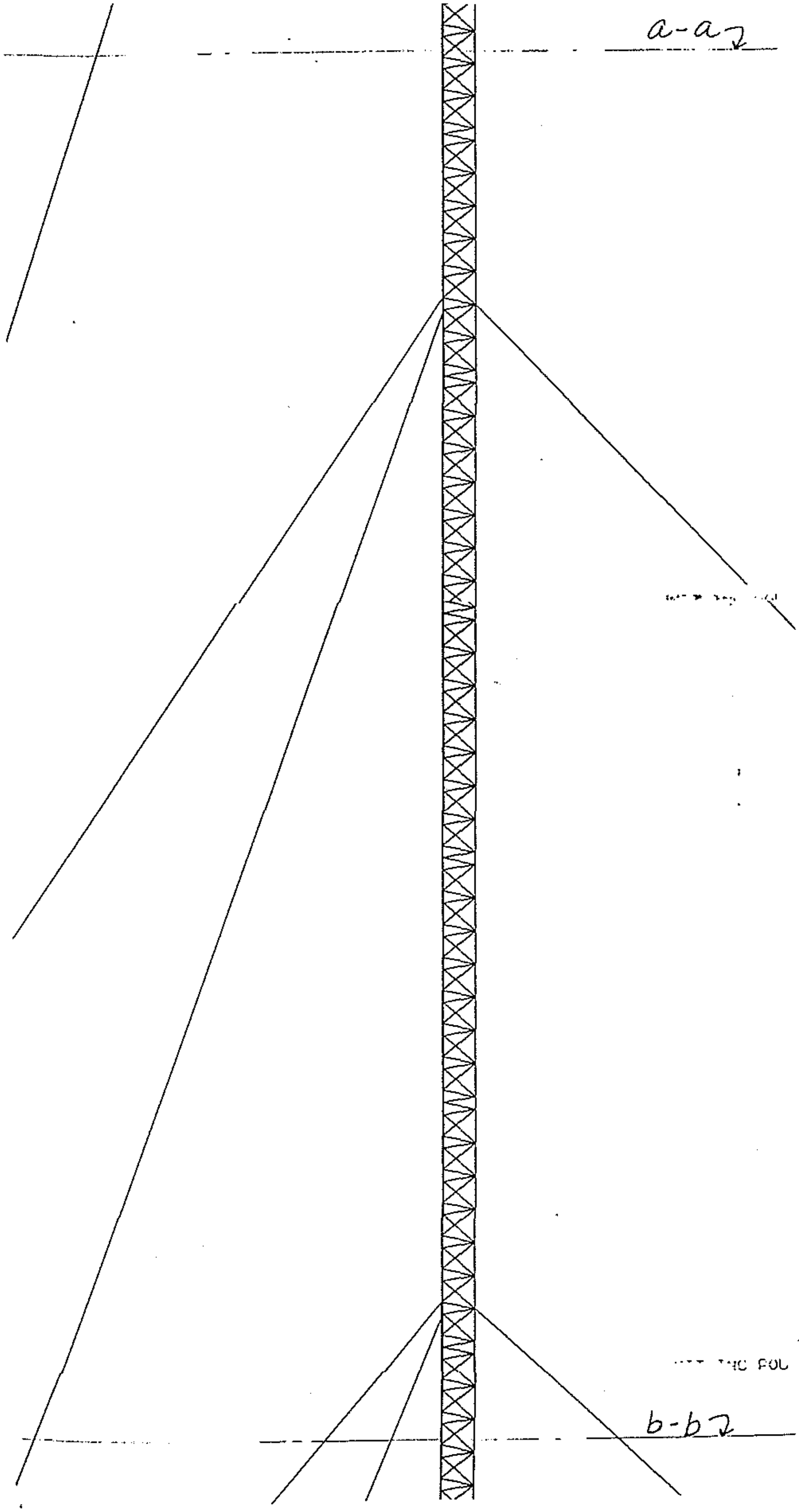


Figure 3.3

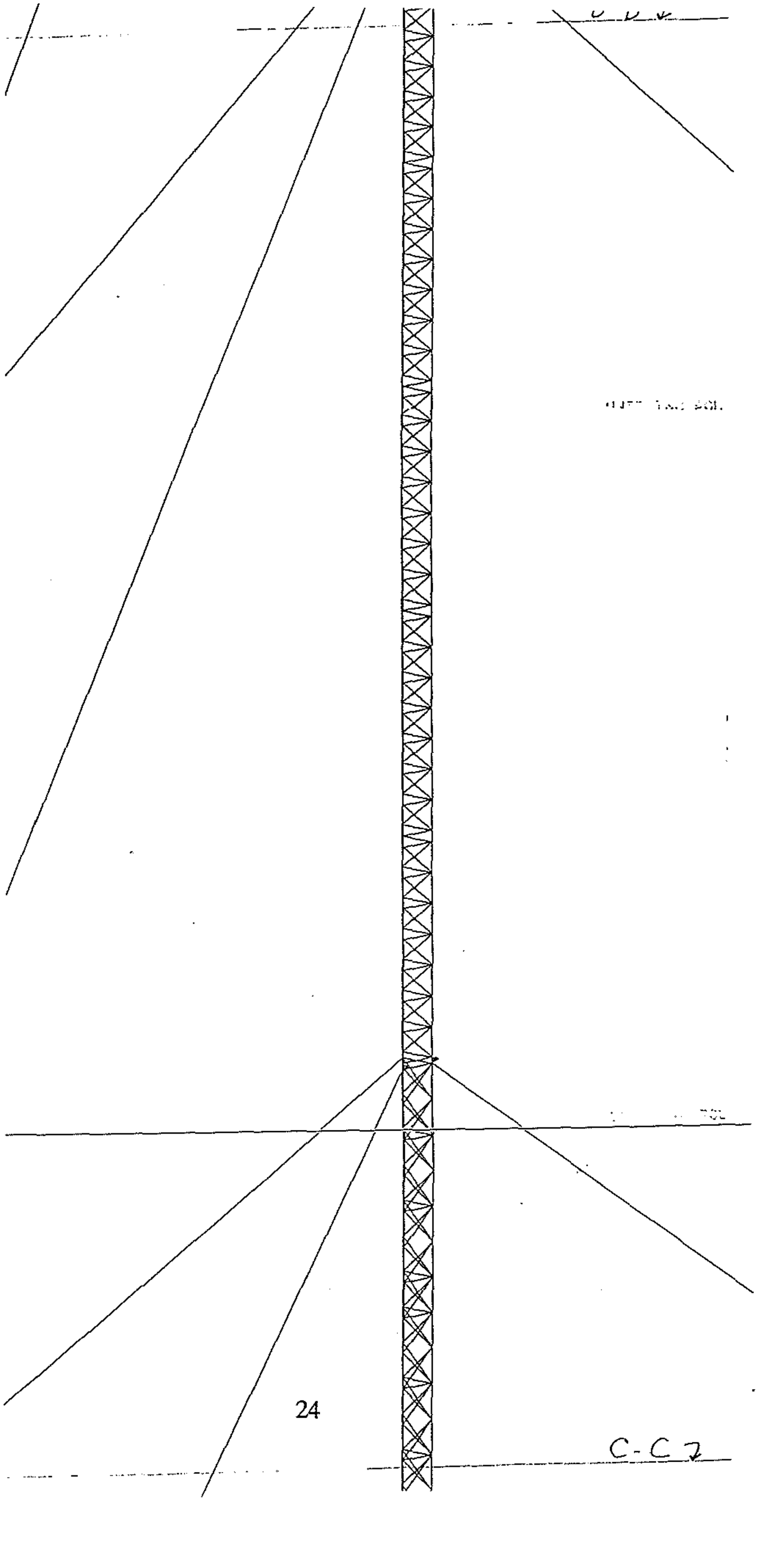


Figure 3.4

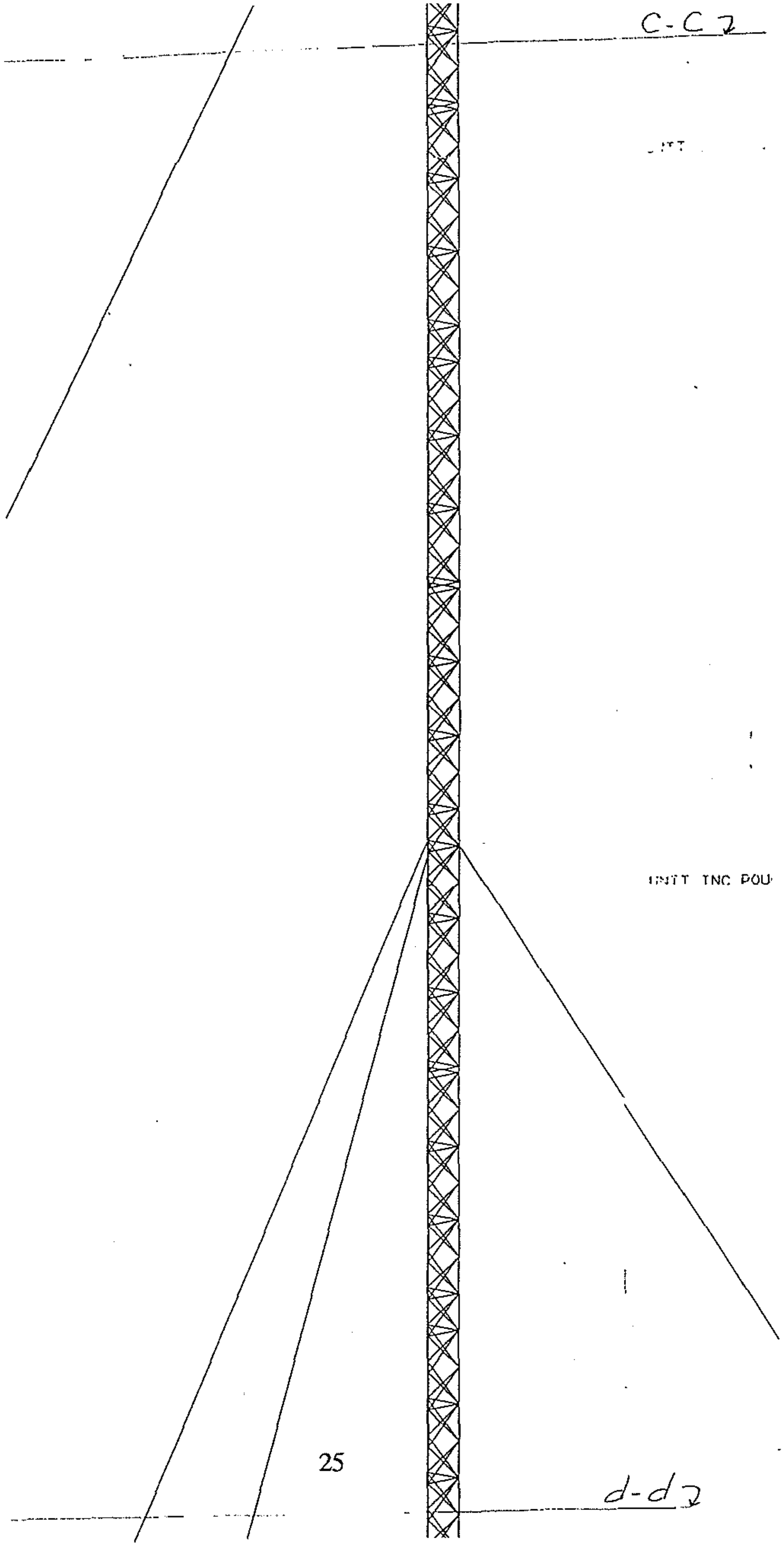


Figure 3.5

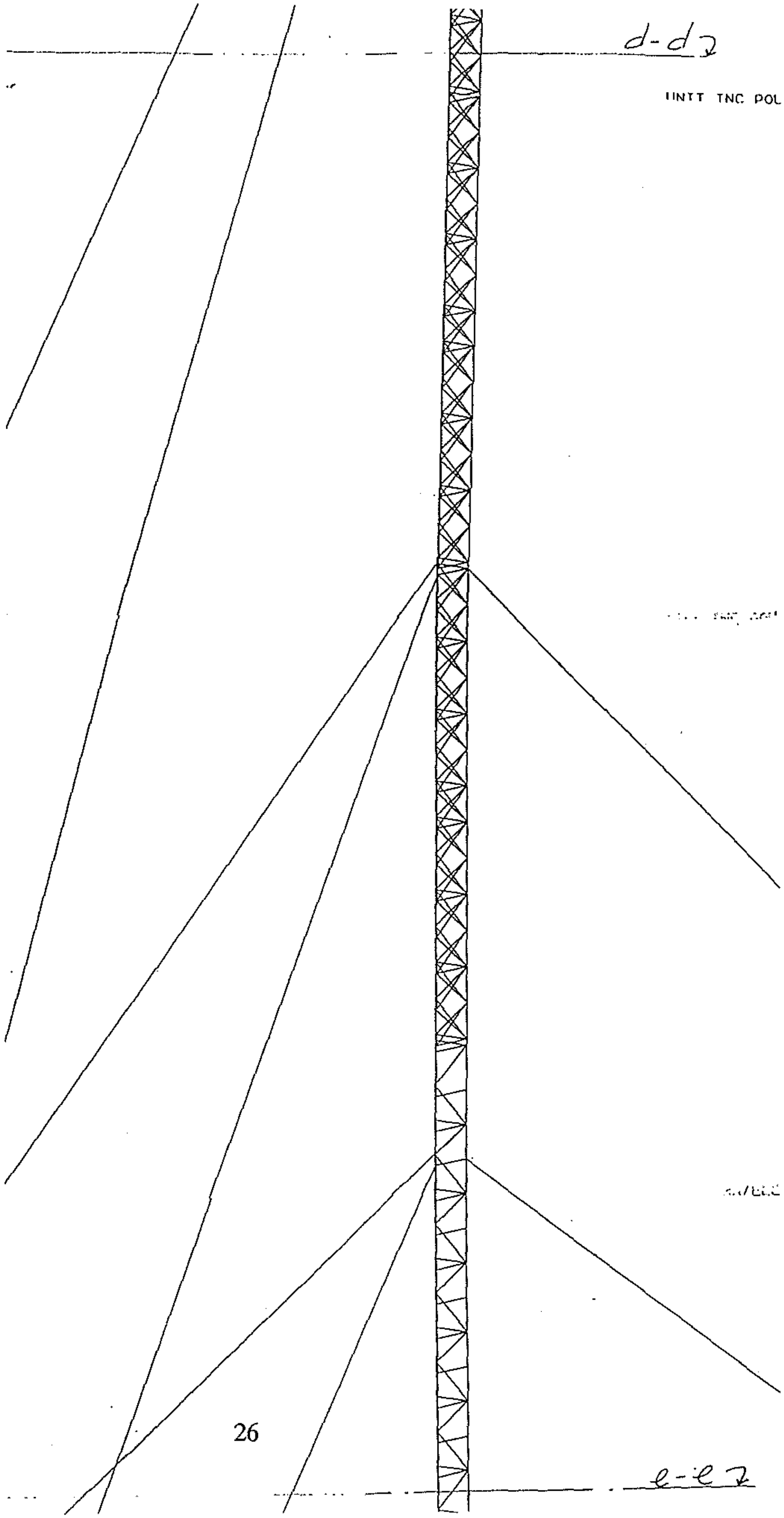


Figure 3.6

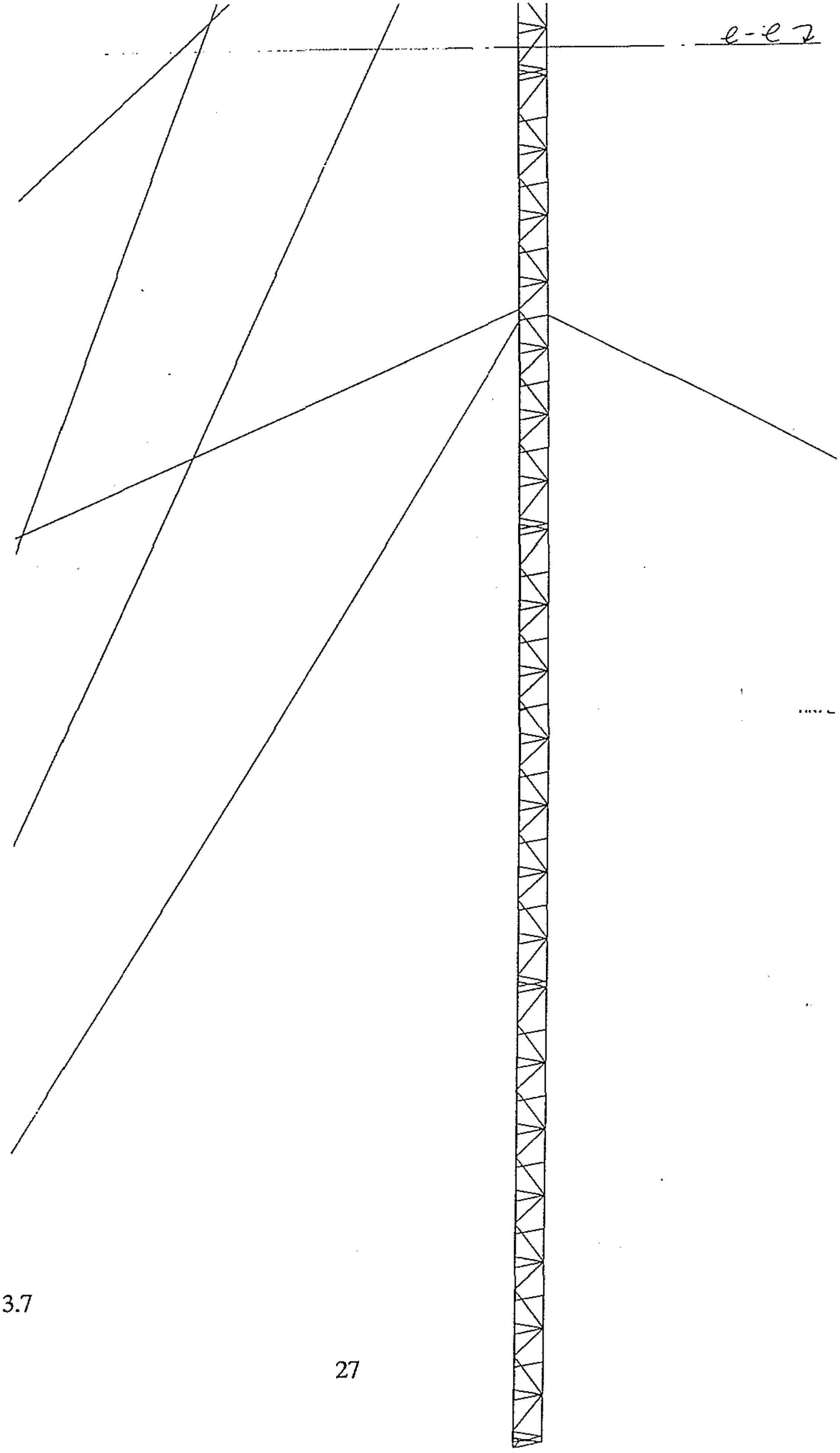


Figure 3.7

Comparison of Member Stress (PSI)
[For Various Column Wall Thickness]

Leg	Member #	Thickness		
		t= 3/16" original	t= 1/16"	t= 1/32"
A	01	6,420	6,347	6,327
	35	10,312	25,665 *	48,671 *
	53	9,457	24,061	45,858 *
B	261	6,420	6,348	6,329
	295	10,312	25,666 *	48,673 *
	313	9,457	24,061	45,858 *
C	523	7,591	7,503	7,477
	557	7,480	20,458	40,052 *
	572	7,311	20,054	39,409 *

*Exceeded AISC Design Requirements

TABLE 1

Comparison of Member Stresses (PSI)

Member #	Horizontal Force (H)			
	H= 0 lbs t = 1/16"	H= 200 lbs t = 1/16"	H = 1000 lbs t = 1/16"	H= 1000 lbs t = 1/32"
1	6,347	8,333	10,090	10,061
15	6,298	6,457	4,469	4,503
35	25,665	25,669	27,651	52,552
261	6,348	3,442	2,430	2,429
275	6,299	6,556	14,264	14,257
295	25,666	25,664	31,389	59,024
523	7,503	9,154	11,235	11,201
537	7,362	7,368	5,208	5,180
557	20,458	20,445	20,725	40,555

TABLE 2

4.0 CONCLUSIONS

Based on the above evaluation and discussion, the following conclusions are drawn:

1. Not withstanding the corrosive damage to the lower sections of the tower, the 350' high tower as erected was determined to be capable of supporting the intended loads.

2. Not withstanding the corrosive damage to the lower sections of the tower, the application of a side load of approximately 200 lbs at a height of about 22 ft above the base would not result in stresses of the tower members in excess of the allowable values.

3. Following the construction of the masonry building for the electrical equipments, the snatch block was repositioned from the base to a location which was approximately 22 ft above the base for hoisting of antennas and coaxial cable. The tower structure of this type in general is not designed for an application of a substantial concentrated lateral load at locations other than at the guywires or the tower base.

4. The corrosive damage to the lower sections of the tower was extensive. Due to the extent of the corrosive damage, the vertical legs of the tower were subjected to stresses beyond their allowable values.

5. The extensively corroded tower sections salvaged from other older towers were re-used by the contractor without any proper evaluation. The structural integrity of the tower structure was rendered questionable as a result of using the corroded used tower sections.

Appendix -A

Contract Agreement

Rt. 1 Box 387
Newbern, Al. 36765
(205) 289-4747

PROPOSAL SUBMITTED TO	PHONE	DATE
Mr. Scott Alexander	205-875-9360	4/13/94
STREET	JOB NAME	
	Hazen, Al.	
CITY, STATE AND ZIP CODE	JOB LOCATION	
Selma Al.		
DATE OF PLANS		JOB PHONE
30 to 45 days	Fax 205-875-1340	

We hereby submit specifications and estimates for:

Installation of a 350' FM Radio Tower (3 Bay Ant.)

Includes foundation, hanging FM antenn and STL dish, and painting tower.

The tower will consist of 150' of 18" x 20' solidleg X-braced sections and 200' of Rohn 55G Tower, guywire and anchors.

One Used Lighting Kit Includes; Two used beacons, and six sidelights.

Scott Alexander will furnish all ants., coaxals, and mounting hardware.

TOTAL COST: $15000.00

ACCOUNTS NOT PAID IN FULL WITHIN 30 DAYS OF INVOICE DATE WILL AUTOMATICALLY BECOME SUBJECT TO A FINANCE CHARGE. THE FINANCE CHARGE IS AT THE MONTHLY PERIODIC RATE OF 1½% (18% PER ANNUM.)

We Propose hereby to furnish material and labor — complete in accordance with above specifications, for the sum of:

Fifteen thousand dollars ($ 15000.00)

Payment to be made as follows:

$9500.00 for tower & Lights / $3000.00 to Start /$2500.00 completi

All material is guaranteed to be as specified. All work to be completed in a workmanlike manner according to standard practices. Any alteration or deviation from above specifications involving extra costs will be executed only upon written orders, and will become an extra charge over and above the estimate. All agreements contingent upon strikes, accidents or delays beyond our control. Owner to carry fire, tornado and other necessary insurance. Our workers are fully covered by Workmen's Compensation Insurance.

Authorized Signature ____________

Note: This proposal may be withdrawn by us if not accepted within 60 days days

Acceptance of Proposal — The above prices, specifications and conditions are satisfactory and are hereby accepted. You are authorized to do the work as specified. Payment will be made as outlined above.

Signature ____________ 4/19/94

Date of Acceptance ____________ Signature ____________

** THE ACCEPTANCE OF THIS PROPOSAL IS SUBJECT TO FCC APPROVAL OF THE TRANSFER OF THE WJAM-FM CONSTRUCTION PERMIT FROM MARION RADIO TO SCOTT COMMUNICATIONS INC.

FROM : WEBB TOWER PHONE NO. : 205 289 4747 P01

Computations

ATA

E

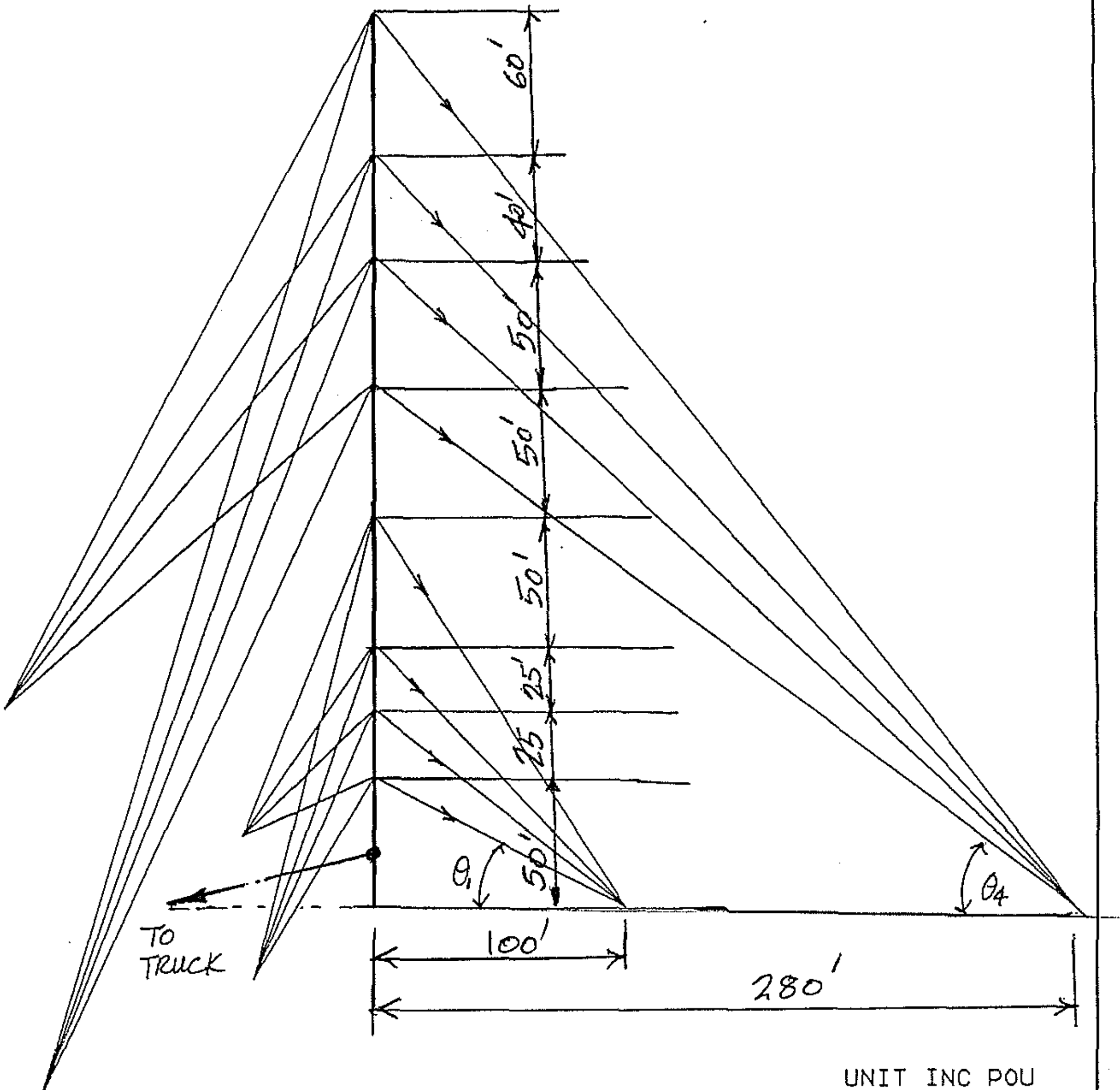
3.0

1.0

0.0

TOWER STRUCTURAL MODEL

32-1



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DEPARTMENT OF LABOR

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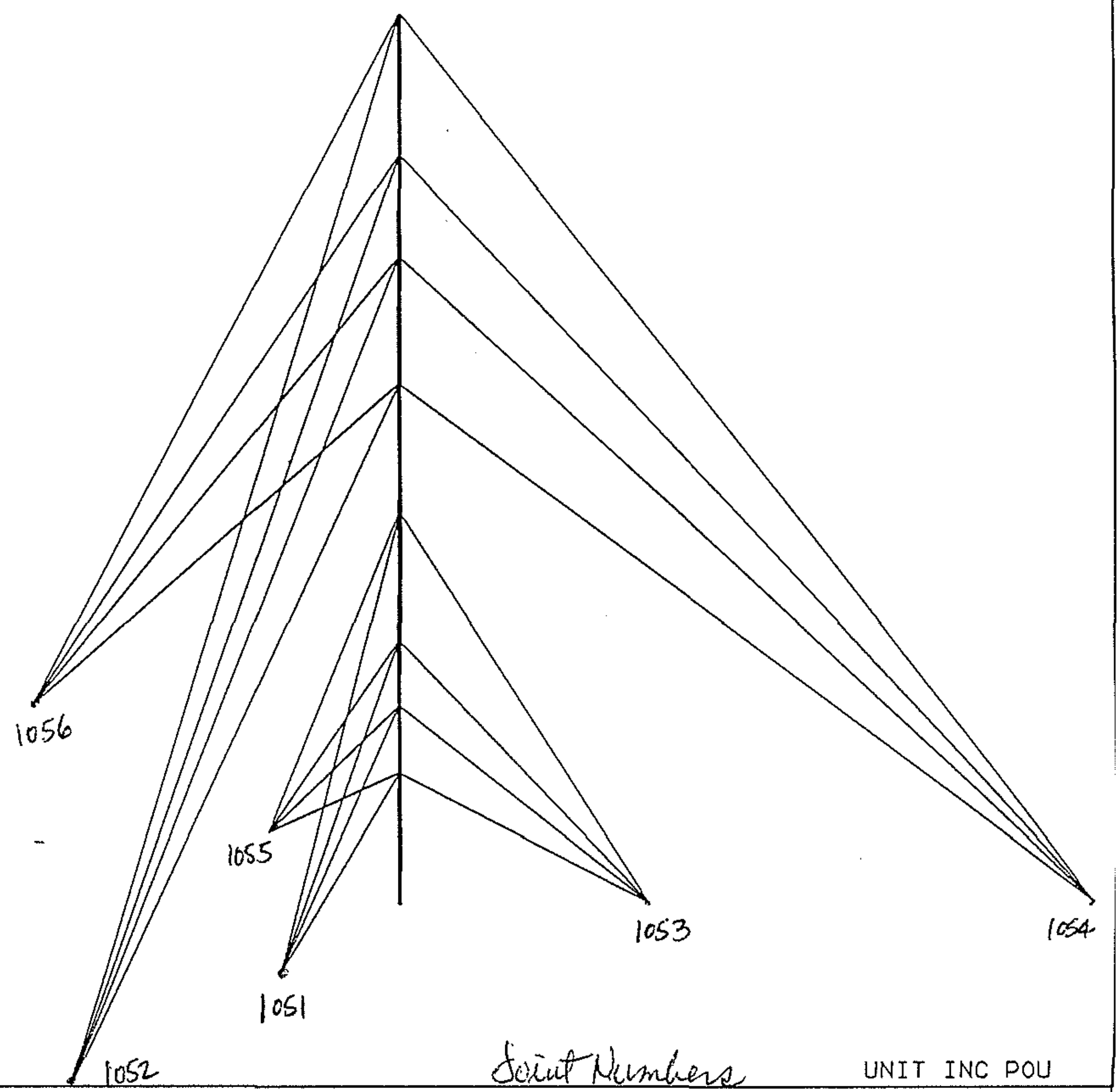
32-2



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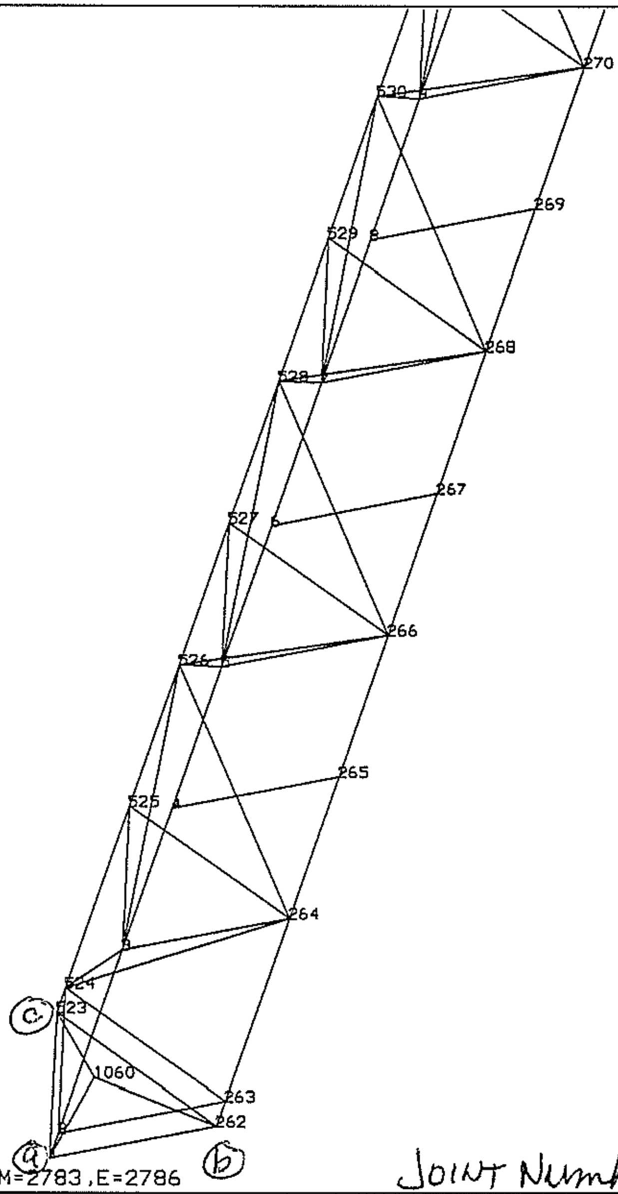

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Joint Numbers.

UNIT INC POU

COMPANY: US DEPARTMENT OF LABOR

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TITLE: - RADIO TOWER @SELMA AL.(RADIO8B), WITH

DATE: OCT 26, 1994

32-4

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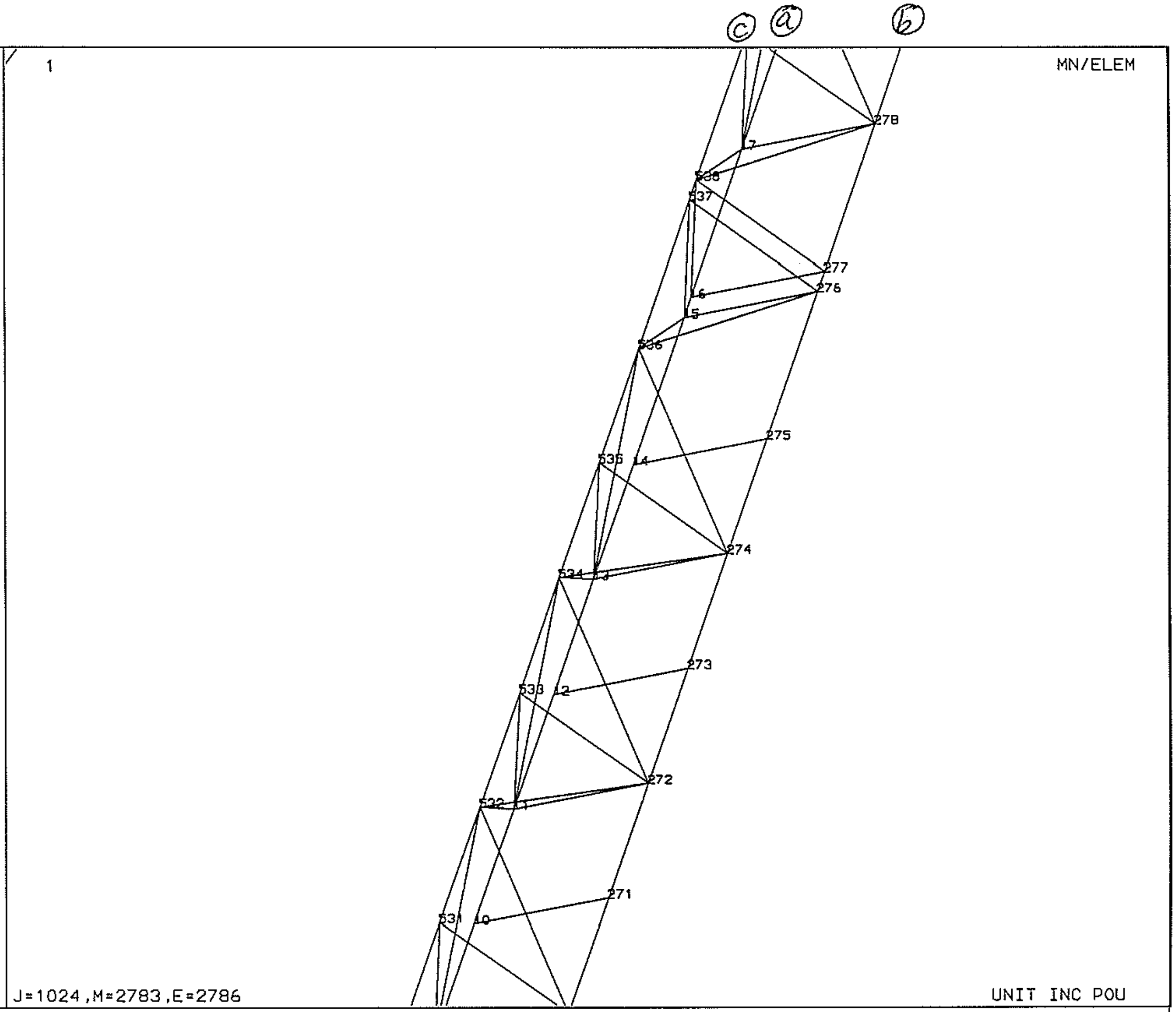

COMPANY: US DEPARTMENT OF LABOR

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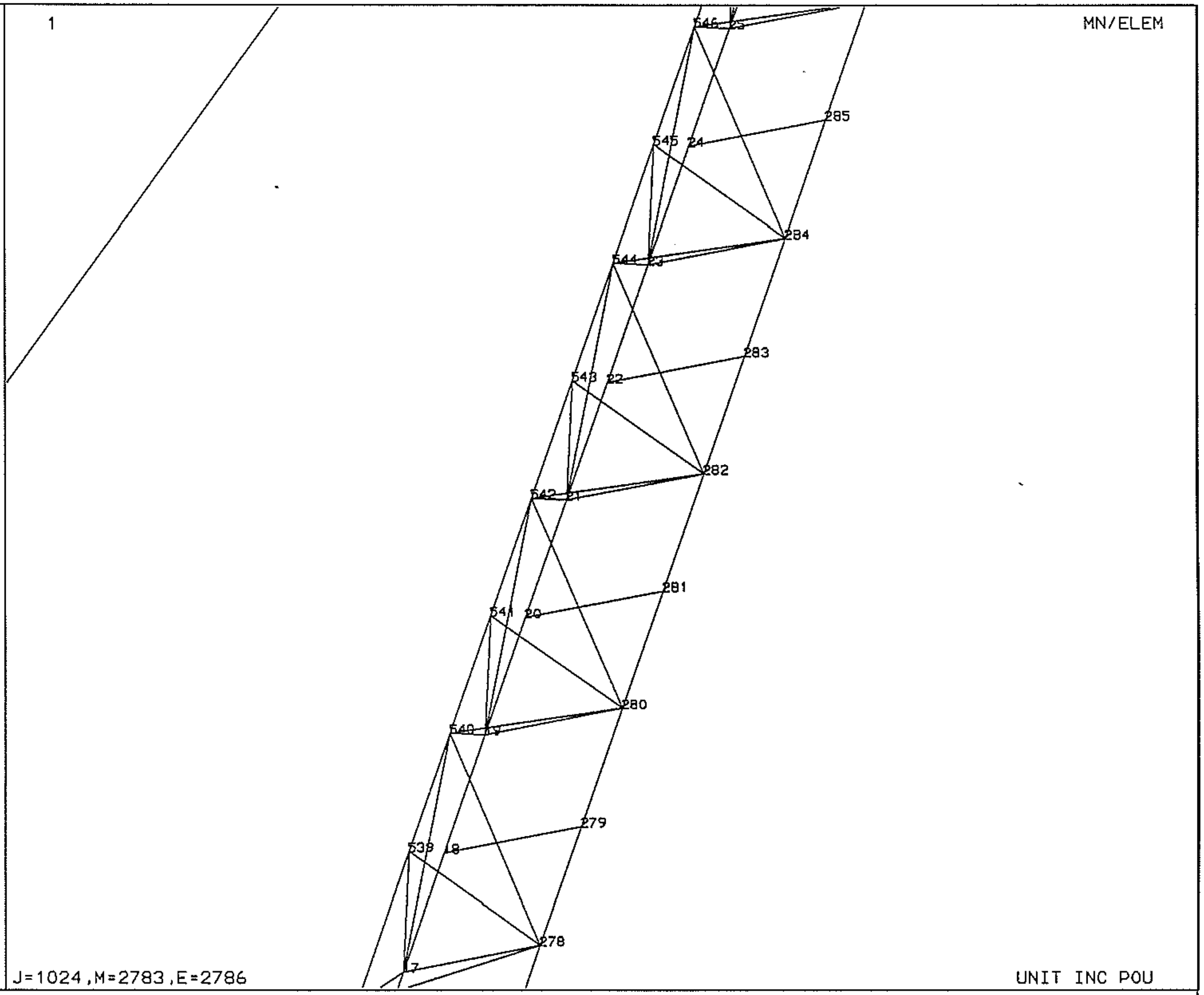

COMPANY: US DEPARTMENT OF LABOR

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DATE: OCT 26, 1994

TITLE: - RADIO TOWER @SELMA AL.(RADIO8B), WITH

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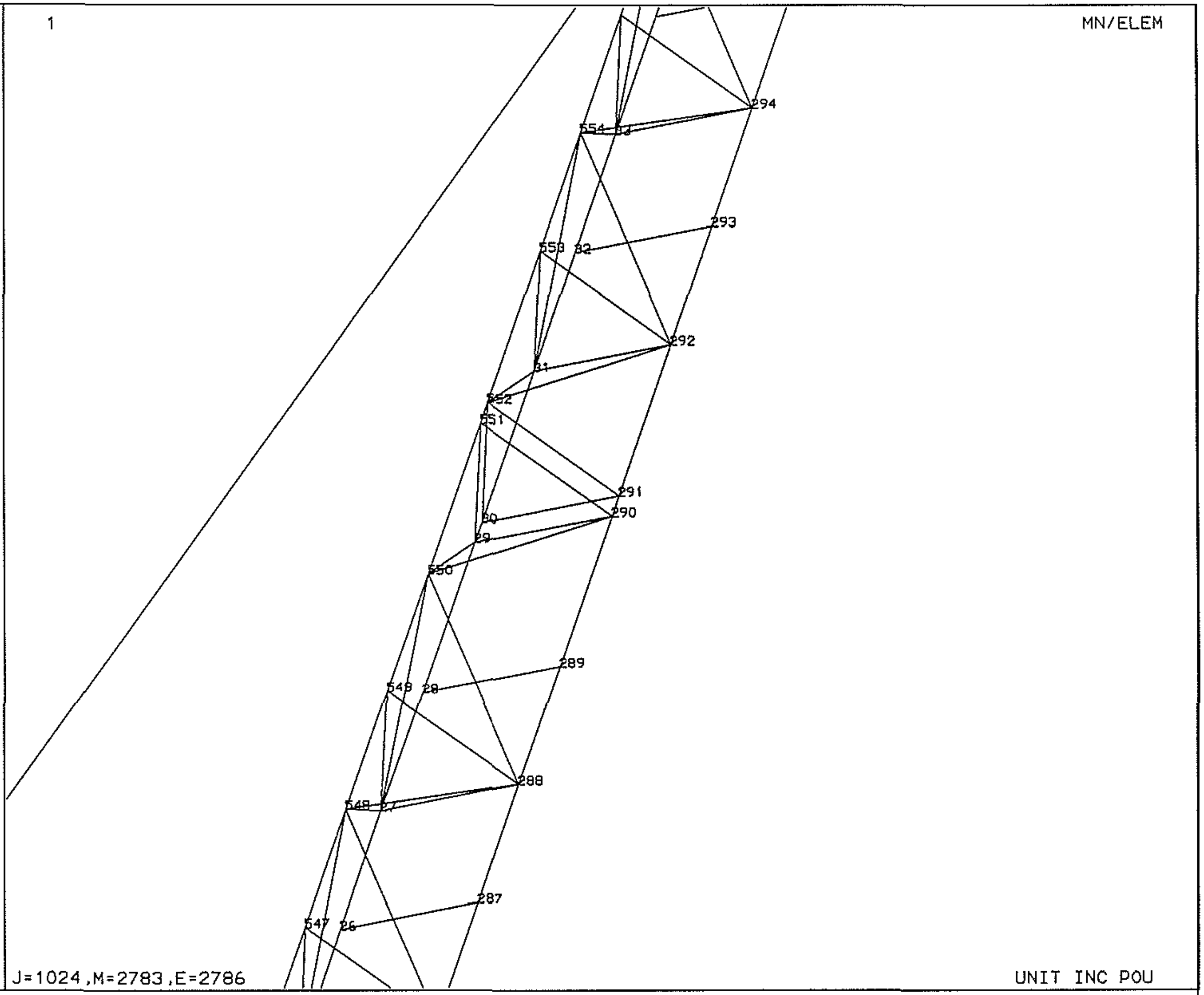

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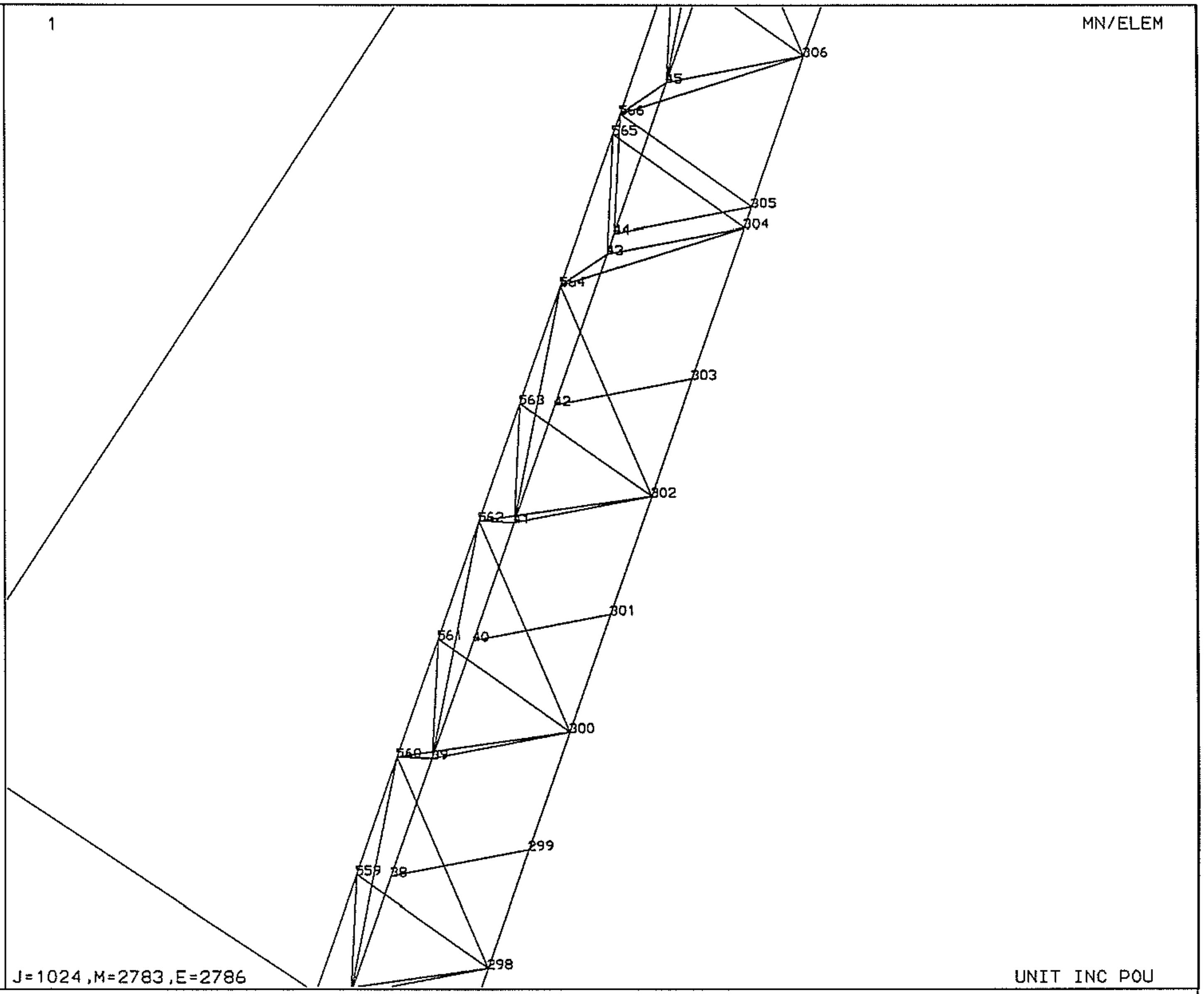

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DATE: OCT 26, 1994

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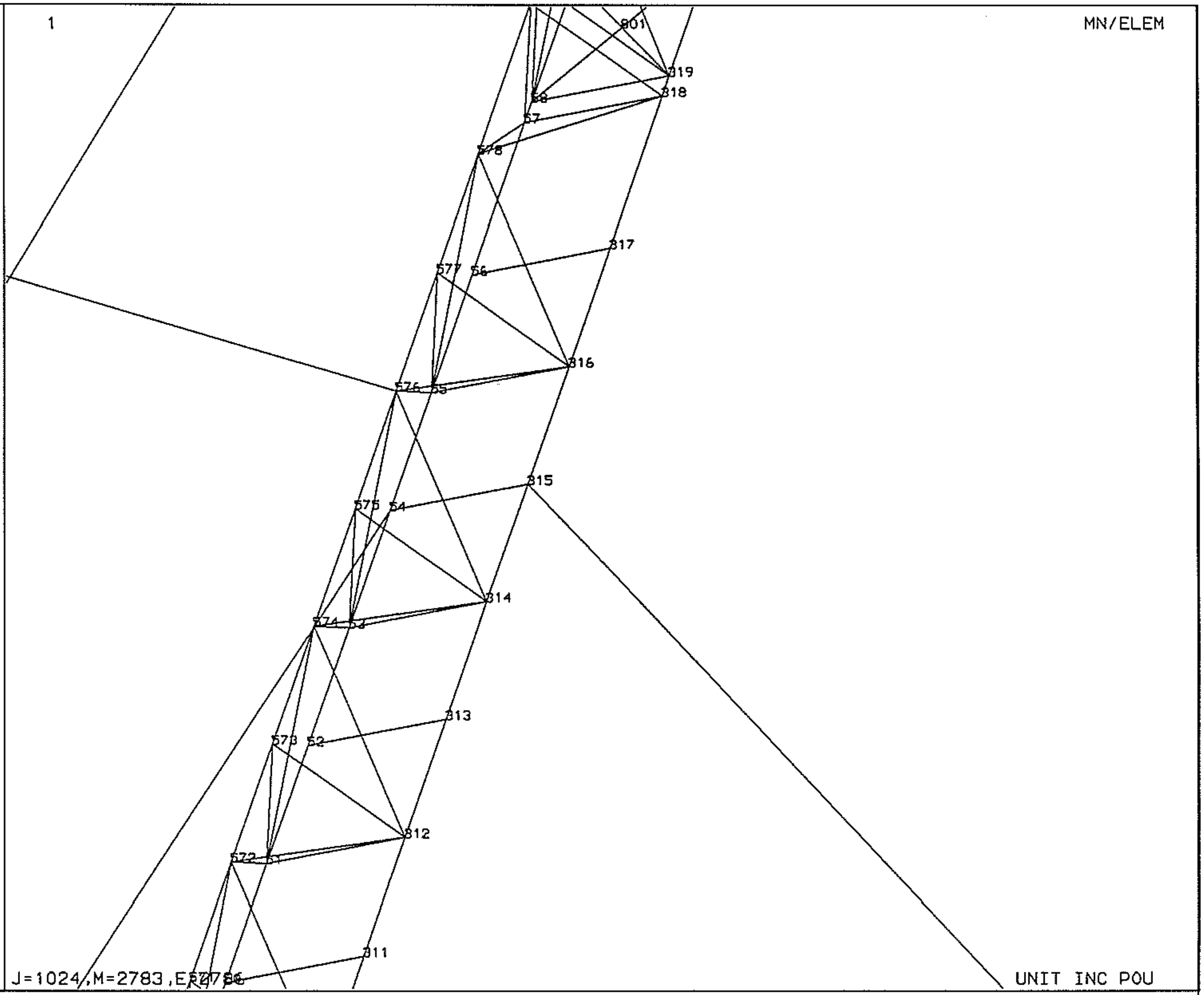

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DATE: OCT 26, 1994

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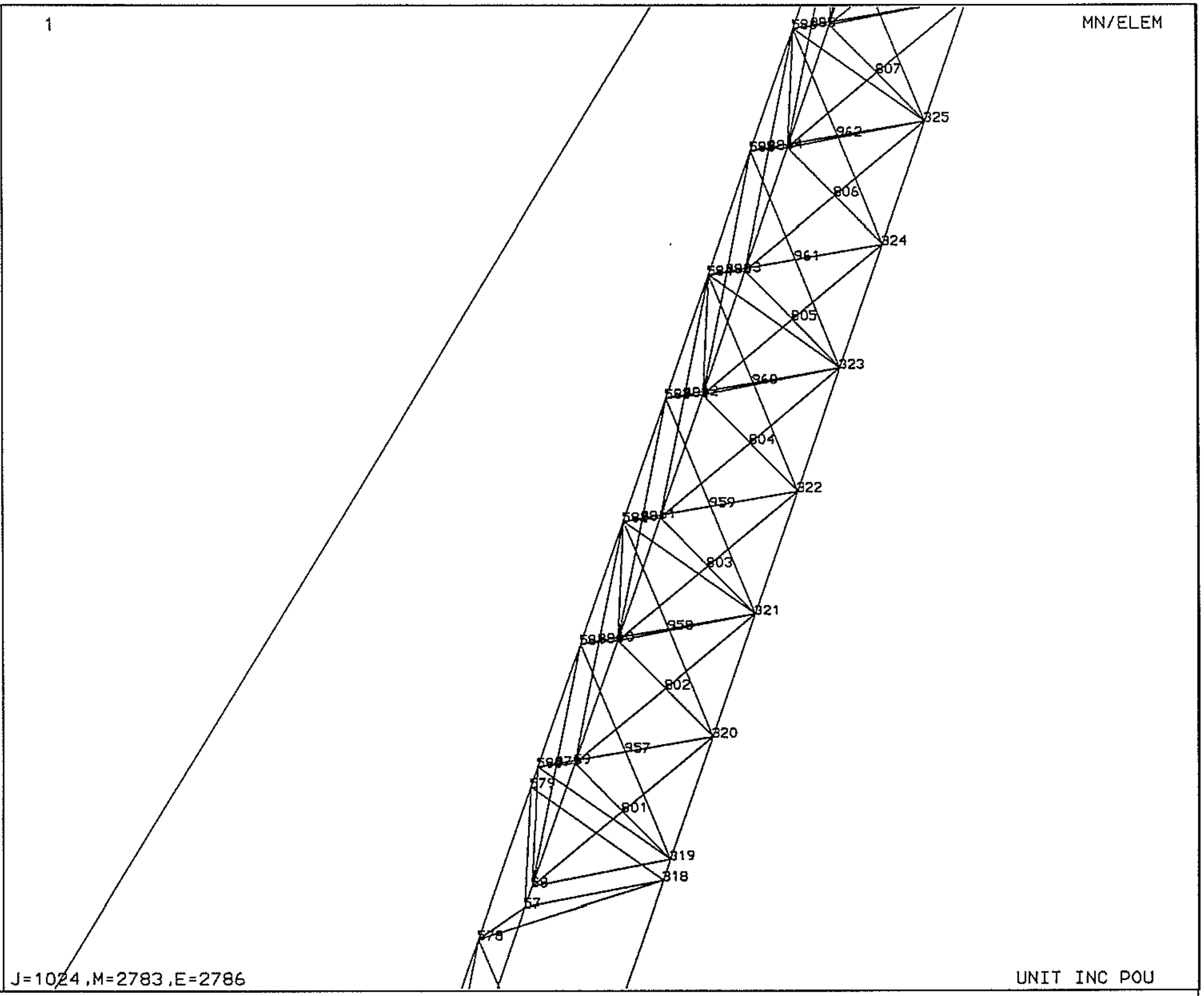

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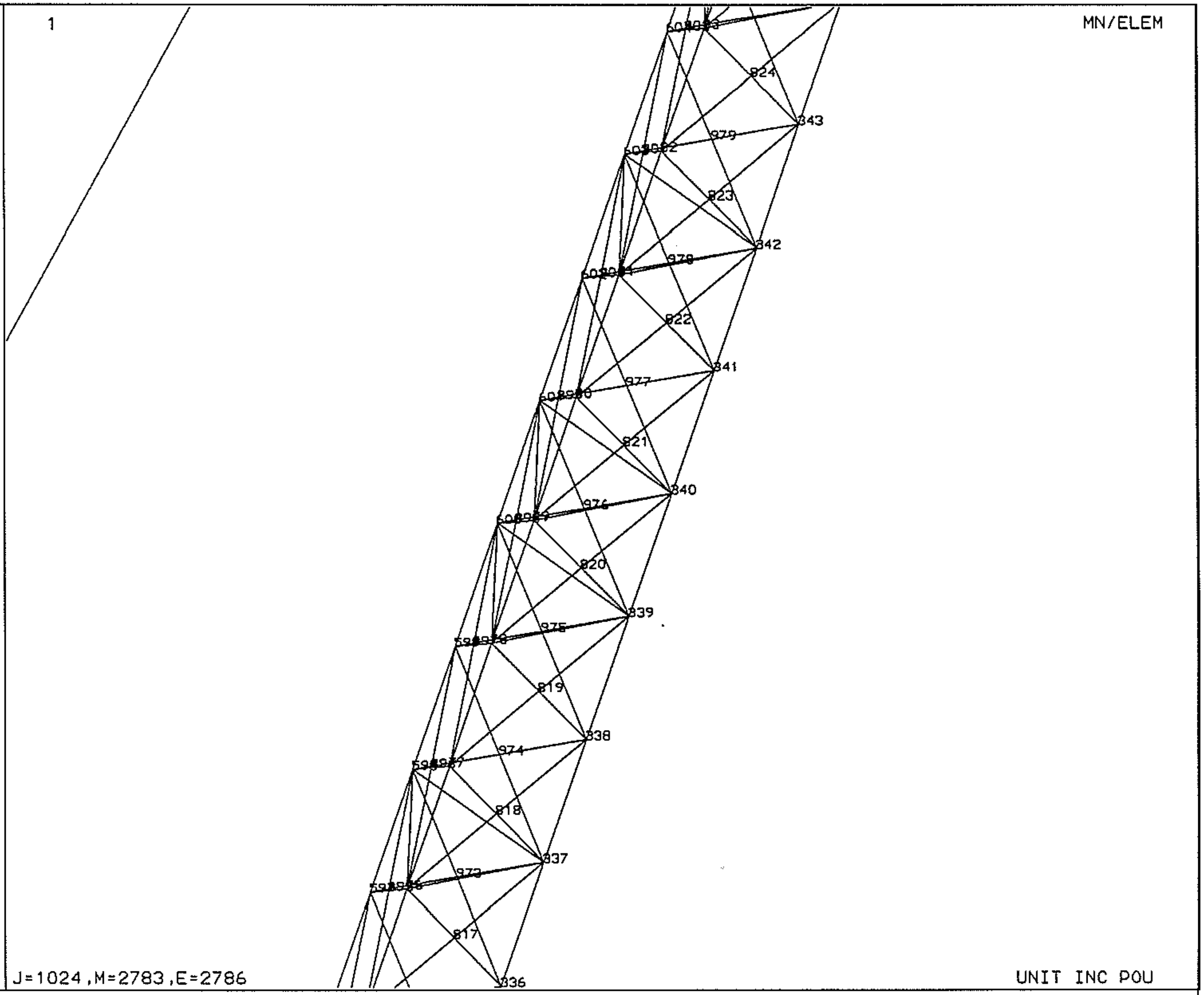

COMPANY: US DEPARTMENT OF LABOR

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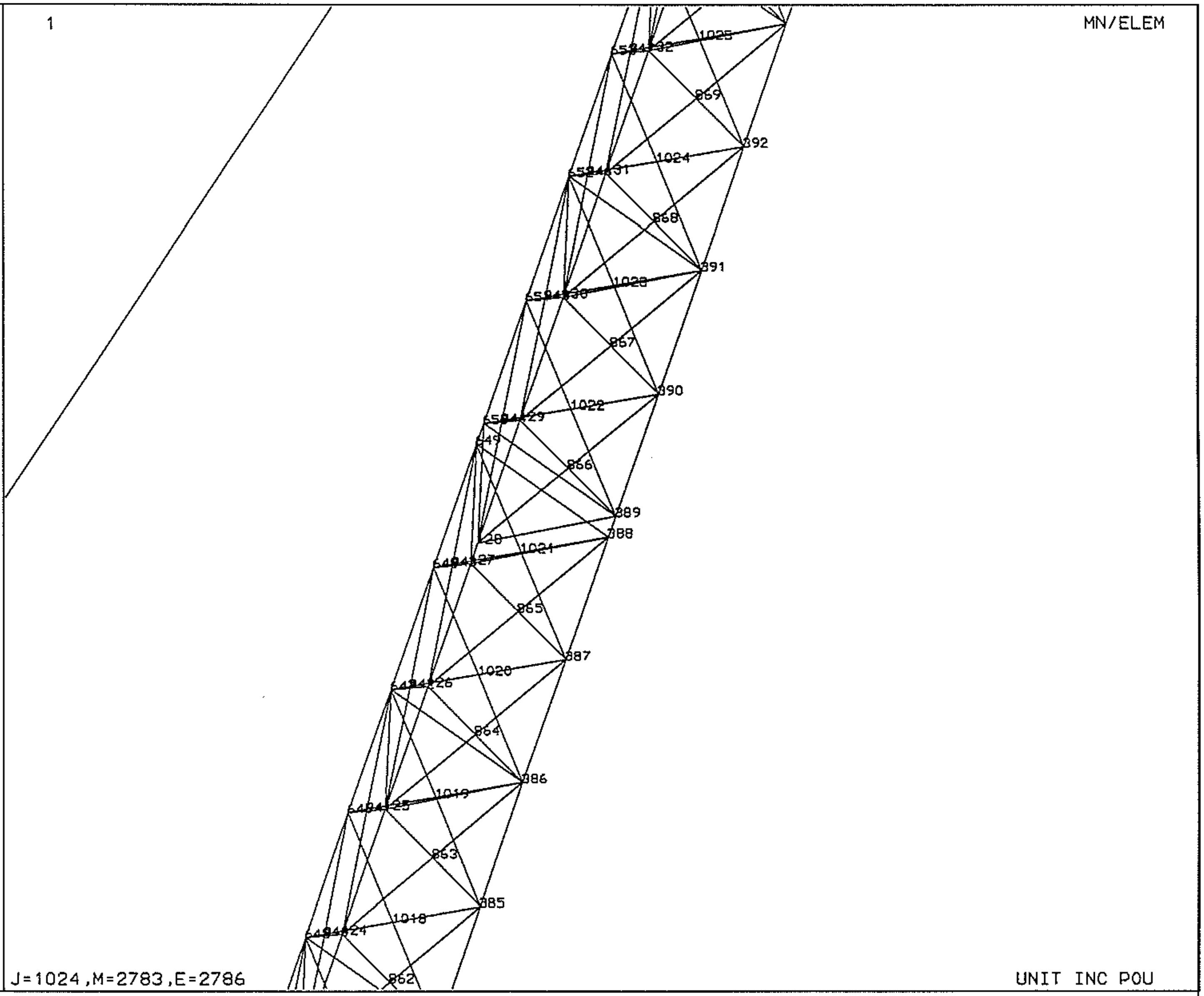

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COMPANY: US DEPARTMENT OF LABOR

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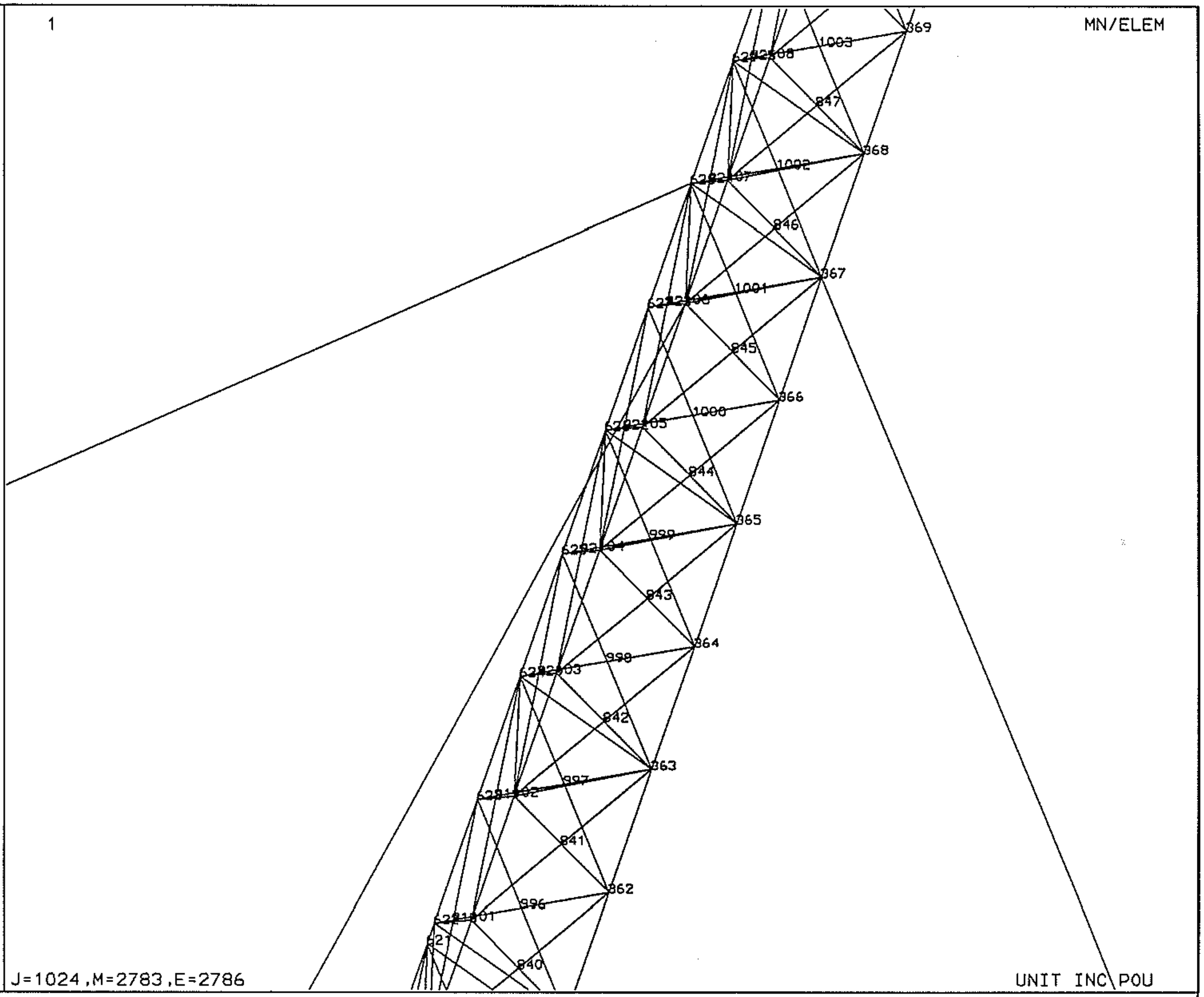

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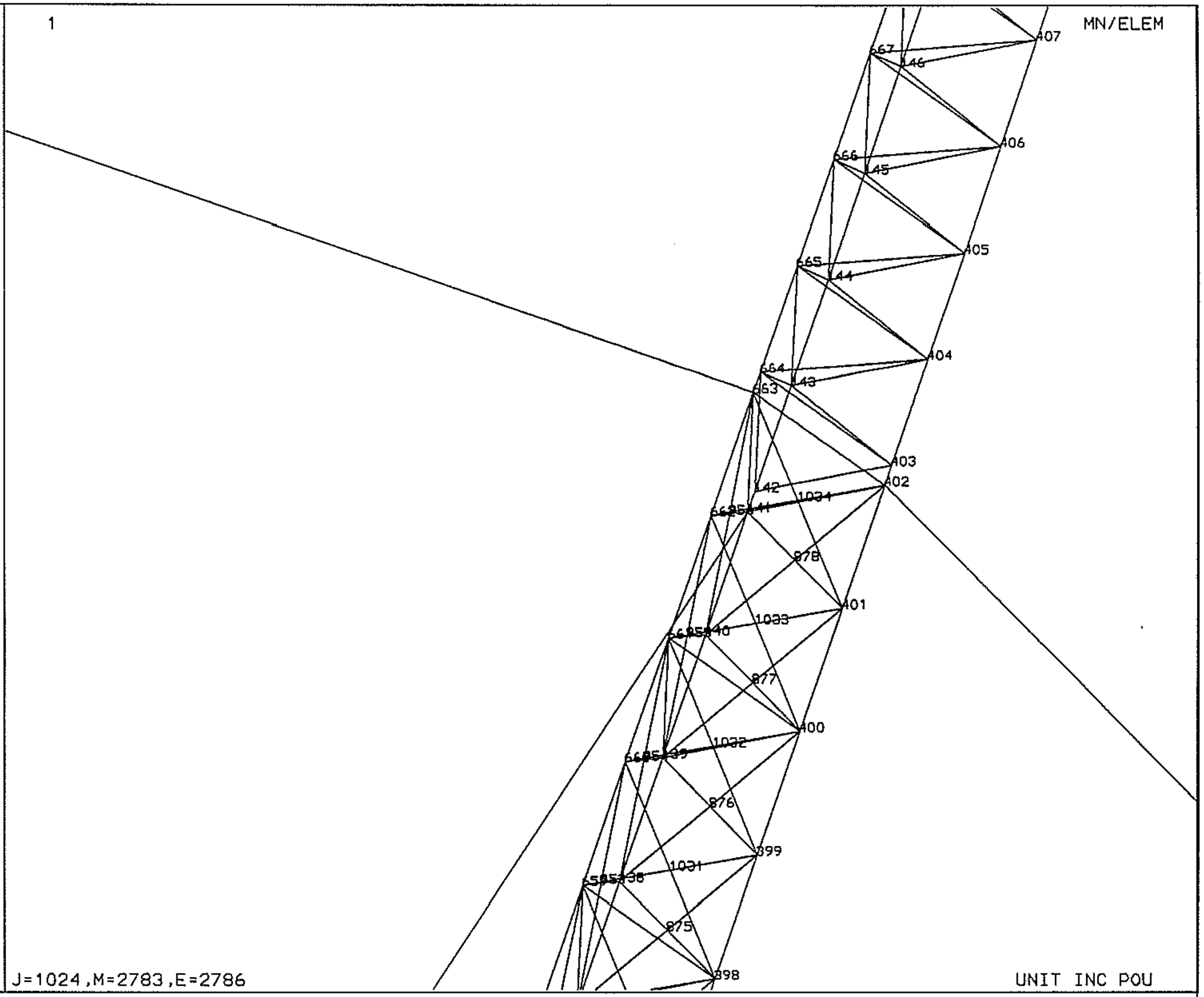

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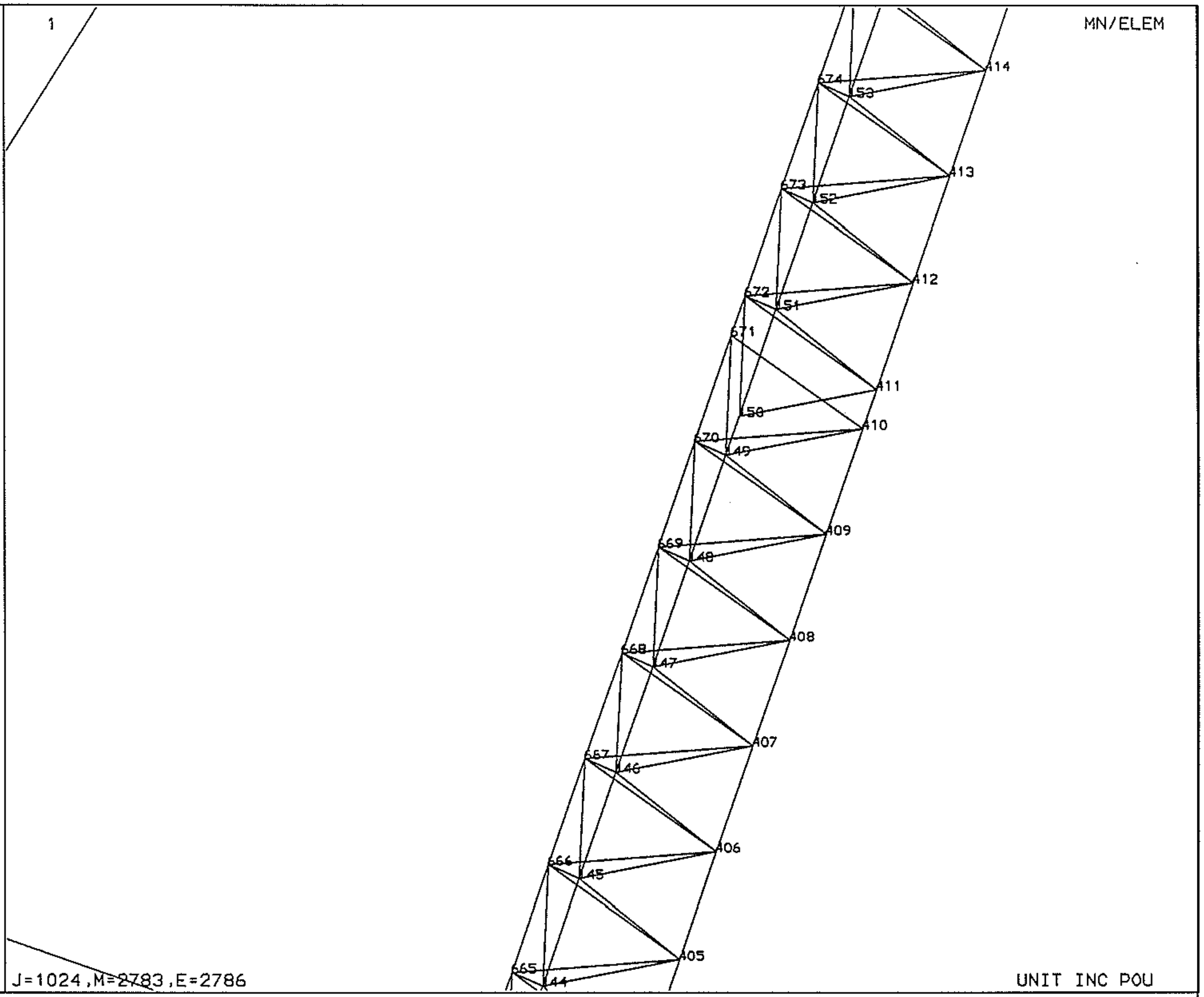

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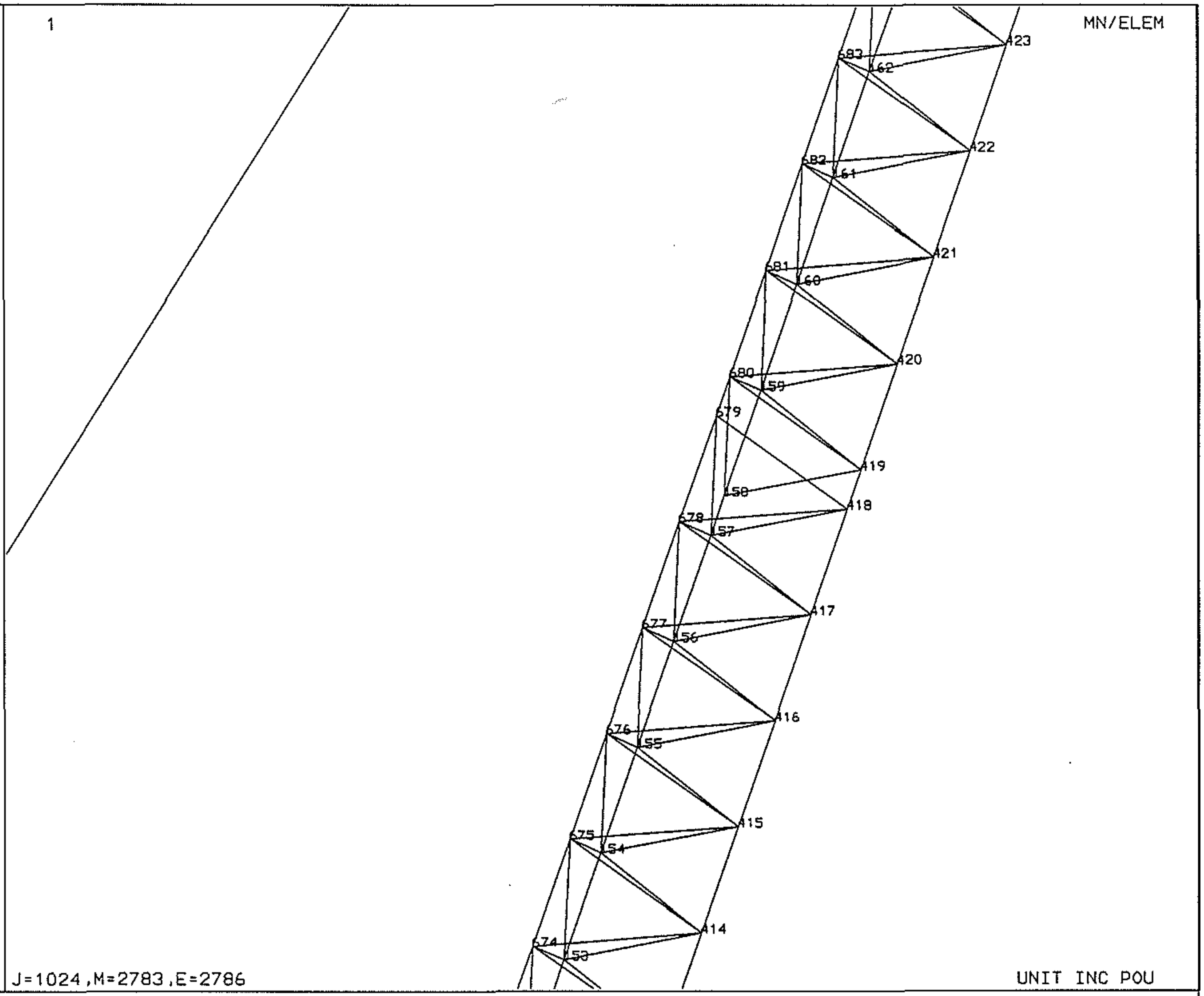

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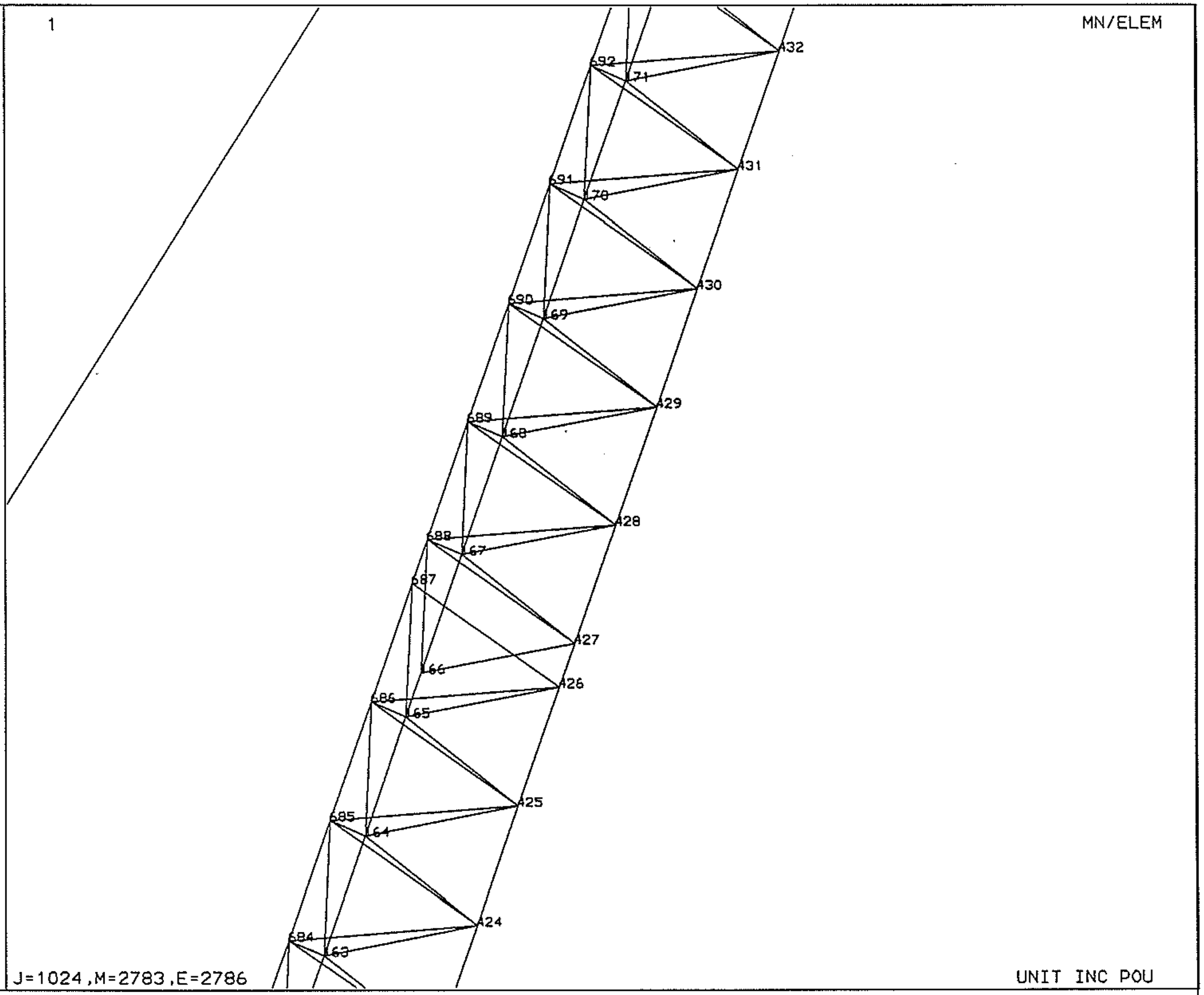

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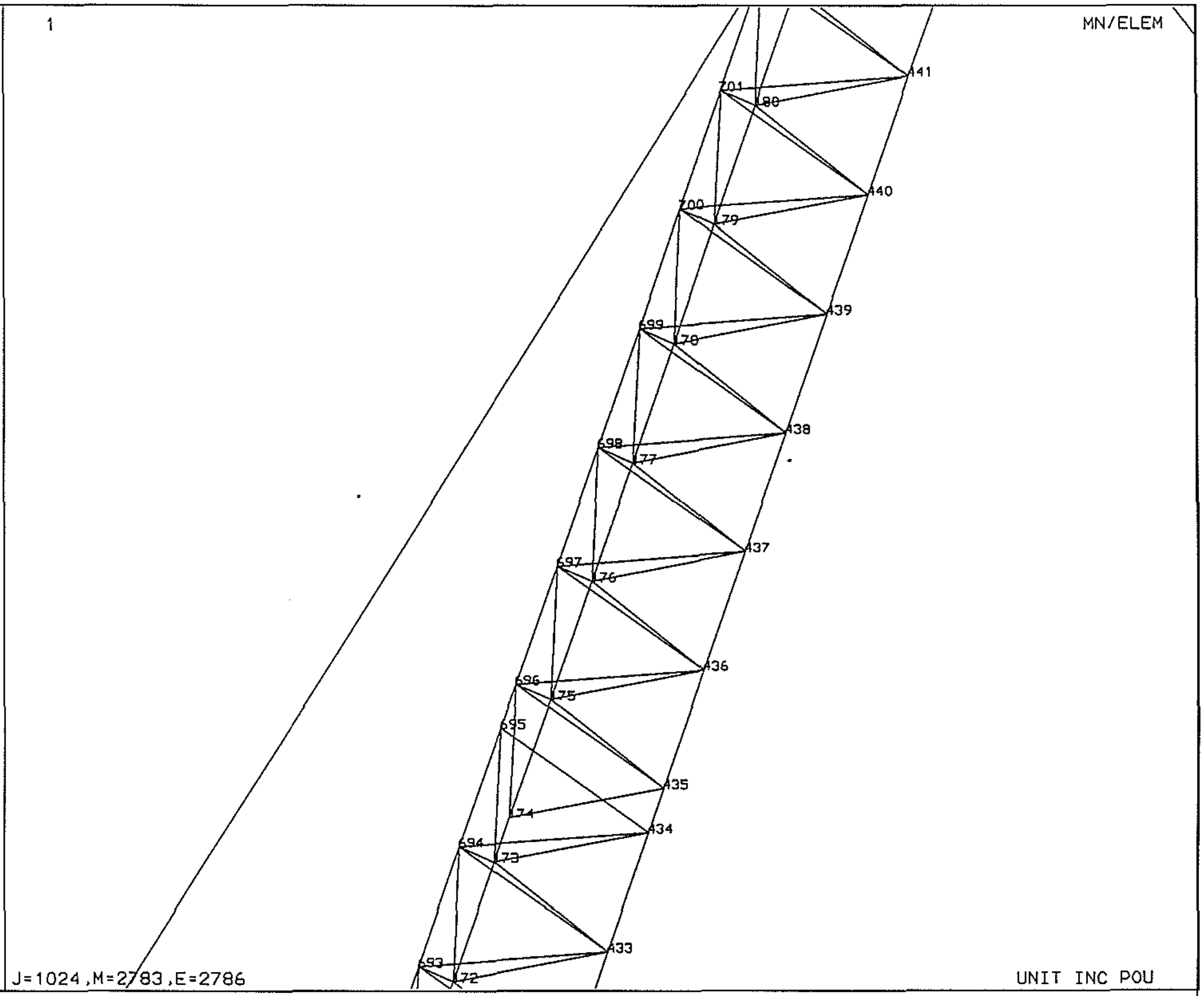

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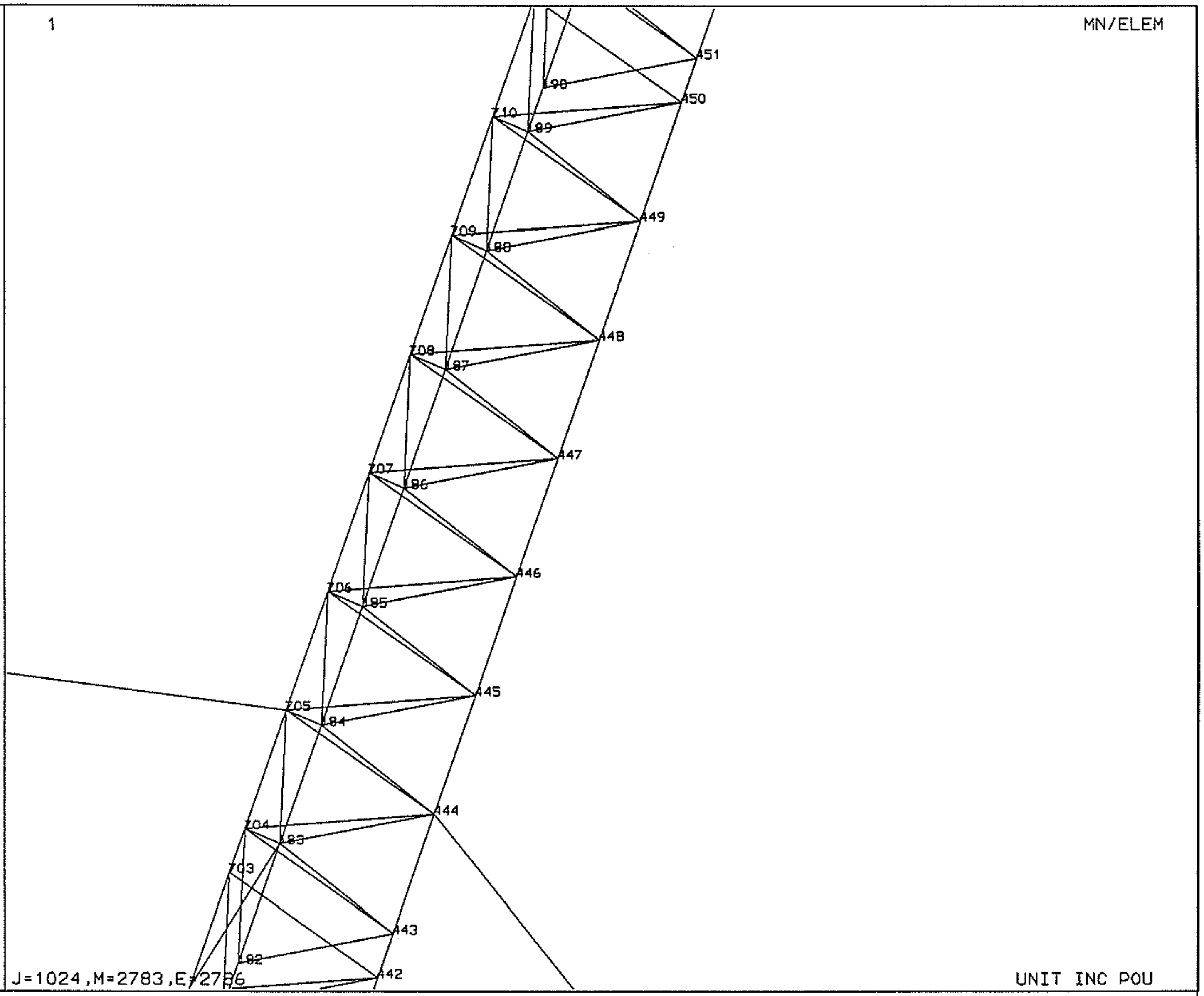

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DATE: OCT 27, 1994

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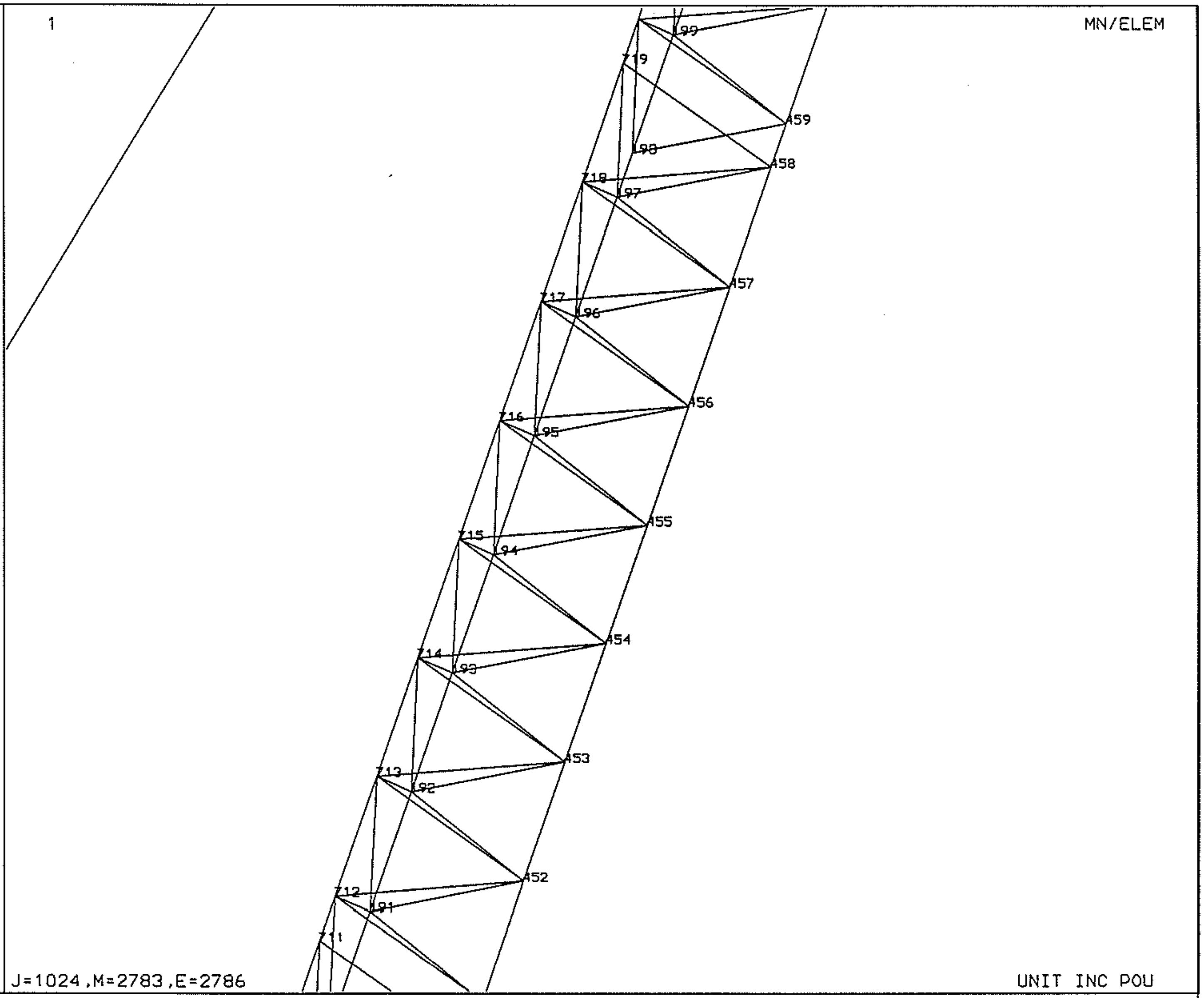
ZMAX= 5040.0



COMPANY: US DEPARTMENT OF LABOR

S T A A D P L - P L O T (REV: 19.0b)

DATE: OCT 27, 1994

TITLE: - RADIO TOWER @SELMA AL.(RADIO8B), WITH

1

MN/ELEM

STRUCTURE DATA

TYPE = SPACE

NJ = 1024

NM = 2783

NE = 2786

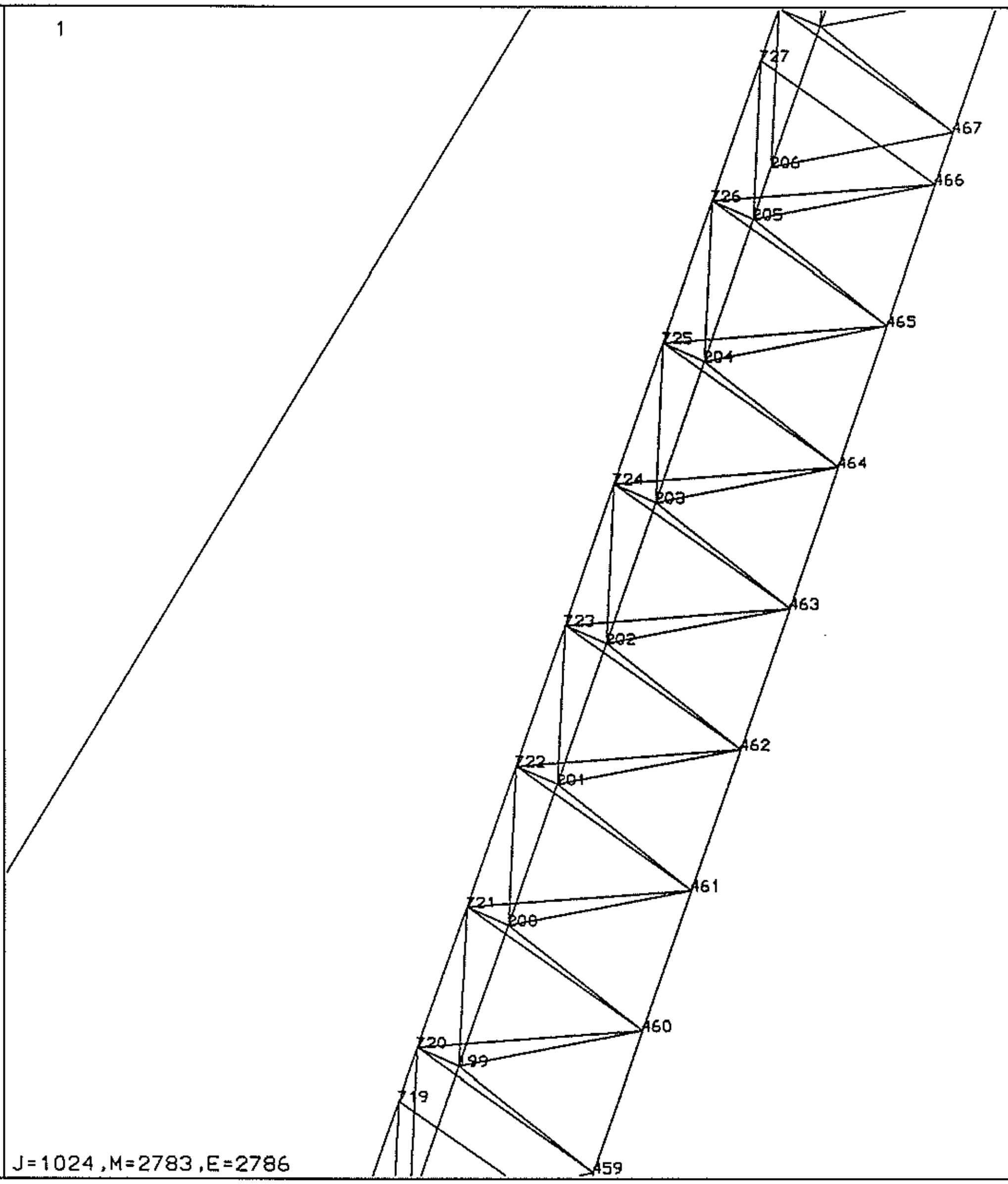
NS = 10

NL = 1

XMAX= 5818.0

YMAX= 4081.0

ZMAX= 5040.0



J=1024,M=2783,E=2786

UNIT INC POU

COMPANY: US DEPARTMENT OF LABOR

S T A A D P L - P L O T (REV: 19.0b)

TITLE: - RADIO TOWER @SELMA AL.(RADIO8B), WITH

DATE: OCT 27, 1994

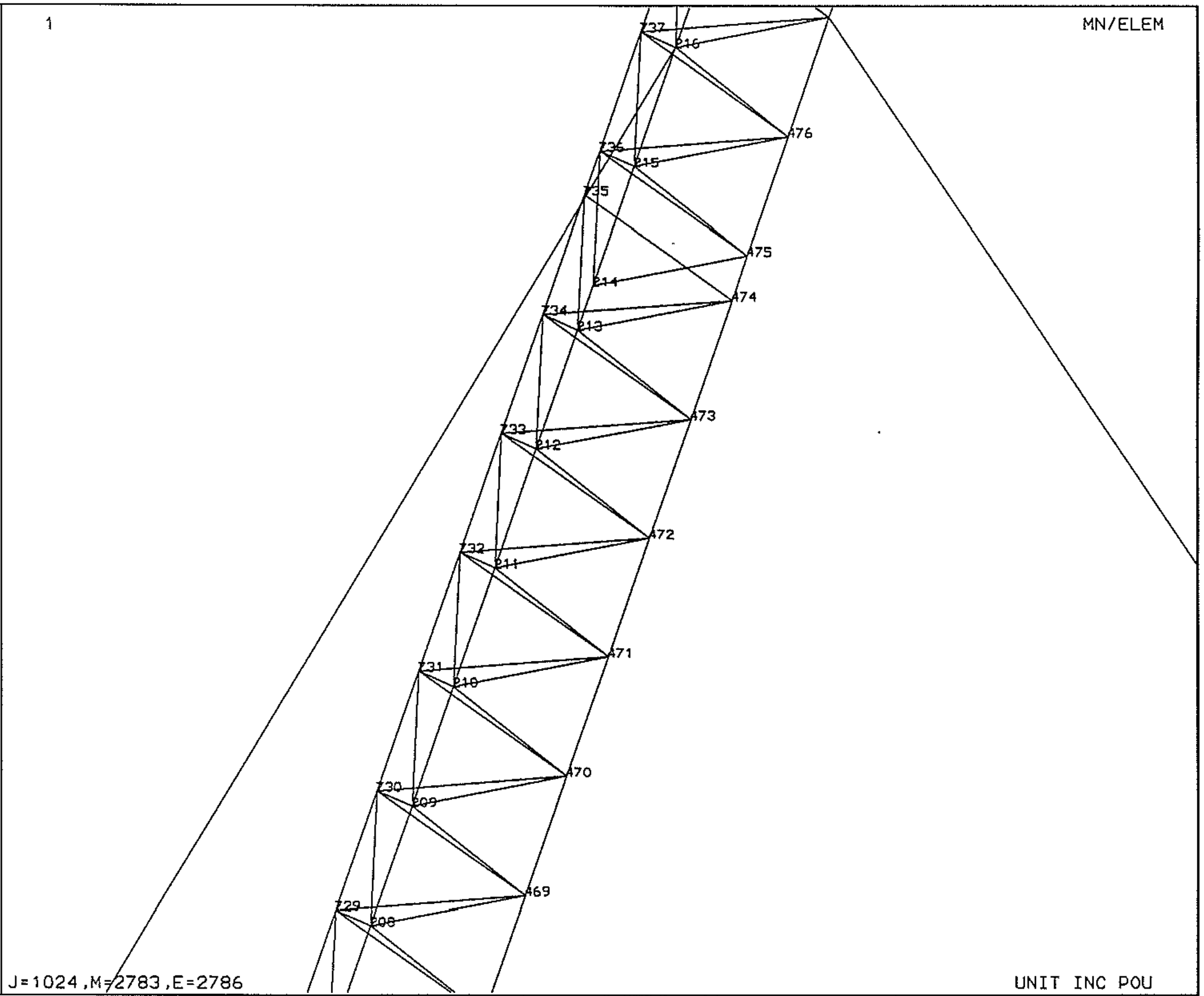
32-20

STRUCTURE DATA

TYPE = SPACE
NJ = 1024
NM = 2783
NE = 2786
NS = 10
NL = 1
XMAX= 5818.0
YMAX= 4081.0
ZMAX= 5040.0

1

MN/ELEM



J=1024,M=2783,E=2786

UNIT INC POU

COMPANY: US DEPARTMENT OF LABOR

S T A A D P L - P L O T (REV: 19.0b)

TITLE: - RADIO TOWER @SELMA AL.(RADIO8B), WITH

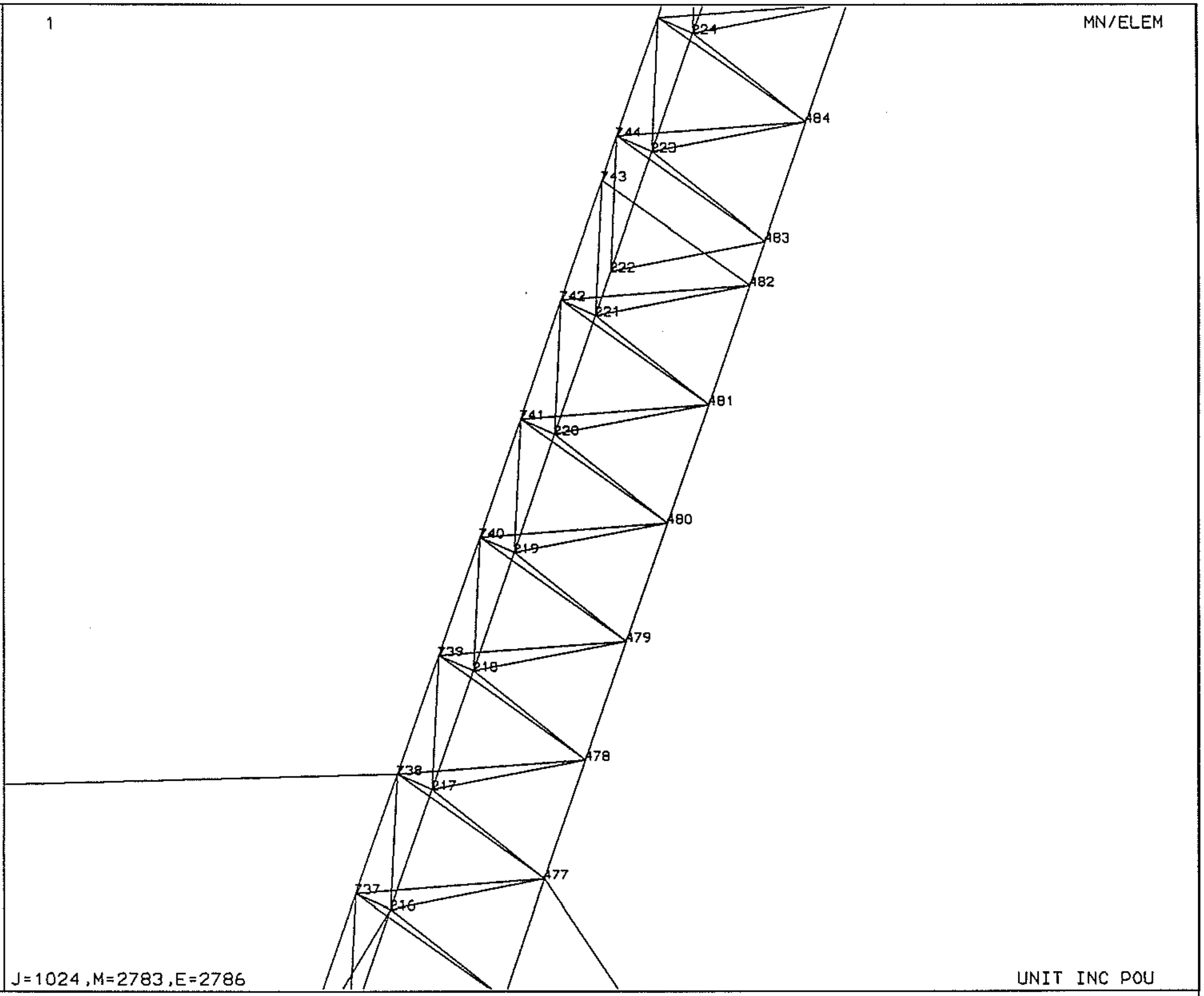
DATE: OCT 27, 1994

32-21

32-22

STRUCTURE DATA

TYPE = SPACE
NJ = 1024
NM = 2783
NE = 2786
NS = 10
NL = 1
XMAX= 5818.0
YMAX= 4081.0
ZMAX= 5040.0



COMPANY: US DEPARTMENT OF LABOR

S T A A D P L - P L O T (REV: 19.0b)

TITLE: - RADIO TOWER @SELMA AL.(RADIO8B), WITH

DATE: OCT 27, 1994

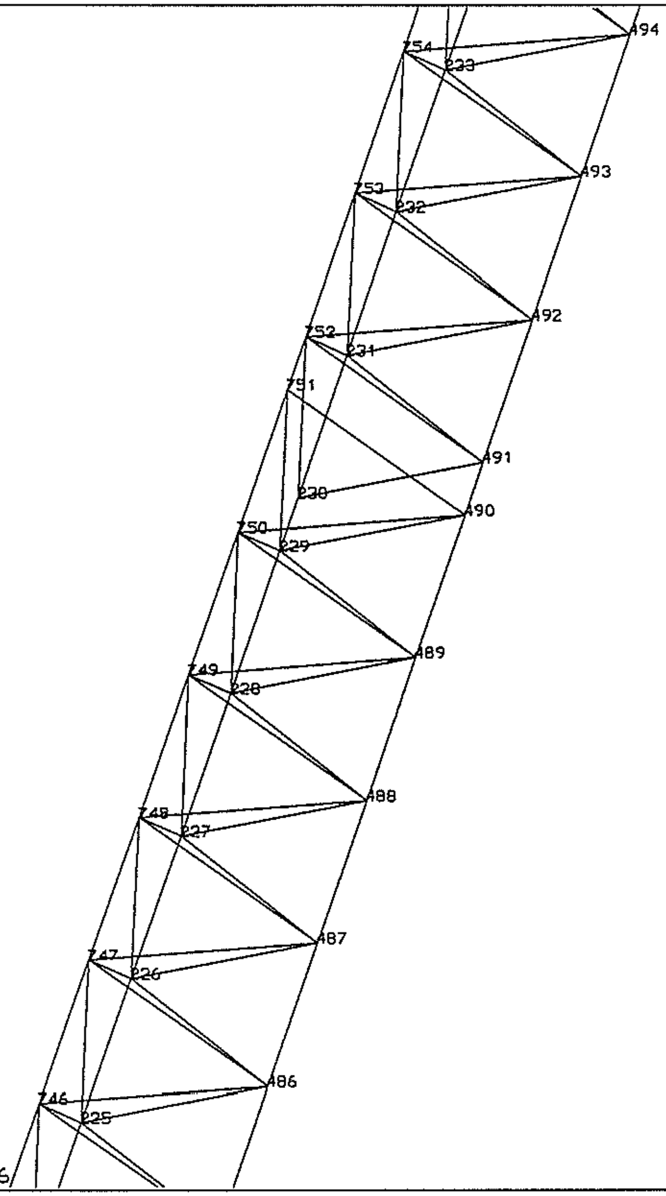
32-23

STRUCTURE DATA

TYPE = SPACE
NJ = 1024
NM = 2783
NE = 2786
NS = 10
NL = 1
XMAX= 5818.0
YMAX= 4081.0
ZMAX= 5040.0

1

MN/ELEM



J=1024,M=2783,E=2786

UNIT INC POU

COMPANY: US DEPARTMENT OF LABOR

S T A A D P L - P L O T (REV: 19.0b)

TITLE: - RADIO TOWER @SELMA AL.(RADIO8B), WITH

DATE: OCT 27, 1994

STRUCTURE DATA

TYPE = SPACE

NJ = 1024

NM = 2783

NE = 2786

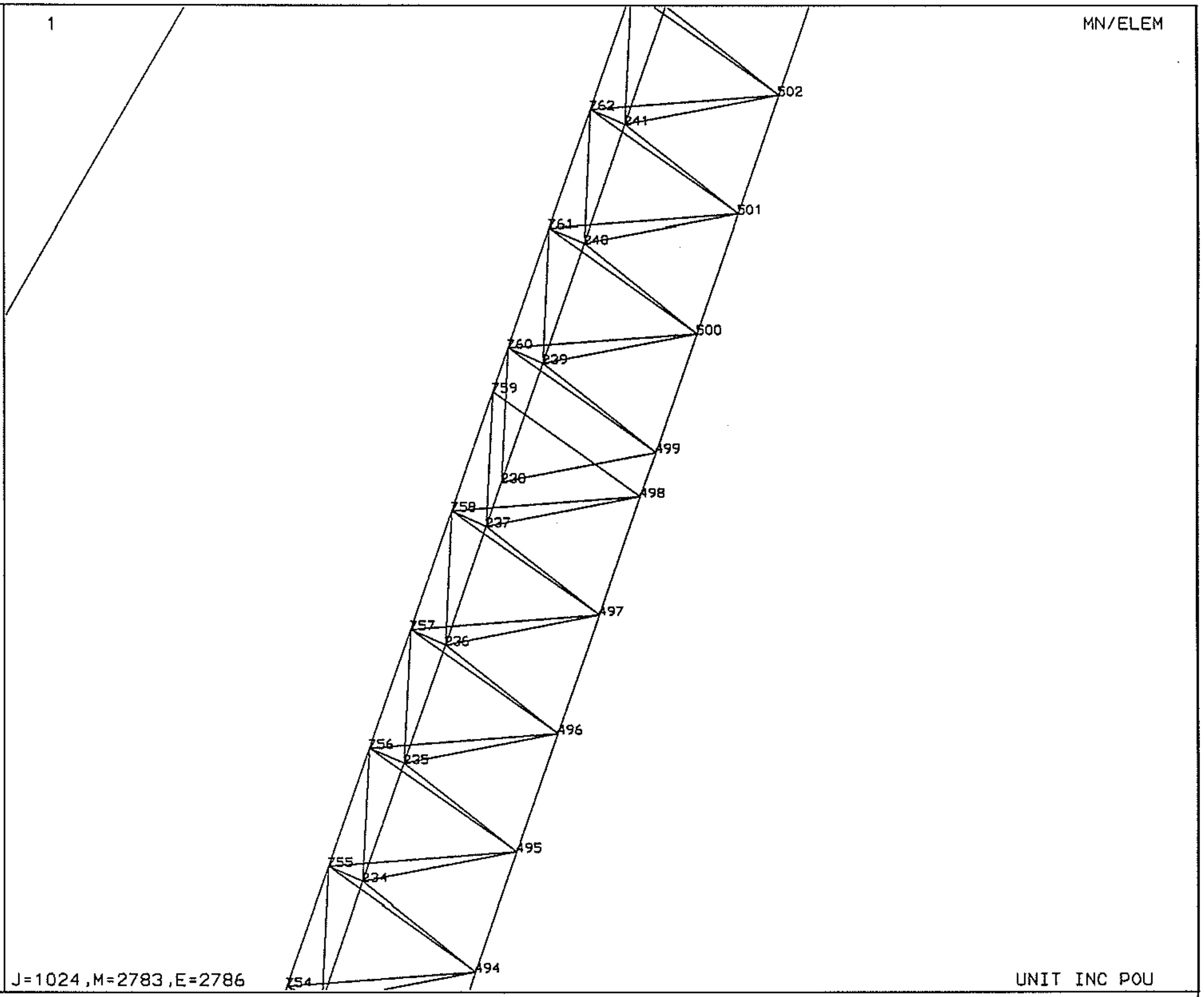
NS = 10

NL = 1

XMAX= 5818.0

YMAX= 4081.0

ZMAX= 5040.0



32-24

COMPANY: US DEPARTMENT OF LABOR

S T A A D P L - P L O T (REV: 19.0b)

DATE: OCT 27, 1994

TITLE: - RADIO TOWER @SELMA AL.(RADIO8B), WITH

32-25

STRUCTURE DATA

TYPE = SPACE

NJ = 1024

NM = 2783

NE = 2786

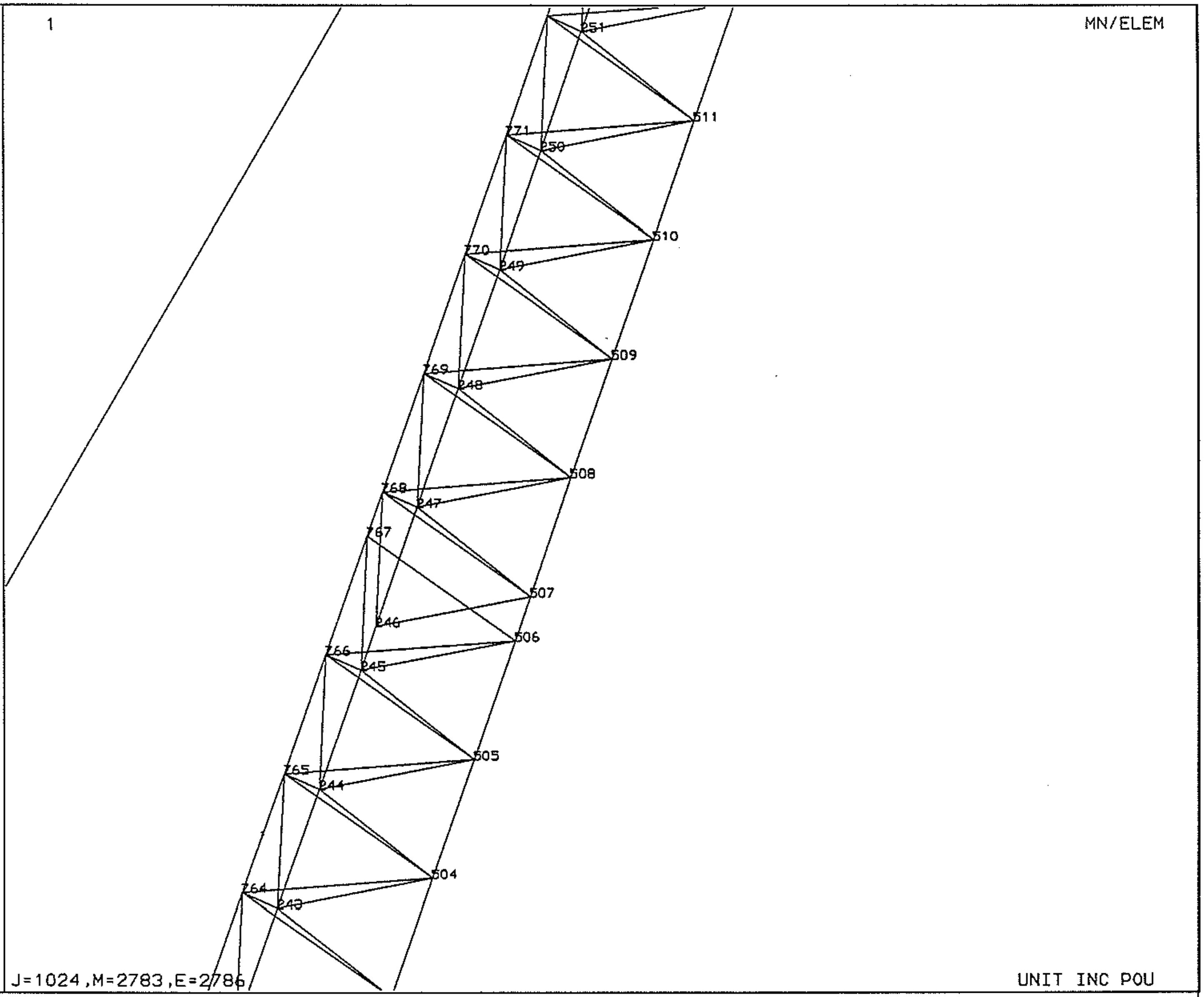
NS = 10

NL = 1

XMAX= 5818.0

YMAX= 4081.0

ZMAX= 5040.0



COMPANY: US DEPARTMENT OF LABOR

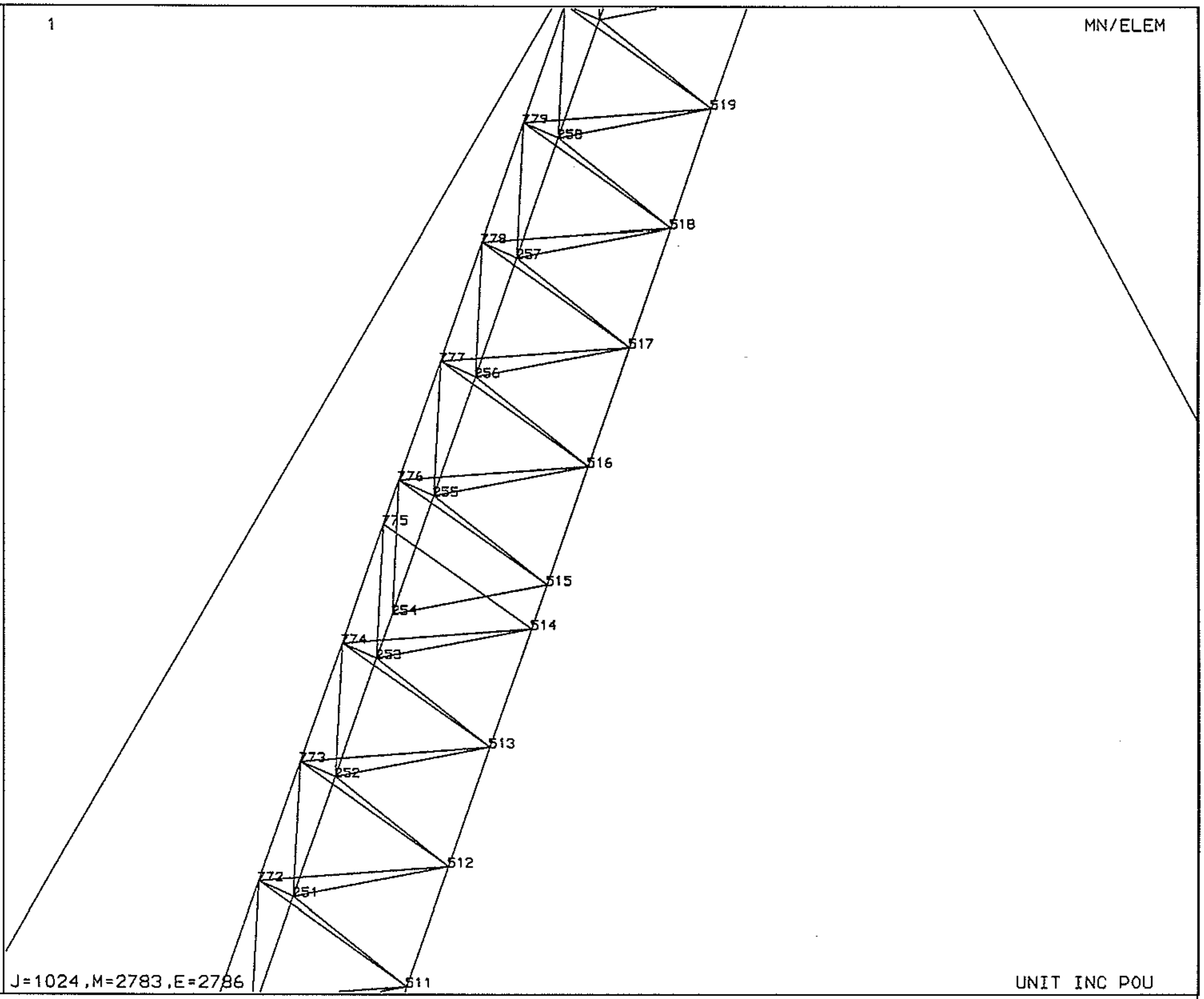
S T A A D P L - P L O T (REV: 19.0b)

TITLE: - RADIO TOWER @SELMA AL.(RADIO8B), WITH

DATE: OCT 27, 1994

STRUCTURE DATA

TYPE = SPACE
NJ = 1024
NM = 2783
NE = 2786
NS = 10
NL = 1
XMAX= 5818.0
YMAX= 4081.0
ZMAX= 5040.0



COMPANY: US DEPARTMENT OF LABOR

S T A A D P L - P L O T (REV: 19.0b)

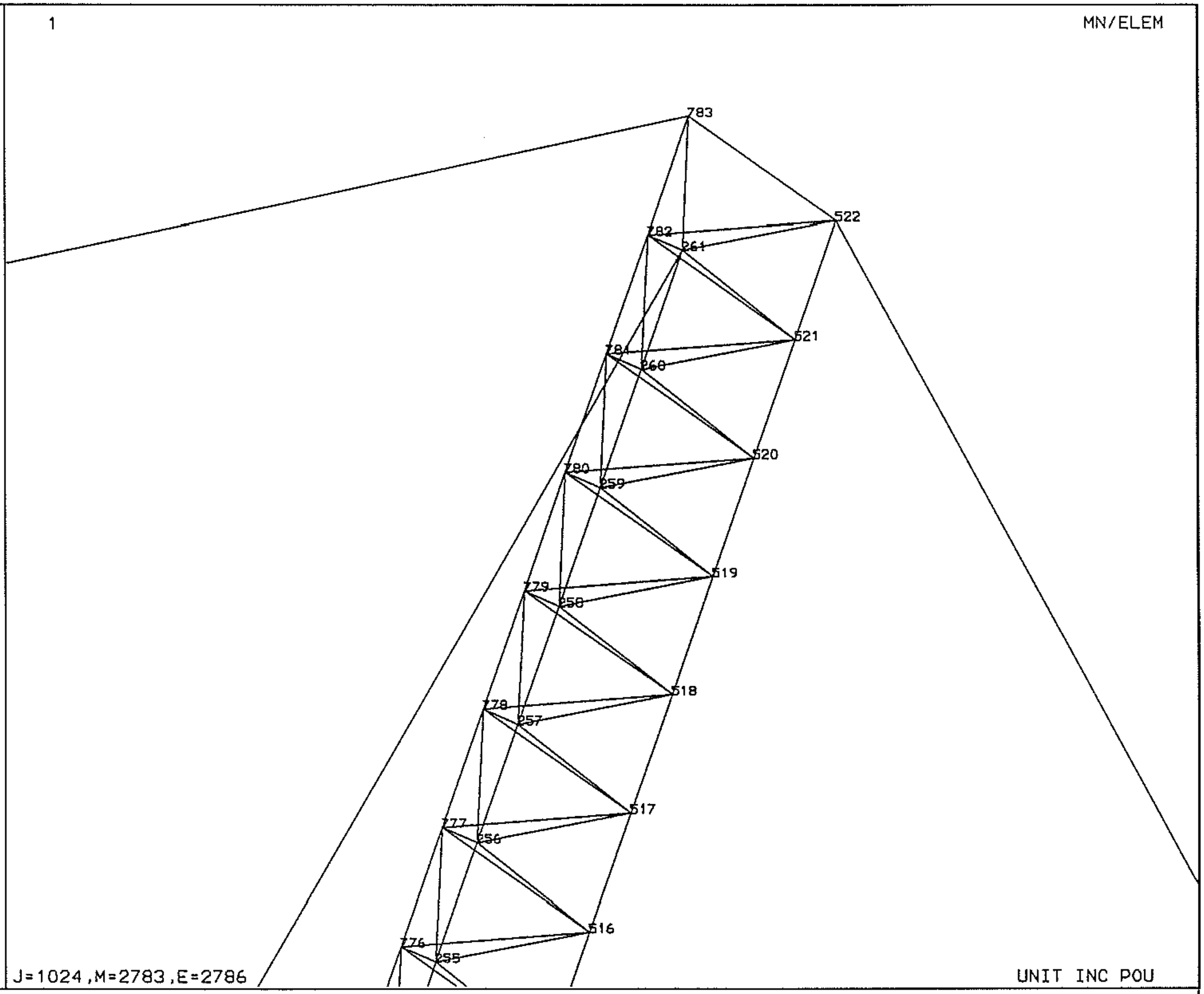
TITLE: - RADIO TOWER @SELMA AL.(RADIO88), WITH

DATE: OCT 27, 1994

32-27

STRUCTURE DATA

TYPE = SPACE
NJ = 1024
NM = 2783
NE = 2786
NS = 10
NL = 1
XMAX= 5818.0
YMAX= 4081.0
ZMAX= 5040.0

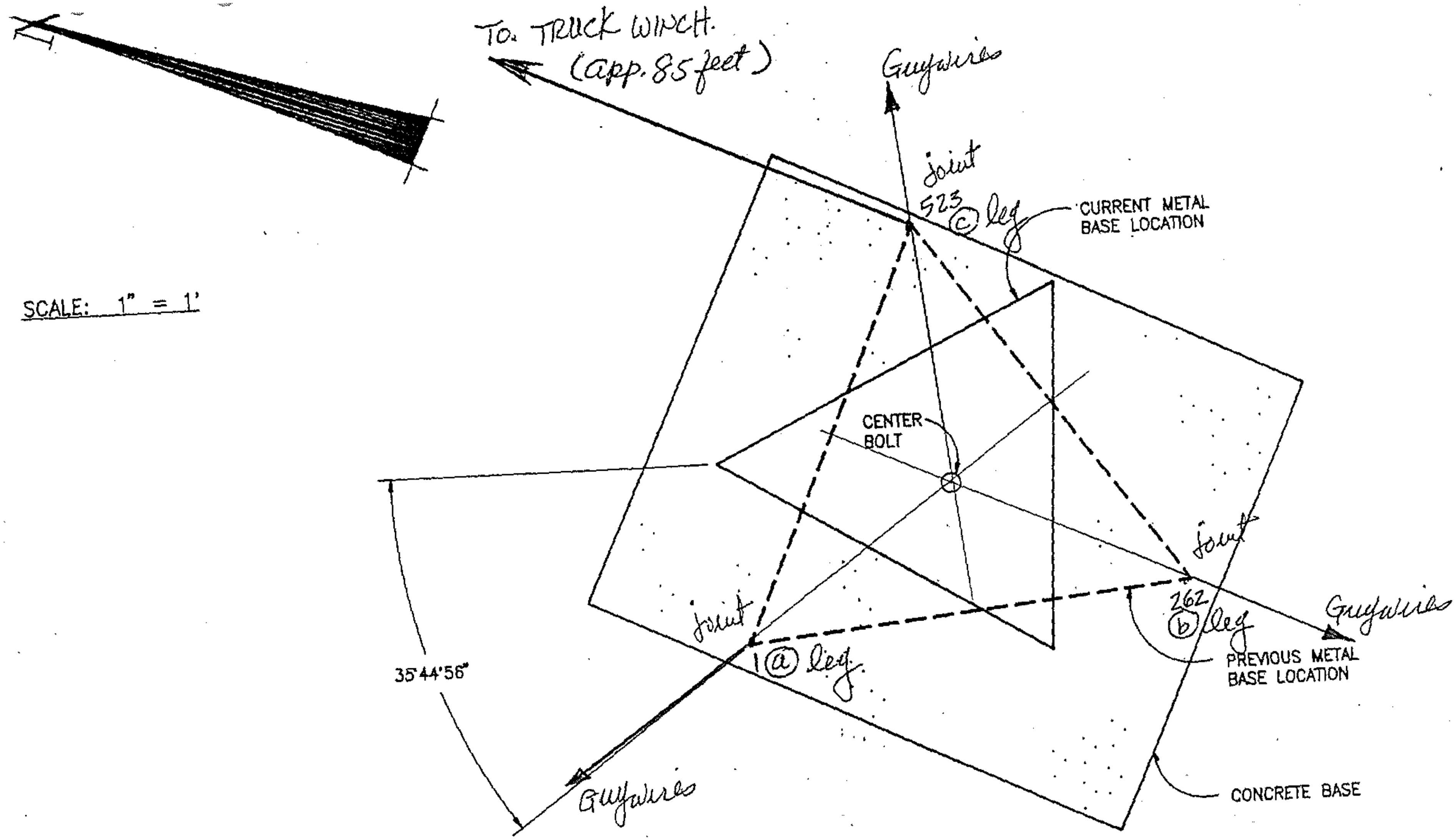


COMPANY: US DEPARTMENT OF LABOR

S T A A D P L - P L O T (REV: 19.0b)

TITLE: - RADIO TOWER @SELMA AL.(RADIO8B), WITH

DATE: OCT 27, 1994



SCALE: 1" = 1'

DETAIL "A"

32-28

MEMBER STRESSES

ALL UNITS ARE POUN/SQ INCH

MEMB	LD	SECT	AXIAL	BEND-Y	BEND-Z	COMBINED	SHEAR-Y	SHEAR-Z
35	1	.0	5867.9 C	2356.1	212.7	8233.5	13.0	217.5
		1.00	5863.0 C	4445.5	193.2	10312.7 ←	13.0	217.5
36	1	.0	5629.5 C	4445.5	183.2	10078.8	12.0	218.1
		1.00	5624.6 C	2375.5	192.6	8007.9	12.0	218.1
37	1	.0	5516.8 C	1791.5	2.1	7308.3	0.2	37.1
		1.00	5511.9 C	631.8	3.4	6143.7	0.2	37.1
38	1	.0	5510.9 C	631.8	7.9	6142.7	1.4	37.1
		1.00	5506.0 C	528.0	34.8	6035.1	1.4	37.1
39	1	.0	5519.5 C	377.2	30.2	5897.9	1.3	7.7
		1.00	5514.6 C	136.0	9.6	5651.0	1.3	7.7
40	1	.0	5513.6 C	136.0	0.7	5649.7	0.2	7.7
		1.00	5508.7 C	105.1	6.6	5614.0	0.2	7.7
41	1	.0	5501.2 C	97.3	5.6	5598.6	0.1	0.9
		1.00	5496.3 C	126.8	2.9	5623.2	0.1	0.9
42	1	.0	5495.2 C	126.8	13.6	5622.8	1.2	0.9
		1.00	5489.0 C	164.8	36.4	5657.7	1.2	0.9
43	1	.0	5497.7 C	371.1	98.1	5881.5	35.1	41.8
		1.00	5496.8 C	143.6	92.6	5667.7	35.1	41.8
44	1	.0	5484.5 C	375.7	49.2	5863.4	2.2	21.7
		1.00	5478.3 C	493.6	38.2	5973.4	2.2	21.7
45	1	.0	5476.7 C	355.6	16.9	5832.7	0.8	7.0
		1.00	5471.8 C	135.8	7.5	5607.8	0.8	7.0
46	1	.0	5470.6 C	135.8	2.4	5606.5	0.2	7.0
		1.00	5465.8 C	84.0	3.6	5549.9	0.2	7.0
47	1	.0	5457.3 C	69.6	4.7	5527.1	0.2	0.4
		1.00	5452.5 C	56.0	3.0	5508.5	0.2	0.4
48	1	.0	5451.4 C	56.0	6.9	5507.9	0.7	0.4
		1.00	5446.5 C	42.4	14.4	5491.3	0.7	0.4
49	1	.0	5446.8 C	92.6	16.4	5540.8	0.8	7.0
		1.00	5441.9 C	126.6	9.7	5568.9	0.8	7.0
50	1	.0	5440.8 C	126.6	0.0	5567.4	0.3	7.0
		1.00	5435.9 C	345.8	8.3	5781.8	0.3	7.0
51	1	.0	5416.7 C	444.7	11.8	5861.6	0.3	32.1

32-35

MEMBER STRESSES

ALL UNITS ARE POUN/SQ INCH

MEMB	LD	SECT	AXIAL	BEND-Y	BEND-Z	COMBINED	SHEAR-Y	SHEAR-Z
52	1	.0	5410.8 C	560.3	6.1	5971.1	0.7	32.1
		1.00	5405.9 C	1565.2	16.4	6971.2	0.7	32.1
53	1	.0	5495.5 C	2118.2	190.9	7622.2	11.7	194.5
		1.00	5490.6 C	3963.4	173.5	9457.8	11.7	194.5
54	1	.0	5151.7 C	3963.4	163.6	9118.4	10.7	193.7
		1.00	5146.8 C	2095.6	171.4	7249.3	10.7	193.7
55	1	.0	5050.1 C	1571.7	3.4	6621.8	0.3	29.3
		1.00	5045.2 C	654.2	5.4	5699.4	0.3	29.3
56	1	.0	5044.1 C	654.2	5.5	5698.4	0.7	29.3
		1.00	5037.9 C	522.9	22.5	5561.2	0.7	29.3
57	1	.0	5074.6 C	326.7	98.2	5415.8	12.0	29.7
		1.00	5073.8 C	165.4	163.6	5306.4	12.0	29.7
58	1	.0	5552.3 C	71.4	837.6	6393.0	19.5	5.0
		1.00	5547.2 C	362.0	847.4	6468.6	19.5	5.0
59	1	.0	5545.4 C	426.5	874.9	6518.7	20.0	10.3
		1.00	5540.3 C	463.9	852.3	6510.7	20.0	10.3
60	1	.0	5533.4 C	500.3	888.8	6553.3	20.2	11.3
		1.00	5528.3 C	472.7	857.2	6507.3	20.2	11.3
61	1	.0	5528.1 C	529.5	878.8	6554.2	19.8	11.7
		1.00	5523.0 C	484.4	836.1	6489.4	19.8	11.7
62	1	.0	5505.4 C	490.8	841.4	6479.4	18.4	10.5
		1.00	5500.3 C	412.2	747.0	6353.4	18.4	10.5
63	1	.0	5526.6 C	463.1	754.3	6411.8	14.4	8.7
		1.00	5521.5 C	286.7	490.1	6089.4	14.4	8.7
64	1	.0	4965.3 C	137.1	216.2	5221.3	0.7	0.5
		1.00	4960.3 C	90.4	157.8	5142.1	0.7	0.5
65	1	.0	5504.6 C	278.4	502.6	6079.2	14.2	7.8
		1.00	5499.5 C	399.7	724.8	6327.3	14.2	7.8
66	1	.0	5471.4 C	456.8	759.4	6357.7	18.1	10.7
		1.00	5466.3 C	465.8	803.6	6395.1	18.1	10.7
67	1	.0	5470.2 C	496.5	854.2	6458.2	19.6	11.2
		1.00	5465.1 C	467.8	841.2	6427.6	19.6	11.2
68	1	.0	5464.3 C	523.8	863.3	6474.1	19.6	11.6

MEMBER STRESSES

ALL UNITS ARE POUN/SQ INCH

MEMB	LD	SECT	AXIAL	BEND-Y	BEND-Z	COMBINED	SHEAR-Y	SHEAR-Z
645	1	.0	4261.6 C	794.8	2.6	5056.4	0.2	18.2
		1.00	4256.5 C	778.1	15.9	5034.8	0.2	18.2
646	1	.0	4252.4 C	712.7	11.7	4965.2	0.1	15.4
		1.00	4247.3 C	619.7	0.9	4866.9	0.1	15.4
647	1	.0	4258.7 C	551.0	8.5	4809.8	0.1	6.1
		1.00	4257.8 C	462.7	7.1	4720.6	0.1	6.1
648	1	.0	4238.8 C	649.4	3.2	4888.2	0.2	16.4
		1.00	4233.7 C	764.9	18.3	4998.8	0.2	16.4
649	1	.0	4233.0 C	708.8	11.8	4941.9	0.1	16.7
		1.00	4227.9 C	736.5	3.1	4964.4	0.1	16.7
650	1	.0	4221.0 C	791.1	2.7	5012.2	0.2	18.4
		1.00	4216.0 C	795.3	17.1	5011.4	0.2	18.4
651	1	.0	4213.8 C	733.9	11.4	4947.8	0.1	16.9
		1.00	4208.7 C	723.5	1.8	4932.2	0.1	16.9
652	1	.0	4195.4 C	753.1	2.0	4948.5	0.2	16.7
		1.00	4190.3 C	693.6	12.4	4884.0	0.2	16.7
653	1	.0	4208.5 C	624.6	11.9	4833.2	0.2	12.0
		1.00	4203.4 C	409.3	7.9	4612.7	0.2	12.0
654	1	.0	3779.4 C	193.1	0.2	3972.5	0.1	0.6
		1.00	3774.3 C	139.7	7.3	3914.2	0.1	0.6
655	1	.0	4188.0 C	460.0	2.8	4648.0	0.2	13.2
		1.00	4182.9 C	678.4	18.2	4861.5	0.2	13.2
656	1	.0	4159.9 C	630.2	12.1	4790.2	0.1	15.3
		1.00	4154.8 C	693.4	3.0	4848.2	0.1	15.3
657	1	.0	4157.3 C	760.3	2.3	4917.6	0.2	17.7
		1.00	4152.2 C	769.4	16.1	4921.8	0.2	17.7
658	1	.0	4151.2 C	708.5	11.7	4859.9	0.1	16.1
		1.00	4146.1 C	681.1	0.9	4827.2	0.1	16.1
659	1	.0	4101.3 C	680.0	0.1	4781.3	0.0	14.5
		1.00	4096.2 C	571.2	2.6	4667.4	0.0	14.5
660	1	.0	4178.1 C	501.0	17.1	4679.4	0.6	8.4
		1.00	4173.0 C	229.0	36.8	4404.9	0.6	8.4
661	1	.0	3385.5 C	277.2	24.8	3663.8	1.0	540.0

661	1.00	3384.6 C	8053.2	10.4	11437.8	1.0	540.0

MEMBER STRESSES

ALL UNITS ARE POUN/SQ INCH

MEMB	LD	SECT	AXIAL	BEND-Y	BEND-Z	COMBINED	SHEAR-Y	SHEAR-Z
662	1	.0	4885.6 C	3728.8	0.2	8614.3	0.0	157.6
		1.00	4881.2 C	885.1	0.8	5766.3	0.0	157.6
663	1	.0	4891.6 C	836.6	9.9	5728.3	0.6	35.8
		1.00	4887.2 C	209.9	8.8	5097.3	0.6	35.8

************** END OF LATEST ANALYSIS RESULT **************

297. PRINT MEMBER STRESS LIST 3701 TO 3708 3801 TO 3808 3901 TO 3908

32-39

±1/16"

...STRESSES

...UNITS ARE POUN/SQ INCH

...MB	LD	SECT	AXIAL		BEND-Y	BEND-Z	COMBINED	SHEAR-Y	SHEAR-Z
35	1	.0	15970.3	C	7223.6	355.9	23202.7	24.2	627.6
		1.00	15965.5	C	9695.6	296.7	25665.6	24.2	627.6
36	1	.0	15321.3	C	9695.7	281.7	25021.1	27.6	573.9
		1.00	15316.4	C	5774.1	462.7	21109.0	27.6	573.9
37	1	.0	15044.3	C	3309.9	259.1	18364.3	12.4	82.0
		1.00	15039.4	C	1098.7	76.1	16140.7	12.4	82.0
38	1	.0	15036.4	C	1098.7	90.3	16138.8	7.5	82.0
		1.00	15031.5	C	1112.5	111.3	16149.6	7.5	82.0
39	1	.0	15055.0	C	608.8	76.4	15668.5	3.8	15.8
		1.00	15050.1	C	183.9	25.5	15235.8	3.8	15.8
40	1	.0	15047.1	C	183.9	0.6	15231.0	0.8	15.8
		1.00	15042.2	C	240.9	20.9	15284.0	0.8	15.8
41	1	.0	15026.2	C	239.1	12.0	15265.6	0.3	0.2
		1.00	15021.3	C	234.0	18.9	15256.1	0.3	0.2
42	1	.0	15018.3	C	234.0	49.3	15257.5	5.4	0.2
		1.00	15012.0	C	227.5	136.3	15277.3	5.4	0.2
43	1	.0	15039.9	C	1119.7	410.0	16232.2	178.3	123.5
		1.00	15039.0	C	540.8	425.8	15727.3	178.3	123.5
44	1	.0	14977.7	C	1670.4	197.0	16659.7	10.3	99.3
		1.00	14971.5	C	1762.4	160.7	16741.2	10.3	99.3
45	1	.0	14990.0	C	982.1	89.5	15976.2	4.6	23.8
		1.00	14985.1	C	341.6	34.9	15328.5	4.6	23.8
46	1	.0	14982.1	C	341.6	9.7	15323.8	0.6	23.8
		1.00	14977.2	C	298.9	7.8	15276.2	0.6	23.8
47	1	.0	14954.4	C	176.8	1.0	15131.2	0.1	2.8
		1.00	14949.5	C	102.6	2.7	15052.1	0.1	2.8
48	1	.0	14946.5	C	102.6	20.2	15051.1	2.1	2.8
		1.00	14941.6	C	28.3	36.4	14987.8	2.1	2.8
49	1	.0	14938.9	C	177.3	40.2	15120.7	2.5	14.0
		1.00	14934.0	C	200.3	27.5	15136.2	2.5	14.0
50	1	.0	14930.9	C	200.3	6.0	15131.3	1.5	14.0
		1.00	14926.0	C	577.9	33.3	15504.8	1.5	14.0
51	1	.0	14883.3	C	984.2	63.6	15869.5	4.6	74.8

32-44

t=1/16

MEMBER STRESSES

ALL UNITS ARE POUN/SQ INCH

MEMB	LD	SECT	AXIAL		BEND-Y	BEND-Z	COMBINED	SHEAR-Y	SHEAR-Z
52	1	.0	14875.4	C	1032.3	93.4	15911.9	13.9	74.8
		1.00	14870.5	C	3048.9	281.7	17932.4	13.9	74.8
53	1	.0	15105.5	C	5434.1	483.1	20561.1	29.6	533.8
		1.00	15100.7	C	8954.9	315.4	24061.1	29.6	533.8
54	1	.0	14165.8	C	8954.9	291.9	23125.5	27.1	537.0
		1.00	14161.0	C	5521.3	437.5	19699.5	27.1	537.0
55	1	.0	13907.3	C	3216.5	232.9	17132.2	11.0	74.4
		1.00	13902.5	C	1211.2	63.6	15115.4	11.0	74.4
56	1	.0	13899.4	C	1211.3	77.6	15113.2	5.1	74.4
		1.00	13893.2	C	1361.0	99.3	15257.8	5.1	74.4
57	1	.0	14001.0	C	717.7	306.7	14781.4	0.7	38.0
		1.00	14000.1	C	539.8	310.2	14622.7	0.7	38.0
58	1	.0	5552.7	C	14.3	811.5	6364.3	19.1	3.8
		1.00	5547.6	C	340.6	839.4	6453.5	19.1	3.8
59	1	.0	5546.3	C	406.4	868.4	6505.2	19.9	10.0
		1.00	5541.3	C	458.0	849.5	6506.4	19.9	10.0
60	1	.0	5533.9	C	497.4	888.2	6551.9	20.2	11.2
		1.00	5528.8	C	472.0	857.1	6507.2	20.2	11.2
61	1	.0	5528.3	C	528.8	878.7	6553.8	19.8	11.7
		1.00	5523.2	C	484.2	836.1	6489.3	19.8	11.7
62	1	.0	5505.6	C	490.7	841.4	6479.7	18.4	10.4
		1.00	5500.5	C	412.1	747.0	6353.7	18.4	10.4
63	1	.0	5526.7	C	463.0	754.4	6411.8	14.4	8.7
		1.00	5521.6	C	286.7	490.2	6089.5	14.4	8.7
64	1	.0	4965.8	C	137.1	216.2	5221.7	0.7	0.5
		1.00	4960.7	C	90.4	157.8	5142.5	0.7	0.5
65	1	.0	5504.9	C	278.5	502.6	6079.5	14.2	7.8
		1.00	5499.8	C	399.6	724.9	6327.6	14.2	7.8
66	1	.0	5471.7	C	456.8	759.5	6358.0	18.1	10.7
		1.00	5466.6	C	465.8	803.6	6395.5	18.1	10.7
67	1	.0	5470.3	C	496.5	854.3	6458.4	19.6	11.2
		1.00	5465.2	C	467.7	841.2	6427.7	19.6	11.2
68	1	.0	5464.7	C	523.8	863.3	6474.5	19.6	11.6

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EMBER STRESSES

ALL UNITS ARE POUN/SQ INCH

EMB	LD	SECT	AXIAL		BEND-Y	BEND-Z	COMBINED	SHEAR-Y	SHEAR-Z
288	1	.0	5761.3	C	96.5	12.1	5858.5	1.1	2.4
		1.00	5755.0	C	193.5	33.4	5951.4	1.1	2.4
289	1	.0	5763.3	C	400.6	103.6	6177.0	36.9	48.5
		1.00	5762.4	C	136.9	97.3	5930.3	36.9	48.5
290	1	.0	5750.1	C	371.7	47.8	6124.9	2.2	19.1
		1.00	5743.9	C	393.1	41.1	6139.1	2.2	19.1
291	1	.0	5745.6	C	219.5	25.7	5966.6	1.2	2.8
		1.00	5740.7	C	305.9	13.1	6046.9	1.2	2.8
292	1	.0	5739.7	C	305.9	3.3	6045.6	0.6	2.8
		1.00	5734.8	C	392.3	16.5	6127.4	0.6	2.8
293	1	.0	5704.8	C	569.9	31.9	6275.6	1.8	44.8
		1.00	5699.9	C	832.8	24.6	6533.0	1.8	44.8
294	1	.0	5698.8	C	832.8	35.3	6532.3	5.0	44.8
		1.00	5693.9	C	2235.3	120.9	7932.5	5.0	44.8
295	1	.0	15971.0	C	7223.7	355.9	23203.5	24.2	627.6
		1.00	15966.2	C	9695.7	296.6	25666.3	24.2	627.6
296	1	.0	15322.0	C	9695.6	281.7	25021.7	27.6	573.9
		1.00	15317.1	C	5774.1	462.8	21109.7	27.6	573.9
297	1	.0	15044.9	C	3310.0	259.1	18364.9	12.4	82.0
		1.00	15040.0	C	1098.7	76.2	16141.3	12.4	82.0
298	1	.0	15037.1	C	1098.7	90.3	16139.5	7.5	82.0
		1.00	15032.2	C	1112.6	111.2	16150.3	7.5	82.0
299	1	.0	15055.4	C	608.8	76.4	15669.0	3.8	15.8
		1.00	15050.5	C	183.9	25.5	15236.2	3.8	15.8
300	1	.0	15047.6	C	183.9	0.6	15231.5	0.8	15.8
		1.00	15042.7	C	240.9	20.8	15284.5	0.8	15.8
301	1	.0	15026.5	C	239.2	12.0	15266.0	0.3	0.2
		1.00	15021.6	C	234.0	18.9	15256.4	0.3	0.2
302	1	.0	15018.6	C	234.1	49.3	15257.8	5.4	0.2
		1.00	15012.4	C	227.5	136.2	15277.5	5.4	0.2
303	1	.0	15040.2	C	1119.8	410.0	16232.7	178.3	123.5
		1.00	15039.4	C	540.6	425.8	15727.5	178.3	123.5
304	1	.0	14978.0	C	1670.4	196.9	16660.0	10.3	99.3

t=1/16

MEMBER STRESSES

ALL UNITS ARE POUN/SQ INCH

MEMB	LD	SECT	AXIAL	BEND-Y	BEND-Z	COMBINED	SHEAR-Y	SHEAR-Z
305	1	.0	14990.2 C	982.1	89.5	15976.4	4.6	23.8
		1.00	14985.4 C	341.6	34.9	15328.8	4.6	23.8
306	1	.0	14982.2 C	341.6	9.8	15323.9	0.7	23.8
		1.00	14977.3 C	298.9	7.9	15276.3	0.7	23.8
307	1	.0	14954.4 C	176.8	1.1	15131.3	0.1	2.8
		1.00	14949.5 C	102.6	2.7	15052.1	0.1	2.8
308	1	.0	14946.4 C	102.6	20.1	15051.0	2.1	2.8
		1.00	14941.5 C	28.3	36.4	14987.6	2.1	2.8
309	1	.0	14938.8 C	177.3	40.1	15120.6	2.5	14.0
		1.00	14933.9 C	200.3	27.4	15136.1	2.5	14.0
310	1	.0	14930.9 C	200.3	6.0	15131.3	1.5	14.0
		1.00	14926.0 C	577.9	33.3	15504.9	1.5	14.0
311	1	.0	14883.4 C	984.1	63.6	15869.6	4.7	74.8
		1.00	14878.5 C	1032.3	61.8	15912.7	4.7	74.8
312	1	.0	14875.5 C	1032.3	93.4	15912.0	13.9	74.8
		1.00	14870.6 C	3048.9	281.6	17932.4	13.9	74.8
313	1	.0	15105.4 C	5434.2	483.1	20561.1	29.6	533.8
		1.00	15100.6 C	8955.0	315.4	24061.1	29.6	533.8
314	1	.0	14165.9 C	8954.9	292.0	23125.6	27.1	537.0
		1.00	14161.0 C	5521.1	437.5	19699.4	27.1	537.0
315	1	.0	13907.4 C	3216.2	233.1	17132.1	11.0	74.4
		1.00	13902.5 C	1211.3	63.8	15115.5	11.0	74.4
316	1	.0	13899.4 C	1211.3	77.7	15113.2	5.1	74.4
		1.00	13893.1 C	1359.8	98.6	15256.5	5.1	74.4
317	1	.0	14000.3 C	713.8	308.7	14778.0	1.4	34.4
		1.00	13999.5 C	552.7	302.2	14629.4	1.4	34.4
318	1	.0	5551.2 C	2.4	820.1	6371.3	19.4	4.2
		1.00	5546.1 C	369.0	856.8	6479.0	19.4	4.2
319	1	.0	5543.9 C	377.6	853.9	6477.7	19.7	9.6
		1.00	5538.8 C	454.7	845.8	6499.2	19.7	9.6
320	1	.0	5532.4 C	494.9	893.2	6553.5	20.5	11.5
		1.00	5527.3 C	499.3	874.9	6534.6	20.5	11.5
321	1	.0	5526.0 C	492.9	861.2	6518.3	19.6	11.3

MEMBER STRESSES

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ALL UNITS ARE POUN/SQ INCH

EMB	LD	SECT	AXIAL	BEND-Y	BEND-Z	COMBINED	SHEAR-Y	SHEAR-Z
35	1	.0	31266.6 C	14984.4	473.5	46258.4	34.7	1247.8
		1.00	31261.7 C	17404.4	426.0	48671.3	34.7	1247.8
36	1	.0	29995.3 C	17404.5	433.9	47405.1	52.4	1114.4
		1.00	29990.4 C	11520.4	925.7	41547.9	52.4	1114.4
37	1	.0	29490.5 C	4911.8	720.9	34454.9	36.4	129.8
		1.00	29485.6 C	1543.4	224.8	31045.3	36.4	129.8
38	1	.0	29479.6 C	1543.4	214.0	31037.8	16.5	129.8
		1.00	29474.8 C	1825.0	215.1	31312.4	16.5	129.8
39	1	.0	29501.6 C	764.9	130.5	30277.5	6.7	22.7
		1.00	29496.7 C	176.7	44.4	29678.9	6.7	22.7
40	1	.0	29490.8 C	176.7	9.2	29667.7	2.5	22.7
		1.00	29485.9 C	411.5	54.7	29901.0	2.5	22.7
41	1	.0	29459.4 C	549.8	34.2	30010.3	0.0	8.9
		1.00	29454.5 C	319.6	34.0	29775.9	0.0	8.9
42	1	.0	29448.6 C	319.6	104.8	29784.9	11.8	8.9
		1.00	29442.3 C	24.3	287.7	29731.0	11.8	8.9
43	1	.0	29502.7 C	2162.8	984.5	31879.1	464.0	196.8
		1.00	29501.9 C	1274.5	1109.9	31191.9	464.0	196.8
44	1	.0	29333.6 C	4394.4	467.5	33752.8	26.4	261.1
		1.00	29327.3 C	4298.4	413.0	33645.6	26.4	261.1
45	1	.0	29403.2 C	1791.9	270.3	31215.4	14.3	46.7
		1.00	29398.3 C	580.6	100.8	29987.6	14.3	46.7
46	1	.0	29392.4 C	580.7	42.6	29974.6	2.9	46.7
		1.00	29387.5 C	630.6	33.6	30019.0	2.9	46.7
47	1	.0	29346.4 C	280.9	11.1	29627.6	0.3	5.8
		1.00	29341.5 C	131.2	3.2	29472.7	0.3	5.8
48	1	.0	29335.5 C	131.1	37.6	29471.9	3.8	5.8
		1.00	29330.6 C	18.7	60.9	29394.3	3.8	5.8
49	1	.0	29319.5 C	253.6	66.1	29581.6	4.4	18.6
		1.00	29314.6 C	229.6	48.7	29549.3	4.4	18.6
50	1	.0	29308.8 C	229.6	12.5	29538.8	3.0	18.6
		1.00	29303.9 C	712.9	64.3	30019.7	3.0	18.6
51	1	.0	29236.6 C	1635.2	138.2	30877.6	11.5	119.7

MEMBER STRESSES

ALL UNITS ARE POUN/SQ INCH

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MEMB	LD	SECT	AXIAL	BEND-Y	BEND-Z	COMBINED	SHEAR-Y	SHEAR-Z
52	1	.0	29225.8 C	1472.7	252.8	30720.0	38.3	119.7
		1.00	29220.9 C	4580.6	742.6	33861.4	38.3	119.7
53	1	.0	29655.0 C	10984.7	983.6	40683.6	59.4	1047.3
		1.00	29650.1 C	16199.1	557.7	45858.8	59.4	1047.3
54	1	.0	27812.1 C	16199.1	513.6	44019.4	54.4	1057.9
		1.00	27807.2 C	11260.1	898.5	39103.1	54.4	1057.9
55	1	.0	27336.2 C	5047.9	652.2	32426.1	32.8	126.2
		1.00	27331.3 C	1771.2	198.8	29113.6	32.8	126.2
56	1	.0	27325.4 C	1771.3	191.3	29107.0	12.5	126.3
		1.00	27319.1 C	2431.9	224.5	29761.3	12.5	126.3
57	1	.0	27522.5 C	1068.1	664.9	28780.6	33.3	18.7
		1.00	27521.6 C	983.8	514.6	28631.9	33.3	18.7
58	1	.0	5553.2 C	16.7	774.3	6327.7	18.6	3.8
		1.00	5548.1 C	340.7	829.6	6444.9	18.6	3.8
59	1	.0	5547.4 C	406.4	859.5	6498.2	19.8	10.0
		1.00	5542.3 C	458.5	847.0	6505.5	19.8	10.0
60	1	.0	5534.4 C	497.3	886.6	6551.0	20.2	11.2
		1.00	5529.3 C	471.9	856.7	6507.4	20.2	11.2
61	1	.0	5528.9 C	528.7	878.4	6554.1	19.8	11.7
		1.00	5523.8 C	484.2	836.0	6489.9	19.8	11.7
62	1	.0	5506.0 C	490.7	841.4	6480.0	18.4	10.4
		1.00	5500.9 C	412.0	747.0	6354.0	18.4	10.4
63	1	.0	5527.3 C	462.9	754.4	6412.4	14.4	8.7
		1.00	5522.2 C	286.7	490.2	6090.1	14.4	8.7
64	1	.0	4966.0 C	137.2	216.2	5222.0	0.7	0.5
		1.00	4960.9 C	90.3	157.8	5142.7	0.7	0.5
65	1	.0	5505.0 C	278.5	502.6	6079.7	14.2	7.8
		1.00	5499.9 C	399.6	724.9	6327.7	14.2	7.8
66	1	.0	5472.4 C	456.7	759.5	6358.7	18.1	10.7
		1.00	5467.3 C	465.8	803.7	6396.2	18.1	10.7
67	1	.0	5470.8 C	496.5	854.4	6459.0	19.6	11.2
		1.00	5465.7 C	467.6	841.3	6428.3	19.6	11.2
68	1	.0	5465.1 C	523.7	863.4	6474.9	19.6	11.6

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MEMBER STRESSES

ALL UNITS ARE POUN/SQ INCH

t=1/32

MEMB	LD	SECT	AXIAL	BEND-Y	BEND-Z	COMBINED	SHEAR-Y	SHEAR-Z
288	1	.0	5742.8 C	96.0	12.0	5839.6	1.1	2.4
		1.00	5736.5 C	192.0	33.1	5931.4	1.1	2.4
289	1	.0	5744.5 C	398.1	103.4	6155.9	36.8	48.6
		1.00	5743.7 C	133.9	96.9	5909.0	36.8	48.6
290	1	.0	5731.8 C	367.5	47.6	6102.4	2.2	18.6
		1.00	5725.5 C	379.9	41.3	6107.7	2.2	18.6
291	1	.0	5727.5 C	204.0	26.2	5933.2	1.3	3.7
		1.00	5722.6 C	319.9	12.9	6042.7	1.3	3.7
292	1	.0	5721.5 C	319.9	3.2	6041.3	0.6	3.7
		1.00	5716.6 C	435.7	15.6	6152.6	0.6	3.7
293	1	.0	5684.6 C	627.9	38.5	6313.7	2.5	48.9
		1.00	5679.7 C	901.9	39.8	6582.5	2.5	48.9
294	1	.0	5678.6 C	901.9	51.9	6582.0	7.5	48.9
		1.00	5673.7 C	2431.7	182.2	8112.3	7.5	48.9
→ 295	1	.0	31268.6 C	14984.5	473.5	46260.6	34.6	1247.8
		1.00	31263.7 C	17404.5	425.6	48673.4	34.6	1247.8
→ 296	1	.0	29997.3 C	17404.4	433.9	47407.1	52.4	1114.4
		1.00	29992.4 C	11520.3	926.0	41549.9	52.4	1114.4
→ 297	1	.0	29492.1 C	4911.9	720.8	34456.6	36.4	129.8
		1.00	29487.2 C	1543.4	225.1	31046.9	36.4	129.8
298	1	.0	29481.4 C	1543.4	214.0	31039.6	16.5	129.8
		1.00	29476.5 C	1825.0	214.8	31314.2	16.5	129.8
299	1	.0	29503.0 C	764.8	130.4	30278.8	6.7	22.7
		1.00	29498.1 C	176.7	44.1	29680.2	6.7	22.7
300	1	.0	29492.2 C	176.7	9.2	29669.1	2.4	22.7
		1.00	29487.3 C	411.4	54.4	29902.3	2.4	22.7
301	1	.0	29460.4 C	549.9	34.1	30011.5	0.0	8.9
		1.00	29455.6 C	319.6	34.3	29777.0	0.0	8.9
302	1	.0	29449.7 C	319.6	104.8	29786.1	11.8	8.9
		1.00	29443.4 C	24.2	287.4	29731.9	11.8	8.9
303	1	.0	29502.7 C	2163.1	984.7	31879.5	464.0	196.9
		1.00	29501.9 C	1274.2	1109.9	31191.7	464.0	196.9
304	1	.0	29334.4 C	4394.6	467.4	33753.7	26.4	261.1

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MEMBER STRESSES

ALL UNITS ARE POUN/SQ INCH

MEMB	LD	SECT	AXIAL		BEND-Y	BEND-Z	COMBINED	SHEAR-Y	SHEAR-Z
305	1	.0	29403.5	C	1791.8	270.1	31215.5	14.3	46.7
		1.00	29398.6	C	580.7	100.6	29987.9	14.3	46.7
306	1	.0	29392.8	C	580.6	42.6	29975.0	2.9	46.7
		1.00	29387.9	C	630.5	33.8	30019.3	2.9	46.7
307	1	.0	29346.3	C	281.0	11.3	29627.6	0.3	5.8
		1.00	29341.4	C	131.1	3.0	29472.6	0.3	5.8
308	1	.0	29335.7	C	131.2	37.4	29472.1	3.8	5.8
		1.00	29330.8	C	18.8	60.7	29394.3	3.8	5.8
309	1	.0	29319.5	C	253.7	65.9	29581.6	4.4	18.6
		1.00	29314.6	C	229.7	48.5	29549.4	4.4	18.6
310	1	.0	29308.8	C	229.6	12.6	29538.8	3.0	18.6
		1.00	29303.9	C	712.9	64.5	30019.8	3.0	18.6
311	1	.0	29236.7	C	1635.1	138.4	30877.7	11.5	119.7
		1.00	29231.8	C	1472.7	160.6	30713.3	11.5	119.7
312	1	.0	29225.9	C	1472.7	252.6	30720.2	38.3	119.7
		1.00	29221.0	C	4580.6	742.3	33861.4	38.3	119.7
313	1	.0	29654.9	C	10984.8	983.6	40683.7	59.4	1047.3
		1.00	29650.1	C	16199.1	557.5	45858.8	59.4	1047.3
314	1	.0	27812.1	C	16199.1	513.7	44019.3	54.4	1057.9
		1.00	27807.2	C	11259.9	898.6	39102.9	54.4	1057.9
315	1	.0	27336.3	C	5047.7	652.6	32426.0	32.8	126.2
		1.00	27331.4	C	1771.3	199.2	29113.9	32.8	126.2
316	1	.0	27325.3	C	1771.2	191.2	29106.8	12.5	126.2
		1.00	27319.0	C	2430.6	223.5	29759.8	12.5	126.2
317	1	.0	27520.6	C	1061.4	669.2	28775.3	37.3	11.9
		1.00	27519.8	C	1007.7	500.8	28645.0	37.3	11.9
318	1	.0	5551.7	C	3.7	783.4	6335.0	18.9	4.2
		1.00	5546.6	C	369.1	846.8	6470.4	18.9	4.2
319	1	.0	5545.1	C	378.3	845.3	6471.2	19.5	9.6
		1.00	5540.0	C	455.4	843.4	6498.5	19.5	9.6
320	1	.0	5532.9	C	495.0	891.7	6552.8	20.4	11.5
		1.00	5527.8	C	499.2	874.6	6534.9	20.4	11.5
321	1	.0	5526.5	C	492.8	861.0	6518.6	19.6	11.3

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MEMBER STRESSES

ALL UNITS ARE POUN/SQ INCH

MEMB	LD	SECT	AXIAL		BEND-Y	BEND-Z	COMBINED	SHEAR-Y	SHEAR-Z
543	1	.0	5761.7	C	1589.5	0.0	7351.3	0.0	101.7
		1.00	5756.8	C	1592.0	0.1	7348.9	0.0	101.7
544	1	.0	5753.7	C	1566.9	0.1	7320.6	0.0	100.1
		1.00	5748.8	C	1565.0	0.0	7313.8	0.0	100.1
545	1	.0	5746.5	C	1582.5	0.0	7329.0	0.0	101.1
		1.00	5741.6	C	1579.6	0.1	7321.2	0.0	101.1
546	1	.0	5740.0	C	1554.3	0.1	7294.3	0.0	98.4
		1.00	5735.1	C	1523.4	0.0	7258.5	0.0	98.4
547	1	.0	5733.3	C	1526.4	0.0	7259.7	0.0	93.2
		1.00	5728.4	C	1387.0	0.1	7115.4	0.0	93.2
548	1	.0	5750.1	C	1355.3	0.1	7105.4	0.0	51.9
		1.00	5743.8	C	728.3	0.0	6472.1	0.0	51.9
549	1	.0	5760.0	C	276.2	0.1	6036.2	0.0	97.0
		1.00	5759.2	C	251.5	0.0	6010.7	0.0	97.0
550	1	.0	5699.6	C	702.2	0.0	6401.9	0.0	51.2
		1.00	5693.4	C	1350.5	0.0	7043.9	0.0	51.2
551	1	.0	5697.6	C	1335.5	0.0	7033.1	0.0	90.9
		1.00	5692.7	C	1508.7	0.1	7201.4	0.0	90.9
552	1	.0	5677.4	C	1482.8	0.1	7160.2	0.0	94.4
		1.00	5672.5	C	1468.0	0.0	7140.5	0.0	94.4
553	1	.0	5659.5	C	1613.7	0.0	7273.2	0.0	107.0
		1.00	5654.6	C	1732.3	0.1	7386.9	0.0	107.0
554	1	.0	5768.4	C	1746.5	0.1	7514.8	0.0	130.1
		1.00	5763.5	C	2321.7	0.0	8085.2	0.0	130.1
555	1	.0	31450.4	C	8994.0	0.1	40444.3	0.0	702.3
		1.00	31445.5	C	9235.8	0.3	40681.3	0.0	702.3
556	1	.0	30013.3	C	8945.8	0.4	38959.1	0.0	649.6
		1.00	30008.4	C	7915.4	0.2	37923.8	0.0	649.6
557	1	.0	29629.8	C	10423.1	0.1	40052.9	0.0	764.4
		1.00	29624.9	C	9417.7	0.3	39042.6	0.0	764.4
558	1	.0	29288.9	C	8970.5	0.3	38259.4	0.0	689.4
		1.00	29284.0	C	8923.6	0.2	38207.7	0.0	689.4
559	1	.0	29327.2	C	8574.1	0.1	37901.3	0.0	665.9

MEMBER STRESSES

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ALL UNITS ARE POUN/SQ INCH

EMB	LD	SECT	AXIAL		BEND-Y	BEND-Z	COMBINED	SHEAR-Y	SHEAR-Z
560	1	.0	29370.3	C	8656.8	0.2	38027.1	0.0	665.7
		1.00	29365.4	C	8622.5	0.2	37987.9	0.0	665.7
561	1	.0	29359.2	C	8577.0	0.0	37936.2	0.0	648.5
		1.00	29354.3	C	8256.0	0.2	37610.3	0.0	648.5
562	1	.0	29369.8	C	8038.7	0.2	37408.5	0.0	432.7
		1.00	29363.5	C	6368.1	0.0	35731.6	0.0	432.7
563	1	.0	29613.9	C	915.7	0.2	30529.6	0.1	393.1
		1.00	29613.1	C	859.0	0.2	30472.1	0.1	393.1
564	1	.0	29067.7	C	6383.2	0.1	35450.9	0.0	437.7
		1.00	29061.4	C	8189.8	0.1	37251.3	0.0	437.7
565	1	.0	29170.7	C	7803.1	0.1	36973.8	0.0	626.2
		1.00	29165.8	C	8451.5	0.0	37617.3	0.0	626.2
566	1	.0	29263.5	C	8478.6	0.1	37742.1	0.0	655.3
		1.00	29258.6	C	8529.9	0.1	37788.5	0.0	655.3
567	1	.0	29221.2	C	8804.2	0.0	38025.4	0.0	677.8
		1.00	29216.3	C	8788.6	0.0	38004.9	0.0	677.8
568	1	.0	29189.6	C	8667.1	0.0	37856.7	0.0	668.4
		1.00	29184.7	C	8681.2	0.0	37865.9	0.0	668.4
569	1	.0	29183.0	C	8677.3	0.0	37860.4	0.0	669.9
		1.00	29178.1	C	8710.0	0.0	37888.2	0.0	669.9
570	1	.0	29119.1	C	8555.3	0.0	37674.4	0.0	654.3
		1.00	29114.2	C	8428.2	0.0	37542.4	0.0	654.3
571	1	.0	29045.0	C	8931.2	0.0	37976.2	0.0	689.8
		1.00	29040.1	C	8974.4	0.0	38014.5	0.0	689.8
572	1	.0	29329.6	C	9177.9	0.0	38507.5	0.0	742.1
		1.00	29324.7	C	10084.7	0.0	39409.4	0.0	742.1
573	1	.0	29662.1	C	7744.2	0.0	37406.3	0.0	620.6
		1.00	29657.2	C	8365.6	0.1	38022.8	0.0	620.6
574	1	.0	27838.0	C	8254.0	0.0	36091.9	0.0	597.9
		1.00	27833.1	C	7266.1	0.2	35099.1	0.0	597.9
575	1	.0	27478.2	C	9570.2	0.3	37048.4	0.0	692.2
		1.00	27473.3	C	8397.8	0.9	35871.1	0.0	692.2
576	1	.0	27133.9	C	7821.3	1.0	34955.2	0.1	433.2