IMPACT REVIEW ACTION NOTICE

96ϕ9L9ϕ 1ϕ8 - Part 4

CRWMS/M&O

Impact Review Action Notice

Complete only applicable items.

QA: N
Page: 1 Of: 1

1. From JOHN PYE	2. Date 08/02/95
3. To DANA ROGERS	

Please review the document or data described below to determine the impact on design documents of the MGDS development organization. Document results of impact review below. State that there are no impacts requiring action or provide your assessment of actions required to ensure consistency between the provisions of the document or data reviewed and design products. Include document and revision numbers of documents to be revised.

4. Please Complete Impact Review by (Date)
08/04/95

5. Document/TDIF/Data to be Evaluated:

Title Letter: Sandia National Laboratories, Joe Grant to John Pye, Strain Gage Data Results, Plots of Stress versus Time

Revision No. Information Only

Effective Date 07/27/95

Document Identifier None

6. Results of Impact Review

See Attachment 1.0 (Page 1 of 1).

M. E. Taylor 8-2-95
Evaluator Date

Attachment 1.0

Impact Review Action Notice for Letter: Sandia National Laboratories, Joe Grant to John Pye, Strain Gage Data Results, Plots of Stress versus Time

6. Results of Impact Review

The document identified in Block 5, transmits preliminary unchecked Stress versus Time Plots based on strain gage data for 28 steel sets installed in the ESF. Review of these stress/time plots indicates that steel stresses at the gages generally range from -12,500 psi (tension) to 11,000 psi (compression) with three major stress deviations ranging from -24,000 psi to 30,000 psi.

Two of the stress deviations are in steel set #158, station 2+50, at stress values of 20,000 psi and 30,000 psi and are based on data from gages identified as defective in February 1995, and are therefore not valid. The other stress deviation is in steel set #189, station 3+48, at a stress value of -24,000 psi. This stress deviation is assumed to be from a valid gage reading for this review. A gage reading opposite this deviation is -4,000 psi for set #189, and does not reflect a similar high stress value. This stress deviation may be the result of an eccentrically loaded flange or the result of a faulty gage.

Using the stress deviation above for set #189, the following axial and bending stresses were developed:

Steel Set #189

Axial Stress = -8333 psi
Bending Stress = 11160 psi
Combined axial tension and bending stresses are proportioned to 0.91 which is less than 1.0 and is in accordance with AISC requirements.

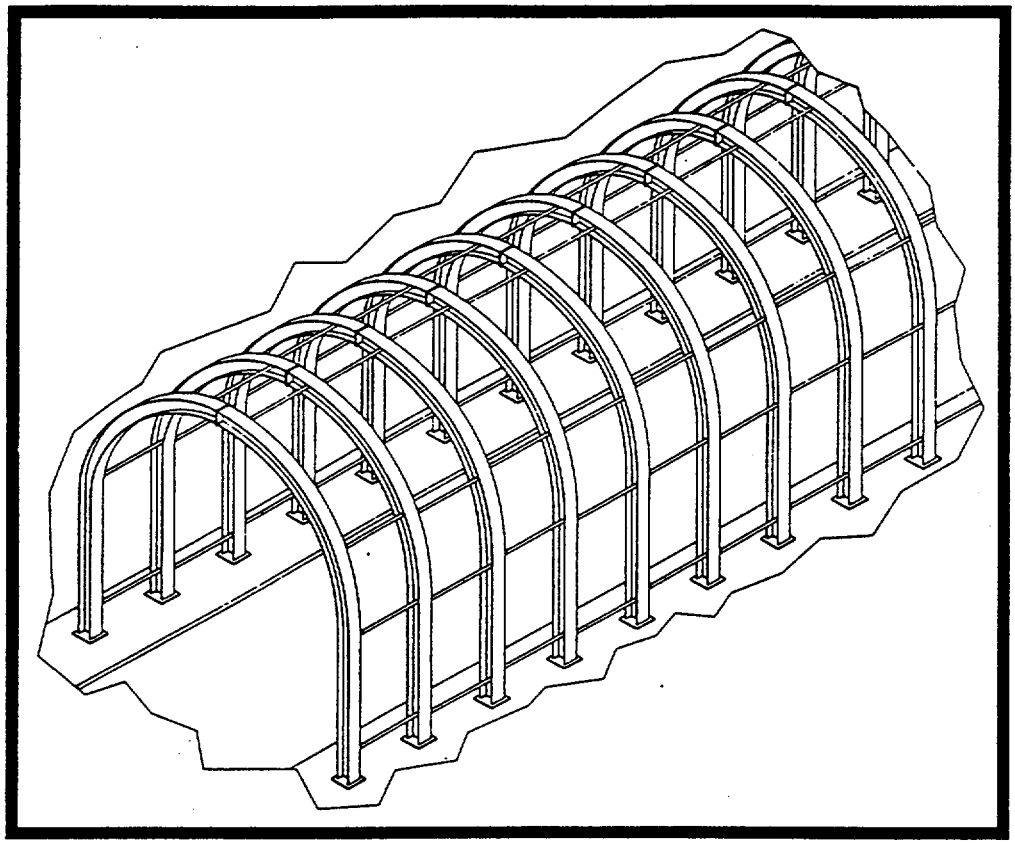
The major stress deviation analyzed is within AISC requirements. The general range of gaged steel stress, -12,500 psi to 11,000 psi, will therefore be within AISC requirements.

Strain gage data and stress/time plots are preliminary and are being checked. A final report on strain gage data and stress/time plots is expected within three weeks and an impact review will be made. No further impact reviews will be made on preliminary and unchecked strain gage data and related reports.

In conclusion, there are no impacts on design products based on data reviewed.

ATTACHMENT V

CPS STRUCTURAL STEEL SUPPORTS CATALOG

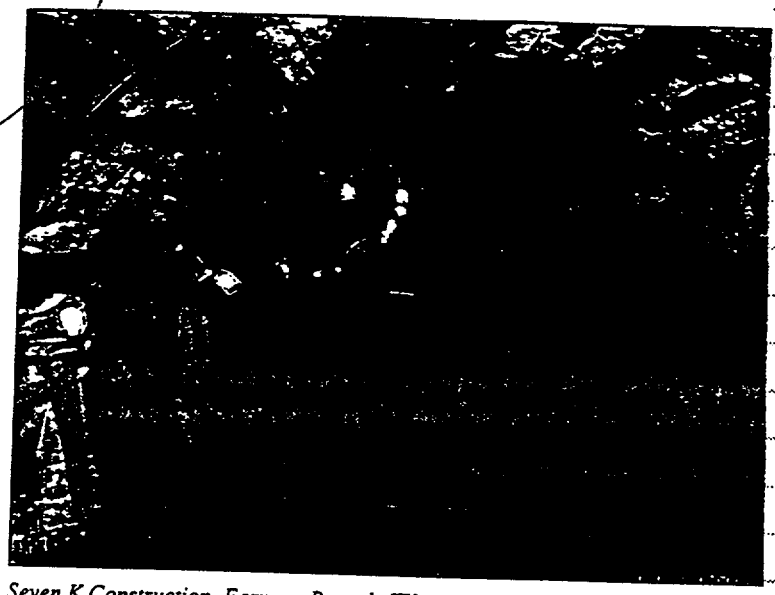


STRUCTURAL STEEL SUPPORTS

Commercial Pantex Sika, Inc.

TECHNICAL CAPABILITIES FOR STEEL RIBS

Commercial Pantex Sika has cold-rolled beams for underground supports for over 70 years. What we have learned about shaping steel for strength, performance and value in the world's tunnels and mines can be applied to the benefit of your project.

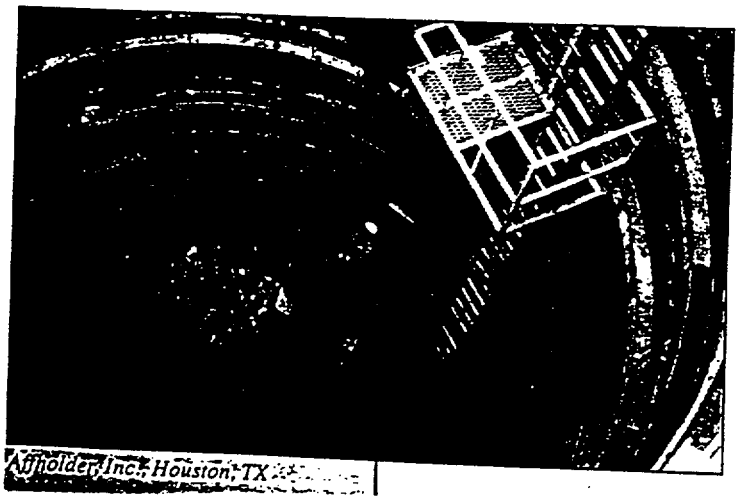


Seven K Construction, Farmers Branch, TX

Our abilities to bend I, WF and H sections range from 4" to 27" in depth. We have bent 14" WF at 287 lbs. per foot with 2" thick flanges. Curvatures range from a minimum radius of 10 times the beam depth for 4" and 6 " sections to 14 times the depth of section for any greater radius. We are also able to bend more than one radius in a single length if compound arcs are specified. While we have worked with 30 foot sections we recommend they not exceed 22 to 25 feet. We also recommend against the use of lighter weight per foot sections when the radius of curvature is less than 25 times the depth of section.

All beams are checked to a template after bending. Both ends must conform to the true template and the maximum departure from the template is held to the following tolerances:

Under 20 ft.	+/- 3/8 inch
20 to 25 ft.	+/- 1/2 inch
25 ft. and up	+/- 3/4 inch



Airholder, Inc., Houston, TX

Variance is gradual without any abrupt change in curvature, the tolerance approaching maximum at beam center. Referenced to any 3 ft. segment of a curved beam tolerance is held to 1/8". Where necessary to hold curvature even closer, additional la-

Seven K Construction, Farmers Branch, TX

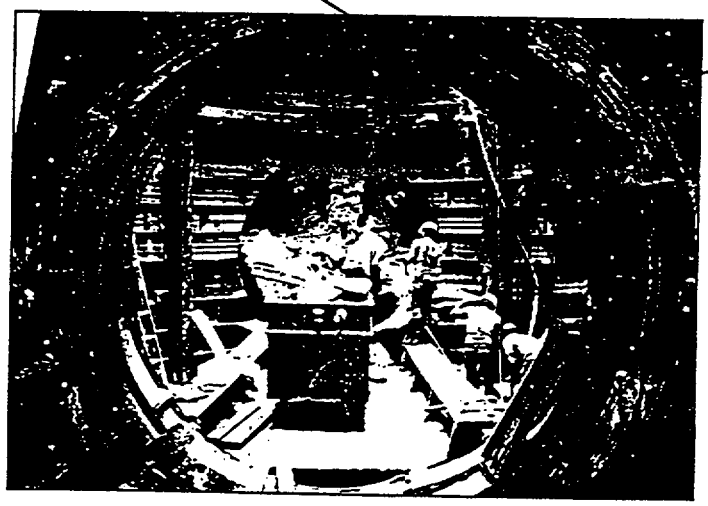
bor over and above standard procedure can be performed to insure even less variation and tighter tolerances.

The uniformity of the material as-rolled is a factor that affects tolerances. The closer the profile of the as-rolled beams conforms to the cross section the closer and more uniform the tolerances of the finished product will be.

The methods we use do not distort or impair the grain flow of the metal, nor do they reduce the load carrying capacity of the finished section. In fact, certain characteristics such as camber and flange alignment are improved. It has also been our experience that cold working of steel actually increases the as-rolled yield point. Nevertheless, we do not feel that load carrying values of our cold rolled bent beams should be calculated as having greater strength than as-rolled sections. When curved to a minimum radius some droop may occur to the outer edges of the top flange.

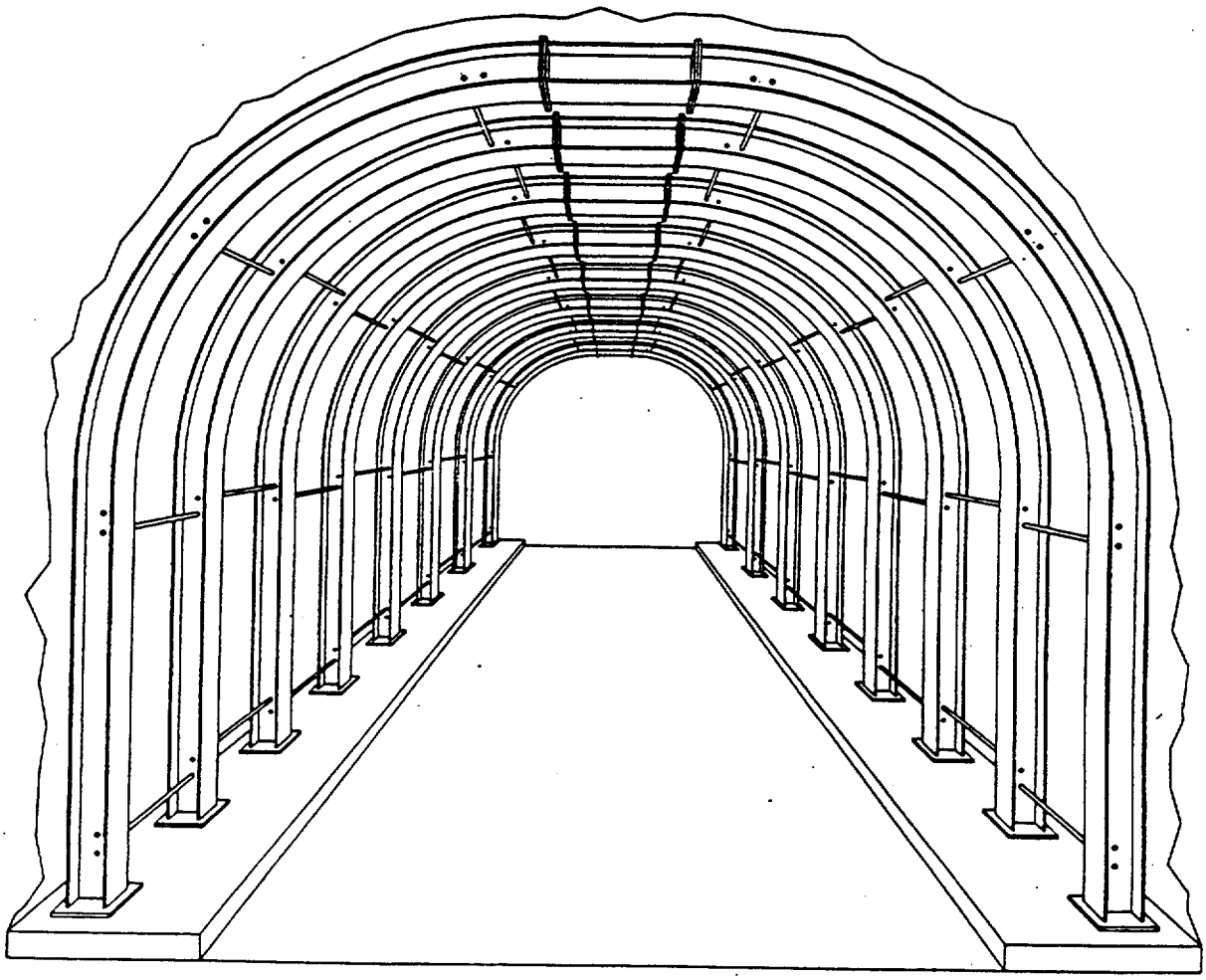
Because every beam necessarily fulfills specific requirements, prices for our work must be quoted for each inquiry. We are prepared to furnish labor and material.

Commercial Pantex Sika is the leading full service supplier of underground support systems and related specialty products in North America. It has been our pleasure to service the North American underground market since 1923. In addition to beams we manufacture liner plates and Pantex design Lattice Girders.



Affholder, Inc., Houston, TX

We also fabricate straight beams, forepoling sheets and steel lagging. Contact us for your underground support needs.



Commercial Pantex Sika, Inc.
1941 Bishop Lane, Suite 1000 • Louisville, KY 40218-1941
(502) 473-1010 • Fax: (502) 473-0707

COLD FORMED STEEL BEAMS

We appreciate your interest in our capabilities to bend structural beams cold for use in curved arch support.

Our abilities to bend I, WF and H sections range generally from 4" to 27" in depth. We have bent 14" WF at 287 lbs. per foot with 2" thick flanges. Curvatures range from a minimum radius of 14 times the depth of the section to any greater radius. We're also able to bend more than one radius in a single length of section if compound arcs are specified. While we have worked with 30 foot sections, we recommend they not exceed 22 to 25 feet which, incidentally, is convenient for shipment by truck. We also recommend against the use of lighter (wt./ft.) sections when the radius of curvature is less than 25 times the depth of the section.

All beams are checked to a template after bending. Both ends must conform to the true template and the maximum departure from the true template is held to ± 3/8" for beams not exceeding 20 feet in length. Tolerance for beams 20 to 25 feet in length are held to ± 1/2"; 25 to 30 feet in length to ± 3/4". Variance is gradual without any abrupt changes in curvature, the tolerance approaching maximum at beam center. Referenced to any 3' segment of a curved beam, tolerance are held to within 1/8". Where necessary to hold curvature even closer, additional labor over and above standard procedure can be performed to insure even less variation.

It becomes obvious that the uniformity of the material as-rolled is a factor that affects tolerances. The closer the profile of the as-rolled beam conforms to the cross section, the closer and more uniform the tolerances of the finished product will be.

The methods we use do not distort or impair the grain flow of the metal, nor do they reduce the load-carrying capacity of the finished section. In fact, certain characteristics such an camber and flange alignment are improved. Also, it has been our experience that cold working of steel actually increases the as-rolled yield point. Nevertheless, we do not feel that load-carrying values of our cold bent beams should be calculated as having greater strength than as-rolled sections. When curved to minimum radius, some droop may occur to the outer edges of the top flange.

Because every beam necessarily fulfills specific requirements, prices for our work must be quoted for each inquiry. We are prepared to furnish labor and material; consequently we carry structurals with heaviest demand in stock. If the customer prefers to supply material, we will quote labor only. Care should be exercised, however, to insure that all structurals furnished are clean and free from excessive rust and scaling surface.

Although we are the recognized leader in the underground support industry, we are not structural fabricators. Therefore we offer no engineering or technical service for the design, specification or other technical aspects of any above-ground structure.

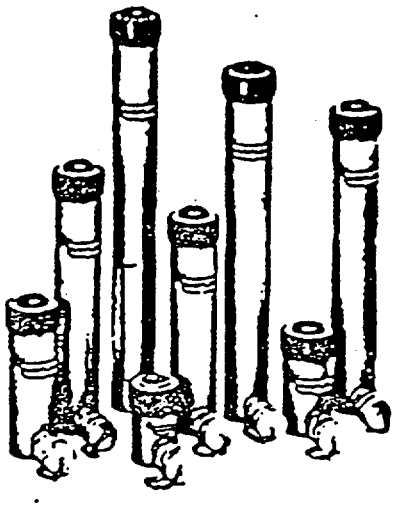
ATTACHMENT VI
MISCELLANEOUS REFERENCE DATA

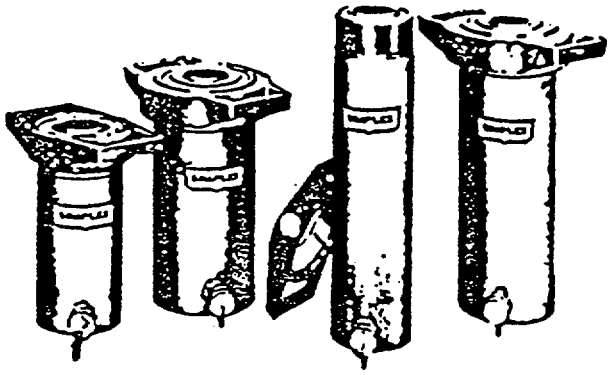
1. JACKING PERFORMANCE INFORMATION, ORIGINAL SOURCE: TK SIMPLEX CATALOG, HYDRAULIC AND MECHANICAL JACKS FOR INDUSTRY, 1990, SEE PAGES VI-2 THRU VI-6 (FOR INFORMATION ONLY: TYPE HSR-258T & HSR-2510T DIMENSIONAL INFORMATION AS USED IN ATTACHMENTS I & IX, WHICH APPROXIMATES THE 25 TON JACK USED IN CONSTRUCTION OF INITIAL W8x31 STEEL SETS)

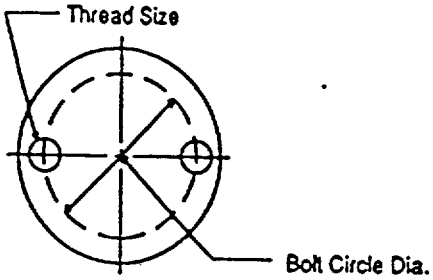
2. JACKING PERFORMANCE INFORMATION, NEW SOURCE: SIMPLEX CATALOG NO. SC101, HYDRAULIC AND MECHANICAL POWER, 1995, SEE PAGES VI-7 & VI-8 (FOR INFORMATION ONLY: DIMENSIONAL INFORMATION FOR TYPES R-258 & R-2510 WHICH ARE SAME AS 25 TON JACKS IN ITEM 1, ABOVE. ALSO, AS NOTED IN ATTACHMENT VIII, PAGE VIII-1, ANALYSIS FOR 15 TON JACKING LOAD REQUIRED FOR PROPOSED W6x20 STEEL SETS USED SAME JACKING CONFIGURATION AS USED IN ATTACHMENT I)

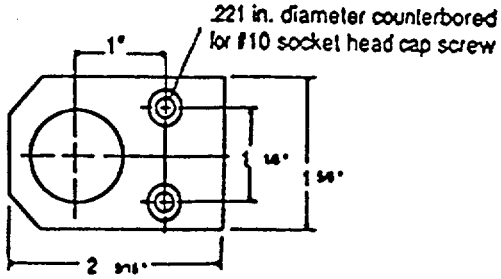
3. TELECON RECORD, M. CHEN/M&O WITH AISC ENGINEERING & RESEARCH STAFF, SUBJECT: DEFINITION OF SNUG TIGHT ON BOLTS, 10/03/95.

SIMPLEX® Spring Return Tooling Cylinders









HSR 50 Dimensions

Mounting Hole Dimensions

Cylinder	Thread Size	Bolt Circle Diameter (in)
*5 ton	1/4 - 20 x 1/2	1.00
10 ton	5/16 - 18 x 1/2	1.56
15 ton	3/8 - 16 x 3/4	1.87
25 ton	1/2 - 16 x 3/4	2.31
**50 ton	1/2 - 13 x 3/4	3.75

* All 5 ton models except HSR50
** HSR506T & HSR5013T only

Collar & Plunger Threads

Cylinder	Collar Thread Size	Plunger Thread Size
*5 ton	1 1/2 - 16 x 1 1/8	3/4 - 16 x 5/8
10 ton	2 1/4 - 14 x 1 1/8	**1 - 8 x 3/4
15 ton	2 3/4 - 16 x 1 13/16	1 - 8 x 1
25 ton	3 5/16 - 12 x 1 13/16	3 5/16 - 12 x 1 13/16
30 ton	3 5/16 - 12 x 1 13/16	1 1/2 - 16 x 1 5/16
50 ton	5 - 12 x 2 1/4	----
75 ton	5 3/4 - 12 x 1 3/4	----
100 ton	6 1/4 - 12 x 2 1/4	----

* None on HSR50
** None on HSR101T

Suggested Tonnage Gauges for HSR Series

Cylinder	Gauge	Gauge Face Diameter (in)
5 ton	1917201	2 1/2
10 ton	1917301	2 1/2
15 ton	1917401	2 1/2
25 ton	1917701	2 1/2
30 ton	1915801	3 1/2
50 ton	1916301	3 1/2
100 ton	1916701	3 1/2

For further information on gauges see page 32.

SIMPLEX® Spring Return Tooling Cylinders

5 to 100 ton HSR-series

These single-acting, spring return cylinders are an excellent choice for maintenance lifting, machinery positioning, or any of a wide variety of high pressure, heavy duty pressing or tooling operations.

All models except the HSR-50 and HSR-101T have plunger, base and collar threads to ensure application flexibility and are equipped with snap in removable grooved load caps. The HSR-series cylinders include high-flow, quick-disconnect ram half-couplers.

Plated pistons not only resist corrosion, they also provide exceptional bearing surfaces. All collar threads are designed to hold the full rated capacity of the cylinders. Simplex HSR-series cylinders have a 2:1 factor of safety on material yield and are in full compliance with ASME/ANSI B30.1 safety standards.

The Simplex HSR-series cylinders are dimensionally interchangeable with most competitive models.

The HSR506T, HSR5013T, HSR756T, HSR1006T and HSR10010T include removable thread-on handles.

AS USED IN ATTACHMENT I & IX FOR W6

AS USED IN ATTACHS. I & IX FOR W8

Solid Ram - Spring Return Cylinders

Model Number	Order Number	Capacity (tons)	Stroke (in)	Closed Height (in)	Pressure @ Capacity (psi)	Reservoir Capacity Required (cu in)	Body Dia. (in)	Effective Area (sq in)	Piston Dia. (in)	Weight (lbs)	Smallest Suggested Hand Pump
HSR-50	13171		5/8	1 5/8		.6				2 1/2	
HSR-51T	13172		1	4 11/32		1.0				2 1/2	
HSR-53T	13173		3	6 1/2		3.0				3 1/2	
HSR-55T	13174	5	5	8 1/2	10,060	5.0	1 1/2	.99	1	4	
HSR-57T	13175		7	10 3/4		7.0				5	
HSR-59T	13176		9 1/8	12 3/4		9.1				5 1/2	
HSR-101T	13177		1	3 17/32		2.2				3 1/2	34145
HSR-102T	13178		2 1/8	4 25/32		4.8				4 3/4	
HSR-104T	13179		4 1/8	6 3/4		9.2				6 1/2	
HSR-106T	13180		6 1/8	9 3/4		13.7				8 3/4	
HSR-108T	13181	10	8	11 3/4	8,945	18.0	2 1/2	2.24	1 1/2	10 1/2	
HSR-1010T	13182		10 1/8	13 3/4		22.7				12	
HSR-1012T	13183		12	15 3/4		27.0				13 1/2	
HSR-1014T	13184		14	17 3/4		31.5				15 1/2	34003
HSR-152T	13152		2	5 7/8		6.3				8 1/2	
HSR-154T	13153		4	7 7/8		12.6				10 3/4	34145
HSR-156T	13154	15	6	10 1/16	9,554	19.0	2 3/4	3.14	1 3/4	14 1/2	
HSR-1510T	13156		10	14 1/16		31.4				19 1/2	
HSR-1512T	13157		12	16 1/16		37.7				22	34003
HSR-1514T	13158		14	18 1/16		44.0				24 1/2	
HSR-251T	13160		1	5 1/2		5.2				12	
HSR-252T	13161		2	6 1/2		10.3				15	34145
HSR-254T	13162		4	8 1/2		20.6				18	
HSR-256T	13163		6 1/2	10 3/4		32.2				23	
HSR-258T	13164	25	8 1/2	12 3/4	9,700	42.5	3 3/4	5.15	2 1/2	27	34003
HSR-2510T	13165		10 1/2	14 3/4		52.8				31	
HSR-2512T	13166		12 1/2	16 3/4		63.1				35	
HSR-2514T	13167		14 1/2	18 3/4		73.4				39	35102
HSR-306T	13270	30	6 1/2	15 1/2	9,245	53.8	4	6.49	2 1/2	40	
HSR-502T	13271		2	8 15/16		22.1				32	34145
HSR-506T	13273	50	6 1/2	11 1/2	9,054	69.0	5	11.05	3 1/2	50	35102
HSR-5013T	13275		13 1/2	18 1/2		146.3				78	
HSR-756T	13276	75	6 1/2	11 1/2	9,430	97.4	5 3/4	15.90	3 3/4	63	
HSR-1006T	13277		6 1/2	13 1/2		137.0				90	
HSR-10010T	13278	100	10 1/2	16 1/2	9,695	212.0	8 1/2	20.63	4 1/2	110	

[illegible] are suggested for these units (see pages 19-25).

SIMPLEX® | VL Jacking Cylinder Tables

VL Plain Piston Cylinders

Model Number	Order Number	Capacity (tons)	Stroke (in)	Closed Ht. (in)	Reservoir Cap. req. (cu in)	Effective Area (sq in)	Pressure @ Cap. (psi)	Body Diam. (in)	Rod Diam. (in)	Weight (lbs)
CC306	15002	30	6	8.87	38.9	6.49	9,240	4.00	2.88	32
CC3012	15003		12	14.87	77.9					53
CC506	15021	50	6	8.97	66.3	11.05	9,054	5.25	3.75	55
CC5012	15022		12	14.97	133.0					92
CC1006	15041	100	6	10.02	124.0	20.63	9,695	7.19	5.13	115
CC10012	15042		12	16.02	248.0					184
CC1502	15060	150	2	6.50	66.4	33.18	9,041	9.00	6.50	117
CC1506	15061		6	10.50	199.0					189
CC15012	15062		12	16.50	398.0					297
CC2002	15080	200	2	7.50	88.4	44.18	9,054	10.50	7.50	184
CC2006	15081		6	11.50	265.0					282
CC20012	15082		12	17.50	530.0					429
CC3002	15201	300	2	9.00	120.3	60.13	9,978	12.00	8.75	288
CC3006	15202		6	13.00	361.0					405
CC30012	15203		12	19.00	722.0					597
CC5002	15220	500	2	11.50	207.7	103.87	9,628	16.00	11.5	655
CC5006	15221		6	15.50	623.0					855
CC50012	15222		12	21.50	1246.0					1197

VL Lock Nut Cylinders

Model Number	Order Number	Cap. (tons)	Stroke (in)	Closed Ht. (in)	Reservoir Cap. Req. (cu in)	Effective Area (sq in)	Pressure @ Cap. (psi)	Body Diam. (in)	Rod Diam. (in)	Lock Nut (in)	Weight (lbs)
CCLN302	15101	30	2	5.87	13.0	6.49	9,240	4.00	2.88	1.00	21
CCLN306	15102		6	9.87	38.9						35
CCLN3012	15103		12	15.87	77.9						57
CCLN502	15120	50	2	6.22	22.1	11.05	9,054	5.25	3.75	1.25	38
CCLN506	15121		6	10.22	66.2						63
CCLN5012	15122		12	10.22	133.0						100
CCLN1002	15140	100	2	7.52	41.3	20.63	9,695	7.19	5.13	1.50	87
CCLN1006	15141		6	11.52	124.0						132
CCLN10012	15142		12	17.52	248.0						202
CCLN1502	15160	150	2	8.25	66.4	33.18	9,041	9.00	6.50	1.75	149
CCLN1506	15161		6	12.25	199.0						221
CCLN15012	15162		12	17.25	398.0						311
CCLN2002	15180	200	2	9.50	88.4	44.18	9,054	10.50	7.50	2.00	233
CCLN2006	15181		6	13.50	265.0						332
CCLN20012	15182		12	19.50	530.0						479
CCLN3002	15401	300	2	11.50	120.3	60.13	9,978	12.00	8.75	2.50	357
CCLN3006	15402		6	15.50	361.0						485
CCLN30012	15403		12	21.50	722.0						677
CCLN5002	15420	500	2	14.75	207.7	103.87	9,628	16.00	11.5	3.25	813
CCLN5006	15421		6	18.75	623.0						1041

SIMPLEX®

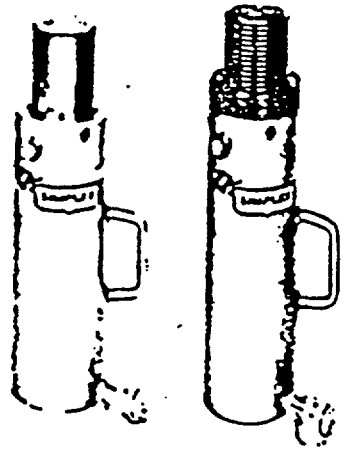
VL Jacking Cylinders

Unparalleled Jacking Performance

These economical, single-acting, load-return cylinders are the perfect choice for use in tight working conditions such as bridge lifting as well as other construction or jacking applications. Simplex VL jacking cylinders offer up to 2" more stroke than conventionally designed single-acting cylinders of equal closed height.

Only Simplex jacking cylinders employ the exclusive Smart Stop™ 3-Way Over-travel Prevention System. First, a red warning ring appears when the piston has reached the limit of its rated stroke. If this warning goes unnoticed when the cylinder is under load, a bleed valve safely vents oil to the atmosphere. Finally, an internal stop ring prevents over-extension of the piston when operating under no load conditions.

VL jacking cylinders are available in a plain piston version, or with threaded pistons and lock nuts. The lock nut version eliminates the need for cribbing loads in applications requiring sustained load holding.



VL plain piston — VL threaded jacking cylinder with lock nut

Other unique Simplex features

- VL jacking cylinders comply with ASME/ANSI B30.1 safety standards.
- Domed piston rods minimize the effect of eccentric and side loading.
- Grease fittings protect against moisture, dirt and corrosion.
- Plated pistons resist corrosion.
- Built-in carrying handles on 30 and 50 ton models.
- Eye bolts for lifting and positioning on 100-500 ton models.
- Specially designed seals avoid damage when the piston is extended beyond its rated stroke under load.
- Black-oxided lock nuts resist corrosion.

Economic Hydraulic System Design

Templeton, Kenly & Co.'s patented Retractor Valve allows the practical application of our VL jacking cylinders into systems less costly than traditional high-tonnage jacking systems.

The following price percentage comparison demonstrates this cost savings. Each system includes four (4) 200 ton X 6 inch stroke cylinders. One of the systems utilizes traditional double-acting cylinders with double runs of hose to each cylinder. The other uses the new Simplex single-acting VL Jacking Cylinders and a Retractor Valve equipped pump.

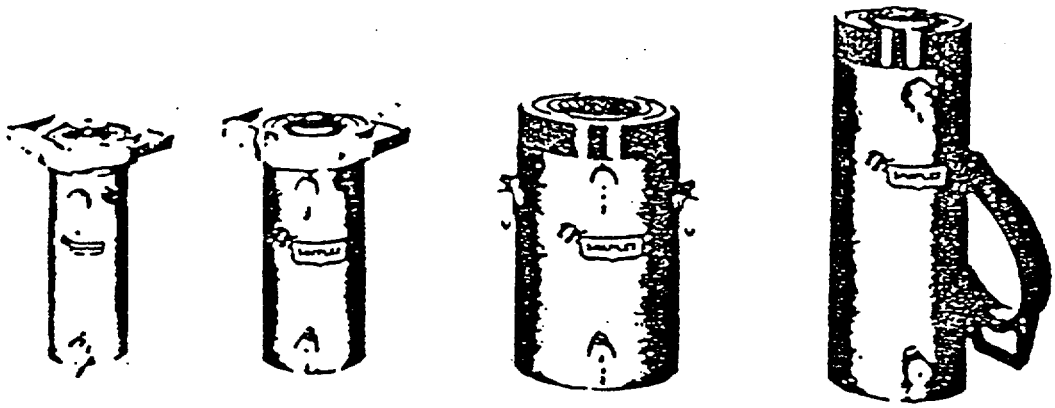
System Component	Traditional Double-Acting System		Simplex System w/VL Jacking Cylinders and Retractor Valve	
	Order #	% of Sys. Cost	Order #	% of Trad. Sys. Cost
Pump: 1.5 HP Perm. Mag. 5 Gallon Reservoir, Manual 3 Pos. Valve.	7100504	12.5	7100513	12.7
Control Manifold:	18086	1.8	18086	1.8
Return Manifold:	1814201	.5	Not Required	0.0
Hoses: Assumes				
• 2 cylinders @ 10' distance	(8) 18204	4.4	(4) 18098	4.0
• 2 cylinders @ 30' distance	(8) 18202	3.7	(4) 18097	3.6
• 1/4" I.D. hose on double-acting	(1) 18164	.3	(8) 18113	.3
• 3/8" I.D. on single-acting.	(16) 18113	.6		
All hoses are 10 foot multiples.				
Check Release Valve:	(4) 18074	4.7	(4) 18074	4.7
Cylinders:	(4) 13233	71.5	(4) 15081	49.9
Total System Cost =		100.0		77.0

Savings with new Simplex VL Jacking Cylinders = 23%

SIMPLEX® Double-Acting Solid Ram Cylinders

Simplex Double-Acting Cylinders should be considered when the application requires fast cylinder retraction and/or frequent duty cycles. They are also necessary for applications requiring both push and pull force. These cylinders not only retract faster, they also allow for better retraction control than single acting cylinders. More rigorous duty cycles are possible because the inherent design keeps the cylinder rod lubricated. All double-acting cylinders are equipped with safety relief valves to protect against over-pressurizing the rod end of the cylinder.

- Most models have threaded plungers to accommodate pulling attachments.
- All cylinders have a 2:1 factor of safety on material yield and comply fully with ASME/ANSI B30.1 safety standards.
- Tonnage gauges and swivel load caps are also available for many of these cylinders.
- The Pine cylinder line is available on a build-to-order basis for solid ram applications up to 664 ton capacity. (See page 29.)
- All models include high flow couplings.

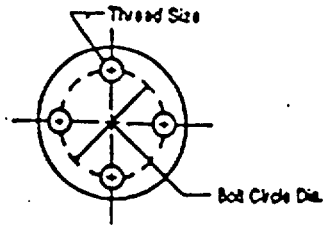


Double-Acting Solid Ram Cylinders

Model Number	Order Number	Push Cap. (tons)	Stroke (in)	Pull Cap. (tons)	Closed Height (in)	Pressure at Cap. (psi)	Effective Area (sq in)	Pump Reservoir Cap. Req. (cu in)	Body Dia. (in)	Plunger Internal Thread Size X Length	Collar Thread Size X Length	Piston Rod Dia. (in)	Weight (lbs)
H506T	1332201	50	6 1/4	16.8	13 1/4	9,054	11.05	46	5	1 - 12 x 1 1/2	5 - 12 x 1 3/4	3 1/4	85
H5012T	1332501		12		19 1/4			92					130
H5024T	1332601		24		31 3/4			184					223
H100-6DAT	13356	100	6 3/32	40	13 7/8	9,239	21.65	77	7	3 1/4 - 12 x 2 1/2	7 - 12 x 2 1/2	4	152
H100-12DAT	13951		12		19 7/8			151					187
H150-6DAT	13363	150	6 3/32	61	15 7/16	9,041	33.18	120	8.5	3 1/2 - 12 x 2 3/4	8 1/2 - 12 x 2 3/16	5	218
H150-12DAT	13953		12		21 1/4			236					295
RC-2006	13233	200	6	72	15 7/16	9,054	44.18	170	10	——	9 3/4 x 1 7/8	6	315
RC-20013	13234		13		22 1/16			368					440

Mounting Holes and Assessories

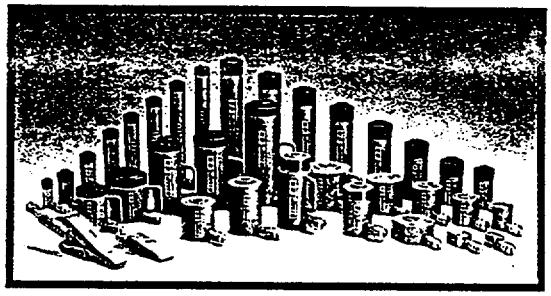
Cylinder Series	Thread Size	Bolt Circle Dia. (in)	Tonnage Gauge	Swivel Cap Number	Additional Height of Cap (in)
50 ton	3/4 - 11 x 3/4	3.75	1916301	——	——
100 ton	3/4 - 11 x 1	4.25	1916801	18325	1/4
150 ton	1 - 8 x 1 3/4	5.00	1917101	18328	1 3/4
200 ton	1 - 8 x 1 1/4	5.00	1900501	——	——

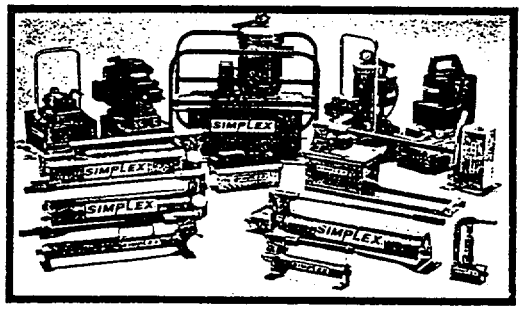


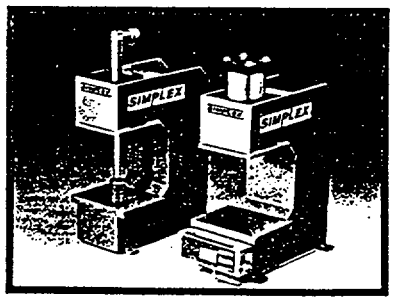
SIMPLEX®

A Division Of Templeton, Kenly & Co., Inc.

HYDRAULIC AND MECHANICAL POWER

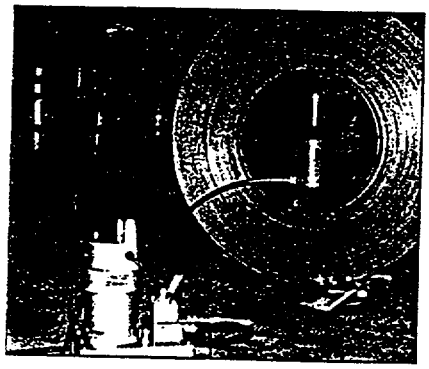






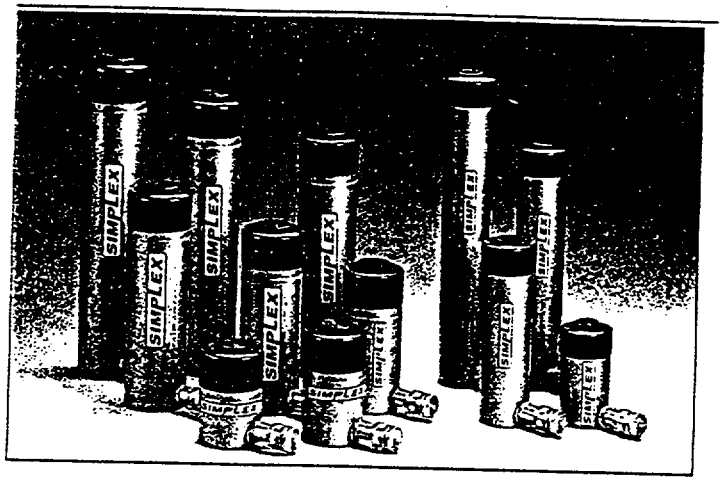
SC101

SPRING RETURN - 15-25 TON CYLINDERS

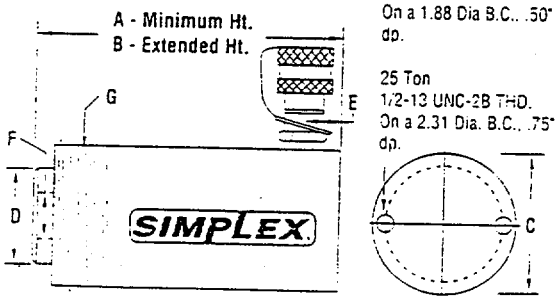


Large steel coils that were damaged in handling would not fit the arbor of a large steel slitting machine. Using a Simplex R256 cylinder and P70 Series pump, maintenance crews were able to reshape the coil I.D. saving time and expense in the process. "Simplex hydraulics were much faster and safer than the methods we used previously."

Simplex Cylinders Quickly & Safely Reshape Steel Coils:



DIAGRAM



BENEFITS/FEATURES

Simplex 15 & 25 ton R Series rams are the choice when reliability & durability are key. Heavy duty steel construction, plated piston rods & large bronze bearings add up to tough, long lasting cylinders. Ideal for a wide range of applications **at construction sites, mills, power plants, rail car shops & industrial maintenance.**

- 13 Models
- High Flow, quality couplers with metal caps.
- Collar threads designed for full load.
- Base & piston mountings for easy fixturing.
- Removable load caps for flexibility & safety.
- Steel stop ring for piston blow-out protection.
- Plated piston to resist scoring & corrosion.
- Large bearings resist side load.
- Rod wiper protects inner cylinder from dirt.

Spring Return Cylinders 15 & 25 Ton Capacities

Model Number	Cap. (tons)	Stroke (in)	A Min. Ht. (in)	B Ext. Ht. (in)	Ram Bore Dia. (in)	Effect Area (sq in)	Pres. @ Cap. (psi)	Oil Cap. Req'd (cu in)	C Body O.D. (in)	D Piston O.D. (in)	E Base To Port C/L (in)	F Piston I.D. Thrds. (in)	F Piston Thrd. Depth (in)	G Collar Thrds. (in)	G Collar Thrd. Lgth. (in)	Wgt. (lbs)	Sugstd. Hand Pump
R152	15	2	5 7/8	7 7/8	2	3.14	9,554	6.3	2 3/4	1 5/8	3/4	1 x 8	1	2 1/2 x 16	1 3/16	8.3	P42
R154		4	7 7/8	11 7/8				12.6								10.8	
R156		6	10 11/16	16 11/16				19.0			1					14.5	
R1510		10	14 11/16	24 11/16				31.4								19.5	P140
R1514		14	18 11/16	32 11/16				44.0								24.5	
R251	25	1	5 1/2	6 1/2	2 9/16	5.15	9,700	5.2	3 3/8	2 1/4		1 1/2 x 16	1 1/8	35/16x12	1 15/16	12.0	P42
R252		2	6 1/2	8 1/2				10.3								15.0	
R254		4	8 1/2	12 1/2				20.6								18.0	
R256		6 1/4	10 3/4	17				32.2								23.0	
R258		8 1/4	12 3/4	21				42.5								27.0	P140
R2510		10 1/4	14 3/4	25				52.8								31.0	
R2512		12 1/4	16 3/4	29				63.1								35.0	
R2514		14 1/4	18 3/4	33				73.4								39.0	

COMPARES TO PAGE VI-3 FOR W8
COMPARES TO PAGE VI-3 FOR W6

M&O

RECORD OF TELEPHONE CONVERSATION

FROM: MORRIE CHEN DATE: OCT. 3, 1995 TIME: 9:00 A.M.

LOCATION: 5TH FLR, 101 CONVENTION CENTER DR. LAS VEGAS, NV. 89109 SUBJECT: SNUG TIGHT OF BOLT.

TO: AISC ENGINEERING & RESEARCH P.O. NO. 04580826

LOCATION: CHICAGO OTHER REF.

PER TELEPHONE CONVERSATION WITH AISC ENGINEERING AND RESEARCH STAFF, THE TENSION IN BOLT IS NEGLIGIBLE WHEN THE BOLT IS BROUGHT TO A SNUG-TIGHT CONDITION. SNUG TIGHT IS DEFINED AS THE TIGHTNESS THAT EXIST WHEN THE PLIES OF THE JOINT ARE IN FIRM CONTACT.

Morrie S. Chen

CC: M.E. TAYLOR
M.D. STINE
D.J. ROGERS

ATTACHMENT VII

MISCELLANEOUS SHOP FABRICATION TOLERANCES AND STEEL SET INSTALLATION TOLERANCES*

*Not Addressed Elsewhere within this Analysis

SHOP FABRICATION TOLERANCES:

A. Source of Fabrication & Installation Tolerances.

Tolerances are established generally based on AISC recommendations. In some instances, Constructor's comments and suggestions were incorporated. Tolerances for structural steel items will be shown on the fabricator's shop drawings that are reviewed and approved by the A/E. The tolerances in Section B, below are representative of good workmanship and industry practice and the values shown are to be used in developing the fabrication drawings (also refer to the Commercial Pantex Sika Catalog information in Attachment V for tolerances common to the steel set fabrication industry). Any deviations from the tolerances indicated must be shown on the shop drawings and will be subject to A/E review and approval. Tolerances which relate to the critical design attributes of Section 8.5 in the Body of the Analysis are described in Section C, below.

B. Mill and Fabrication Tolerances.

1. Mill tolerances shall be in accordance with AISC M016, pages 1-145 to 1-158, and ASTM A6/A6M.

2. The following fabrication tolerances are non-critical and are in accordance with standard industry practice for fabricating steel sets and miscellaneous associated structural steel. In addition, judgement, based on observed field conditions, and experience gained from previously installed steel sets, result in upper bound tolerances for bending and fabrication as follows:

   a. Bending Tolerances: After bending, all steel shapes shall conform to mill tolerances except as allowed below for bounding the upper limits of the tolerances for bending:

      - Departure from true template between rib ends - 1/2" max. (based on Attachment V).
      - Departure from true template for any one point - 1/4" max. in any gage length of 4'-0" max.
      - Flange droop - 1/4" max.
      - Deviation from flat for web buckling - 3/16" max. within 1/2 beam depth from each end.

- Deviation from nominal beam depth - 1/4" (minus) max.
- Sweep in beams between end plates will be allowed to vary from established mill rolling tolerances, but shall not exceed 5 inches.

b. Fabrication Tolerances - Tolerances shall not exceed the following upper bounding limits:

- Departure from theoretical plane of face of butt plate - 1/4" max.
- Gap between butt plate and beam end - 1/16" max. for 75% of bearing prior to welding contact. Excess gap filled with weld.
- Tie rod hole spacing in a group - 3/8" max. tolerance on dimension between holes as shown on shop drawings.
- Tie rod hole group spacing - (±)3/8" on dimension from W-shape centerline, and (±) 1" on dimension along the length of the beam (all dimensions as shown on shop drawings).
- Deviation of sheared plate dimensions from dimension shown - (±) 1/8".
- Deviation of holes within butt plate group - 3/16" max.
- Deviation of butt plate holes after assembly - 3/16" max.
- Camber and sweep permitted in straight structural members not to exceed mill rolling tolerances.

C. **Installation Tolerances.**

Some of the following installation features and their respective tolerances relate to selected critical design attributes of Section 8.5 in the Body of the Analysis. Where a tolerance on an installation feature is not critical, and not specifying a tolerance will have no effect on the capability of the steel set to perform its safety related function, it is so noted as a non-critical feature. Similarly, critical features important to performance are also noted and will require QA Controls:

1. Location on Inverts (Critical):
Steel sets shall be located away from the joints in the concrete invert segments a sufficient distance to prevent damage or overstress in the invert segment. The clear distance from the edge of the steel set foot plate to edge of invert segment at joints shall be 4" minimum (Page VII-6). In addition, the inside edge of the W8x31 steel set flange shall not be offset inward from the inside edge of the invert segment curb by more than 5/8-inch (Attachment III.E, Page III-83). Similarly, the W6x20 shall not be offset beyond the inside edge of the invert segment curb by more than 1-1/2 inches (Attachment III.E, Page III-84).

2. Spacing Tolerance Parallel to Longitudinal Tunnel Centerline (Critical):
Steel set spacing (2 ft, 4 ft or 6 ft, see Table 14, Ref. 5.20) is controlled by the length of the pipe spacers, which are snugged into position when the tie rods are tightened. It may occasionally be necessary to add shims between the end of the pipe spacers and the web of the ring beam, or to cut a short section off the end of the pipe spacers, to adjust set spacing due to a buildup of tolerances when a series of sets have been erected through a given reach of tunnel. There is no tolerance for decreasing the set spacing to less than the nominal value represented by Table 14 in Ref. 5.20. By inspection of the steel set interaction equations of Attachments I & III.A and the lagging analysis of Attachment III.B, it is judged that an increase of up to 2 inches beyond the nominal set spacing will not adversely affect the load carrying capacity of the steel set or lagging.

3. Tie Rod Spacing (Critical):

The spacing of the tie rods along the centerline of the steel set W-shape shall not exceed 35°. Tie rods shall be located within the foot segment, no more than 7° from the foot segment base plate. In addition, the tie rods shall be located 1/2" inside of centerline of the W-shape (±) 3/8".

4. Expansion/Blocking of the Steel Set (Critical):

The critical attribute relating to this tolerance is that the set, via the lagging,be forced to make positive contact with the as-excavated tunnel crown and walls to the extent practical, i.e. consistent with standard industry practice (see Section 8.5F). This is accomplished by either expanding the set using jacks, or blocking the set where voids occur, or a combination of both as appropriate. Because the set is often pre-assembled and lagged under cover of the tail shield on the TBM (for obvious safety reasons), there is no way to verify/quantify the number or location of points the set or lagging actually makes contact with the rock. This sort of verification is not considered necessary as long as experienced supervision is available to oversee the steel set erection process. Therefore, there is not an appropriate tolerance to control this feature.

5. Vertical Alignment (Non-Critical):

The vertical plane of the steel sets shall be nominally perpendicular to the horizontal axis of the tunnel. The maximum offset of 16-1/4" at the crown measured relative to the base calculated on Page VII-8 is an upper bound limit on the worst offset possible due to tunnel grade, fabrication tolerance on steel set bearing plates, and invert segment bearing surface slope. As shown on Page VII-10, vertical misalignment of the steel set will not overstress the steel set even at this worst case offset. It is judged that normal installation of the foot plate flat on the invert segment curb will adequately control the installation. Therefore, no tolerance is necessary to control this feature.

6. Skew Parallel to Longitudinal Tunnel Centerline (Non-Critical):

Skew is not considered important, as the erection process will only tolerate a minor amount of skewing before it is impossible to insert the bolts used to make up the joints. Therefore, no tolerance is necessary to control this feature.

7. Diametrical Tolerance Transverse to Longit. Tunnel Centerline (Non-Critical):

There is no tolerance associated with the vertical and horizontal placement of the steel set transverse to the longitudinal tunnel centerline. The overriding concern is that the set be expanded/blocked as stated under Section C.4, above.

8. Bolted Connections (Critical):

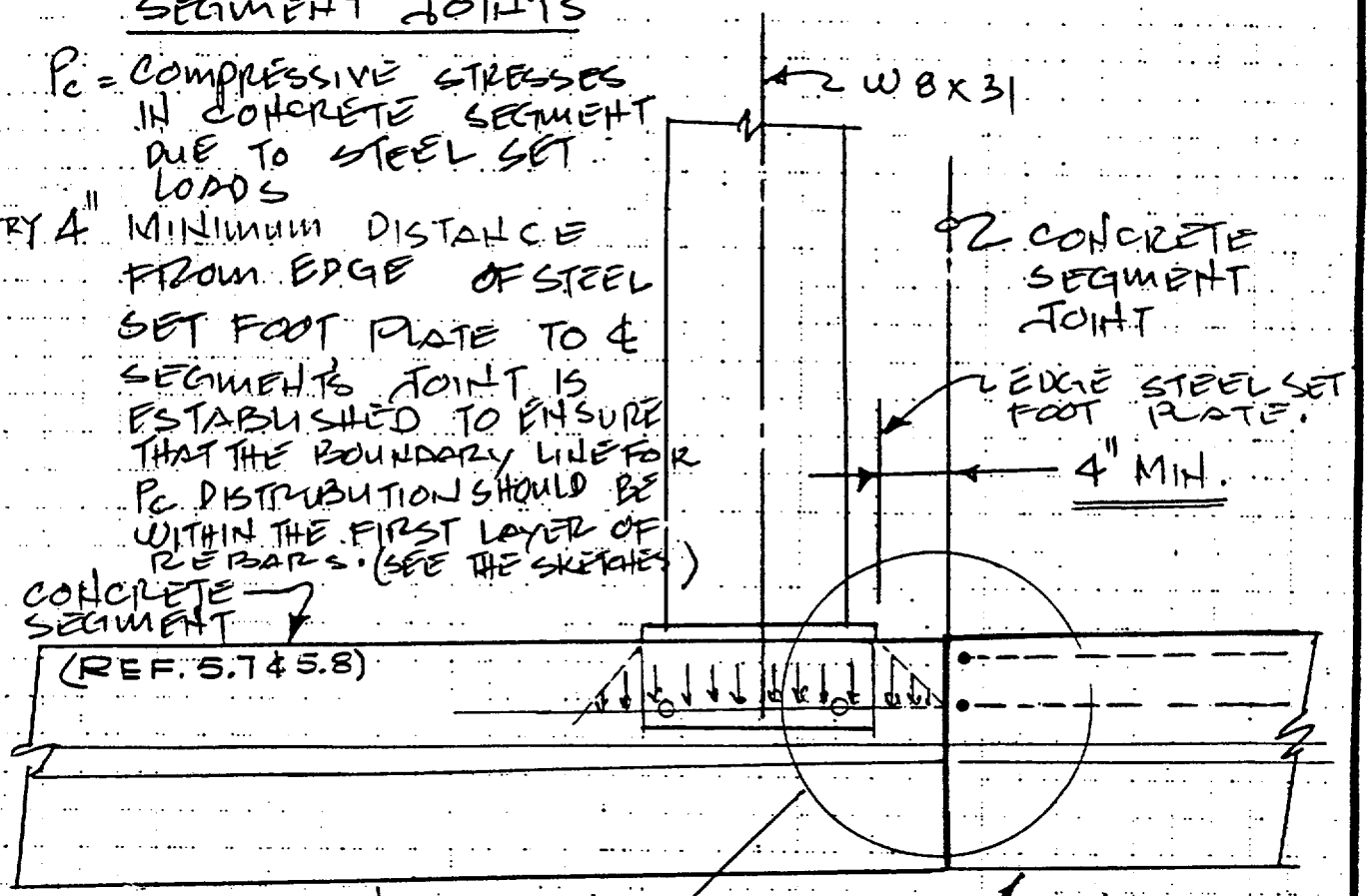
All bolted connections using ASTM A307 (or higher strength) bolts shall be installed to a snug tight condition. Bolt head and nut or washer(s) shall make contact with the joint plates. Snug tightness shall be in accordance with AISC M016, except that gaps between joint plates and shims may exceed 1/16 inch if plates or plates and shims contact at any point in the connection plane. As a result of vibrations due to the passage of rail traffic over the invert segment rails and seating of the connection plates as the sets take load, it is anticipated that the nuts on the steel set connection bolts might loosen over time. This condition will be mitigated by the requirement in the construction specifications (Section 01501, Paragraph 3.01J - Reference 5.4) that the Constructor provide "routine inspection, maintenance, monitoring and repair (as required) of the permanent function ground support system" in order to meet the maintainable life of 100 years required for incorporation into a potential repository. This inspection and repair program will ensure that the steel set connections are maintained during the life of the ESF, but will have to be carried forward (along with other ground support maintenance tasks) through the ESF operations phase into repository construction and operations, when the ground support begins to perform its nuclear safety-related function.

STEEL SET INSTALLATION TOLERANCES:

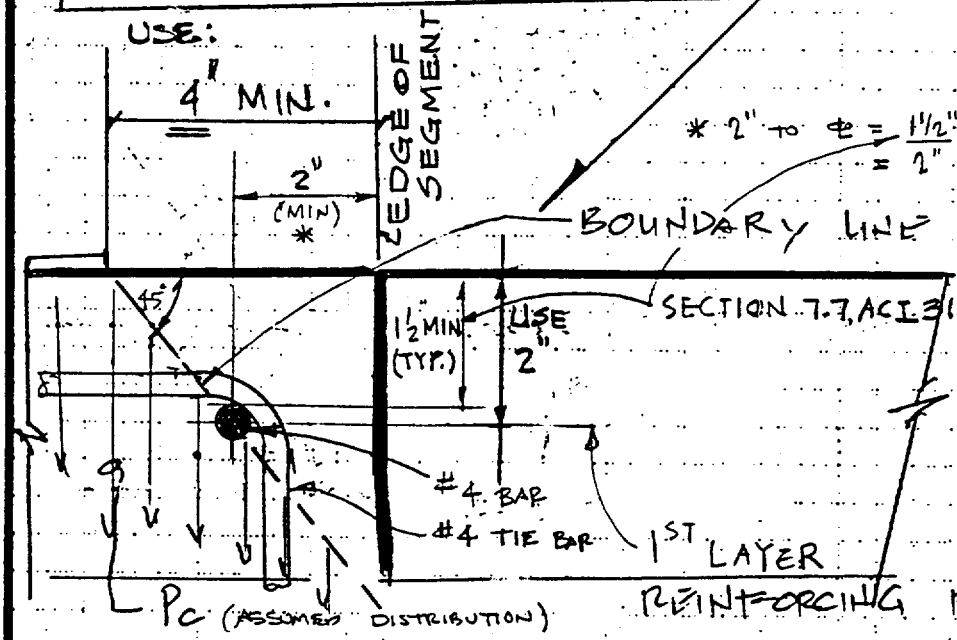
MINIMUM EDGE DISTANCE FROM STEEL FOOT PLATE TO SEGMENT JOINTS

P_c = COMPRESSIVE STRESSES IN CONCRETE SEGMENT DUE TO STEEL SET LOADS

TRY 4" MINIMUM DISTANCE FROM EDGE OF STEEL SET FOOT PLATE TO ℄ SEGMENTS JOINT IS ESTABLISHED TO ENSURE THAT THE BOUNDARY LINE FOR P_c DISTRIBUTION SHOULD BE WITHIN THE FIRST LAYER OF REBARS. (SEE THE SKETCHES)



USE:



* 2" TO ℄ = 1½" CLR + ¼" (MIN) TIE + ½ (⅝) #4
= 2" MIN TO ℄ #4

BOUNDARY LINE FOR P_c DISTRIBUTION SHOULD BE WITHIN THE 1ST LAYER OF REINFORCING BARS WHICH WILL BE AIDED IN RESISTING SHEAR FAILURE @ CORNER BY #4 TIE BARS.

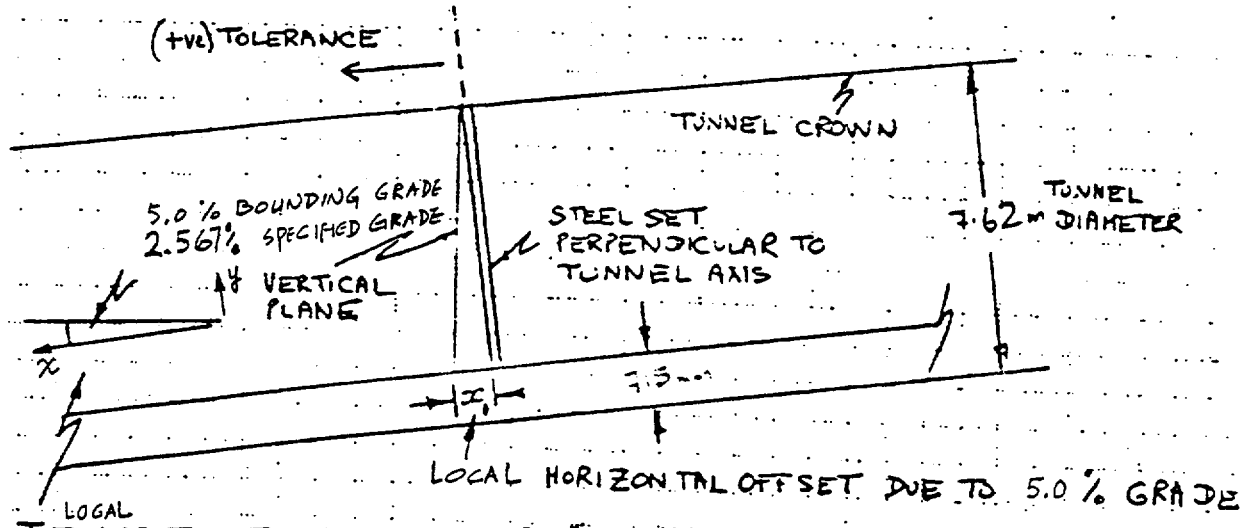
SECTION 7.7, ACI 318

TUNNEL GRADE :

REQUIRED MAX. TUNNEL GRADE = 2.567 % (REF. 5.12). TO INCLUDE TOLERANCE, A 5.0 % BOUNDING GRADE IS USED IN THE FOLLOWING CALCULATIONS FOR INVESTIGATING THE IMPACT ON STEEL SET DESIGN DUE TO TUNNEL GRADE.

STEEL SETS TO BE POSITIONED ON PRECAST SEGMENTS SUCH THAT THE STEEL END PLATE BEARING SURFACES ARE REASONABLY IN CONTACT. TO TRANSFER ROCK LOADS THRU STEEL SET BASE PLATE INTO PRECAST CONCRETE CURBS LOCATED ON THE INVERT OF THE TUNNEL.

DIAMETER OF TUNNEL = 7.62 m (REF. 5.12)
BASE THICKNESS OF CONCRETE SEGMENT = 715 mm (REF. 5.8)

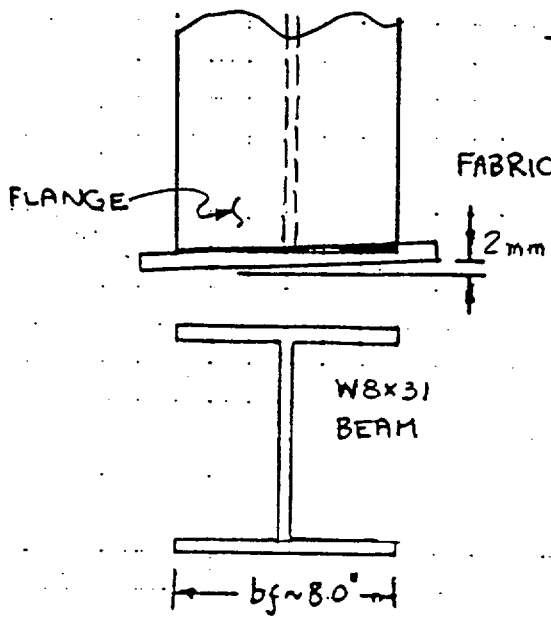


THE LOCAL HORIZONTAL OFF-SET "x_1" FOR A STEEL SET NORMAL TO TUNNEL AT 5.0 % GRADE

$$x_1 = \frac{5.0}{100}(7.62 - 0.715) \times 1000 \text{ mm}$$

$$x_1 = \underline{345 \text{ mm}} \; (\approx \cancel{5.8''}\ 13.6'')$$

JMDS 9/11/95



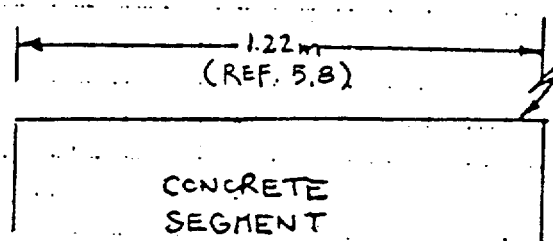
STEEL SET/BEARING PLATE

FABRICATION TOLERANCE = 1/16" --- (See Para. II.2.B, pg VII-2)
= 1.588 mm USE 2 mm

VERTICAL OFF-SET INDUCED BY 1mm FABRICATION OFF-SET FROM PERPENDICULAR

$$\frac{1}{203}(7.62-0.715)(1000) = \underline{34.00\,mm} = (x_2)$$

CONCRETE SEGMENT



BEARING SURFACE ON EDGE OF SEGMENT
3/4" = 6.35 mm SAY 6 mm **

5mm FABRICATION TOLERANCE (Code Ref. 4.1.4.1, ACI 301) *

VERTICAL OFF-SET INDUCED BY 6mm CASTING TOLERANCE

$$\frac{6\,mm}{1.22\,(1000)}(7.62-0.715)(1000)$$

$$= \underline{34.0\,mm} = (x_3)$$

*NOTE: FABRICATION TOLERANCE OF 1/4" FROM ACI 301, TABLE 4.3.1 IS 1/4" IN 10 FT FOR CAST-IN-PLACE FORMS. THIS VALUE IS CONSERVATIVELY APPLIED HERE AS THE MAXIMUM TOLERANCE ON THE FLATNESS OF THE PRECAST STEEL FORMED INVERT CURBS ACROSS ONLY 4 FT.

CUMMULATIVE TOLERANCE

$$\Sigma x = x_1 + x_2 + x_3$$

1. LINE & GRADE @ 5.0% 345.0 mm (x_1)
2. STEEL SET/BEARING PLATE. 34.0 mm (x_2)
3. CONCRETE INVERT SEGMENT. 34.0 mm (x_3)

413.0 mm ≈ (16 1/4")

INSTALLATION TOLERANCE = 16 1/4" (413 mm)

** THESE VALUES ROUNDED DOWN DUE TO CONSERVATISM IN INITIAL VALUE SELECTED (1/4") & UNLIKELYHOOD OF ALL WORST TOLERANCES OCCURRING SIMULTANEOUSLY

IMPACT OF CUMMULATIVE OFFSET ON STEEL SET DESIGN:

THE OFFSET OF 16 1/4" FROM PLUMB AS SHOWN ON PAGE VII-8 OF THIS ATTACHMENT FOR THE STEEL SETS IS BASED ON STEEL FABRICATION TOLERANCE, CONCRETE SEGMENT TOLERANCE AND THE TUNNEL GRADE. THE OFFSET FROM PLUMB COULD CREATE ECCENTRIC LOAD FROM UTILITY WEIGHTS TO STEEL SET AND INDUCE A LOCAL BENDING IN STEEL SET WEB. REFERRING TO FIG. 1 ON THE RIGHT, THE ROCK LOAD IS RESOLVED INTO TWO COMPONENTS. THE PERPENDICULAR TO STEEL SET FLANGE SURFACE COMPONENT IS THE TRUE ROCK PRESSURE ON STEEL SET AND SHOULD INDUCE NO ECCENTRIC LOAD. THE PARALLEL TO STEEL SET FLANGE SURFACE COMPONENT IS SUPPORTED BY THE ROCK ITSELF. THE DESIGN OF STEEL SET USES FULL ROCK, NOT THE COMPONENT, WHICH IS CONSERVATIVE.

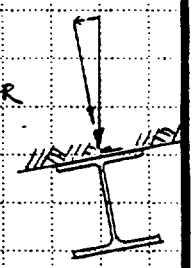
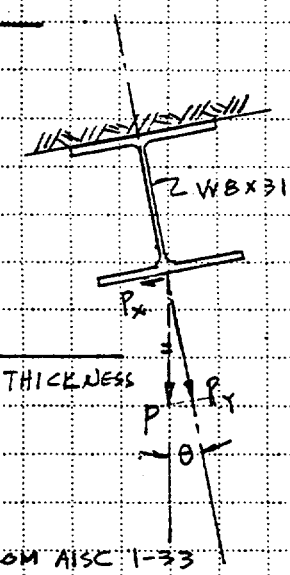


FIG. 1

TO EVALUATE THE IMPACT OF THE CUMULATIVE OFFSET ON STEEL SET DESIGN, A CALCULATION TO OBTAIN THE MAXIMUM STRESS IN W8 X31 WEB IS SHOWN ON NEXT PAGE. THE MIDDLE SUPPORT OF VENTILATION DUCTS REPRESENTS THE HEAVIEST UTILITY LOAD ON STEEL SET & IS CHOSEN TO DEMONSTRATE THE WORST CONDITION. THE RESULT SHOWS THE MAXIMUM STRESS INDUCED BY CUMULATIVE TOLERANCE IS MUCH LESS THAN ALLOWABLE.

STRESS AT CROWN OF STEEL SET INDUCED BY ECCENTRIC LOAD FROM INSTALLATION CUMMULATIVE OFFSET :



MAXIMUM UTILITY LOAD AT THE CROWN OF STEEL SET SUPPORTING VENTILATION DUCTS

$P = 3.88^k$ ---- PAGE II-11, ATTACHMENT II

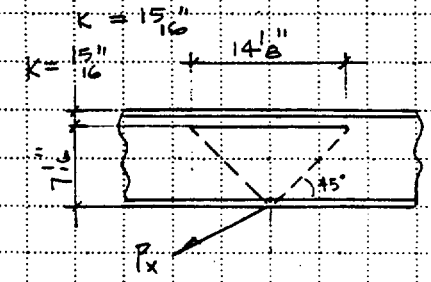
FOR 413 mm (OR 16 1/4") CUMMULATIVE OFFSET,

ANGLE $\theta \cong \tan^{-1} \dfrac{\text{CUMMULATIVE OFFSET}}{\text{TUNNEL DIAMETER} - \text{CONCRETE SEGMENT THICKNESS}}$

$= \tan^{-1} \dfrac{413^{mm}/1000 = 0.05931}{7.62 - 0.715}$

$= 3.423°$

FROM AISC 1-33
$d = 8"$
$t_w = .285"$
$k = 15/16"$



FORCES ACTING AT SUPPORT

$P_Y = P \cos\theta = 3.873^k \cong P = 3.88^k$

$P_x = P \sin\theta = 0.23^k$

P_x WILL INDUCE A LOCAL BENDING IN W8 WEB.

SECTION MODULUS OF THE PORTION OF WEB IN BENDING DUE TO P_x

$= \dfrac{bt^2}{6} = 14.125" \times (0.285)^2/6 = 0.1912 \text{ IN}^3$

$M = 0.23^k \times 7.0625" = 1.624^{"k}$

$f_b = \dfrac{1.624}{0.1912} = 8.49^{ksi} << F_b = 0.75 F_y = 27^{ksi}$ ---- O.K.
(AISC F2-1)

THE INDUCED STRESS IS WITHIN THE ALLOWABLE STRESS, AND THE ABOVE STRESS IS NOT ADDITIVE TO STEEL SET DESIGN UNITY CHECK. THEREFORE, THE IMPACT OF STEEL SET INSTALLATION TOLERANCES ON STEEL SET DESIGN IS NOT SIGNIFICANT.

ATTACHMENT VIII STRUCTURAL STEEL SET USING W6X20

PURPOSE AND DESCRIPTION

The purpose of the attachment VIII is to confirm the capacity of the W6X20 steel shape to WITHSTAND THE LONG TERM ROCK LOAD AND TO DETERMINE THE MAXIMUM ALLOWABLE JACKING LOAD BASED ON A JACKING PROCESS SIMILAR TO THAT USED FOR THE W8x31 STEEL SETS.

For jacking loads two computer analysis were performed, one with 20 Ton jacking load and another with 17 ton jacking load. The results are that the W6X20 shape is adequate for 17 Ton jacking, but not for 20 Ton jacking. (See "Summary of computer analyses for W6X20 steel shape" at the end of this attachment).

For all inputs used in the computer analyses performed in this attachment, see Attachment I, the 51 degrees runs. The jacking bracket for jacking without insert is situated at 51 degrees with the vertical axis. (See page IX-3).

The configuration from Attachment I can be used in this analysis because the difference in radius is 1" which represents a difference of less than 1% in configuration. From the resulting interaction coefficient for the 17 Ton jack (see page VIII-26), we can conclude that the results are adequate.

W6 x 20. 17 TON JACKING.

BOTH SIDES @ 51°.

CRITICAL MEMBERS: 3, 4, 41 & 42.

$P = 32.2^K$ $M = 15.41^{'K}$ (FROM STRUT 3D - 17 TON)

UNBRACED LENGTHS.

$L_y = 7.43' = 89.16'' = 35°$ TIE ROD SPACING

L_x = distance between blocking = $4 \times 18.79''$ $\cong 75''$

since $r_x > r_y$, L_x DOES NOT GOVERN FOR COLUMN BUCKLING

ARCH LENGTH FROM SPRINGLINE TO CONCRETE INVERT $= \frac{\pi r A}{180} = \frac{\pi (146)(90° - 31°)}{180}$

ARCH LENGTH $= \frac{\pi * 146 * 59}{180} = 150.34266$

MEMBER LENGTH COMPRESSIVE FLANGE UNBRACED LENGTH. $= \frac{150.34266}{8 (= \text{No. OF MEMBERS})} = 18.79$ in

So $L_x \cong 3.0 * 18.79'' \cong 56.37''$

SEE MOMENT DIAGRAM - FOR DISTANCE BTWEEN INFLEXION POINTS ≅ 3 MEMBER LENGTHS = UNBRACED COMPRESSIVE FLANGE LENGTH

$\frac{K l_x}{r_x} = \frac{56.37}{2.66} = 21.19$ $P'_e = 332.9$

AISC 5-122

DETERMINE ALLOWABLE STRESSES

Fa USE K = 1 - CONSERVATIVELY

$\frac{KL_y}{r_y} = \frac{89.16}{1.50} = 59.44$ - CRITICAL BY INSPECTION

$F_a = 17.49$ ksi AISC TABLE C-36

Fb

AISC 5-45

$L_c = \frac{76\, b_f}{\sqrt{F_y}} = \frac{76 \times 6.02}{6} = 76''$ (F1-2)

$F_b = .66 F_y = 36 * .66 = 24$ ksi (F1-1) -

DETERMINE INTERACTION COEFFICIENT

AISC 5-54

$C_m = 1.0$ AISC pg 5-55

H 1-1 : $\frac{f_a}{F_a} + \frac{C_m f_b}{\left(1 - \frac{f_a}{F'_{ex}}\right) F_b} = \frac{5.486}{17.49} + \frac{13.8}{\left(1 - \frac{5.486}{332.9}\right) 24}$

.983

$= .313 + .585$

$f_a = \frac{32.2}{5.87} = 5.486$ ksi $= .898 < 1.0$

OK

$f_b = \frac{15.41 * 12}{13.4} = 13.8$ ksi

H 1-2 : $\frac{f_a}{21.6} + \frac{f_b}{24} = \frac{5.486}{21.6} + \frac{13.8}{24} = .829 < 1$

NOT CRITICAL

CHECK 20 TON JACKS

CRITICAL MEMBERS 3, 4, 41, 42

Paxial = 37.81 K M = 17.6 1K

FROM STR 3D. 20 TON JACK

$f_a = \frac{37.81}{5.87} = 6.44$ Ksi

$f_b = \frac{17.6 \times 12}{13.4} = 15.76$ Ksi

$F_a = 17.49$ Ksi

$F_b = 24$ Ksi

$F_e' = 332.9$ Ksi

see SAT VIII-2

AISC 5-54 - H1-1.

$$\frac{6.44}{17.49} + \frac{15.76}{\left(1 - \frac{6.44}{332.9}\right)24} = .368 + .67 = 1.038$$

.98

> 1. NG.

HENCE 20T JACK IS TOO HIGH. -

```
**************************************************
*                                                *
*            S T A A D - III                     *
*            Revision 16.0b                      *
*            Proprietary Program of              *
*            RESEARCH ENGINEERS, Inc.            *
*            Date=    SEP 11, 1995               *
*            Time=    13:42:18                   *
*                                                *
**************************************************
```

```
 1. STAAD PLANE BABEE0000-01717-0200-00003 ATTACHMENT VIII
 2. * ESF GROUND SUPPORT-STRUCTURAL STEEL ANALYSIS REV 00
 3. * FILE STLRV3D
 4. * 20 TON JACKS APPLIED BOTH SIDES @ 51 DEGREES
 5. * W6X20
 6. UNIT FT KIP
 7. JOINT COORDINATES
 8. 3 2.71 2.77 ; 4 2.43 3.13
 9. 5 1.58 4.44 ; 6 0.90 5.85 ; 7 0.40 7.33 ; 8 0.10 8.87
10. 9 0.0 10.43 ; 10 0.08 11.79 ; 11 0.31 13.14 ; 12 0.68 14.45
11. 13 1.21 15.71 ; 14 1.86 16.90 ; 15 2.65 18.02 ; 16 3.56 19.03
12. 17 4.58 19.94 ; 18 5.69 20.73 ; 19 6.89 21.39 ; 20 8.15 21.91
13. 21 9.46 22.29 ; 22 10.80 22.52 ; 23 12.17 22.60 ; 24 13.53 22.52
14. 25 14.87 22.29 ; 26 16.18 21.91 ; 27 17.45 21.39 ; 28 18.64 20.73
15. 29 19.75 19.94 ; 30 20.77 19.03 ; 31 21.68 18.02 ; 32 22.47 16.90
16. 33 23.13 15.71 ; 34 23.65 14.45 ; 35 24.03 13.14 ; 36 24.26 11.79
17. 37 24.33 10.43 ; 38 24.23 8.87 ; 39 23.93 7.33 ; 40 23.44 5.85
18. 41 22.76 4.44 ; 42 21.90 3.13 ; 43 21.62 2.77
19. MEMBER INCIDENCE
20. 3 3 4 42
21. UNIT KIP INCH
22. MEMBER PROPERTIES
23. 3 TO 42 TA STA W6X20
24. CONSTANTS
25. E 29000.0 ALL
26. DENSITY 0.00028 ALL
27. BETA 0 ALL
28. UNIT FT
29. SUPPORT
30. 3 7 11 35 39 43 FIXED BUT FY MZ
31. 22 24 FIXED BUT FX MZ
32. 16 30 PINNED
33. UNIT KIP
34. LOAD 1
35. SELF WEIGHT Y -1.0
36. LOADING 2
37. * 20 TON JACKS @ BOTH SIDES
38. * TO OBTAIN LOADS FOR 20 TON JACKS: MULTIPLY
39. * THE LOADS FOR 25 TON JACKS BY 0.80
40. * THEN, MULTIPLY MOMENTS BY 5/12 BECAUSE
41. * EXCENTRICITY IS 5" FOR  W6X20
42. * 31.47 X .8 = 25.176 K
43. * 38.86 X .8 = 31.088 K
44. * 40K X 5"/12 = 16.667 FT K
45. JOINT LOADING
46. 3 FX -25.176
47. 43 FX 25.176
```

```
48. 3 43 FY 31.088
49. 43 MZ -16.667
50. 3 MZ 16.667
51. LOADING COMBINATION 3
52. 1 2.5 2 1.0
53. PERFORM ANALYSIS

        P R O B L E M   S T A T I S T I C S
        -----------------------------------

 NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =    41/   40/   10
 ORIGINAL/FINAL BAND-WIDTH =     1/    1
 TOTAL PRIMARY LOAD CASES  =     2, TOTAL DEGREES OF FREEDOM =   111
 SIZE OF STIFFNESS MATRIX =      666 DOUBLE PREC. WORDS
 TOTAL REQUIRED DISK SPACE =     0.07 MEGA-BYTES

++ PROCESSING ELEMENT STIFFNESS MATRIX.                13:42:21
++ PROCESSING GLOBAL STIFFNESS MATRIX.                 13:42:21
++ PROCESSING TRIANGULAR FACTORIZATION.                13:42:22
++ CALCULATING JOINT DISPLACEMENTS.                    13:42:22
++ CALCULATING MEMBER  FORCES.                         13:42:22

54. LOAD LIST 3
55. PRINT ANALYSIS RESULTS
```

JOINT DISPLACEMENT (INCH RADIANS) STRUCTURE TYPE = PLANE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
3	3	0.00000	0.08192	0.00000	0.00000	0.00000	0.00474
4	3	-0.01809	0.06631	0.00000	0.00000	0.00000	0.00380
5	3	-0.04977	0.04079	0.00000	0.00000	0.00000	0.00068
6	3	-0.03522	0.04325	0.00000	0.00000	0.00000	-0.00138
7	3	0.00000	0.05094	0.00000	0.00000	0.00000	-0.00102
8	3	0.00240	0.04800	0.00000	0.00000	0.00000	0.00006
9	3	-0.00041	0.04444	0.00000	0.00000	0.00000	0.00002
10	3	0.00129	0.04139	0.00000	0.00000	0.00000	-0.00001
11	3	0.00000	0.03866	0.00000	0.00000	0.00000	0.00077
12	3	-0.02438	0.04216	0.00000	0.00000	0.00000	0.00125
13	3	-0.04181	0.04588	0.00000	0.00000	0.00000	0.00042
14	3	-0.04065	0.04146	0.00000	0.00000	0.00000	-0.00084
15	3	-0.02225	0.02440	0.00000	0.00000	0.00000	-0.00173
16	3	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00135
17	3	0.00747	-0.00918	0.00000	0.00000	0.00000	-0.00038
18	3	0.00726	-0.00984	0.00000	0.00000	0.00000	0.00011
19	3	0.00470	-0.00638	0.00000	0.00000	0.00000	0.00026
20	3	0.00246	-0.00246	0.00000	0.00000	0.00000	0.00021
21	3	0.00122	-0.00026	0.00000	0.00000	0.00000	0.00009
22	3	0.00060	0.00000	0.00000	0.00000	0.00000	0.00003
23	3	0.00001	0.00050	0.00000	0.00000	0.00000	0.00000
24	3	-0.00057	0.00000	0.00000	0.00000	0.00000	-0.00003
25	3	-0.00119	-0.00024	0.00000	0.00000	0.00000	-0.00009
26	3	-0.00242	-0.00242	0.00000	0.00000	0.00000	-0.00021
27	3	-0.00465	-0.00633	0.00000	0.00000	0.00000	-0.00026
28	3	-0.00722	-0.00979	0.00000	0.00000	0.00000	-0.00011
29	3	-0.00745	-0.00916	0.00000	0.00000	0.00000	0.00038
30	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00135
31	3	0.02221	0.02437	0.00000	0.00000	0.00000	0.00173
32	3	0.04065	0.04146	0.00000	0.00000	0.00000	0.00085
33	3	0.04197	0.04601	0.00000	0.00000	0.00000	-0.00043
34	3	0.02425	0.04229	0.00000	0.00000	0.00000	-0.00125
35	3	0.00000	0.03866	0.00000	0.00000	0.00000	-0.00076
36	3	-0.00141	0.04137	0.00000	0.00000	0.00000	0.00000
37	3	-0.00015	0.04438	0.00000	0.00000	0.00000	-0.00004
38	3	-0.00292	0.04794	0.00000	0.00000	0.00000	-0.00004
39	3	0.00000	0.05078	0.00000	0.00000	0.00000	0.00106
40	3	0.03606	0.04302	0.00000	0.00000	0.00000	0.00141
41	3	0.05073	0.04051	0.00000	0.00000	0.00000	-0.00070
42	3	0.01832	0.06678	0.00000	0.00000	0.00000	-0.00385
43	3	0.00000	0.08257	0.00000	0.00000	0.00000	-0.00479

SUPPORT REACTIONS -UNIT KIP FEET STRUCTURE TYPE = PLANE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
3	3	3.59	0.00	0.00	0.00	0.00	0.00
7	3	21.42	0.00	0.00	0.00	0.00	0.00
11	3	17.06	0.00	0.00	0.00	0.00	0.00
35	3	-17.11	0.00	0.00	0.00	0.00	0.00
39	3	-21.43	0.00	0.00	0.00	0.00	0.00
43	3	-3.56	0.00	0.00	0.00	0.00	0.00
22	3	0.00	-1.48	0.00	0.00	0.00	0.00
24	3	0.00	-1.49	0.00	0.00	0.00	0.00
16	3	-11.12	-28.26	0.00	0.00	0.00	0.00
30	3	11.15	-28.25	0.00	0.00	0.00	0.00

MEMBER END FORCES STRUCTURE TYPE = PLANE

ALL UNITS ARE -- KIP FEET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
3	3	3	37.79	2.05	0.00	0.00	0.00	-16.67
		4	-37.77	-2.03	0.00	0.00	0.00	17.60
4	3	4	37.81	-1.20	0.00	0.00	0.00	-17.60
		5	-37.75	1.24	0.00	0.00	0.00	15.69
5	3	5	37.29	-5.98	0.00	0.00	0.00	-15.69
		6	-37.22	6.02	0.00	0.00	0.00	6.30
6	3	6	36.19	-10.56	0.00	0.00	0.00	-6.30
		7	-36.12	10.58	0.00	0.00	0.00	-10.21
7	3	7	30.30	5.73	0.00	0.00	0.00	10.21
		8	-30.22	-5.71	0.00	0.00	0.00	-1.23
8	3	8	30.70	1.80	0.00	0.00	0.00	1.23
		9	-30.63	-1.79	0.00	0.00	0.00	1.58
9	3	9	30.62	1.97	0.00	0.00	0.00	1.58
		10	-30.55	-1.97	0.00	0.00	0.00	1.11
10	3	10	30.15	5.31	0.00	0.00	0.00	-1.11
		11	-30.08	-5.30	0.00	0.00	0.00	8.37
11	3	11	33.98	-7.95	0.00	0.00	0.00	-8.37
		12	-33.92	7.97	0.00	0.00	0.00	-2.46
12	3	12	34.64	-3.75	0.00	0.00	0.00	2.46
		13	-34.58	3.77	0.00	0.00	0.00	-7.60
13	3	13	34.78	-0.24	0.00	0.00	0.00	7.60
		14	-34.72	0.27	0.00	0.00	0.00	-7.95
14	3	14	34.53	3.69	0.00	0.00	0.00	7.95
		15	-34.47	-3.65	0.00	0.00	0.00	-2.92
15	3	15	33.80	7.72	0.00	0.00	0.00	2.92
		16	-33.75	-7.68	0.00	0.00	0.00	7.55
16	3	16	5.61	-2.38	0.00	0.00	0.00	-7.55
		17	-5.56	2.43	0.00	0.00	0.00	4.26
17	3	17	5.79	-1.81	0.00	0.00	0.00	-4.26
		18	-5.76	1.86	0.00	0.00	0.00	1.76
18	3	18	5.93	-1.19	0.00	0.00	0.00	-1.76
		19	-5.90	1.25	0.00	0.00	0.00	0.09

MEMBER END FORCES STRUCTURE TYPE = PLANE

ALL UNITS ARE -- KIP FEET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
19	3	19	6.00	-0.58	0.00	0.00	0.00	-0.09
		20	-5.98	0.64	0.00	0.00	0.00	-0.74
20	3	20	6.01	0.01	0.00	0.00	0.00	0.74
		21	-5.99	0.05	0.00	0.00	0.00	-0.77
21	3	21	5.96	0.62	0.00	0.00	0.00	0.77
		22	-5.95	-0.55	0.00	0.00	0.00	0.03
22	3	22	5.76	-0.27	0.00	0.00	0.00	-0.03
		23	-5.76	0.33	0.00	0.00	0.00	-0.39
23	3	23	5.76	0.34	0.00	0.00	0.00	0.39
		24	-5.76	-0.27	0.00	0.00	0.00	0.03
24	3	24	5.95	-0.55	0.00	0.00	0.00	-0.03
		25	-5.96	0.62	0.00	0.00	0.00	-0.77
25	3	25	5.99	0.05	0.00	0.00	0.00	0.77
		26	-6.01	0.01	0.00	0.00	0.00	-0.74
26	3	26	5.98	0.63	0.00	0.00	0.00	0.74
		27	-6.00	-0.56	0.00	0.00	0.00	0.08
27	3	27	5.90	1.26	0.00	0.00	0.00	-0.08
		28	-5.93	-1.21	0.00	0.00	0.00	1.76
28	3	28	5.76	1.86	0.00	0.00	0.00	-1.76
		29	-5.80	-1.81	0.00	0.00	0.00	4.26
29	3	29	5.56	2.43	0.00	0.00	0.00	-4.26
		30	-5.61	-2.38	0.00	0.00	0.00	7.55
30	3	30	33.77	-7.65	0.00	0.00	0.00	-7.55
		31	-33.82	7.69	0.00	0.00	0.00	-2.88
31	3	31	34.49	-3.62	0.00	0.00	0.00	2.88
		32	-34.55	3.66	0.00	0.00	0.00	-7.88
32	3	32	34.74	0.08	0.00	0.00	0.00	7.88
		33	-34.80	-0.05	0.00	0.00	0.00	-7.79
33	3	33	34.57	4.04	0.00	0.00	0.00	7.79
		34	-34.63	-4.01	0.00	0.00	0.00	-2.30
34	3	34	33.99	7.76	0.00	0.00	0.00	2.30
		35	-34.05	-7.74	0.00	0.00	0.00	8.27
35	3	35	30.08	-5.31	0.00	0.00	0.00	-8.27
		36	-30.15	5.32	0.00	0.00	0.00	0.99

MEMBER END FORCES STRUCTURE TYPE = PLANE

ALL UNITS ARE -- KIP FEET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
36	3	36	30.56	-1.76	0.00	0.00	0.00	-0.99
		37	-30.63	1.76	0.00	0.00	0.00	-1.41
37	3	37	30.63	-1.78	0.00	0.00	0.00	-1.41
		38	-30.71	1.78	0.00	0.00	0.00	-1.37
38	3	38	30.22	-5.70	0.00	0.00	0.00	1.37
		39	-30.30	5.71	0.00	0.00	0.00	-10.32
39	3	39	36.06	10.83	0.00	0.00	0.00	10.32
		40	-36.14	-10.80	0.00	0.00	0.00	6.53
40	3	40	37.23	6.04	0.00	0.00	0.00	-6.53
		41	-37.30	-6.01	0.00	0.00	0.00	15.96
41	3	41	37.77	1.06	0.00	0.00	0.00	-15.96
		42	-37.83	-1.02	0.00	0.00	0.00	17.59
42	3	42	37.79	-2.01	0.00	0.00	0.00	-17.59
		43	-37.81	2.03	0.00	0.00	0.00	16.67

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

56. CHECK CODE ALL

STAAD-III CODE CHECKING - (AISC)
****

ALL UNITS ARE - KIP FEET (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
3	ST W6X 20	PASS	AISC- H1-2	0.963	3
		37.77 C	0.00	17.60	0.46
4	ST W6X 20	PASS	AISC- H1-2	0.964	3
		37.81 C	0.00	-17.60	0.00
5	ST W6X 20	PASS	AISC- H1-2	0.888	3
		37.29 C	0.00	-15.69	0.00
6	ST W6X 20	PASS	AISC- H1-2	0.671	3
		36.12 C	0.00	-10.21	1.56
7	ST W6X 20	PASS	AISC- H1-2	0.625	3
		30.30 C	0.00	10.21	0.00
8	ST W6X 20	PASS	AISC- H1-2	0.301	3
		30.63 C	0.00	1.58	1.56
9	ST W6X 20	PASS	AISC- H1-2	0.301	3
		30.62 C	0.00	1.58	0.00
10	ST W6X 20	PASS	AISC- H1-2	0.554	3
		30.08 C	0.00	8.37	1.37
11	ST W6X 20	PASS	AISC- H1-2	0.585	3
		33.98 C	0.00	-8.37	0.00
12	ST W6X 20	PASS	AISC- H1-2	0.560	3
		34.58 C	0.00	-7.60	1.37
13	ST W6X 20	PASS	AISC- H1-2	0.574	3
		34.72 C	0.00	-7.95	1.36
14	ST W6X 20	PASS	AISC- H1-2	0.573	3
		34.53 C	0.00	7.95	0.00
15	ST W6X 20	PASS	AISC- H1-2	0.552	3
		33.75 C	0.00	7.55	1.36
16	ST W6X 20	PASS	AISC- H1-3	0.331	3
		5.61 C	0.00	-7.55	0.00
17	ST W6X 20	PASS	AISC- H1-3	0.208	3
		5.79 C	0.00	-4.26	0.00
18	ST W6X 20	PASS	AISC- H1-3	0.114	3
		5.93 C	0.00	-1.76	0.00
19	ST W6X 20	PASS	AISC- H1-3	0.076	3
		5.98 C	0.00	-0.74	1.36
20	ST W6X 20	PASS	AISC- H1-3	0.077	3
		5.99 C	0.00	-0.77	1.36
21	ST W6X 20	PASS	AISC- H1-3	0.077	3
		5.96 C	0.00	0.77	0.00
22	ST W6X 20	PASS	AISC- H1-3	0.061	3
		5.76 C	0.00	-0.39	1.37
23	ST W6X 20	PASS	AISC- H1-3	0.061	3
		5.76 C	0.00	0.39	0.00
24	ST W6X 20	PASS	AISC- H1-3	0.077	3
		5.96 C	0.00	-0.77	1.36
25	ST W6X 20	PASS	AISC- H1-3	0.077	3
		5.99 C	0.00	0.77	0.00
26	ST W6X 20	PASS	AISC- H1-3	0.076	3
		5.98 C	0.00	0.74	0.00

L UNITS ARE - KIP FEET (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
27	ST W6X 20	PASS	AISC- H1-3	0.114	3
		5.93 C	0.00	1.76	1.36
28	ST W6X 20	PASS	AISC- H1-3	0.208	3
		5.80 C	0.00	4.26	1.36
29	ST W6X 20	PASS	AISC- H1-3	0.331	3
		5.61 C	0.00	7.55	1.37
30	ST W6X 20	PASS	AISC- H1-2	0.552	3
		33.77 C	0.00	-7.55	0.00
31	ST W6X 20	PASS	AISC- H1-2	0.570	3
		34.55 C	0.00	-7.88	1.37
32	ST W6X 20	PASS	AISC- H1-2	0.572	3
		34.74 C	0.00	7.88	0.00
33	ST W6X 20	PASS	AISC- H1-2	0.567	3
		34.57 C	0.00	7.79	0.00
34	ST W6X 20	PASS	AISC- H1-2	0.581	3
		34.05 C	0.00	8.27	1.36
35	ST W6X 20	PASS	AISC- H1-2	0.550	3
		30.08 C	0.00	-8.27	0.00
36	ST W6X 20	PASS	AISC- H1-2	0.295	3
		30.63 C	0.00	-1.41	1.36
37	ST W6X 20	PASS	AISC- H1-2	0.295	3
		30.63 C	0.00	-1.41	0.00
38	ST W6X 20	PASS	AISC- H1-2	0.629	3
		30.30 C	0.00	-10.32	1.57
39	ST W6X 20	PASS	AISC- H1-2	0.675	3
		36.06 C	0.00	10.32	0.00
40	ST W6X 20	PASS	AISC- H1-2	0.898	3
		37.30 C	0.00	15.96	1.57
41	ST W6X 20	PASS	AISC- H1-2	0.964	3
		37.83 C	0.00	17.59	1.57
42	ST W6X 20	PASS	AISC- H1-2	0.963	3
		37.79 C	0.00	-17.59	0.00

********** END OF TABULATED RESULT OF DESIGN **********

57. PLOT DISPLACEMENT FILE
58. PLOT BENDING FILE
59. FINISH

********** END OF STAAD-III **********

DATE= SEP 11,1995 TIME= 13:42:26 ******

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**********************************************************
*       For questions on STAAD-III/ISDS, contact:        *
*       RESEARCH ENGINEERS, Inc at (714) 974-2500        *
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**************************************************
*                                                *
*            S T A A D - III                     *
*            Revision 16.0b                      *
*            Proprietary Program of              *
*            RESEARCH ENGINEERS, Inc.            *
*            Date=    SEP 11, 1995               *
*            Time=    13:57:37                   *
*                                                *
**************************************************
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```
 1. STAAD PLANE BABEE0000-01717-0200-00003 ATTACHMENT VIII
 2. * ESF GROUND SUPPORT-STRUCTURAL STEEL ANALYSIS REV 00
 3. * FILE STLRV3D
 4. * 17 TON JACKS APPLIED BOTH SIDES @ 51 DEGREES
 5. * W6X20
 6. UNIT FT KIP
 7. JOINT COORDINATES
 8. 3 2.71 2.77 ; 4 2.43 3.13
 9. 5 1.58 4.44 ; 6 0.90 5.85 ; 7 0.40 7.33 ; 8 0.10 8.87
10. 9 0.0 10.43 ; 10 0.08 11.79 ; 11 0.31 13.14 ; 12 0.68 14.45
11. 13 1.21 15.71 ; 14 1.86 16.90 ; 15 2.65 18.02 ; 16 3.56 19.03
12. 17 4.58 19.94 ; 18 5.69 20.73 ; 19 6.89 21.39 ; 20 8.15 21.91
13. 21 9.46 22.29 ; 22 10.80 22.52 ; 23 12.17 22.60 ; 24 13.53 22.52
14. 25 14.87 22.29 ; 26 16.18 21.91 ; 27 17.45 21.39 ; 28 18.64 20.73
15. 29 19.75 19.94 ; 30 20.77 19.03 ; 31 21.68 18.02 ; 32 22.47 16.90
16. 33 23.13 15.71 ; 34 23.65 14.45 ; 35 24.03 13.14 ; 36 24.26 11.79
17. 37 24.33 10.43 ; 38 24.23 8.87 ; 39 23.93 7.33 ; 40 23.44 5.85
18. 41 22.76 4.44 ; 42 21.90 3.13 ; 43 21.62 2.77
19. MEMBER INCIDENCE
20. 3 3 4 42
21. UNIT KIP INCH
22. MEMBER PROPERTIES
23. 3 TO 42 TA STA W6X20
24. CONSTANTS
25. E 29000.0 ALL
26. DENSITY 0.00028 ALL
27. BETA 0 ALL
28. UNIT FT
29. SUPPORT
30. 3 7 11 35 39 43 FIXED BUT FY MZ
31. 22 24 FIXED BUT FX MZ
32. 16 30 PINNED
33. UNIT KIP
34. LOAD 1
35. SELF WEIGHT Y -1.0
36. LOADING 2
37. * 17 TON JACKS @ BOTH SIDES
38. * TO OBTAIN LOADS FOR 17 TON JACKS: MULTIPLY
39. * THE LOADS FOR 20 TON JACKS BY 0.85
40. * THEN, MULTIPLY MOMENTS BY 5/12 BECAUSE
41. * EXCENTRICITY IS 5" FOR  W6X20
42. * 25.176 K X .85 = 21.4 K
43. * 31.088 K X .85 = 26.425 K
44. * 34K X 5"/12 = 14.667 FT K
45. JOINT LOADING
46. 3 FX -21.4
47. 43 FX 21.4
```

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48. 3 43 FY 26.425
49. 43 MZ -14.667
50. 3 MZ 14.667
51. LOADING COMBINATION 3
52. 1 2.5 2 1.0
53. PERFORM ANALYSIS

      P R O B L E M   S T A T I S T I C S
      -----------------------------------

 NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =    41/   40/   10
 ORIGINAL/FINAL BAND-WIDTH =    1/    1
 TOTAL PRIMARY LOAD CASES  =    2, TOTAL DEGREES OF FREEDOM =   111
 SIZE OF STIFFNESS MATRIX =     666 DOUBLE PREC. WORDS
 TOTAL REQUIRED DISK SPACE =    0.07 MEGA-BYTES

++ PROCESSING ELEMENT STIFFNESS MATRIX.              13:57:40
++ PROCESSING GLOBAL STIFFNESS MATRIX.               13:57:41
++ PROCESSING TRIANGULAR FACTORIZATION.              13:57:41
++ CALCULATING JOINT DISPLACEMENTS.                  13:57:41
++ CALCULATING MEMBER  FORCES.                       13:57:42

54. LOAD LIST 3
55. PRINT ANALYSIS RESULTS
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'OINT DISPLACEMENT (INCH RADIANS) STRUCTURE TYPE = PLANE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
3	3	0.00000	0.06971	0.00000	0.00000	0.00000	0.00413
4	3	-0.01575	0.05615	0.00000	0.00000	0.00000	0.00331
5	3	-0.04322	0.03410	0.00000	0.00000	0.00000	0.00059
6	3	-0.03055	0.03632	0.00000	0.00000	0.00000	-0.00120
7	3	0.00000	0.04307	0.00000	0.00000	0.00000	-0.00089
8	3	0.00230	0.04063	0.00000	0.00000	0.00000	0.00004
9	3	-0.00010	0.03760	0.00000	0.00000	0.00000	0.00003
10	3	0.00122	0.03503	0.00000	0.00000	0.00000	0.00000
11	3	0.00000	0.03274	0.00000	0.00000	0.00000	0.00065
12	3	-0.02067	0.03571	0.00000	0.00000	0.00000	0.00106
13	3	-0.03541	0.03885	0.00000	0.00000	0.00000	0.00036
14	3	-0.03442	0.03510	0.00000	0.00000	0.00000	-0.00071
15	3	-0.01884	0.02066	0.00000	0.00000	0.00000	-0.00147
16	3	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00115
17	3	0.00634	-0.00780	0.00000	0.00000	0.00000	-0.00033
18	3	0.00618	-0.00839	0.00000	0.00000	0.00000	0.00009
19	3	0.00402	-0.00548	0.00000	0.00000	0.00000	0.00022
20	3	0.00212	-0.00216	0.00000	0.00000	0.00000	0.00018
21	3	0.00105	-0.00026	0.00000	0.00000	0.00000	0.00008
22	3	0.00051	0.00000	0.00000	0.00000	0.00000	0.00003
23	3	0.00001	0.00044	0.00000	0.00000	0.00000	0.00000
24	3	-0.00049	0.00000	0.00000	0.00000	0.00000	-0.00003
25	3	-0.00103	-0.00025	0.00000	0.00000	0.00000	-0.00008
26	3	-0.00208	-0.00212	0.00000	0.00000	0.00000	-0.00018
27	3	-0.00398	-0.00544	0.00000	0.00000	0.00000	-0.00022
28	3	-0.00614	-0.00835	0.00000	0.00000	0.00000	-0.00009
29	3	-0.00632	-0.00778	0.00000	0.00000	0.00000	0.00033
30	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00114
31	3	0.01881	0.02063	0.00000	0.00000	0.00000	0.00147
32	3	0.03442	0.03510	0.00000	0.00000	0.00000	0.00072
33	3	0.03556	0.03896	0.00000	0.00000	0.00000	-0.00036
34	3	0.02056	0.03581	0.00000	0.00000	0.00000	-0.00106
35	3	0.00000	0.03273	0.00000	0.00000	0.00000	-0.00065
36	3	-0.00132	0.03501	0.00000	0.00000	0.00000	-0.00001
37	3	-0.00038	0.03755	0.00000	0.00000	0.00000	-0.00004
38	3	-0.00275	0.04058	0.00000	0.00000	0.00000	-0.00003
39	3	0.00000	0.04293	0.00000	0.00000	0.00000	0.00092
40	3	0.03127	0.03613	0.00000	0.00000	0.00000	0.00123
41	3	0.04403	0.03386	0.00000	0.00000	0.00000	-0.00060
42	3	0.01594	0.05656	0.00000	0.00000	0.00000	-0.00335
43	3	0.00000	0.07027	0.00000	0.00000	0.00000	-0.00418

SUPPORT REACTIONS -UNIT KIP FEET STRUCTURE TYPE = PLANE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
3	3	2.93	0.00	0.00	0.00	0.00	0.00
7	3	18.36	0.00	0.00	0.00	0.00	0.00
11	3	14.40	0.00	0.00	0.00	0.00	0.00
35	3	-14.45	0.00	0.00	0.00	0.00	0.00
39	3	-18.37	0.00	0.00	0.00	0.00	0.00
43	3	-2.90	0.00	0.00	0.00	0.00	0.00
22	3	0.00	-1.24	0.00	0.00	0.00	0.00
24	3	0.00	-1.24	0.00	0.00	0.00	0.00
16	3	-9.36	-23.84	0.00	0.00	0.00	0.00
30	3	9.39	-23.84	0.00	0.00	0.00	0.00

MEMBER END FORCES STRUCTURE TYPE = PLANE

ALL UNITS ARE -- KIP FEET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
3	3	3	32.20	1.64	0.00	0.00	0.00	-14.67
		4	-32.18	-1.63	0.00	0.00	0.00	15.41
4	3	4	32.20	-1.13	0.00	0.00	0.00	-15.41
		5	-32.14	1.17	0.00	0.00	0.00	13.62
5	3	5	31.74	-5.20	0.00	0.00	0.00	-13.62
		6	-31.67	5.24	0.00	0.00	0.00	5.45
6	3	6	30.78	-9.10	0.00	0.00	0.00	-5.45
		7	-30.71	9.13	0.00	0.00	0.00	-8.79
7	3	7	25.71	4.89	0.00	0.00	0.00	8.79
		8	-25.63	-4.88	0.00	0.00	0.00	-1.13
8	3	8	26.05	1.55	0.00	0.00	0.00	1.13
		9	-25.97	-1.55	0.00	0.00	0.00	1.30
9	3	9	25.97	1.64	0.00	0.00	0.00	1.30
		10	-25.90	-1.64	0.00	0.00	0.00	0.94
10	3	10	25.56	4.47	0.00	0.00	0.00	-0.94
		11	-25.50	-4.46	0.00	0.00	0.00	7.05
11	3	11	28.79	-6.71	0.00	0.00	0.00	-7.05
		12	-28.73	6.73	0.00	0.00	0.00	-2.10
12	3	12	29.34	-3.16	0.00	0.00	0.00	2.10
		13	-29.27	3.19	0.00	0.00	0.00	-6.44
13	3	13	29.45	-0.20	0.00	0.00	0.00	6.44
		14	-29.39	0.23	0.00	0.00	0.00	-6.73
14	3	14	29.22	3.13	0.00	0.00	0.00	6.73
		15	-29.17	-3.09	0.00	0.00	0.00	-2.47
15	3	15	28.59	6.53	0.00	0.00	0.00	2.47
		16	-28.54	-6.49	0.00	0.00	0.00	6.38
16	3	16	4.81	-2.01	0.00	0.00	0.00	-6.38
		17	-4.77	2.06	0.00	0.00	0.00	3.60
17	3	17	4.97	-1.52	0.00	0.00	0.00	-3.60
		18	-4.93	1.58	0.00	0.00	0.00	1.49
18	3	18	5.08	-1.00	0.00	0.00	0.00	-1.49
		19	-5.04	1.06	0.00	0.00	0.00	0.09

MEMBER END FORCES STRUCTURE TYPE = PLANE

ALL UNITS ARE -- KIP FEET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
19	3	19	5.13	-0.49	0.00	0.00	0.00	-0.09
		20	-5.10	0.55	0.00	0.00	0.00	-0.62
20	3	20	5.13	0.01	0.00	0.00	0.00	0.62
		21	-5.12	0.06	0.00	0.00	0.00	-0.65
21	3	21	5.09	0.52	0.00	0.00	0.00	0.65
		22	-5.08	-0.45	0.00	0.00	0.00	0.01
22	3	22	4.92	-0.22	0.00	0.00	0.00	-0.01
		23	-4.92	0.29	0.00	0.00	0.00	-0.34
23	3	23	4.92	0.29	0.00	0.00	0.00	0.34
		24	-4.92	-0.22	0.00	0.00	0.00	0.01
24	3	24	5.08	-0.45	0.00	0.00	0.00	-0.01
		25	-5.09	0.52	0.00	0.00	0.00	-0.65
25	3	25	5.12	0.05	0.00	0.00	0.00	0.65
		26	-5.13	0.01	0.00	0.00	0.00	-0.62
26	3	26	5.11	0.53	0.00	0.00	0.00	0.62
		27	-5.13	-0.47	0.00	0.00	0.00	0.08
27	3	27	5.04	1.07	0.00	0.00	0.00	-0.08
		28	-5.07	-1.01	0.00	0.00	0.00	1.49
28	3	28	4.93	1.57	0.00	0.00	0.00	-1.49
		29	-4.97	-1.52	0.00	0.00	0.00	3.60
29	3	29	4.77	2.06	0.00	0.00	0.00	-3.60
		30	-4.82	-2.01	0.00	0.00	0.00	6.38
30	3	30	28.56	-6.46	0.00	0.00	0.00	-6.38
		31	-28.61	6.51	0.00	0.00	0.00	-2.44
31	3	31	29.18	-3.06	0.00	0.00	0.00	2.44
		32	-29.24	3.10	0.00	0.00	0.00	-6.66
32	3	32	29.40	0.07	0.00	0.00	0.00	6.66
		33	-29.46	-0.03	0.00	0.00	0.00	-6.60
33	3	33	29.26	3.41	0.00	0.00	0.00	6.60
		34	-29.32	-3.39	0.00	0.00	0.00	-1.96
34	3	34	28.78	6.56	0.00	0.00	0.00	1.96
		35	-28.85	-6.54	0.00	0.00	0.00	6.97
35	3	35	25.49	-4.47	0.00	0.00	0.00	-6.97
		36	-25.56	4.48	0.00	0.00	0.00	0.84

MEMBER END FORCES STRUCTURE TYPE = PLANE

ALL UNITS ARE -- KIP FEET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
36	3	36	25.91	-1.46	0.00	0.00	0.00	-0.84
		37	-25.98	1.47	0.00	0.00	0.00	-1.16
37	3	37	25.97	-1.54	0.00	0.00	0.00	-1.16
		38	-26.05	1.54	0.00	0.00	0.00	-1.25
38	3	38	25.64	-4.86	0.00	0.00	0.00	1.25
		39	-25.71	4.88	0.00	0.00	0.00	-8.89
39	3	39	30.66	9.33	0.00	0.00	0.00	8.89
		40	-30.73	-9.31	0.00	0.00	0.00	5.64
40	3	40	31.68	5.26	0.00	0.00	0.00	-5.64
		41	-31.75	-5.22	0.00	0.00	0.00	13.85
41	3	41	32.16	1.01	0.00	0.00	0.00	-13.85
		42	-32.22	-0.97	0.00	0.00	0.00	15.40
42	3	42	32.20	-1.61	0.00	0.00	0.00	-15.40
		43	-32.21	1.62	0.00	0.00	0.00	14.67

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

56. CHECK CODE ALL

STAAD-III CODE CHECKING - (AISC)
****

ALL UNITS ARE - KIP FEET (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
3	ST W6X 20	PASS	AISC- H1-2	0.837	3
		32.18 C	0.00	15.41	0.46
4	ST W6X 20	PASS	AISC- H1-2	0.837	3
		32.20 C	0.00	-15.41	0.00
5	ST W6X 20	PASS	AISC- H1-2	0.765	3
		31.74 C	0.00	-13.62	0.00
6	ST W6X 20	PASS	AISC- H1-2	0.575	3
		30.71 C	0.00	-8.79	1.56
7	ST W6X 20	PASS	AISC- H1-2	0.535	3
		25.71 C	0.00	8.79	0.00
8	ST W6X 20	PASS	AISC- H1-2	0.254	3
		25.97 C	0.00	1.30	1.56
9	ST W6X 20	PASS	AISC- H1-2	0.254	3
		25.97 C	0.00	1.30	0.00
10	ST W6X 20	PASS	AISC- H1-2	0.468	3
		25.50 C	0.00	7.05	1.37
11	ST W6X 20	PASS	AISC- H1-2	0.494	3
		28.79 C	0.00	-7.05	0.00
12	ST W6X 20	PASS	AISC- H1-2	0.474	3
		29.27 C	0.00	-6.44	1.37
13	ST W6X 20	PASS	AISC- H1-2	0.486	3
		29.39 C	0.00	-6.73	1.36
14	ST W6X 20	PASS	AISC- H1-2	0.485	3
		29.22 C	0.00	6.73	0.00
15	ST W6X 20	PASS	AISC- H1-2	0.466	3
		28.54 C	0.00	6.38	1.36
16	ST W6X 20	PASS	AISC- H1-3	0.280	3
		4.81 C	0.00	-6.38	0.00
17	ST W6X 20	PASS	AISC- H1-3	0.176	3
		4.97 C	0.00	-3.60	0.00
18	ST W6X 20	PASS	AISC- H1-3	0.097	3
		5.08 C	0.00	-1.49	0.00
19	ST W6X 20	PASS	AISC- H1-3	0.065	3
		5.10 C	0.00	-0.62	1.36
20	ST W6X 20	PASS	AISC- H1-3	0.066	3
		5.12 C	0.00	-0.65	1.36
21	ST W6X 20	PASS	AISC- H1-3	0.066	3
		5.09 C	0.00	0.65	0.00
22	ST W6X 20	PASS	AISC- H1-3	0.052	3
		4.92 C	0.00	-0.34	1.37
23	ST W6X 20	PASS	AISC- H1-3	0.052	3
		4.92 C	0.00	0.34	0.00
24	ST W6X 20	PASS	AISC- H1-3	0.066	3
		5.09 C	0.00	-0.65	1.36
25	ST W6X 20	PASS	AISC- H1-3	0.066	3
		5.12 C	0.00	0.65	0.00
26	ST W6X 20	PASS	AISC- H1-3	0.065	3
		5.11 C	0.00	0.62	0.00

UNITS ARE - KIP FEET (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
27	ST W6X 20	PASS	AISC- H1-3	0.097	3
		5.07 C	0.00	1.49	1.36
28	ST W6X 20	PASS	AISC- H1-3	0.176	3
		4.97 C	0.00	3.60	1.36
29	ST W6X 20	PASS	AISC- H1-3	0.280	3
		4.82 C	0.00	6.38	1.37
30	ST W6X 20	PASS	AISC- H1-2	0.466	3
		28.56	0.00	-6.38	0.00
31	ST W6X 20	PASS	AISC- H1-2	0.483	3
		29.24 C	0.00	-6.66	1.37
32	ST W6X 20	PASS	AISC- H1-2	0.484	3
		29.40 C	0.00	6.66	0.00
33	ST W6X 20	PASS	AISC- H1-2	0.480	3
		29.26 C	0.00	6.60	0.00
34	ST W6X 20	PASS	AISC- H1-2	0.491	3
		28.85 C	0.00	6.97	1.36
35	ST W6X 20	PASS	AISC- H1-2	0.465	3
		25.49 C	0.00	-6.97	0.00
36	ST W6X 20	PASS	AISC- H1-2	0.249	3
		25.98 C	0.00	-1.16	1.36
37	ST W6X 20	PASS	AISC- H1-2	0.253	3
		26.05 C	0.00	-1.25	1.56
38	ST W6X 20	PASS	AISC- H1-2	0.539	3
		25.71 C	0.00	-8.89	1.57
39	ST W6X 20	PASS	AISC- H1-2	0.578	3
		30.66 C	0.00	8.89	0.00
40	ST W6X 20	PASS	AISC- H1-2	0.774	3
		31.75 C	0.00	13.85	1.57
41	ST W6X 20	PASS	AISC- H1-2	0.837	3
		32.22 C	0.00	15.40	1.57
42	ST W6X 20	PASS	AISC- H1-2	0.836	3
		32.20 C	0.00	-15.40	0.00

********** END OF TABULATED RESULT OF DESIGN **********

57. PLOT DISPLACEMENT FILE
58. PLOT BENDING FILE
59. FINISH

********** END OF STAAD-III **********

DATE= SEP 11,1995 TIME= 13:57:46 ******

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*        For questions on STAAD-III/ISDS, contact:          *
*        RESEARCH ENGINEERS, Inc at (714) 974-2500          *
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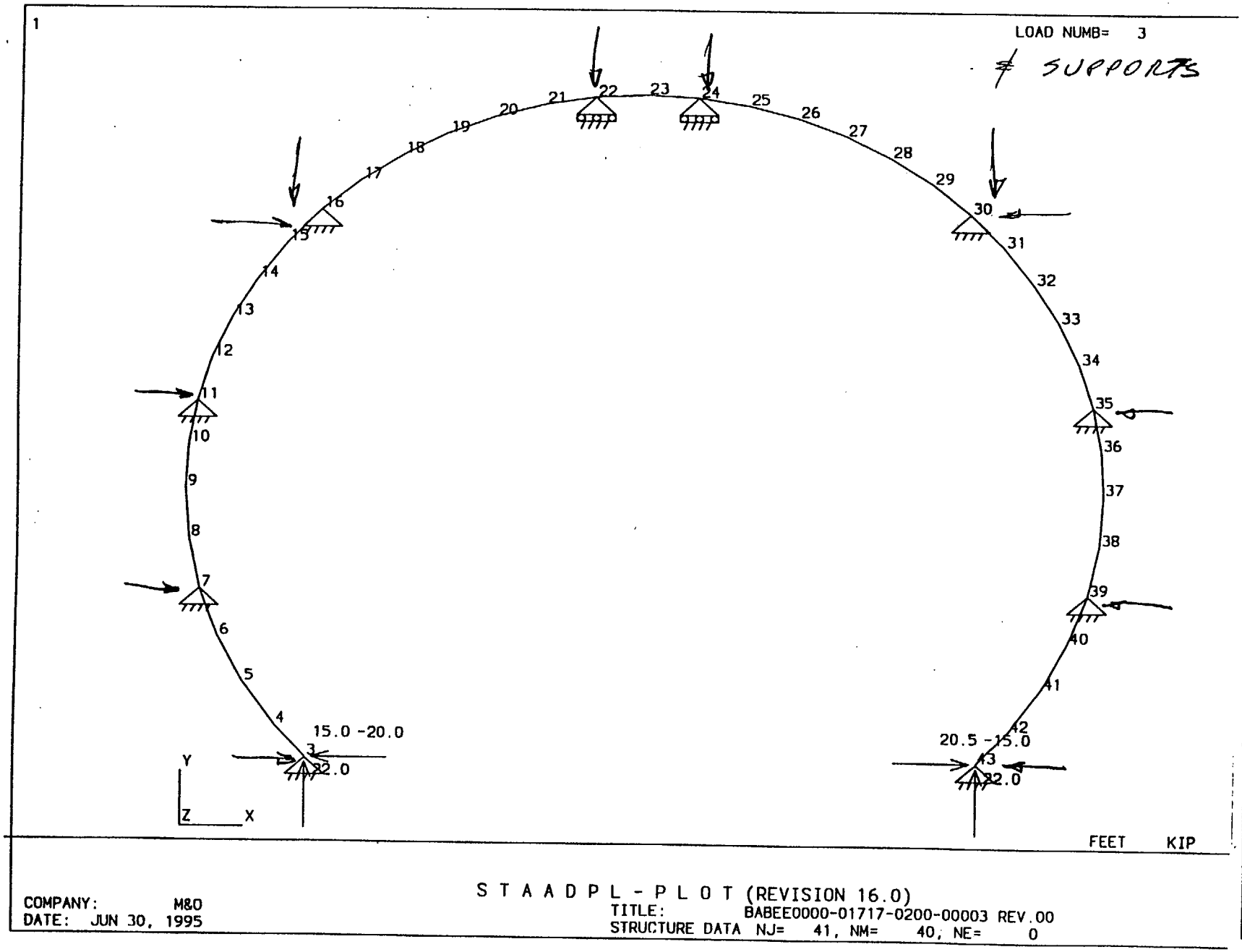
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DATE: JUN 30, 1995
S T A A D P L - P L O T (REVISION 16.0)
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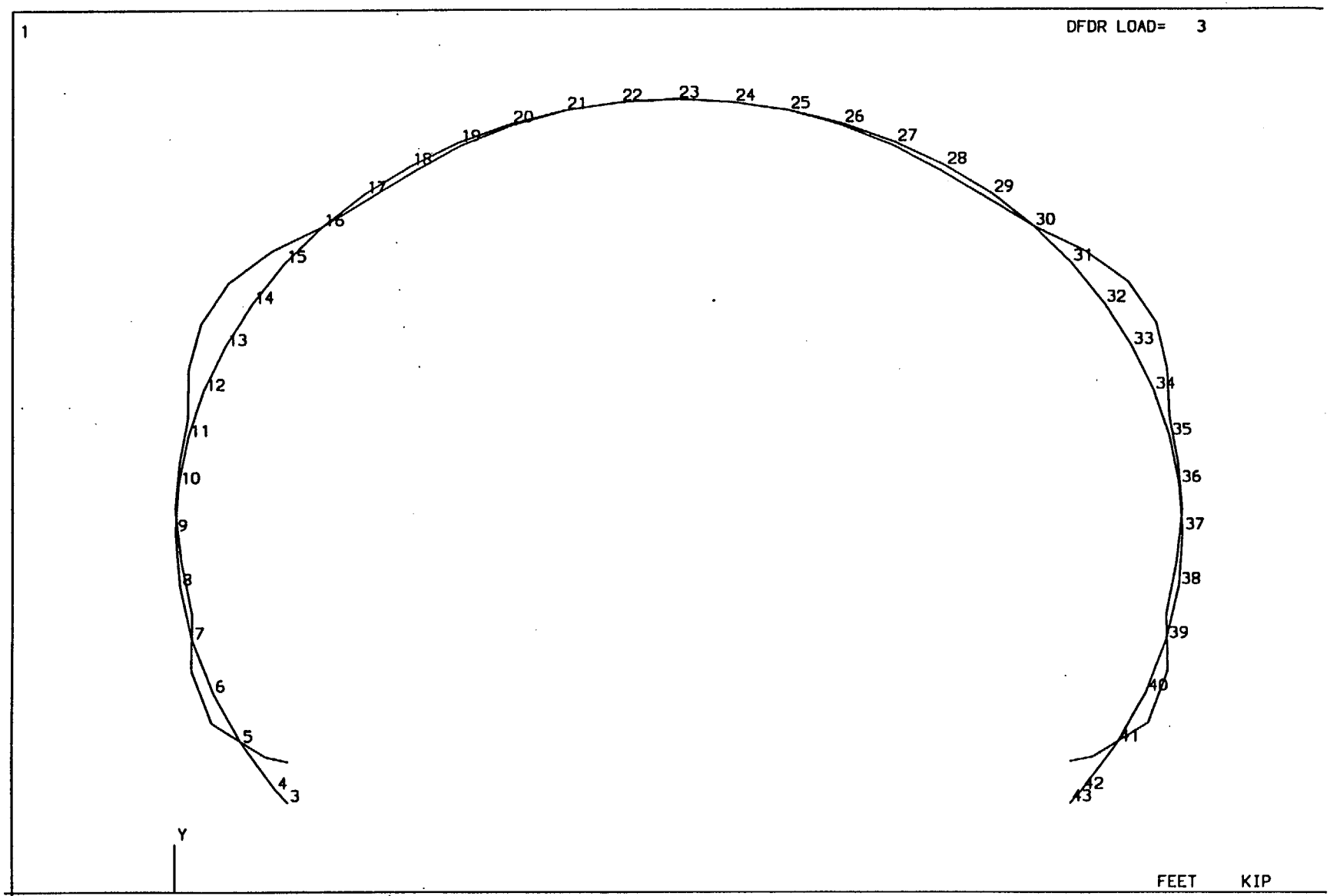

S T A A D P L - P L O T (REVISION 16.0)

COMPANY: M&O
DATE: SEP 11, 1995

TITLE: BABEE0000-01717-0200-00003 ATTACHMENT VIII
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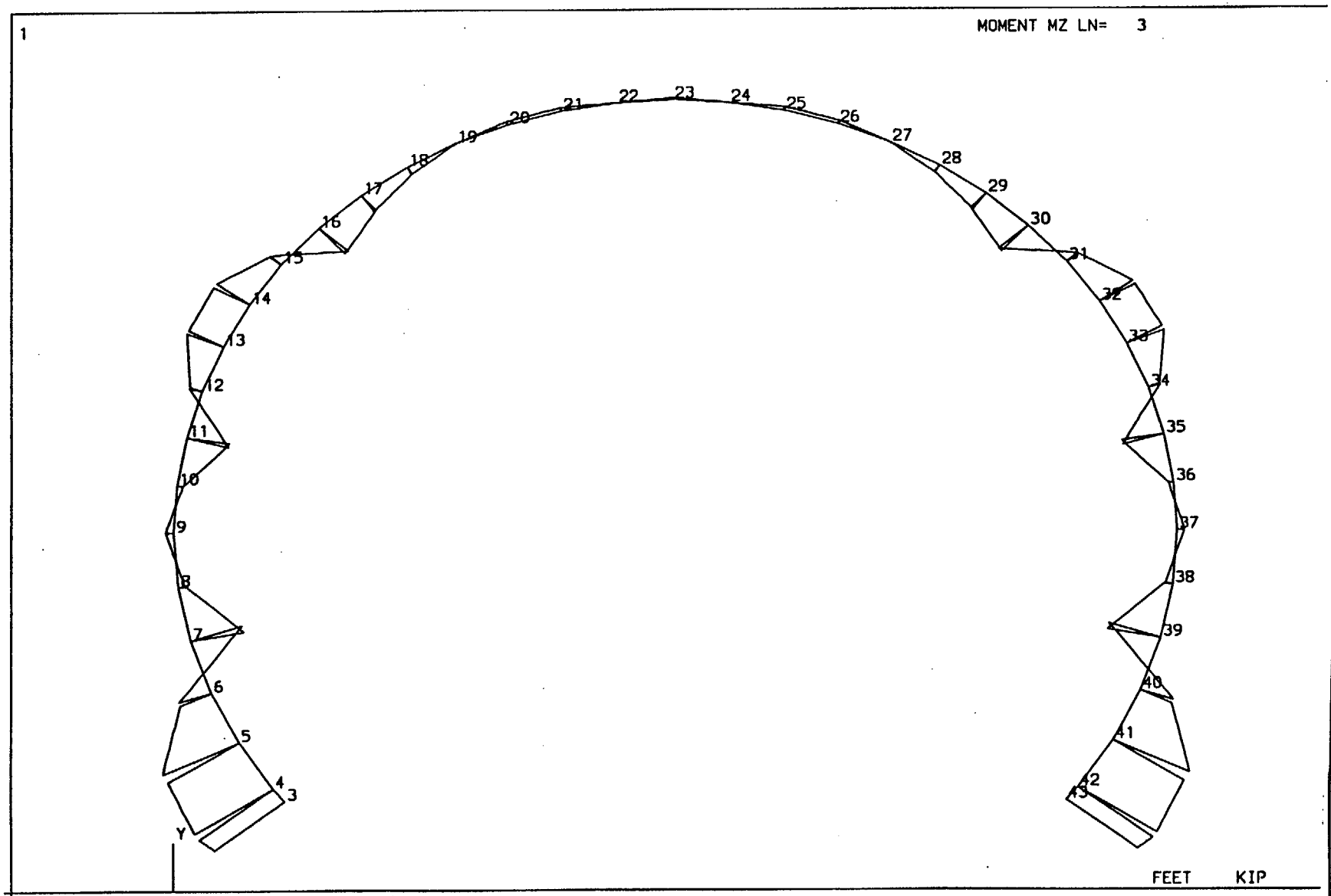


S T A A D P L - P L O T (REVISION 16.0)

COMPANY: M&O
DATE: SEP 11, 1995

TITLE: BABEE0000-01717-0200-00003 ATTACHMENT VIII
STRUCTURE DATA NJ= 41, NM= 40, NE= 0

SUMMARY OF COMPUTER ANALYSES FOR W6X20 STEEL SHAPE

Analysis No.	LOAD	SCOPE	INTERACTION COEFFICIENT Computer	Hand calc's	MEMBER	CONCLUSIONS
1. STLRV3 20 TONS	20 TON JACK	)Determine)W6X20)Jack	0.964	1.038	3,4,41,42	W6X20 is not adequate for 20 T jack
2. STLRV3 17 TONS	17 TON JACK	)capacity)	0.837	0.898	3,4,41,42	W6X20 is adequate for 17 T jack

ATTACHMENT VIII

CONCLUSIONS

The conclusions of the analyses performed in attachment VIII are:

1. The W6X20 steel shape is adequate for a 17 Ton jacking force, but not for a 20 Ton jacking force.

ATTACHMENT IX — SUMMARY OF DESIGN SKETCHES

GENERAL NOTES:

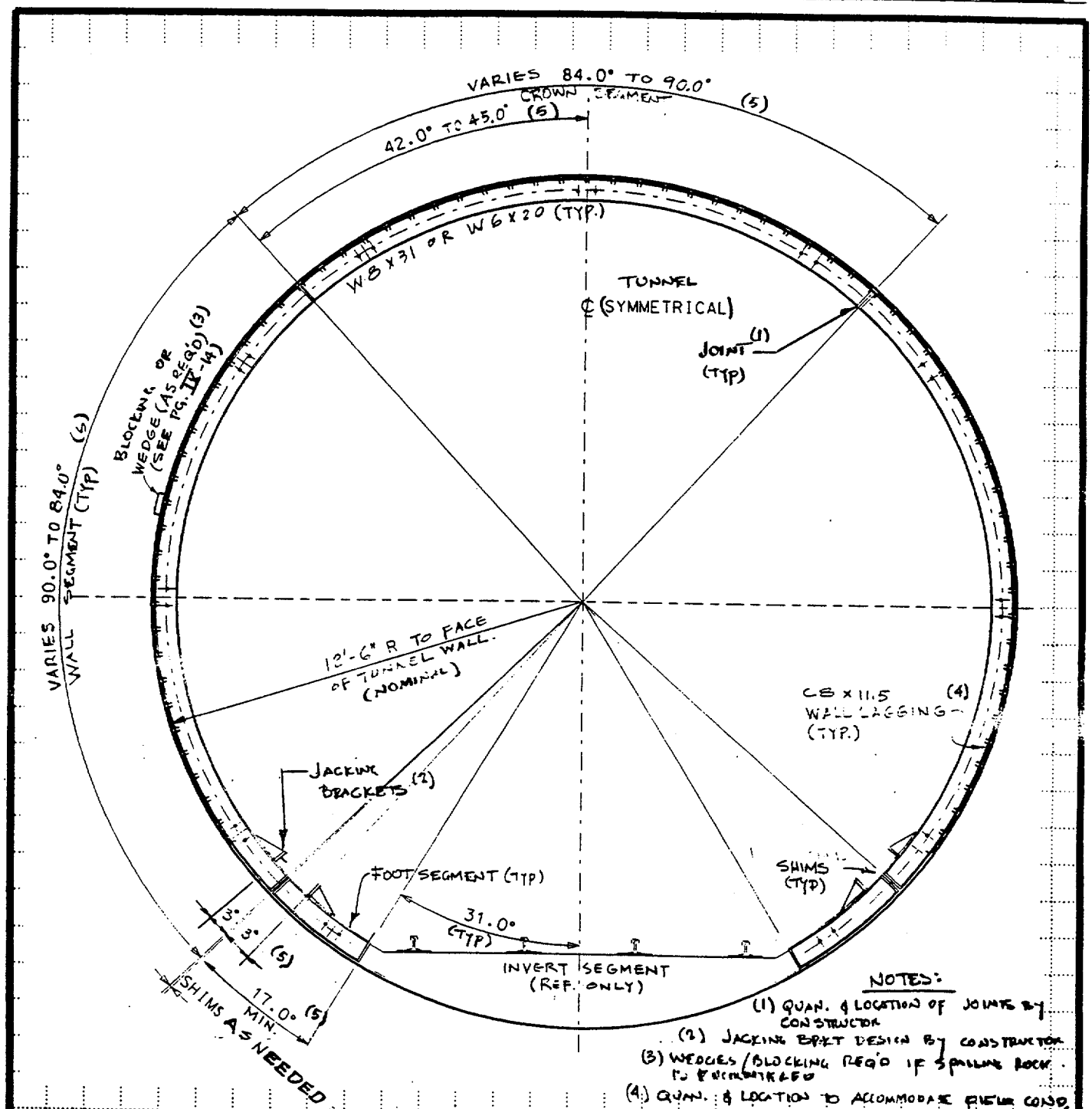
(1) ALL MATERIALS USED IN ENGINEERING CALCULATIONS FOR ESF GROUND SUPPORT — STRUCTURAL STEEL ANALYSIS AND DESIGN ARE BASED ON THE FOLLOWING UNLESS NOTED OTHERWISE:

ITEM	DESIGNATION	CRITICAL MATERIAL CHARACTERISTIC (MINIMUM)
a. STRUCTURAL STEEL SHAPE AND PLATE	ASTM A36	58 ksi MINIMUM TENSILE STRENGTH
b. BOLTS, STUDS AND TIE RODS	ASTM A307	58 ksi MINIMUM TENSILE STRENGTH
NUTS	ASTM A563	175 ksi MINIMUM PROOF LOAD STRESS
WASHERS	ASTM F436	HARDNESS 38 TO 45 HRC MINIMUM
c. STRUCTURAL PIPE	ASTM A53 GRADE B	60 ksi MINIMUM TENSILE STRENGTH
d. WELDING	AWS A5.1 E70XX	70 ksi MINIMUM TENSILE STRENGTH
e. SHIM PLATE	ASTM A36	58 ksi MINIMUM TENSILE STRENGTH
f. CONCRETE		$f'_c = 5000$ psi

(2) THE DESIGN SKETCHES CONTAINED IN THIS ATTACHMENT ARE THE ESF GROUND SUPPORT STRUCTURAL STEEL SET SUMMARY INCLUDING SUPPORT COMPONENTS AND CONNECTION DETAILS.
THE CONFIGURATION OF THE STEEL SET, THE LENGTH OF THE SUBTENDED ARC, THE JACKING LOCATION, AND DETAILS MAY BE MODIFIED BY THE CONSTRUCTOR TO FACILITATE THE STEEL SET FABRICATION, ASSEMBLY AND ERECTION.
THE CONSTRUCTOR SHALL SUBMIT ALL MODIFICATIONS, IF ANY, FOR A/E REVIEW AND APPROVAL. HOWEVER, THE FOLLOWING ITEMS ARE NOT SUBJECT TO MODIFICATION:

a. STRUCTURAL STEEL SHAPES FOR STEEL SETS AND LAGGING.
b. NOMINAL TUNNEL DIAMETER.
c. STEEL SET SPACING.
d. INVERT SEGMENT FOUNDATION CURB CONFIGURATION.

(3) CONNECTIONS FOR UTILITY SUPPORT BRACKET TO STEEL SET SHALL BE BOLTED AND THE BOLT HOLES IN STEEL SET SHALL BE FIELD DRILLED.



NOTES:

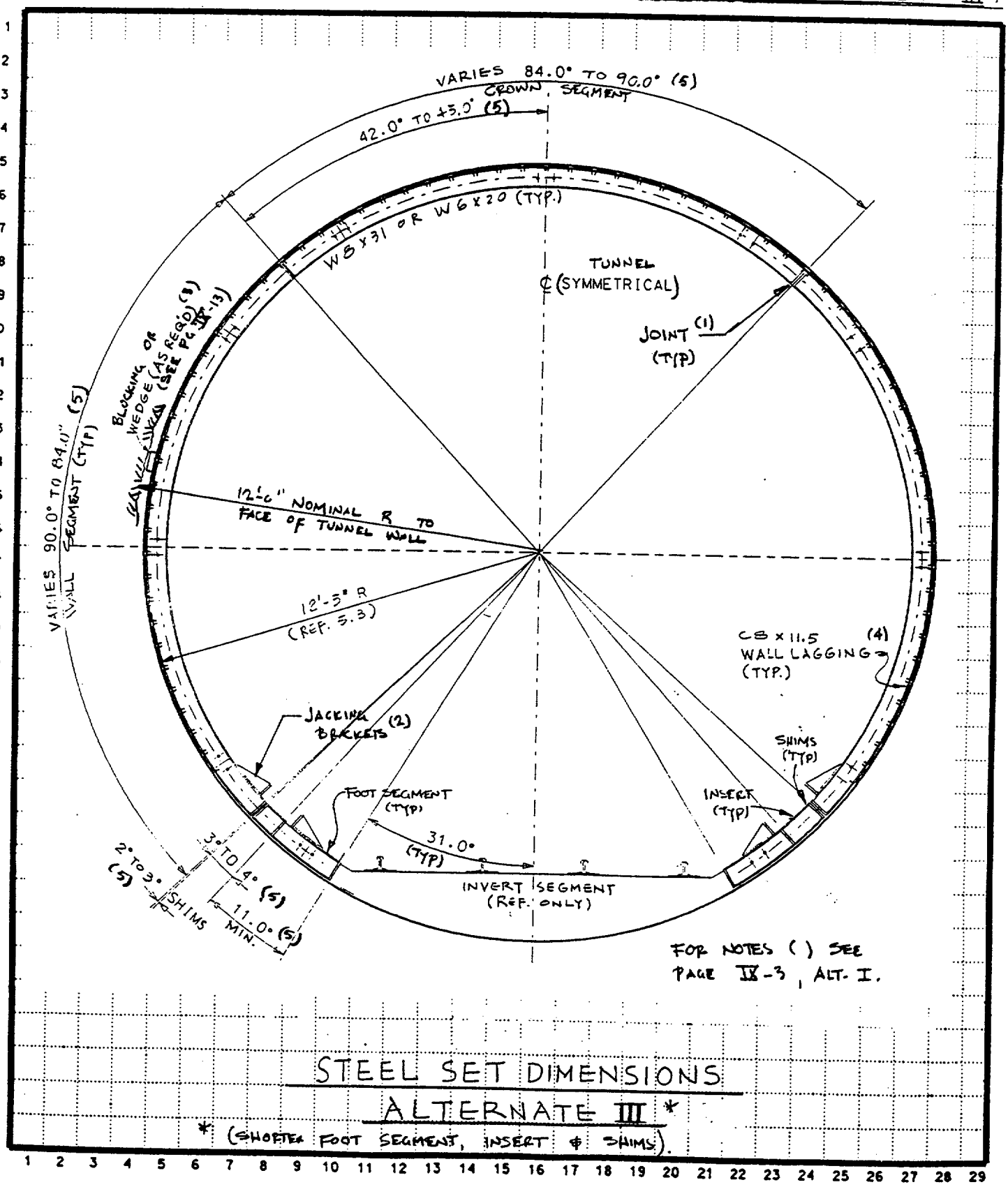
(1) QUAN. & LOCATION OF JOINTS BY CONSTRUCTOR
(2) JACKING BRKT DESIGN BY CONSTRUCTOR
(3) WEDGES/BLOCKING REQ'D IF SPALLING ROCK IS ENCOUNTERED
(4) QUAN. & LOCATION TO ACCOMMODATE FIELD COND.
(5) AS USED IN THIS ANALYSIS (INFO ONLY)

NOTE 2: FOR SOURCE OF DIMENSIONS, ANGLES & STEEL SET CONFIGURATION SEE SECTION 4.1.4 THIS ANALYSIS.

STEEL SET DIMENSIONS

ALTERNATE I *

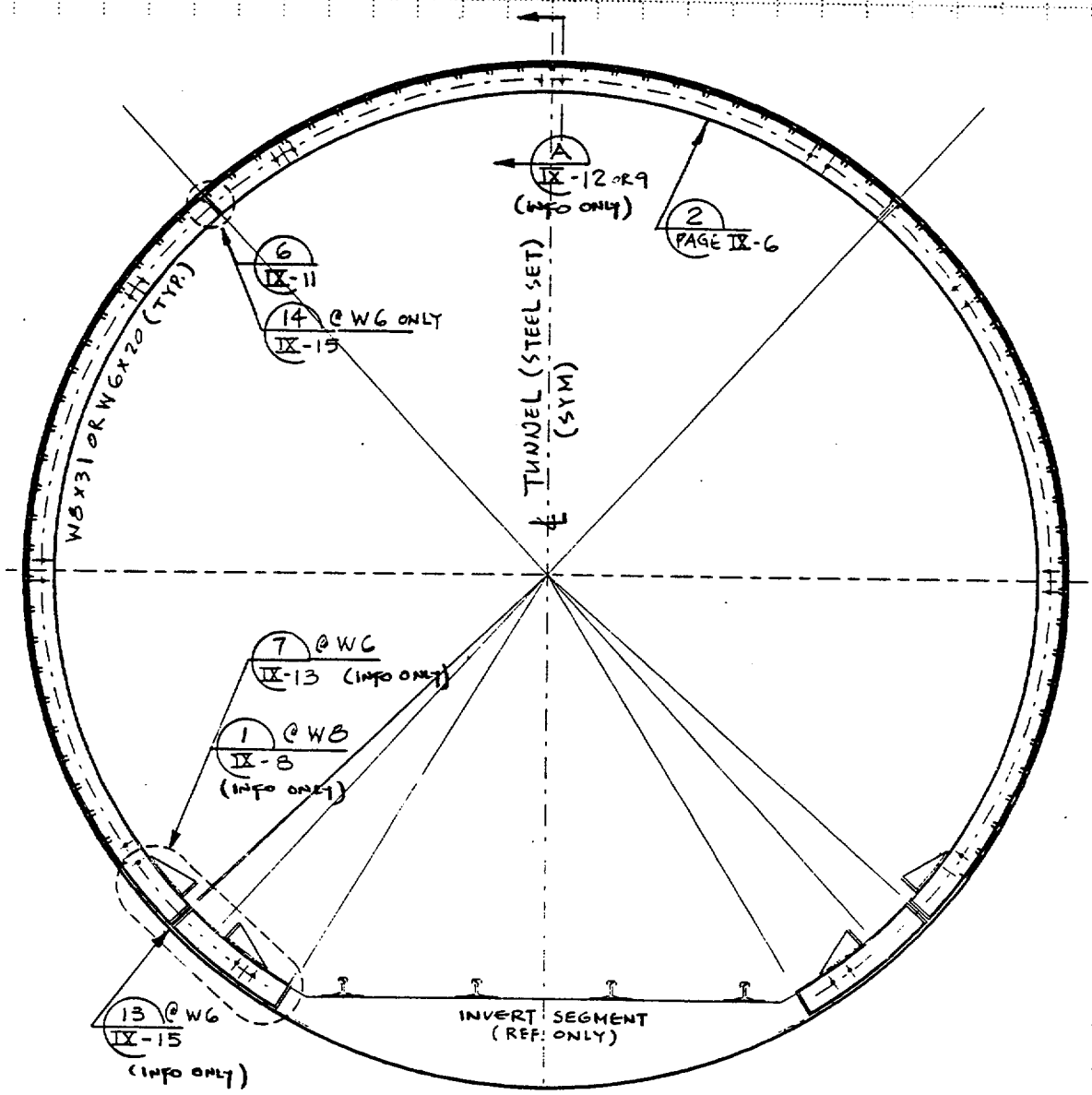
* (LONGER FOOT SEGMENT & NO INSERT, SHIMS ONLY)



STEEL SET DIMENSIONS

ALTERNATE III *

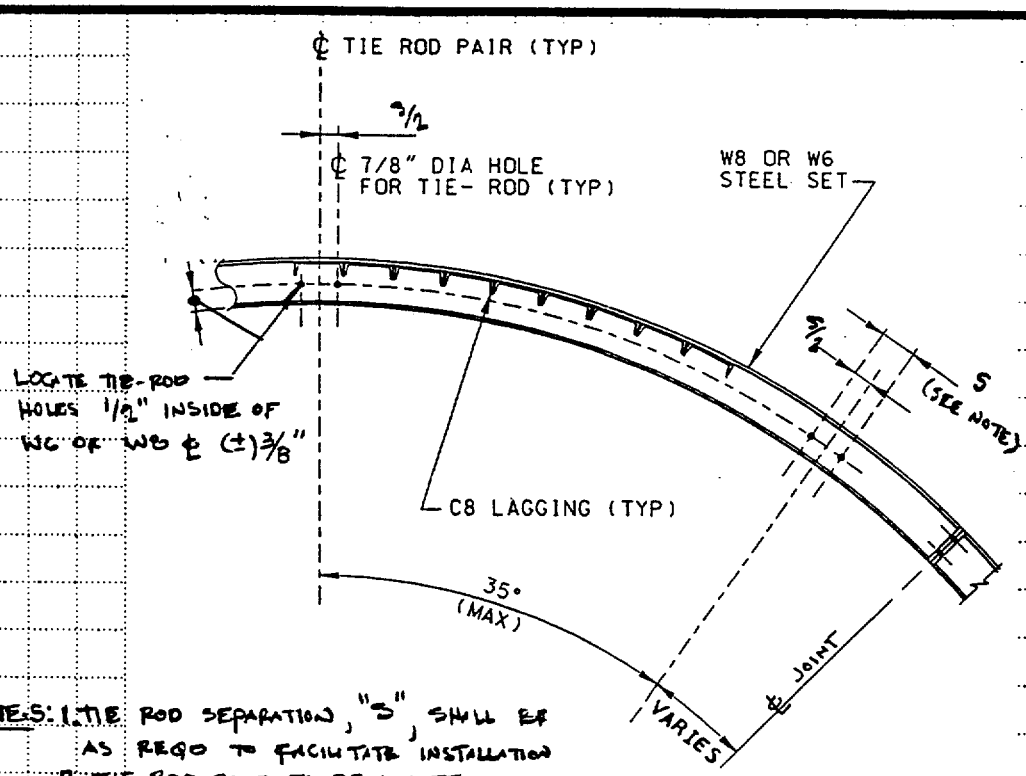
* (SHORTER FOOT SEGMENT, INSERT & SHIMS).



NOTE: "(INFO ONLY)" ITEMS ARE AS USED IN THIS ANALYSIS — MAY BE SUBJECT TO MODIFICATION BY CONSTRUCTOR WITH A/E APPROVAL (NON-CRITICAL ATTRIBUTES).

STEEL SET DETAIL

ALTERNATE I



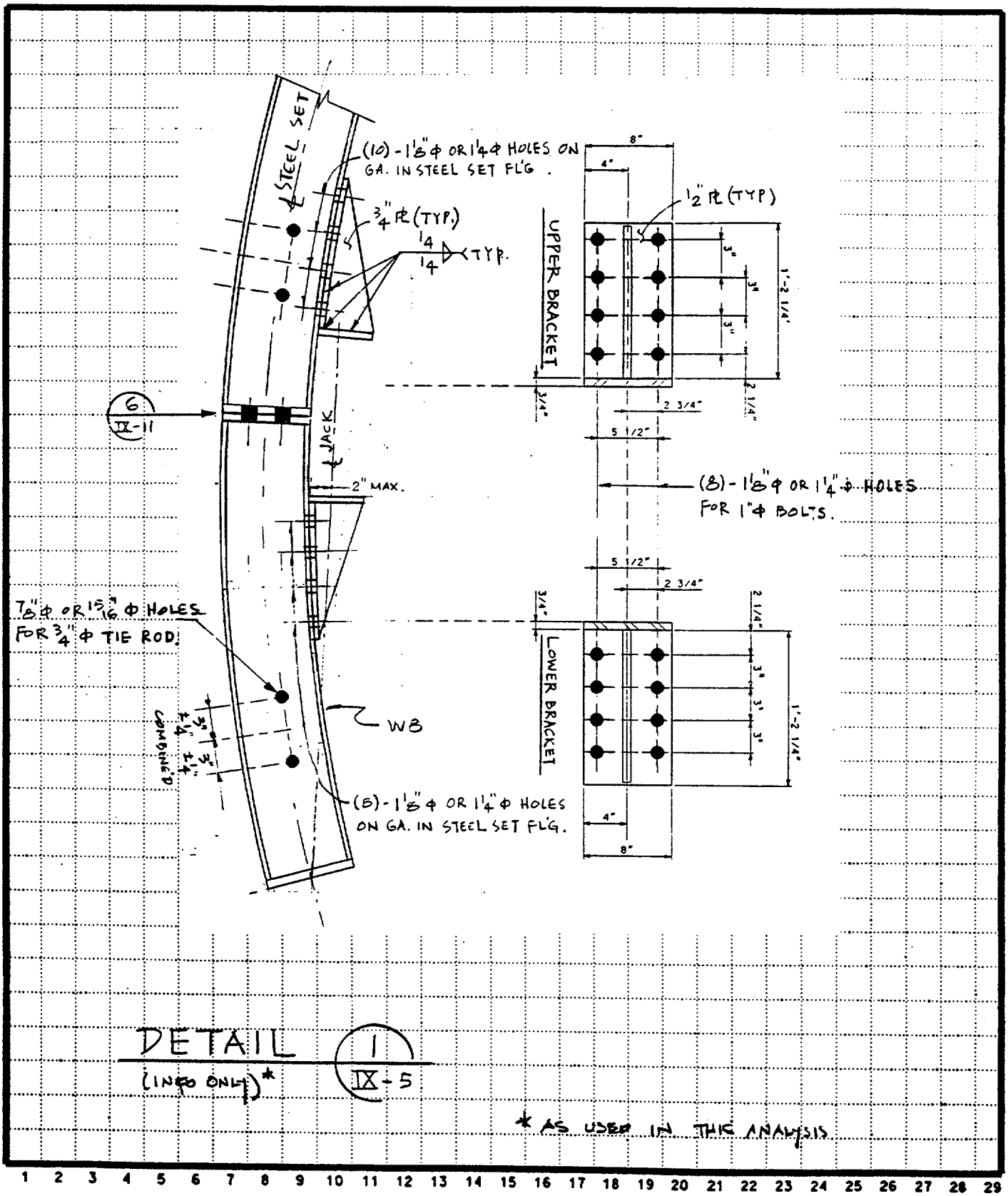
NOTES: 1. TIE ROD SEPARATION, "S", SHALL BE AS REQD TO FACILITATE INSTALLATION
2. TIE ROD PAIR TO BE LOCATED NO MORE THAN 7° FROM FOOT SEGMENT BASE PLATES.

DETAIL 2

SCALE: NONE

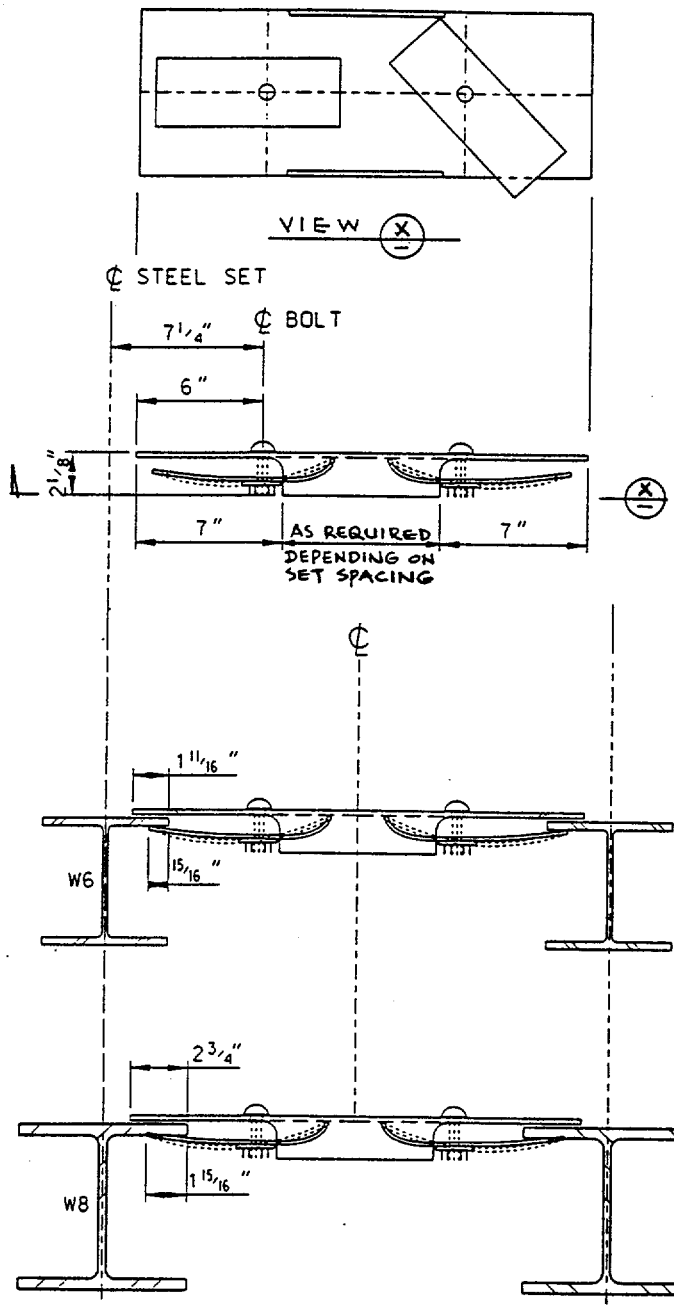
PAGE IX-5 & IX-16

(NOT USED)



DETAIL 1 IX-5
(INFO ONLY)*

* AS USED IN THIS ANALYSIS

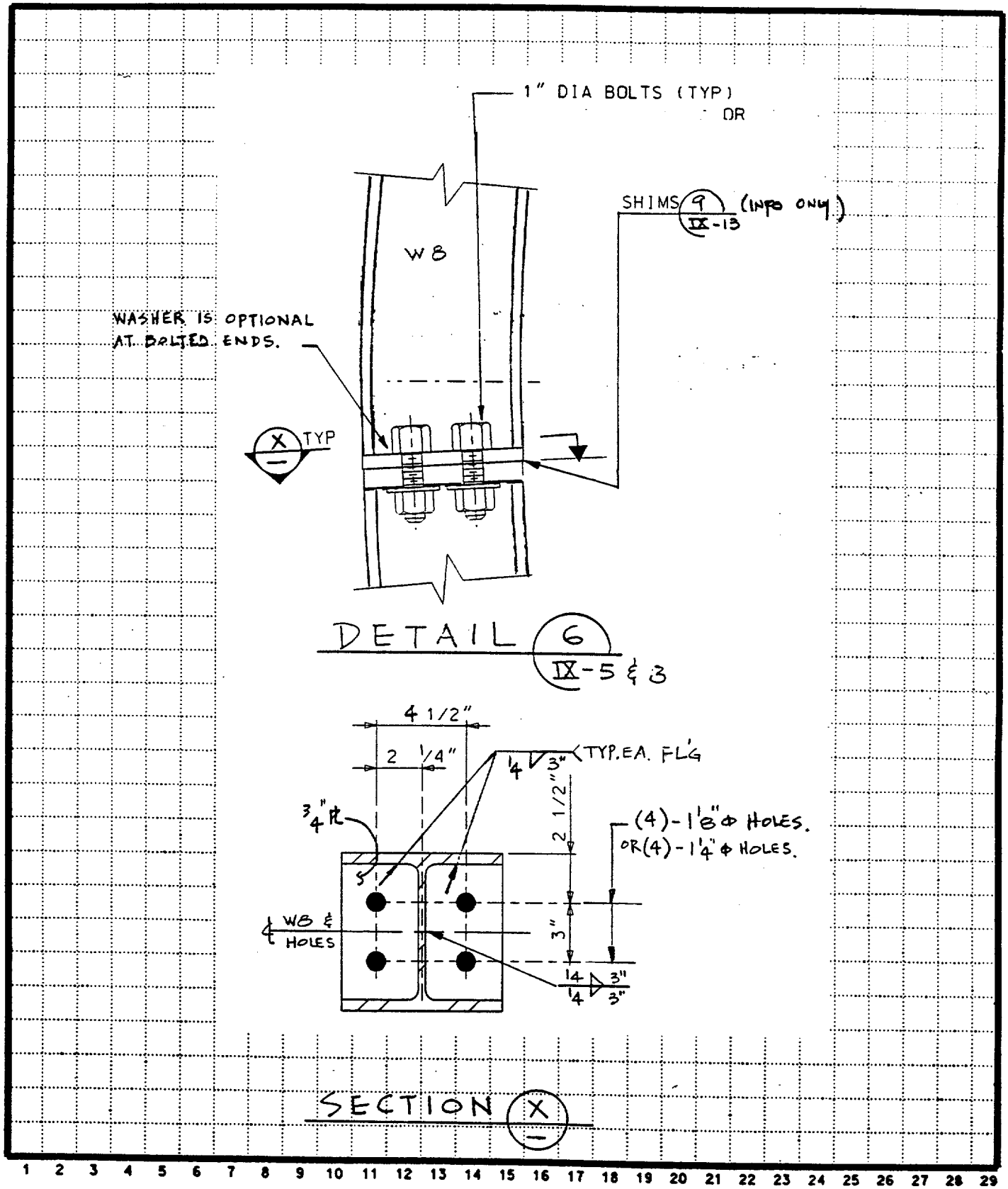


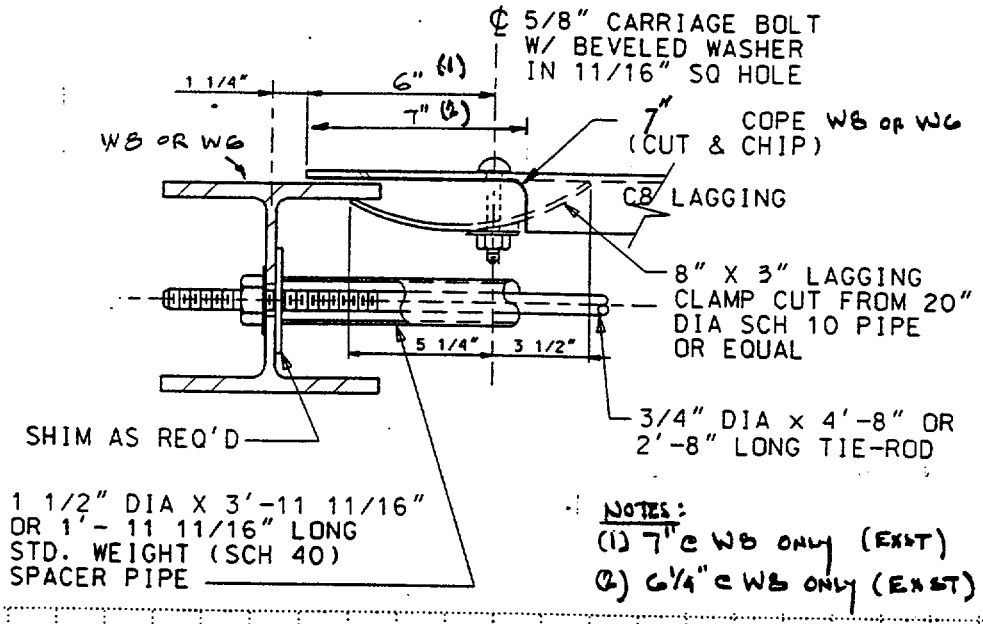
LAGGING CONFIGURATION USED IN THIS ANALYSIS.

SECTION A
(INFO ONLY)* IX-5

*AS USED IN THIS ANALYSIS

(NOT USED)

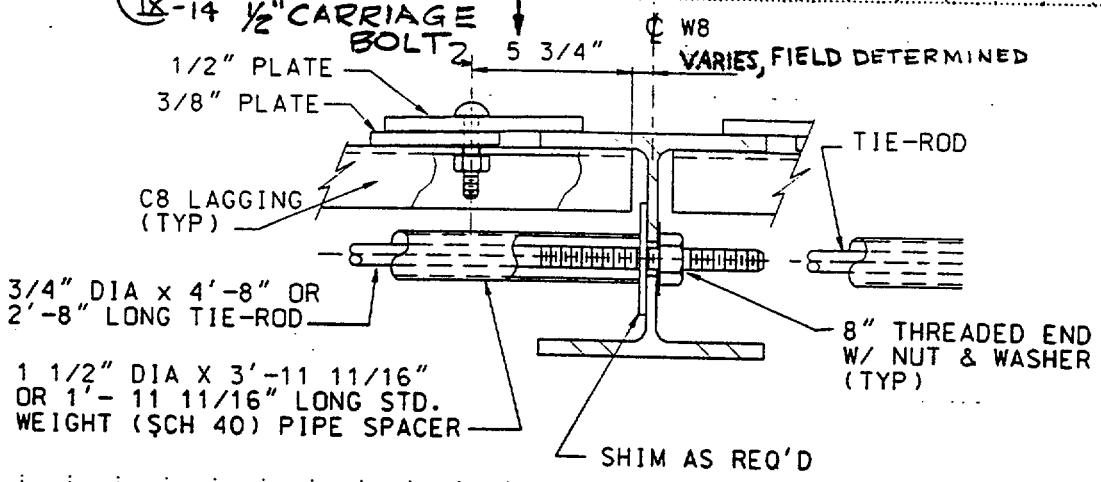

1" DIA BOLTS (TYP)
OR
SHIMS 9 IX-13 (INFO ONLY)
W8
WASHER IS OPTIONAL AT BOLTED ENDS.
X TYP
DETAIL 6 IX-5 & 3
4 1/2"
2 1/4"
1/4 3"
TYP. EA. FLG
2 1/2"
3/4" PL
(4)-1 1/8" Φ HOLES.
OR (4)-1 1/4" Φ HOLES.
WB ℄ HOLES
3"
1/4 3"
1/4 3"
SECTION X



NOTES:
(1) 7" ℄ W8 ONLY (EXIST)
(2) 6 1/4" ℄ W8 ONLY (EXIST)

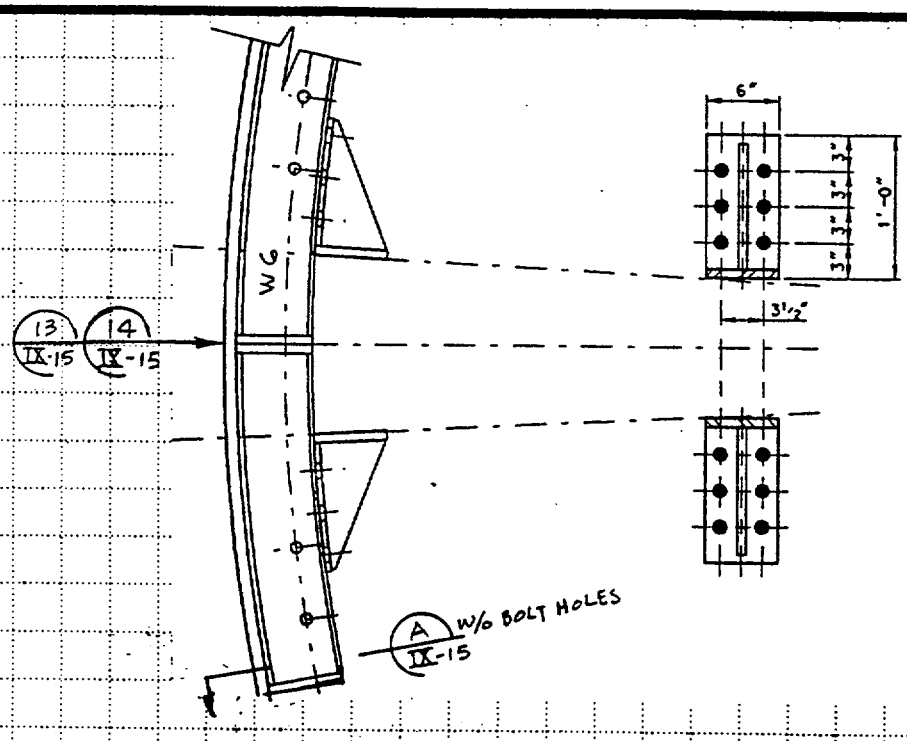
SECTION (A) LAGGING CLAMP, CARRIAGE BOLT, NUT AND WASHER ARE NON-Q ITEMS.
(INFO ONLY)* IX-5 OPTION III

(D) (INFO ONLY)
IX-14 1/2" CARRIAGE BOLT

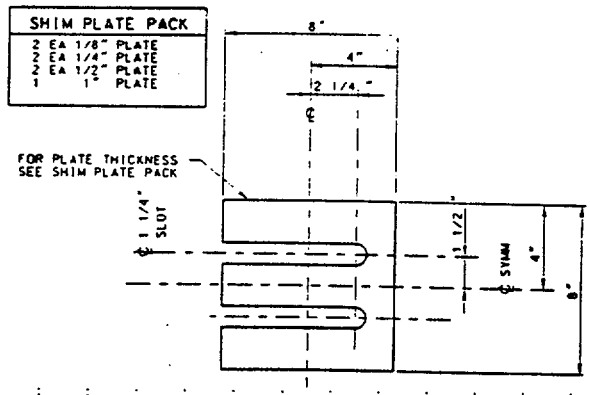


* DETAILS AS USED IN THIS ANALYSIS.

DETAIL (8) (FOR W8 ONLY)
(INFO ONLY)* — OPTION I

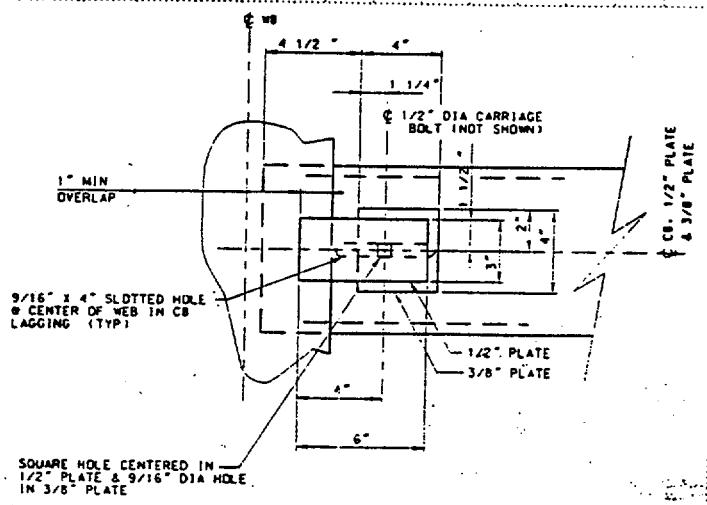


DETAIL 7
(INFO ONLY)* PAGE IX-5 & IX-17



DETAIL 9
(INFO ONLY)* IX-11

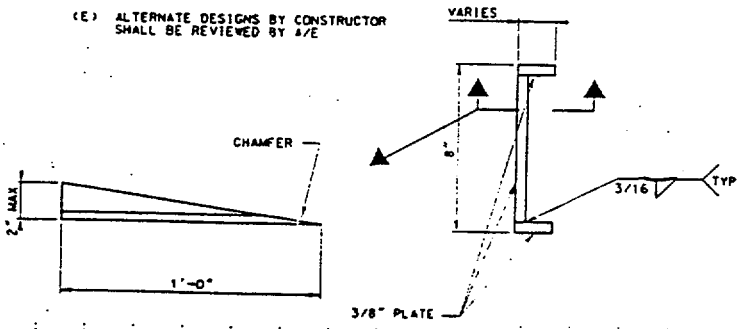
*DETAILS AS USED IN THIS ANALYSIS ONLY



VIEW D
SCALE: 3" = 1'-0"
IX-12
(INFO ONLY)*

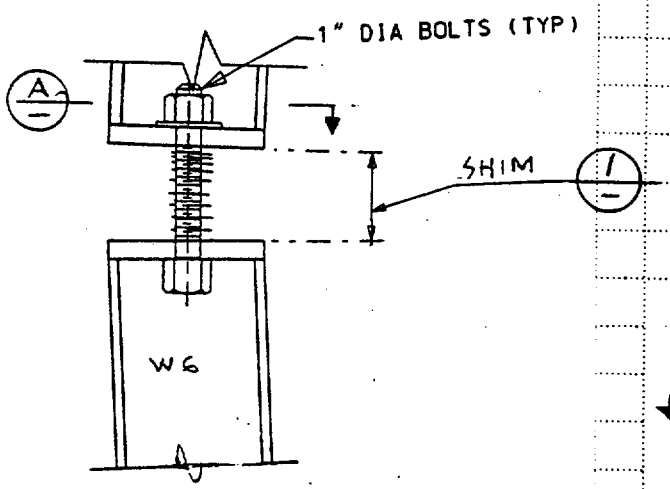
FABRICATION OF STEEL WEDGES SHALL BE CONSTRUCTORS OPTION OF THE FOLLOWING:

(A) FABRICATE AS SHOWN ON THIS DETAIL.
(B) CUT FROM TS 8x2x3/8 STRUCTURAL TUBING.
(C) CUT & BEND 3/8" PLATE.
(D) CUT FROM C8x11.5
(E) ALTERNATE DESIGNS BY CONSTRUCTOR SHALL BE REVIEWED BY A/E

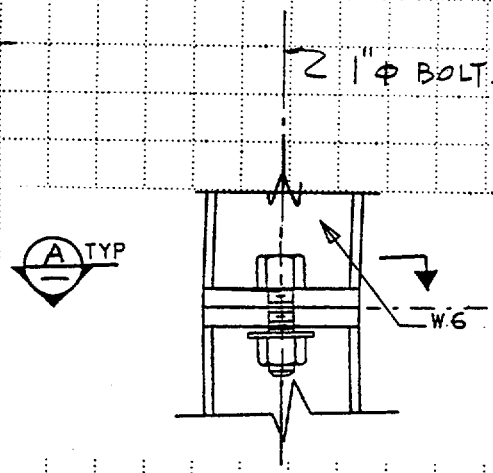


WEDGE DETAIL
(INFO ONLY)*

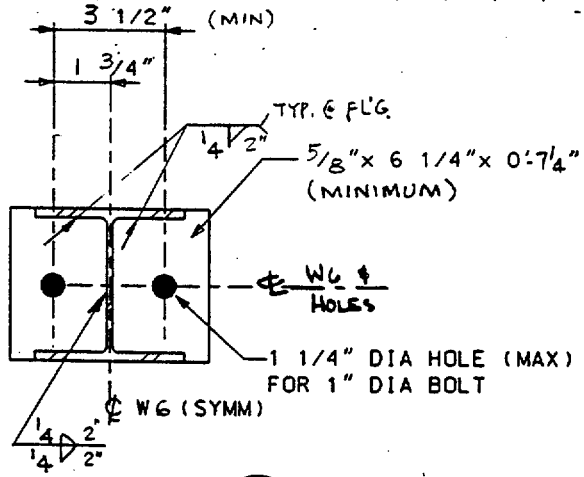
* DETAILS AS USED IN THIS ANALYSIS ONLY.



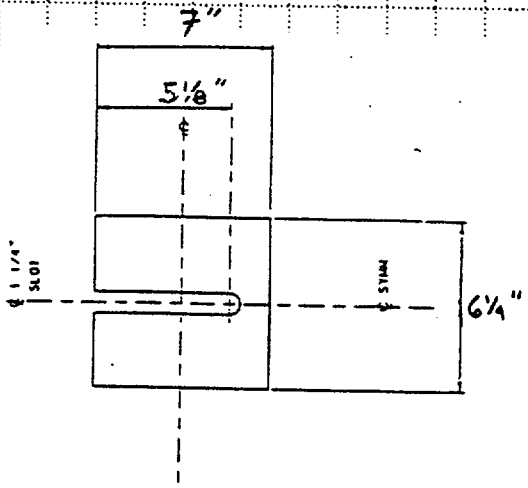
DETAIL 13
(INFO ONLY)* IX-5, IX-13



DETAIL 14
IX-5, IX-13



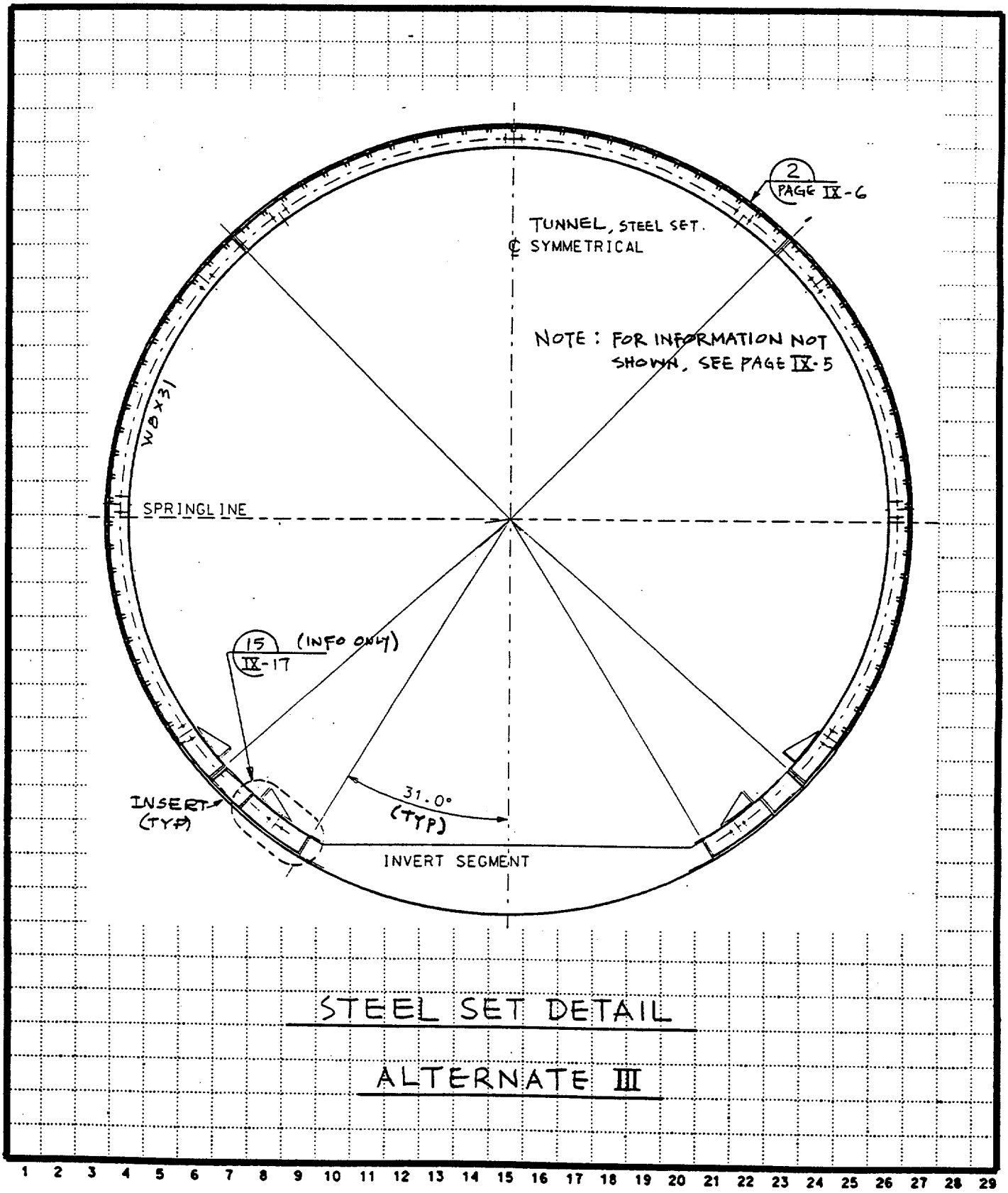
SECTION A
IX-13 (w/o Holes)



DETAIL 1
SCALE: NONE
(INFO ONLY)*

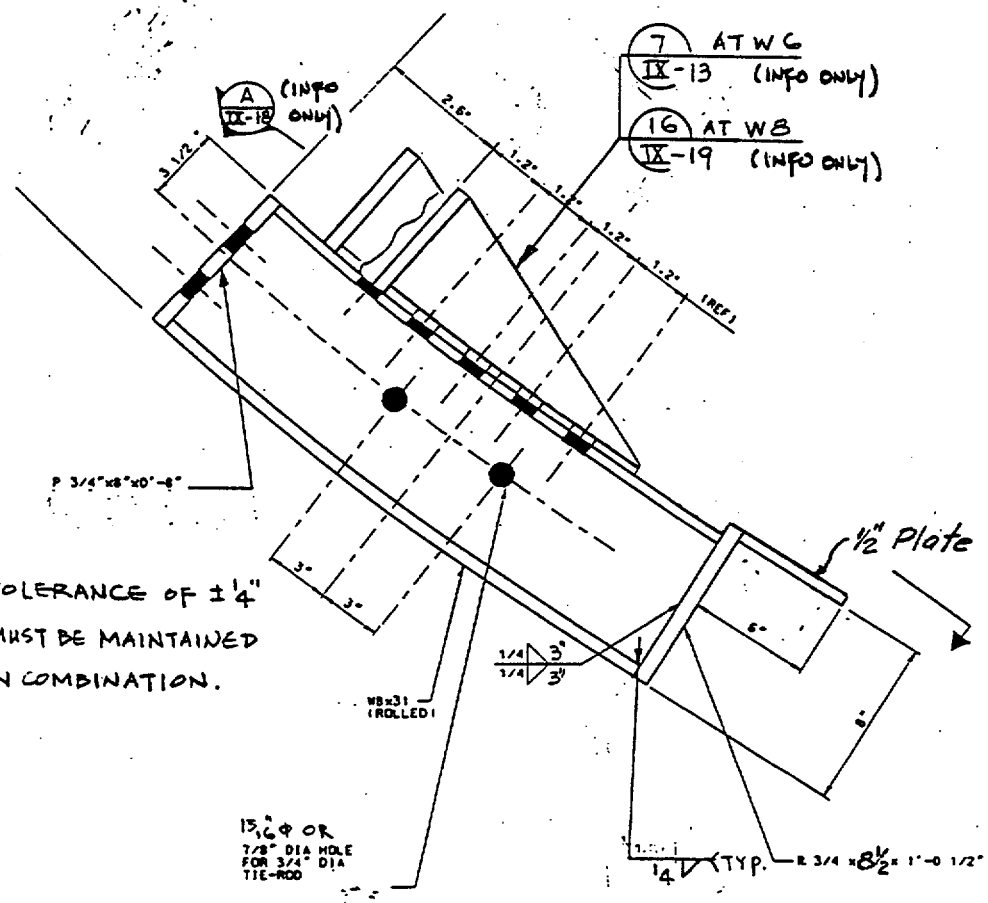
QUANTITY OF SHIM PACK AND PLATE THICKNESS IS CONSTRUCTORS OPTION

* DETAILS 1 & 13 AS USED IN THIS ANALYSIS ONLY



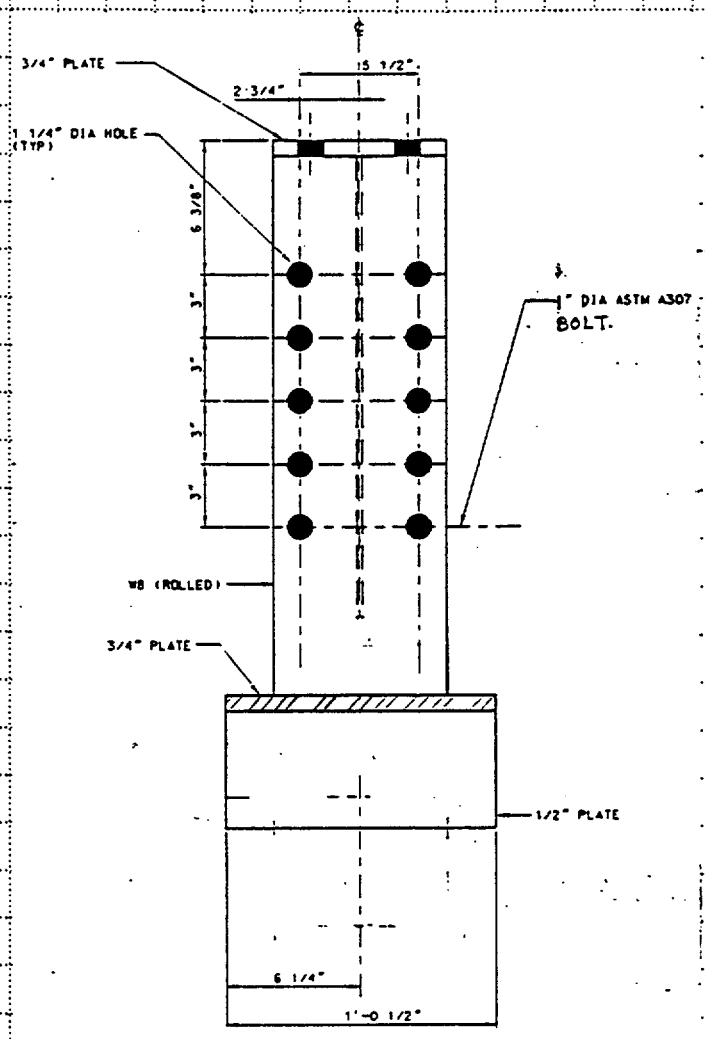
STEEL SET DETAIL

ALTERNATE III



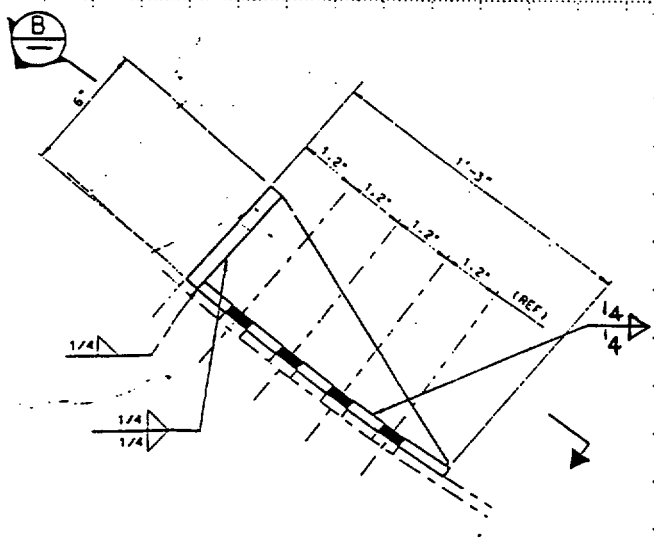
DETAIL 15
(INFO ONLY)* IX-16

*DETAILS AS USED IN THIS ANALYSIS ONLY

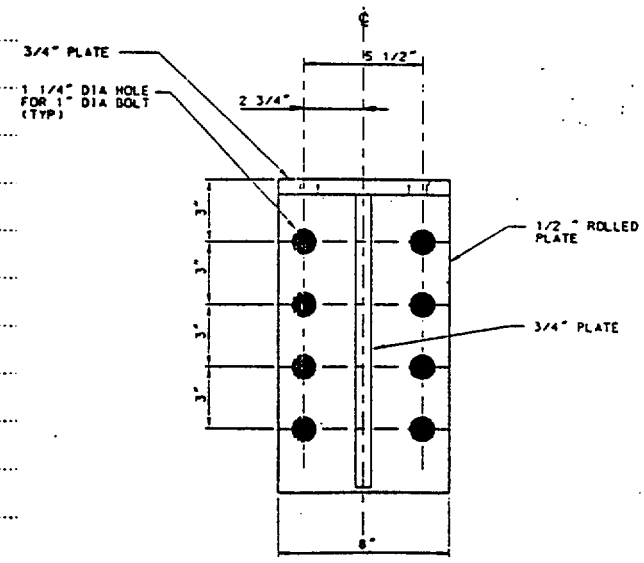


VIEW (A)
(INFO ONLY)* IX-17

*DETAIL AS USED IN THIS ANALYSIS ONLY



DETAIL 16 IX-17 2 BRACKETS EA RIB (4 TOTAL) REQD
SCALE: 3" = 1'-0" (INFO ONLY)*



VIEW B (INFO ONLY)*
SCALE: 3" = 1'-0"

* DETAILS AS USED IN THIS ANALYSIS ONLY

ATTACHMENT X

FINITE ELEMENT ANALYSIS FOR W8x31 BASE PLATE

Contents

Contents/Purpose/Design Data	X-1
Description	X-2
Analysis Methodology (Spring Approach)	X-2
Deviations from Normal Installation	X-3
Conclusions	X-4
Figure X.1	X-5
Node Numbering & Dimensions (Spring Model)	X-6
Element Numbering (Spring Model)	X-7
Loading & Fixed Node Configuration (Spring Model)	X-8
Stress Plot (K = 4000 kip/in) "PLATEZ"	X-9
Complete Analysis Results for "PLATEZ"	X-10

Purpose

The purpose of this finite element analysis of the W8x31 base plate is to determine if the stress developed in the plate under the following loading is less than the AISC allowable stress:

Dead + Utility + Rock + Seismic Load (D+U+R+S) = P_a = 121.8 kips (see Design Data).

The AISC Allowable Bending Stress = $F_b = 0.75F_y = 0.75(36)$ (AISC pg 5-48, Eqn F2-1)
= 27 ksi x 1.333 (1/3 increase for seismic)
= 36 ksi.

The static load case of (D +U + R) is addressed in Attachment III, page III-65 of this analysis.

Design Data

Base plate dimensions: 12-1/2" x 3/4" x 0'-8" (Attachment III, pg III - 65)
W8x31 Properties (AISC M016, pg I - 32):

$t_f = 0.435"$ $b_f = 7.995"$ $d = 8.00"$
$t_w = 0.285"$ $A = 9.13"$

Design Axial Load on W8x31:

P_a = 121.8 kips (D+U+R+S, Attachment III, pg III - 108)

Description

The 12-1/2" x 3/4" x 0'-8" base plate is supported by the invert segment curb which is 6-3/4" wide at the location of bearing contact with the base plate. The invert segment curb is 8" wide with a blockout for a seal on the side nearest the rock wall of ½" and a 3/4" chamfer on the interior side (see Figure X.1 on page X-5). The W8x31 steel set ring beam is welded to the base plate with 3" long fillet welds on the inside of the flanges and on both sides of the web (Attachment IX, page IX-11).

Analysis Methodology (Spring Approach)

Since the base plate is not fully supported by the invert curb, it cannot be analyzed by the conventional AISC methods (AISC M016, pg 3-106). The base plate is welded to the W8 at the flanges and at the web (see above); therefore, the plate is analyzed with only the welded portions of the flanges and web fixed to the plate at corresponding nodes (see Loading/Fixed Node Configuration, page X-8), with those same nodes free to deflect vertically (or with vertical springs depending on location). The base plate area in contact with the invert curb is modeled with vertical springs to represent the concrete support as described in the following paragraph.

To model the concrete support under the base plate, a spring element is placed at each node that is in contact with the concrete. A value of 4000 kip/in was chosen as a best estimate spring stiffness (constant) to represent the concrete based on the following, assuming the curb acts as a short column in compression:

Average invert depth = (6-3/4" @ curb & 24" @ center) so assume ≈ 14"

Assume 12" wide x 14" deep column; Area = A = (12")(14") =168 in^2

$E = 57000\ (f_c')^{1/2} = 57000\ (5000psi)^{1/2} = 4030$ ksi (From ACI 318, Section 8.5)

L = Length of column ≐ arc length of invert≈ [(2)(31.01°)/360°](25')(π) = 13.53 ft

K = stiffness ≈ AE/L = (168 in^2)(4030 ksi)/(13.53ft)(12in/ft)
= 4170 kip/in say = 4000 kip/in

Axial load from the W8 is applied as a pressure loading through the web and flanges of the W8 (see Loading/Fixed Joint Configuration, page X-8). The pressure loading is determined by dividing the total load (P_a) by the area the W8 member:

121.8 kip / 9.13 in^2 = 13.341 ksi.

However, since all the nodes do not have the same tributary area, it was necessary to factor the spring constant for the remaining nodes by multiplying the ratio of tributary areas by 4000 as shown in the following example for node number 73:

Approx. tributary area of greatest number of elements = 1.0185*0.938 = 0.9554
Tributary area of node 73 = (1.126+0.80)/2 * 0.938 = 0.9033
Spring constant for node 73 = 4000*0.9033/0.9554 = 3782 ≈ 3800 (rounded)

As shown above, the results were rounded for simplicity. In addition, nodes that occur at the corners and along the edges are further reduced by 1/4 and 1/2 respectively, as only 1/4 (corner) or 1/2 (edge) of the tributary area contributes at these nodes. Each node is also released in the x and y directions.

The resulting stress plot for the 4000 kip/in case shows a maximum stress contour of 29.54 ksi (pg X-9), with a maximum stress value of 33.23 ksi (elements 122 and 126, page X-27). The stress in the plate is below the allowable stress of 36 ksi; therefore, the plate is adequate for the governing (D+R+U+S) design load of 121.8 kips.

Deviations from Normal Installation

The base plate is designed for the normal condition of relatively uniform bearing on the invert segment curb as shown on Figure X.1. However, due to installation conditions, uneven bearing may occur, in which case the allowable stresses of the AISC and ACI codes might be exceeded as described below.

Prior to expanding the steel set, the foot segment is installed nominally perpendicular to the tunnel alignment and as close to the tunnel wall as practical with the base plate bearing flat on the invert segment curb. As jacking and expansion of the steel set occurs, the foot segment may rotate and move, creating uneven bearing on the invert curb. Rotation and movement of the foot segment during the jacking process may occur because of construction and/or erection conditions such as excavated tunnel shape (out-of-round), accumulation of tolerances, irregularities or voids in the tunnel walls, or other conditions that may affect the relative alignment of the steel set and concrete invert. When the foot segment base plate bears unevenly on the concrete invert curb or when the foot segment base plate is offset toward the tunnel centerline, the plate bearing area will decrease, increasing the bearing pressure on the concrete and the bending stress in the steel base plate. Bending of the steel base plate or localized spalling of the concrete curb might occur. However, excessive offset of the foot segment base plate towards the tunnel centerline is limited during the jacking/expansion process because if the base plate is offset excessively, the jacking force cannot be applied, i.e. there will be inadequate support for the base plate and the foot segment will rotate toward the centerline of the tunnel. The offset of the base plate should not exceed 1 inch at any location measured from the face of the curb to the inside face of the W8. This value was determined on page III-84 in Attachment III of this analysis.

Base plate and curb contact in the extreme case may occur initially through a single plate edge bearing on the concrete curb. To distribute the design load, this bearing condition might spall the contacted concrete in the localized bearing area until support is achieved through development of a satisfactory bearing area. In addition, the steel base plate might also deform and assist in developing a satisfactory bearing area. Provided the foot segment is properly positioned prior to jacking, localized spalling of the concrete invert curb or distortion of the base plate will not prohibit the steel set from performing its intended function of providing ground support in the ESF (invert arrangement will be modified and upgraded prior to incorporation into the repository).

Localized spalling of the concrete invert curb, obvious distortion of the base plate, or offset of the base plate exceeding 1 inch (page III-84) should be reported as nonconforming in accordance with Yucca Mountain Site Characterization Project Procedures so that the supports can be tracked for further manifestation of loading through ongoing monitoring programs. Reported nonconforming items will be evaluated according to specific conditions and dispositioned accordingly.

Conclusions

The 12-1/2" x 3/4" x 0'-8" plate is adequate for the design axial load applied.

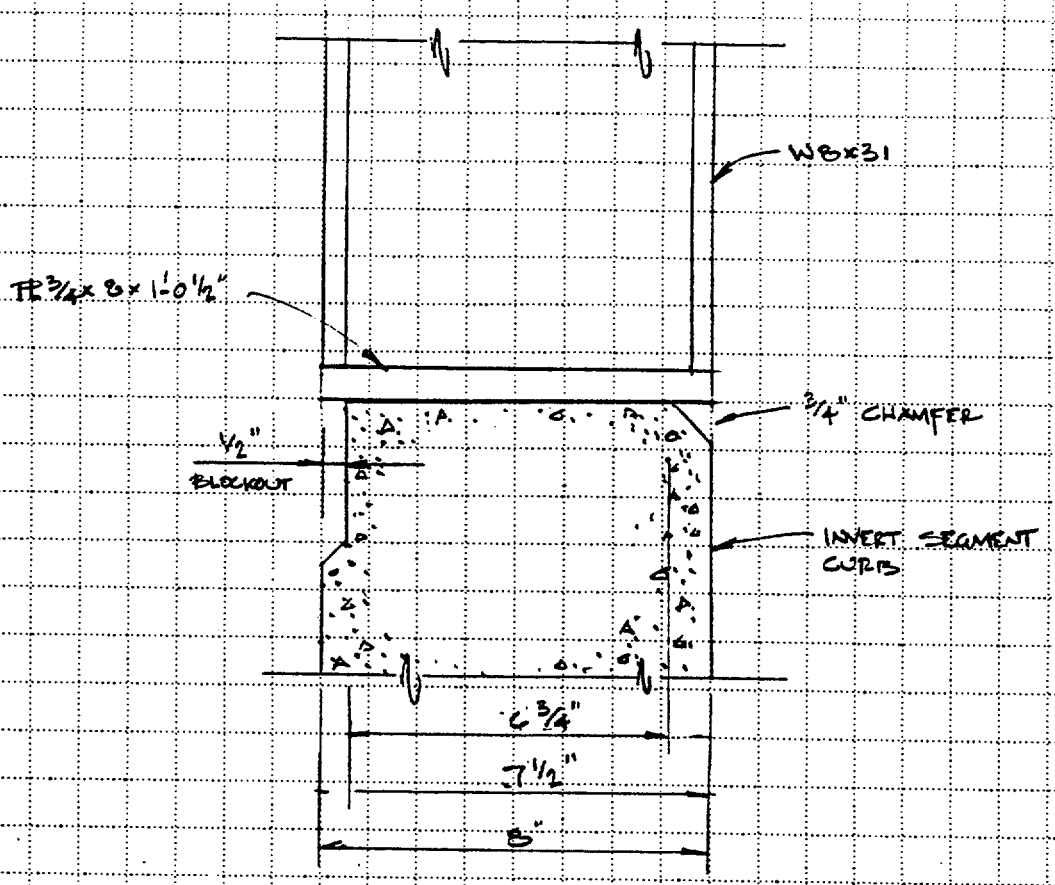
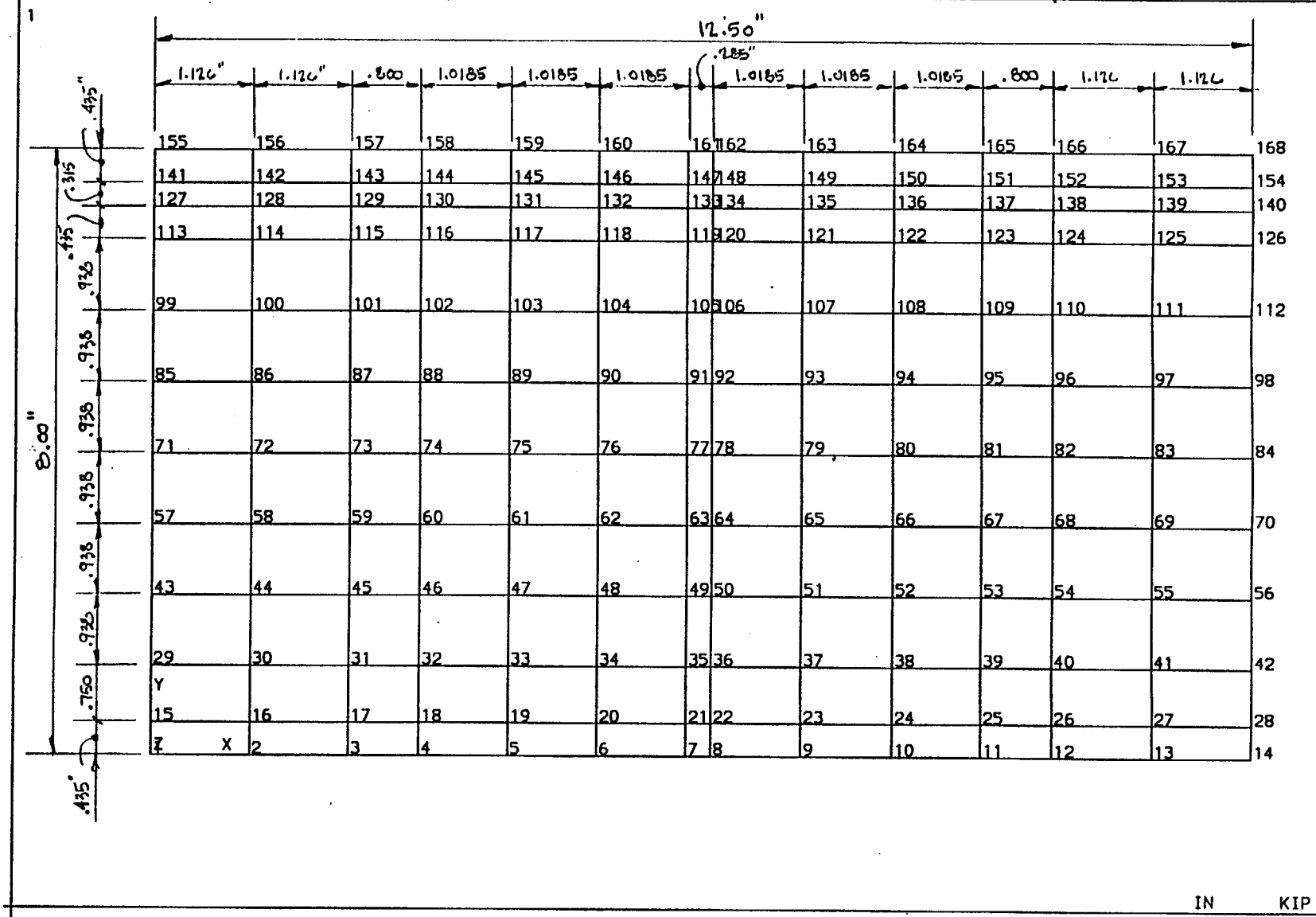


FIGURE X.1 W8 & CURB INTERFACE

NODE NUMBERING & DIMENSIONS - SPRING MODEL



COMPANY: M&O
DATE: MAY 2, 1996

S T A A D P L - P L O T (REVISION 16.0)
TITLE: FINITE ELEMENT ANALYSIS FOR W8X31 BASEPL
STRUCTURE DATA NJ= 168, NM= 0, NE= 143

ELEMENT NUMBERING - SPRING MODEL

1

131	132	133	134	135	136	137	138	139	140	141	142	143
118	119	120	121	122	123	124	125	126	127	128	129	130
105	106	107	108	109	110	111	112	113	114	115	116	117
92	93	94	95	96	97	98	99	100	101	102	103	104
79	80	81	82	83	84	85	86	87	88	89	90	91
66	67	68	69	70	71	72	73	74	75	76	77	78
53	54	55	56	57	58	59	60	61	62	63	64	65
40	41	42	43	44	45	46	47	48	49	50	51	52
27	28	29	30	31	32	33	34	35	36	37	38	39
Y 14	15	16	17	18	19	20	21	22	23	24	25	26
Z 1 X	2	3	4	5	6	7	8	9	10	11	12	13

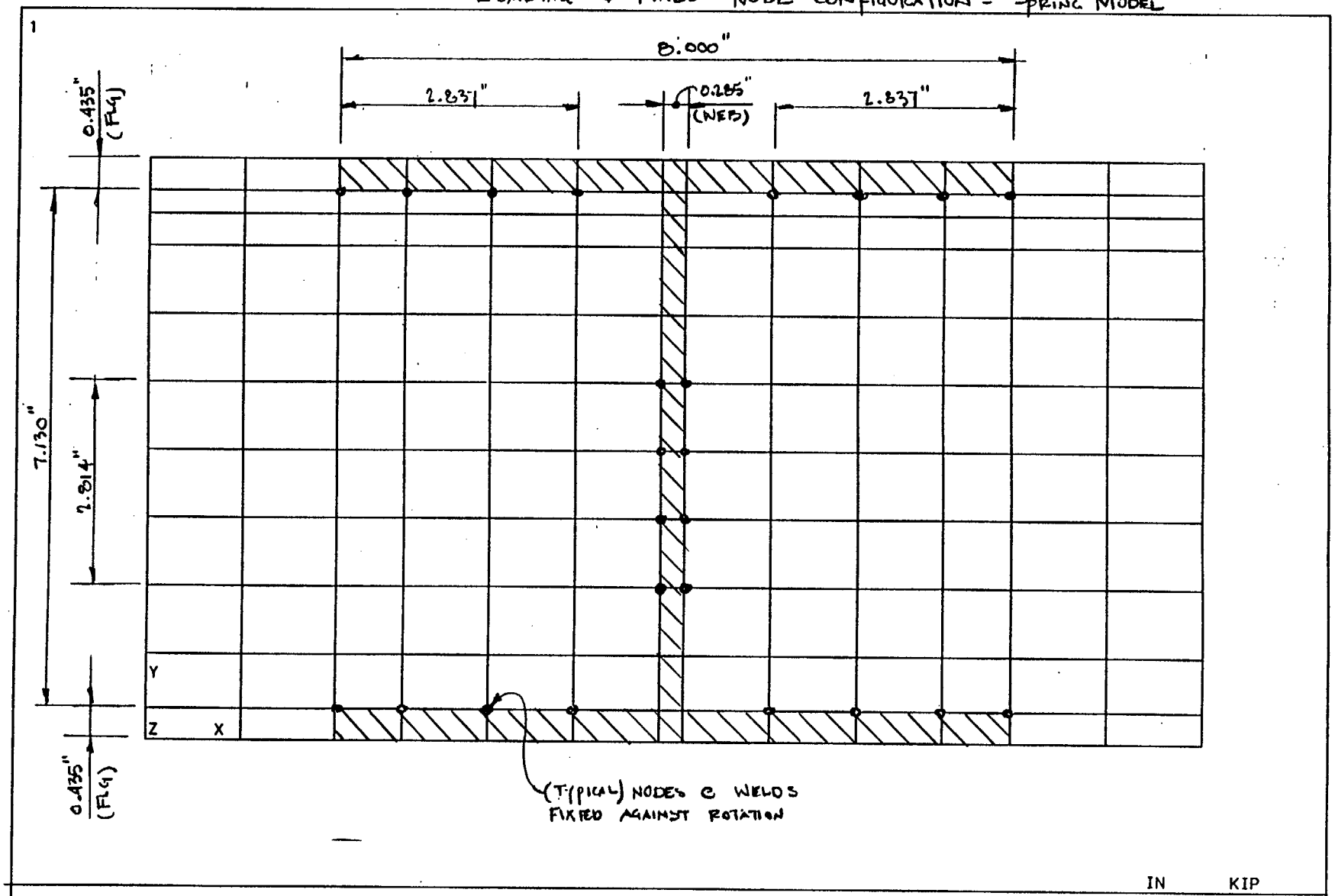
IN KIP

S T A A D P L - P L O T (REVISION 16.0)

COMPANY: M&O
DATE: MAY 2, 1996

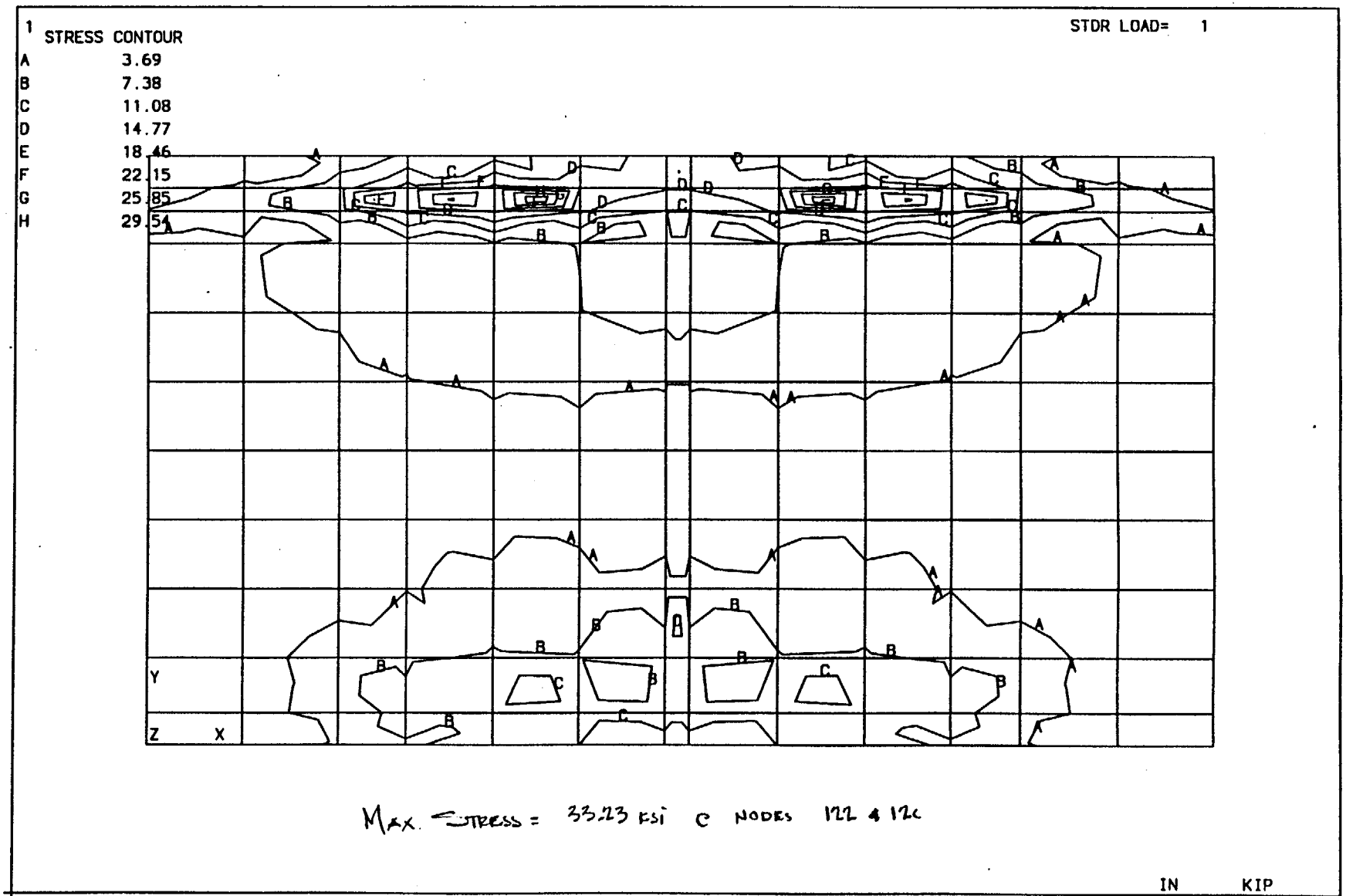
TITLE: FINITE ELEMENT ANALYSIS FOR W8X31 BASEPL
STRUCTURE DATA NJ= 168, NM= 0, NE= 143

LOADING & FIXED NODE CONFIGURATION - SPRING MODEL



COMPANY: M&O
DATE: JUN 18, 1996

S T A A D P L - P L O T (REVISION 16.0)
TITLE: FINITE ELEMENT ANALYSIS FOR W8X31 BASEPL
STRUCTURE DATA NJ= 168, NM= 0, NE= 143



MAX. STRESS = 33.23 KSI @ NODES 122 & 126

S T A A D P L - P L O T (REVISION 16.0)

COMPANY: M&O
DATE: JUN 21, 1996

TITLE: FINITE ELEMENT ANALYSIS FOR W8X31 BASEPL
STRUCTURE DATA NJ= 168, NM= 0, NE= 143

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**************************************************
*                                                *
*            S T A A D - III                     *
*            Revision 16.0b                      *
*            Proprietary Program of              *
*            RESEARCH ENGINEERS, Inc.            *
*            Date=    JUN 21, 1996               *
*            Time=    15: 3:44                   *
*                                                *
**************************************************


 1. STAAD SPACE FINITE ELEMENT ANALYSIS FOR W8X31 BASEPLATE
 2. * THIS ANALYSIS DETERMINES STRESS IN 3/4" BASE PLATE
 3. * SPRING CONSTANTS ARE BASED ON K = 4000 K/IN
 4. * LOADING IS ON WEB AND FLANGES
 5. * PLATE IS FIXED AT WELD LOCATIONS WITH FZ FREE OR KFZ SPRINGS
 6. * FILENAME = "PLATEZ"
 7. UNIT KIP IN
 8. INPUT WIDTH 79
 9. JOINT COORDINATES
10. 1 0.0 0.0 0.0 3 2.252 0.0 0.0
11. 4 3.052 0.0 0.0
12. 5 4.0705 0.0 0.0 7 6.1075 0.0 0.0
13. 8 6.3925 0.0 0.0 11 9.448 0.0 0.0
14. 12 10.248 0.0 0.0
15. 13 11.374 0.0 0.0 14 12.5 0 0
16. REPEAT ALL 11 0 .435 0 0 .75 0 0 .9383 0 15*0 0 .435 0 0 .315 0 0 .435 0
17. ELEMENT INCIDENCE
18. 1 1 2 16 15
19. REPEAT 12 1 1
20. REPEAT ALL 10 13 14
21. UNIT KIP INCH
22. ELEMENT PROPERTIES
23. 1 TO 143 TH 0.75
24. CONSTANTS
25. E 29000.0 ALL
26. DENSITY 0.000283 ALL
27. BETA 0 ALL
28. SUPPORTS
29. 72 83 86 97 FIXED BUT FX FY MX MY KFZ 4400
30. 71 84 85 98 FIXED BUT FX FY MX MY KFZ 2200
31. 73 82 87 96 FIXED BUT FX FY MX MY KFZ 3800
32. 75 76 79 80 89 90 93 94 FIXED BUT FX FY MX MY KFZ 4000
33. 49 63 77 91 FIXED BUT KFZ 2600
34. 105 FIXED BUT FX FY MX MY KFZ 2600
35. 50 64 78 92 FIXED BUT KFZ 2600
36. 106 FIXED BUT FX FY MX MY KFZ 2600
37. 133 134 FIXED BUT FX FY MX MY KFZ 600
38. 35 36 FIXED BUT FX FY MX MY KFZ 2300
39. 15 28 FIXED BUT FX FY MX MY KFZ 900
40. 43 56 57 70 99 112 FIXED BUT FX FY MX MY KFZ 2200
41. 127 140 FIXED BUT FX FY MX MY KFZ 500
42. 16 27 FIXED BUT FX FY MX MY KFZ 1800
43. 31 40 FIXED BUT FX FY MX MY KFZ 3400
44. 44 55 58 69 100 111 FIXED BUT FX FY MX MY KFZ 4400
45. 128 139 FIXED BUT FX FY MX MY KFZ 1000
46. 45 54 59 68 101 110 FIXED BUT FX FY MX MY KFZ 3800
47. 129 138 FIXED BUT FX FY MX MY KFZ 900
```

```
48. 47 48 51 52 61 62 65 66 FIXED BUT FX FY MX MY KFZ 4000
49. 103 104 107 108 FIXED BUT FX FY MX MY KFZ 4000
50. 46 53 60 67 74 81 88 95 102 109 FIXED BUT FX FY MX MY KFZ 3600
51. 29 42 FIXED BUT FX FY MX MY KFZ 2000
52. 30 41 FIXED BUT FX FY MX MY KFZ 4000
53. 33 34 37 38 FIXED BUT FX FY MX MY KFZ 3600
54. 32 39 FIXED BUT FX FY MX MY KFZ 3200
55. 113 126 FIXED BUT FX FY MX MY KFZ 1600
56. 114 125 FIXED BUT FX FY MX MY KFZ 3200
57. 115 124 FIXED BUT FX FY MX MY KFZ 2800
58. 116 123 FIXED BUT FX FY MX MY KFZ 2600
59. 117 118 121 122 FIXED BUT FX FY MX MY KFZ 2900
60. 119 120 FIXED BUT FX FY MX MY KFZ 1900
61. 130 137 FIXED BUT FX FY MX MY KFZ 800
62. 131 132 135 136 FIXED BUT FX FY MX MY KFZ 900
63. 17 26 FIXED BUT KFZ 1500
64. 18 25 FIXED BUT KFZ 1400
65. 19 20 23 24 FIXED BUT KFZ 1600
66. 21 22 FIXED BUT FX FY MX MY KFZ 1000
67. 143 TO 146 FIXED BUT FZ
68. 149 TO 152 FIXED BUT FZ
69. UNIT KIP IN
70. LOAD 1 PRESSURE ON WEB & FLANGES ONLY FROM 121.8 K AXIAL LOAD
71. ELEMENT LOAD
72. 3 TO 11 PRESSURE 13.341
73. 133 TO 141 PRESSURE 13.341
74. 20 33 46 59 72 85 98 111 124 PRESSURE 13.341
75. PERFORM ANALYSIS


        P R O B L E M   S T A T I S T I C S
        -----------------------------------

 NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =   168/  143/  134
 ORIGINAL/FINAL BAND-WIDTH =   15/   15
 TOTAL PRIMARY LOAD CASES  =    1, TOTAL DEGREES OF FREEDOM =  1008
 SIZE OF STIFFNESS MATRIX =   96768 DOUBLE PREC. WORDS
 TOTAL REQUIRED DISK SPACE =    2.55 MEGA-BYTES


++ PROCESSING ELEMENT STIFFNESS MATRIX.              15: 3:48
++ PROCESSING GLOBAL STIFFNESS MATRIX.               15: 4: 6
++ PROCESSING TRIANGULAR FACTORIZATION.              15: 4:38
++ CALCULATING JOINT DISPLACEMENTS.                  15: 5:18
++ CALCULATING MEMBER  FORCES.                       15: 5:22

76. PRINT SUPPORT REACTIONS
```

SUPPORT REACTIONS -UNIT KIP IN STRUCTURE TYPE = SPACE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
72	1	0.00	0.00	0.20	0.00	0.00	0.00
83	1	0.00	0.00	0.20	0.00	0.00	0.00
86	1	0.00	0.00	0.20	0.00	0.00	0.00
97	1	0.00	0.00	0.20	0.00	0.00	0.00
71	1	0.00	0.00	0.09	0.00	0.00	0.00
84	1	0.00	0.00	0.09	0.00	0.00	0.00
85	1	0.00	0.00	0.15	0.00	0.00	0.00
98	1	0.00	0.00	0.15	0.00	0.00	0.00
73	1	0.00	0.00	0.24	0.00	0.00	0.00
82	1	0.00	0.00	0.24	0.00	0.00	0.00
87	1	0.00	0.00	0.15	0.00	0.00	0.00
96	1	0.00	0.00	0.15	0.00	0.00	0.00
75	1	0.00	0.00	0.24	0.00	0.00	0.00
76	1	0.00	0.00	-0.42	0.00	0.00	0.00
79	1	0.00	0.00	-0.42	0.00	0.00	0.00
80	1	0.00	0.00	0.24	0.00	0.00	0.00
89	1	0.00	0.00	0.09	0.00	0.00	0.00
90	1	0.00	0.00	-0.45	0.00	0.00	0.00
93	1	0.00	0.00	-0.45	0.00	0.00	0.00
94	1	0.00	0.00	0.09	0.00	0.00	0.00
49	1	0.00	0.00	-1.29	0.97	0.42	0.00
63	1	0.00	0.00	-1.03	0.24	0.59	0.00
77	1	0.00	0.00	-0.94	0.08	0.62	0.00
91	1	0.00	0.00	-0.90	-0.28	0.50	0.00
105	1	0.00	0.00	-1.53	0.00	0.00	0.00
50	1	0.00	0.00	-1.29	0.97	-0.42	0.00
64	1	0.00	0.00	-1.03	0.24	-0.59	0.00
78	1	0.00	0.00	-0.94	0.08	-0.62	0.00
92	1	0.00	0.00	-0.90	-0.28	-0.50	0.00
106	1	0.00	0.00	-1.53	0.00	0.00	0.00
133	1	0.00	0.00	-1.42	0.00	0.00	0.00
134	1	0.00	0.00	-1.42	0.00	0.00	0.00
35	1	0.00	0.00	-2.39	0.00	0.00	0.00
36	1	0.00	0.00	-2.39	0.00	0.00	0.00
15	1	0.00	0.00	-0.03	0.00	0.00	0.00
28	1	0.00	0.00	-0.03	0.00	0.00	0.00
43	1	0.00	0.00	0.14	0.00	0.00	0.00
56	1	0.00	0.00	0.14	0.00	0.00	0.00
57	1	0.00	0.00	0.10	0.00	0.00	0.00
70	1	0.00	0.00	0.10	0.00	0.00	0.00
99	1	0.00	0.00	0.20	0.00	0.00	0.00
112	1	0.00	0.00	0.20	0.00	0.00	0.00
127	1	0.00	0.00	-0.05	0.00	0.00	0.00
140	1	0.00	0.00	-0.05	0.00	0.00	0.00
16	1	0.00	0.00	-0.68	0.00	0.00	0.00
27	1	0.00	0.00	-0.68	0.00	0.00	0.00
31	1	0.00	0.00	-1.64	0.00	0.00	0.00
40	1	0.00	0.00	-1.64	0.00	0.00	0.00
44	1	0.00	0.00	-0.08	0.00	0.00	0.00
55	1	0.00	0.00	-0.08	0.00	0.00	0.00

SUPPORT REACTIONS -UNIT KIP IN STRUCTURE TYPE = SPACE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
58	1	0.00	0.00	0.15	0.00	0.00	0.00
69	1	0.00	0.00	0.15	0.00	0.00	0.00
100	1	0.00	0.00	-0.17	0.00	0.00	0.00
111	1	0.00	0.00	-0.17	0.00	0.00	0.00
128	1	0.00	0.00	-0.55	0.00	0.00	0.00
139	1	0.00	0.00	-0.55	0.00	0.00	0.00
45	1	0.00	0.00	-0.36	0.00	0.00	0.00
54	1	0.00	0.00	-0.36	0.00	0.00	0.00
59	1	0.00	0.00	0.14	0.00	0.00	0.00
68	1	0.00	0.00	0.14	0.00	0.00	0.00
101	1	0.00	0.00	-0.57	0.00	0.00	0.00
110	1	0.00	0.00	-0.57	0.00	0.00	0.00
129	1	0.00	0.00	-1.02	0.00	0.00	0.00
138	1	0.00	0.00	-1.02	0.00	0.00	0.00
47	1	0.00	0.00	-0.79	0.00	0.00	0.00
48	1	0.00	0.00	-1.21	0.00	0.00	0.00
51	1	0.00	0.00	-1.21	0.00	0.00	0.00
52	1	0.00	0.00	-0.79	0.00	0.00	0.00
61	1	0.00	0.00	0.07	0.00	0.00	0.00
62	1	0.00	0.00	-0.57	0.00	0.00	0.00
65	1	0.00	0.00	-0.57	0.00	0.00	0.00
66	1	0.00	0.00	0.07	0.00	0.00	0.00
103	1	0.00	0.00	-1.18	0.00	0.00	0.00
104	1	0.00	0.00	-1.58	0.00	0.00	0.00
107	1	0.00	0.00	-1.58	0.00	0.00	0.00
108	1	0.00	0.00	-1.18	0.00	0.00	0.00
46	1	0.00	0.00	-0.52	0.00	0.00	0.00
53	1	0.00	0.00	-0.52	0.00	0.00	0.00
60	1	0.00	0.00	0.15	0.00	0.00	0.00
67	1	0.00	0.00	0.15	0.00	0.00	0.00
74	1	0.00	0.00	0.29	0.00	0.00	0.00
81	1	0.00	0.00	0.29	0.00	0.00	0.00
88	1	0.00	0.00	0.16	0.00	0.00	0.00
95	1	0.00	0.00	0.16	0.00	0.00	0.00
102	1	0.00	0.00	-0.80	0.00	0.00	0.00
109	1	0.00	0.00	-0.80	0.00	0.00	0.00
29	1	0.00	0.00	0.10	0.00	0.00	0.00
42	1	0.00	0.00	0.10	0.00	0.00	0.00
30	1	0.00	0.00	-0.75	0.00	0.00	0.00
41	1	0.00	0.00	-0.75	0.00	0.00	0.00
33	1	0.00	0.00	-3.02	0.00	0.00	0.00
34	1	0.00	0.00	-3.34	0.00	0.00	0.00
37	1	0.00	0.00	-3.34	0.00	0.00	0.00
38	1	0.00	0.00	-3.02	0.00	0.00	0.00
32	1	0.00	0.00	-2.12	0.00	0.00	0.00
39	1	0.00	0.00	-2.12	0.00	0.00	0.00
113	1	0.00	0.00	0.03	0.00	0.00	0.00
126	1	0.00	0.00	0.03	0.00	0.00	0.00
114	1	0.00	0.00	-1.04	0.00	0.00	0.00
125	1	0.00	0.00	-1.04	0.00	0.00	0.00

SUPPORT REACTIONS -UNIT KIP IN STRUCTURE TYPE = SPACE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
115	1	0.00	0.00	-2.02	0.00	0.00	0.00
124	1	0.00	0.00	-2.02	0.00	0.00	0.00
116	1	0.00	0.00	-2.55	0.00	0.00	0.00
123	1	0.00	0.00	-2.55	0.00	0.00	0.00
117	1	0.00	0.00	-3.57	0.00	0.00	0.00
118	1	0.00	0.00	-4.05	0.00	0.00	0.00
121	1	0.00	0.00	-4.05	0.00	0.00	0.00
122	1	0.00	0.00	-3.57	0.00	0.00	0.00
119	1	0.00	0.00	-2.88	0.00	0.00	0.00
120	1	0.00	0.00	-2.88	0.00	0.00	0.00
130	1	0.00	0.00	-1.20	0.00	0.00	0.00
137	1	0.00	0.00	-1.20	0.00	0.00	0.00
131	1	0.00	0.00	-1.69	0.00	0.00	0.00
132	1	0.00	0.00	-1.97	0.00	0.00	0.00
135	1	0.00	0.00	-1.97	0.00	0.00	0.00
136	1	0.00	0.00	-1.69	0.00	0.00	0.00
17	1	0.00	0.00	-1.32	1.92	1.40	0.00
26	1	0.00	0.00	-1.32	1.92	-1.40	0.00
18	1	0.00	0.00	-1.74	2.89	1.10	0.00
25	1	0.00	0.00	-1.74	2.89	-1.10	0.00
19	1	0.00	0.00	-2.42	3.82	0.96	0.00
20	1	0.00	0.00	-2.85	4.18	1.36	0.00
23	1	0.00	0.00	-2.85	4.18	-1.36	0.00
24	1	0.00	0.00	-2.42	3.82	-0.96	0.00
21	1	0.00	0.00	-2.14	0.00	0.00	0.00
22	1	0.00	0.00	-2.14	0.00	0.00	0.00
143	1	0.00	0.00	0.00	-2.70	1.59	0.00
144	1	0.00	0.00	0.00	-3.79	1.36	0.00
145	1	0.00	0.00	0.00	-5.12	1.41	0.00
146	1	0.00	0.00	0.00	-5.64	1.92	0.00
149	1	0.00	0.00	0.00	-5.64	-1.92	0.00
150	1	0.00	0.00	0.00	-5.12	-1.41	0.00
151	1	0.00	0.00	0.00	-3.79	-1.36	0.00
152	1	0.00	0.00	0.00	-2.70	-1.59	0.00

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

77. PRINT ELEMENT STRESSES

ELEMENT FORCES FORCE,LENGTH UNITS= KIP IN

FORCE OR STRESS = FORCE/WIDTH/THICK, MOMENT = FORCE-LENGTH/WIDTH

ELEMENT	LOAD	QX	QY / FX	MX / FY	MY / FXY	MXY
1	1	0.12	-0.12	-0.09	0.00	0.05
			0.00	0.00	0.00	
TOP :	SMAX=	0.26	SMIN= -1.19	TMAX=	0.73	ANGLE= -26.1
BOTT:	SMAX=	1.19	SMIN= -0.26	TMAX=	0.73	ANGLE= -26.1
2	1	1.34	-0.61	0.14	-0.13	0.08
			0.00	0.00	0.00	
TOP :	SMAX=	1.77	SMIN= -1.60	TMAX=	1.68	ANGLE= 15.0
BOTT:	SMAX=	1.60	SMIN= -1.77	TMAX=	1.68	ANGLE= 15.0
3	1	3.10	-3.38	-0.04	-0.53	0.30
			0.00	0.00	0.00	
TOP :	SMAX=	1.15	SMIN= -7.15	TMAX=	4.15	ANGLE= 25.5
BOTT:	SMAX=	7.15	SMIN= -1.15	TMAX=	4.15	ANGLE= 25.5
4	1	1.55	-3.65	-0.13	-0.59	0.19
			0.00	0.00	0.00	
TOP :	SMAX=	-0.66	SMIN= -7.04	TMAX=	3.19	ANGLE= 19.7
BOTT:	SMAX=	7.04	SMIN= 0.66	TMAX=	3.19	ANGLE= 19.7
5	1	1.77	-4.43	-0.25	-0.80	0.26
			0.00	0.00	0.00	
TOP :	SMAX=	-1.52	SMIN= -9.64	TMAX=	4.06	ANGLE= 21.9
BOTT:	SMAX=	9.64	SMIN= 1.52	TMAX=	4.06	ANGLE= 21.9
6	1	4.48	-3.59	-0.15	-0.56	0.79
			0.00	0.00	0.00	
TOP :	SMAX=	4.90	SMIN= -12.45	TMAX=	8.67	ANGLE= 37.7
BOTT:	SMAX=	12.45	SMIN= -4.90	TMAX=	8.67	ANGLE= 37.7
7	1	0.00	-0.41	1.16	0.20	0.00
			0.00	0.00	0.00	
TOP :	SMAX=	12.36	SMIN= 2.17	TMAX=	5.10	ANGLE= 0.0
BOTT:	SMAX=	-2.17	SMIN= -12.36	TMAX=	5.10	ANGLE= 0.0
8	1	-4.48	-3.59	-0.15	-0.56	-0.79
			0.00	0.00	0.00	
TOP :	SMAX=	4.90	SMIN= -12.45	TMAX=	8.67	ANGLE= -37.7
BOTT:	SMAX=	12.45	SMIN= -4.90	TMAX=	8.67	ANGLE= -37.7
9	1	-1.77	-4.43	-0.25	-0.80	-0.26
			0.00	0.00	0.00	
TOP :	SMAX=	-1.52	SMIN= -9.64	TMAX=	4.06	ANGLE= -21.9
BOTT:	SMAX=	9.64	SMIN= 1.52	TMAX=	4.06	ANGLE= -21.9
10	1	-1.55	-3.65	-0.13	-0.59	-0.19
			0.00	0.00	0.00	
TOP :	SMAX=	-0.66	SMIN= -7.04	TMAX=	3.19	ANGLE= -19.7
BOTT:	SMAX=	7.04	SMIN= 0.66	TMAX=	3.19	ANGLE= -19.7

ELEMENT FORCES FORCE,LENGTH UNITS= KIP IN

FORCE OR STRESS = FORCE/WIDTH/THICK, MOMENT = FORCE-LENGTH/WIDTH

ELEMENT	LOAD	QX	QY / FX	MX / FY	MY / FXY	MXY
11	1	-3.10	-3.38	-0.04	-0.53	-0.30
			0.00	0.00	0.00	
TOP :	SMAX=	1.15	SMIN= -7.15	TMAX=	4.15	ANGLE= -25.5
BOTT:	SMAX=	7.15	SMIN= -1.15	TMAX=	4.15	ANGLE= -25.5
12	1	-1.34	-0.61	0.14	-0.13	-0.08
			0.00	0.00	0.00	
TOP :	SMAX=	1.77	SMIN= -1.60	TMAX=	1.68	ANGLE= -15.0
BOTT:	SMAX=	1.60	SMIN= -1.77	TMAX=	1.68	ANGLE= -15.0
13	1	-0.12	-0.12	-0.09	0.00	-0.05
			0.00	0.00	0.00	
TOP :	SMAX=	0.26	SMIN= -1.19	TMAX=	0.73	ANGLE= 26.1
BOTT:	SMAX=	1.19	SMIN= -0.26	TMAX=	0.73	ANGLE= 26.1
14	1	-0.33	0.29	-0.10	-0.15	0.13
			0.00	0.00	0.00	
TOP :	SMAX=	0.03	SMIN= -2.72	TMAX=	1.37	ANGLE= 39.8
BOTT:	SMAX=	2.72	SMIN= -0.03	TMAX=	1.37	ANGLE= 39.8
15	1	1.44	-1.61	0.24	0.29	-0.07
			0.00	0.00	0.00	
TOP :	SMAX=	3.61	SMIN= 2.07	TMAX=	0.77	ANGLE= 34.4
BOTT:	SMAX=	-2.07	SMIN= -3.61	TMAX=	0.77	ANGLE= 34.4
16	1	1.97	-3.39	0.22	0.81	-0.11
			0.00	0.00	0.00	
TOP :	SMAX=	8.82	SMIN= 2.09	TMAX=	3.37	ANGLE= 10.3
BOTT:	SMAX=	-2.09	SMIN= -8.82	TMAX=	3.37	ANGLE= 10.3
17	1	1.00	-4.19	0.30	1.02	-0.09
			0.00	0.00	0.00	
TOP :	SMAX=	11.02	SMIN= 3.05	TMAX=	3.98	ANGLE= 7.1
BOTT:	SMAX=	-3.05	SMIN= -11.02	TMAX=	3.98	ANGLE= 7.1
18	1	0.90	-5.30	0.32	1.20	-0.06
			0.00	0.00	0.00	
TOP :	SMAX=	12.89	SMIN= 3.36	TMAX=	4.77	ANGLE= 4.0
BOTT:	SMAX=	-3.36	SMIN= -12.89	TMAX=	4.77	ANGLE= 4.0
19	1	-0.16	-2.95	0.00	0.06	0.39
			0.00	0.00	0.00	
TOP :	SMAX=	4.52	SMIN= -3.83	TMAX=	4.17	ANGLE= -42.8
BOTT:	SMAX=	3.83	SMIN= -4.52	TMAX=	4.17	ANGLE= -42.8
20	1	0.00	-0.78	0.34	-1.00	0.00
			0.00	0.00	0.00	
TOP :	SMAX=	3.67	SMIN= -10.64	TMAX=	7.16	ANGLE= 0.0
BOTT:	SMAX=	10.64	SMIN= -3.67	TMAX=	7.16	ANGLE= 0.0

ELEMENT FORCES FORCE,LENGTH UNITS= KIP IN

FORCE OR STRESS = FORCE/WIDTH/THICK, MOMENT = FORCE-LENGTH/WIDTH

ELEMENT	LOAD	QX	QY FX	MX FY	MY FXY	MXY
21	1	0.16	-2.95 0.00	0.00 0.00	0.06 0.00	-0.39
TOP :	SMAX=	4.52	SMIN= -3.83	TMAX=	4.17	ANGLE= 42.8
BOTT:	SMAX=	3.83	SMIN= -4.52	TMAX=	4.17	ANGLE= 42.8
22	1	-0.90	-5.30 0.00	0.32 0.00	1.20 0.00	0.06
TOP :	SMAX=	12.89	SMIN= 3.36	TMAX=	4.77	ANGLE= -4.0
BOTT:	SMAX=	-3.36	SMIN= -12.89	TMAX=	4.77	ANGLE= -4.0
23	1	-1.00	-4.19 0.00	0.30 0.00	1.02 0.00	0.09
TOP :	SMAX=	11.02	SMIN= 3.05	TMAX=	3.98	ANGLE= -7.1
BOTT:	SMAX=	-3.05	SMIN= -11.02	TMAX=	3.98	ANGLE= -7.1
24	1	-1.97	-3.39 0.00	0.22 0.00	0.81 0.00	0.11
TOP :	SMAX=	8.82	SMIN= 2.09	TMAX=	3.37	ANGLE= -10.3
BOTT:	SMAX=	-2.09	SMIN= -8.82	TMAX=	3.37	ANGLE= -10.3
25	1	-1.44	-1.61 0.00	0.24 0.00	0.29 0.00	0.07
TOP :	SMAX=	3.61	SMIN= 2.07	TMAX=	0.77	ANGLE= -34.4
BOTT:	SMAX=	-2.07	SMIN= -3.61	TMAX=	0.77	ANGLE= -34.4
26	1	0.33	0.29 0.00	-0.10 0.00	-0.15 0.00	-0.13
TOP :	SMAX=	0.03	SMIN= -2.72	TMAX=	1.37	ANGLE= -39.8
BOTT:	SMAX=	2.72	SMIN= -0.03	TMAX=	1.37	ANGLE= -39.8
27	1	-0.16	0.25 0.00	-0.06 0.00	-0.12 0.00	0.11
TOP :	SMAX=	0.20	SMIN= -2.14	TMAX=	1.17	ANGLE= 36.7
BOTT:	SMAX=	2.14	SMIN= -0.20	TMAX=	1.17	ANGLE= 36.7
28	1	-0.17	-0.12 0.00	-0.05 0.00	-0.19 0.00	0.16
TOP :	SMAX=	0.56	SMIN= -3.13	TMAX=	1.85	ANGLE= 32.8
BOTT:	SMAX=	3.13	SMIN= -0.56	TMAX=	1.85	ANGLE= 32.8
29	1	-0.27	-0.39 0.00	-0.05 0.00	-0.26 0.00	0.15
TOP :	SMAX=	0.32	SMIN= -3.64	TMAX=	1.98	ANGLE= 27.5
BOTT:	SMAX=	3.64	SMIN= -0.32	TMAX=	1.98	ANGLE= 27.5
30	1	-0.33	-0.62 0.00	-0.04 0.00	-0.33 0.00	0.11
TOP :	SMAX=	-0.09	SMIN= -3.85	TMAX=	1.88	ANGLE= 18.3
BOTT:	SMAX=	3.85	SMIN= 0.09	TMAX=	1.88	ANGLE= 18.3

ELEMENT FORCES FORCE,LENGTH UNITS= KIP IN

FORCE OR STRESS = FORCE/WIDTH/THICK, MOMENT = FORCE-LENGTH/WIDTH

ELEMENT	LOAD	QX	QY FX	MX FY	MY FXY	MXY
31	1	-0.41	-0.42 0.00	-0.13 0.00	-0.45 0.00	0.05
TOP :	SMAX= -1.31	SMIN= -4.85	TMAX= 1.77	ANGLE= 8.3		
BOTT:	SMAX= 4.85	SMIN= 1.31	TMAX= 1.77	ANGLE= 8.3		
32	1	0.07	-0.25 0.00	-0.06 0.00	-0.80 0.00	-0.06
TOP :	SMAX= -0.61	SMIN= -8.64	TMAX= 4.02	ANGLE= -4.8		
BOTT:	SMAX= 8.64	SMIN= 0.61	TMAX= 4.02	ANGLE= -4.8		
33	1	0.00	-0.74 0.00	-0.25 0.00	-1.17 0.00	0.00
TOP :	SMAX= -2.71	SMIN= -12.46	TMAX= 4.87	ANGLE= 0.0		
BOTT:	SMAX= 12.46	SMIN= 2.71	TMAX= 4.87	ANGLE= 0.0		
34	1	-0.07	-0.25 0.00	-0.06 0.00	-0.80 0.00	0.06
TOP :	SMAX= -0.61	SMIN= -8.64	TMAX= 4.02	ANGLE= 4.8		
BOTT:	SMAX= 8.64	SMIN= 0.61	TMAX= 4.02	ANGLE= 4.8		
35	1	0.41	-0.42 0.00	-0.13 0.00	-0.45 0.00	-0.05
TOP :	SMAX= -1.31	SMIN= -4.85	TMAX= 1.77	ANGLE= -8.3		
BOTT:	SMAX= 4.85	SMIN= 1.31	TMAX= 1.77	ANGLE= -8.3		
36	1	0.33	-0.62 0.00	-0.04 0.00	-0.33 0.00	-0.11
TOP :	SMAX= -0.09	SMIN= -3.85	TMAX= 1.88	ANGLE= -18.3		
BOTT:	SMAX= 3.85	SMIN= 0.09	TMAX= 1.88	ANGLE= -18.3		
37	1	0.27	-0.39 0.00	-0.05 0.00	-0.26 0.00	-0.15
TOP :	SMAX= 0.32	SMIN= -3.64	TMAX= 1.98	ANGLE= -27.5		
BOTT:	SMAX= 3.64	SMIN= -0.32	TMAX= 1.98	ANGLE= -27.5		
38	1	0.17	-0.12 0.00	-0.05 0.00	-0.19 0.00	-0.16
TOP :	SMAX= 0.56	SMIN= -3.13	TMAX= 1.85	ANGLE= -32.8		
BOTT:	SMAX= 3.13	SMIN= -0.56	TMAX= 1.85	ANGLE= -32.8		
39	1	0.16	0.25 0.00	-0.06 0.00	-0.12 0.00	-0.11
TOP :	SMAX= 0.20	SMIN= -2.14	TMAX= 1.17	ANGLE= -36.7		
BOTT:	SMAX= 2.14	SMIN= -0.20	TMAX= 1.17	ANGLE= -36.7		
40	1	-0.09	0.19 0.00	-0.02 0.00	-0.06 0.00	0.06
TOP :	SMAX= 0.21	SMIN= -1.07	TMAX= 0.64	ANGLE= 33.6		
BOTT:	SMAX= 1.07	SMIN= -0.21	TMAX= 0.64	ANGLE= 33.6		

ELEMENT FORCES FORCE,LENGTH UNITS= KIP IN

FORCE OR STRESS = FORCE/WIDTH/THICK, MOMENT = FORCE-LENGTH/WIDTH

ELEMENT	LOAD	QX	QY / FX	MX / FY	MY / FXY	MXY
41	1	-0.16	0.20	-0.03	-0.16	0.07
			0.00	0.00	0.00	
TOP :	SMAX= 0.03	SMIN= -2.00	TMAX= 1.02	ANGLE= 23.6		
BOTT:	SMAX= 2.00	SMIN= -0.03	TMAX= 1.02	ANGLE= 23.6		
42	1	-0.16	0.33	-0.07	-0.27	0.06
			0.00	0.00	0.00	
TOP :	SMAX= -0.53	SMIN= -3.04	TMAX= 1.25	ANGLE= 16.3		
BOTT:	SMAX= 3.04	SMIN= 0.53	TMAX= 1.25	ANGLE= 16.3		
43	1	-0.19	0.31	-0.13	-0.35	0.03
			0.00	0.00	0.00	
TOP :	SMAX= -1.33	SMIN= -3.75	TMAX= 1.21	ANGLE= 7.0		
BOTT:	SMAX= 3.75	SMIN= 1.33	TMAX= 1.21	ANGLE= 7.0		
44	1	-0.06	0.55	-0.22	-0.41	-0.02
			0.00	0.00	0.00	
TOP :	SMAX= -2.29	SMIN= -4.44	TMAX= 1.08	ANGLE= -6.0		
BOTT:	SMAX= 4.44	SMIN= 2.29	TMAX= 1.08	ANGLE= -6.0		
45	1	1.30	0.09	0.15	-0.15	-0.13
			0.00	0.00	0.00	
TOP :	SMAX= 2.14	SMIN= -2.12	TMAX= 2.13	ANGLE= -20.3		
BOTT:	SMAX= 2.12	SMIN= -2.14	TMAX= 2.13	ANGLE= -20.3		
46	1	0.00	-1.11	0.00	0.00	0.00
			0.00	0.00	0.00	
TOP :	SMAX= 0.00	SMIN= 0.00	TMAX= 0.00	ANGLE= 90.0		
BOTT:	SMAX= 0.00	SMIN= 0.00	TMAX= 0.00	ANGLE= 90.0		
47	1	-1.30	0.09	0.15	-0.15	0.13
			0.00	0.00	0.00	
TOP :	SMAX= 2.14	SMIN= -2.12	TMAX= 2.13	ANGLE= 20.3		
BOTT:	SMAX= 2.12	SMIN= -2.14	TMAX= 2.13	ANGLE= 20.3		
48	1	0.06	0.55	-0.22	-0.41	0.02
			0.00	0.00	0.00	
TOP :	SMAX= -2.29	SMIN= -4.44	TMAX= 1.08	ANGLE= 6.0		
BOTT:	SMAX= 4.44	SMIN= 2.29	TMAX= 1.08	ANGLE= 6.0		
49	1	0.19	0.31	-0.13	-0.35	-0.03
			0.00	0.00	0.00	
TOP :	SMAX= -1.33	SMIN= -3.75	TMAX= 1.21	ANGLE= -7.0		
BOTT:	SMAX= 3.75	SMIN= 1.33	TMAX= 1.21	ANGLE= -7.0		
50	1	0.16	0.33	-0.07	-0.27	-0.06
			0.00	0.00	0.00	
TOP :	SMAX= -0.53	SMIN= -3.04	TMAX= 1.25	ANGLE= -16.3		
BOTT:	SMAX= 3.04	SMIN= 0.53	TMAX= 1.25	ANGLE= -16.3		

ELEMENT FORCES FORCE,LENGTH UNITS= KIP IN

FORCE OR STRESS = FORCE/WIDTH/THICK, MOMENT = FORCE-LENGTH/WIDTH

ELEMENT	LOAD	QX	QY / FX	MX / FY	MY / FXY	MXY
51	1	0.16	0.20	-0.03	-0.16	-0.07
			0.00	0.00	0.00	
TOP :	SMAX= 0.03	SMIN= -2.00	TMAX= 1.02	ANGLE= -23.6		
BOTT:	SMAX= 2.00	SMIN= -0.03	TMAX= 1.02	ANGLE= -23.6		
52	1	0.09	0.19	-0.02	-0.06	-0.06
			0.00	0.00	0.00	
TOP :	SMAX= 0.21	SMIN= -1.07	TMAX= 0.64	ANGLE= -33.6		
BOTT:	SMAX= 1.07	SMIN= -0.21	TMAX= 0.64	ANGLE= -33.6		
53	1	-0.01	0.06	0.00	-0.01	0.01
			0.00	0.00	0.00	
TOP :	SMAX= 0.08	SMIN= -0.19	TMAX= 0.13	ANGLE= 90.0		
BOTT:	SMAX= 0.19	SMIN= -0.08	TMAX= 0.13	ANGLE= 90.0		
54	1	-0.08	0.07	-0.01	-0.06	0.01
			0.00	0.00	0.00	
TOP :	SMAX= -0.02	SMIN= -0.64	TMAX= 0.31	ANGLE= 15.5		
BOTT:	SMAX= 0.64	SMIN= 0.02	TMAX= 0.31	ANGLE= 15.5		
55	1	-0.12	0.12	-0.04	-0.11	0.01
			0.00	0.00	0.00	
TOP :	SMAX= -0.35	SMIN= -1.18	TMAX= 0.41	ANGLE= 10.4		
BOTT:	SMAX= 1.18	SMIN= 0.35	TMAX= 0.41	ANGLE= 10.4		
56	1	-0.15	0.13	-0.12	-0.15	0.01
			0.00	0.00	0.00	
TOP :	SMAX= -1.28	SMIN= -1.63	TMAX= 0.17	ANGLE= 9.5		
BOTT:	SMAX= 1.63	SMIN= 1.28	TMAX= 0.17	ANGLE= 9.5		
57	1	0.04	0.18	-0.19	-0.16	0.00
			0.00	0.00	0.00	
TOP :	SMAX= -1.66	SMIN= -2.06	TMAX= 0.20	ANGLE= 2.3		
BOTT:	SMAX= 2.06	SMIN= 1.66	TMAX= 0.20	ANGLE= 2.3		
58	1	1.12	-0.05	0.24	0.02	-0.03
			0.00	0.00	0.00	
TOP :	SMAX= 2.58	SMIN= 0.13	TMAX= 1.22	ANGLE= -6.6		
BOTT:	SMAX= -0.13	SMIN= -2.58	TMAX= 1.22	ANGLE= -6.6		
59	1	0.00	-0.39	0.00	0.00	0.00
			0.00	0.00	0.00	
TOP :	SMAX= 0.00	SMIN= 0.00	TMAX= 0.00	ANGLE= 90.0		
BOTT:	SMAX= 0.00	SMIN= 0.00	TMAX= 0.00	ANGLE= 90.0		
60	1	-1.12	-0.05	0.24	0.02	0.03
			0.00	0.00	0.00	
TOP :	SMAX= 2.58	SMIN= 0.13	TMAX= 1.22	ANGLE= 6.6		
BOTT:	SMAX= -0.13	SMIN= -2.58	TMAX= 1.22	ANGLE= 6.6		

ELEMENT FORCES FORCE,LENGTH UNITS= KIP IN

FORCE OR STRESS = FORCE/WIDTH/THICK, MOMENT = FORCE-LENGTH/WIDTH

ELEMENT	LOAD	QX	QY / FX	MX / FY	MY / FXY	MXY
61	1	-0.04	0.18	-0.19	-0.16	0.00
			0.00	0.00	0.00	
TOP :	SMAX= -1.66	SMIN= -2.06	TMAX= 0.20	ANGLE= -2.3		
BOTT:	SMAX= 2.06	SMIN= 1.66	TMAX= 0.20	ANGLE= -2.3		
62	1	0.15	0.13	-0.12	-0.15	-0.01
			0.00	0.00	0.00	
TOP :	SMAX= -1.28	SMIN= -1.63	TMAX= 0.17	ANGLE= -9.5		
BOTT:	SMAX= 1.63	SMIN= 1.28	TMAX= 0.17	ANGLE= -9.5		
63	1	0.12	0.12	-0.04	-0.11	-0.01
			0.00	0.00	0.00	
TOP :	SMAX= -0.35	SMIN= -1.18	TMAX= 0.41	ANGLE= -10.4		
BOTT:	SMAX= 1.18	SMIN= 0.35	TMAX= 0.41	ANGLE= -10.4		
64	1	0.08	0.07	-0.01	-0.06	-0.01
			0.00	0.00	0.00	
TOP :	SMAX= -0.02	SMIN= -0.64	TMAX= 0.31	ANGLE= -15.5		
BOTT:	SMAX= 0.64	SMIN= 0.02	TMAX= 0.31	ANGLE= -15.5		
65	1	0.01	0.06	0.00	-0.01	-0.01
			0.00	0.00	0.00	
TOP :	SMAX= 0.08	SMIN= -0.19	TMAX= 0.13	ANGLE= 90.0		
BOTT:	SMAX= 0.19	SMIN= -0.08	TMAX= 0.13	ANGLE= 90.0		
66	1	-0.02	-0.12	-0.01	-0.03	-0.02
			0.00	0.00	0.00	
TOP :	SMAX= 0.08	SMIN= -0.43	TMAX= 0.25	ANGLE= -32.8		
BOTT:	SMAX= 0.43	SMIN= -0.08	TMAX= 0.25	ANGLE= -32.8		
67	1	-0.10	-0.15	-0.01	-0.09	-0.02
			0.00	0.00	0.00	
TOP :	SMAX= -0.04	SMIN= -0.99	TMAX= 0.47	ANGLE= -16.0		
BOTT:	SMAX= 0.99	SMIN= 0.04	TMAX= 0.47	ANGLE= -16.0		
68	1	-0.13	-0.25	-0.04	-0.15	-0.02
			0.00	0.00	0.00	
TOP :	SMAX= -0.44	SMIN= -1.66	TMAX= 0.61	ANGLE= -9.6		
BOTT:	SMAX= 1.66	SMIN= 0.44	TMAX= 0.61	ANGLE= -9.6		
69	1	-0.16	-0.27	-0.13	-0.21	0.00
			0.00	0.00	0.00	
TOP :	SMAX= -1.38	SMIN= -2.23	TMAX= 0.42	ANGLE= -3.2		
BOTT:	SMAX= 2.23	SMIN= 1.38	TMAX= 0.42	ANGLE= -3.2		
70	1	-0.02	-0.37	-0.20	-0.24	0.02
			0.00	0.00	0.00	
TOP :	SMAX= -2.10	SMIN= -2.63	TMAX= 0.26	ANGLE= 21.2		
BOTT:	SMAX= 2.63	SMIN= 2.10	TMAX= 0.26	ANGLE= 21.2		

ELEMENT FORCES FORCE,LENGTH UNITS= KIP IN

FORCE OR STRESS = FORCE/WIDTH/THICK, MOMENT = FORCE-LENGTH/WIDTH

ELEMENT	LOAD	QX	QY FX	MX FY	MY FXY	MXY
71	1	1.18	-0.33 0.00	0.21 0.00	-0.04 0.00	0.03
TOP :	SMAX=	2.28	SMIN= -0.49	TMAX=	1.39	ANGLE= 7.3
BOTT:	SMAX=	0.49	SMIN= -2.28	TMAX=	1.39	ANGLE= 7.3
72	1	0.00	-0.18 0.00	0.00 0.00	0.00 0.00	0.00
TOP :	SMAX=	0.00	SMIN= 0.00	TMAX=	0.00	ANGLE= 90.0
BOTT:	SMAX=	0.00	SMIN= 0.00	TMAX=	0.00	ANGLE= 90.0
73	1	-1.18	-0.33 0.00	0.21 0.00	-0.04 0.00	-0.03
TOP :	SMAX=	2.28	SMIN= -0.49	TMAX=	1.39	ANGLE= -7.3
BOTT:	SMAX=	0.49	SMIN= -2.28	TMAX=	1.39	ANGLE= -7.3
74	1	0.02	-0.37 0.00	-0.20 0.00	-0.24 0.00	-0.02
TOP :	SMAX=	-2.10	SMIN= -2.63	TMAX=	0.26	ANGLE= -21.2
BOTT:	SMAX=	2.63	SMIN= 2.10	TMAX=	0.26	ANGLE= -21.2
75	1	0.16	-0.27 0.00	-0.13 0.00	-0.21 0.00	0.00
TOP :	SMAX=	-1.38	SMIN= -2.23	TMAX=	0.42	ANGLE= 3.2
BOTT:	SMAX=	2.23	SMIN= 1.38	TMAX=	0.42	ANGLE= 3.2
76	1	0.13	-0.25 0.00	-0.04 0.00	-0.15 0.00	0.02
TOP :	SMAX=	-0.44	SMIN= -1.66	TMAX=	0.61	ANGLE= 9.6
BOTT:	SMAX=	1.66	SMIN= 0.44	TMAX=	0.61	ANGLE= 9.6
77	1	0.10	-0.15 0.00	-0.01 0.00	-0.09 0.00	0.02
TOP :	SMAX=	-0.04	SMIN= -0.99	TMAX=	0.47	ANGLE= 16.0
BOTT:	SMAX=	0.99	SMIN= 0.04	TMAX=	0.47	ANGLE= 16.0
78	1	0.02	-0.12 0.00	-0.01 0.00	-0.03 0.00	0.02
TOP :	SMAX=	0.08	SMIN= -0.43	TMAX=	0.25	ANGLE= 32.8
BOTT:	SMAX=	0.43	SMIN= -0.08	TMAX=	0.25	ANGLE= 32.8
79	1	-0.13	-0.32 0.00	-0.03 0.00	-0.13 0.00	-0.08
TOP :	SMAX=	0.12	SMIN= -1.89	TMAX=	1.01	ANGLE= -28.6
BOTT:	SMAX=	1.89	SMIN= -0.12	TMAX=	1.01	ANGLE= -28.6
80	1	-0.23	-0.31 0.00	-0.05 0.00	-0.26 0.00	-0.10
TOP :	SMAX=	-0.12	SMIN= -3.19	TMAX=	1.54	ANGLE= -21.7
BOTT:	SMAX=	3.19	SMIN= 0.12	TMAX=	1.54	ANGLE= -21.7

ELEMENT FORCES FORCE,LENGTH UNITS= KIP IN

FORCE OR STRESS = FORCE/WIDTH/THICK, MOMENT = FORCE-LENGTH/WIDTH

ELEMENT	LOAD	QX	QY FX	MX FY	MY FXY	MXY
81	1	-0.23	-0.47 0.00	-0.10 0.00	-0.40 0.00	-0.09
TOP :	SMAX= -0.76	SMIN= -4.54	TMAX= 1.89	ANGLE= -15.3		
BOTT:	SMAX= 4.54	SMIN= 0.76	TMAX= 1.89	ANGLE= -15.3		
82	1	-0.26	-0.48 0.00	-0.16 0.00	-0.52 0.00	-0.05
TOP :	SMAX= -1.59	SMIN= -5.65	TMAX= 2.03	ANGLE= -8.2		
BOTT:	SMAX= 5.65	SMIN= 1.59	TMAX= 2.03	ANGLE= -8.2		
83	1	-0.11	-0.65 0.00	-0.24 0.00	-0.61 0.00	0.01
TOP :	SMAX= -2.56	SMIN= -6.51	TMAX= 1.97	ANGLE= 2.0		
BOTT:	SMAX= 6.51	SMIN= 2.56	TMAX= 1.97	ANGLE= 2.0		
84	1	0.77	-0.77 0.00	-0.02 0.00	-0.62 0.00	0.04
TOP :	SMAX= -0.16	SMIN= -6.69	TMAX= 3.26	ANGLE= 3.8		
BOTT:	SMAX= 6.69	SMIN= 0.16	TMAX= 3.26	ANGLE= 3.8		
85	1	0.00	-0.45 0.00	0.06 0.00	-0.66 0.00	0.00
TOP :	SMAX= 0.62	SMIN= -7.08	TMAX= 3.85	ANGLE= 0.0		
BOTT:	SMAX= 7.08	SMIN= -0.62	TMAX= 3.85	ANGLE= 0.0		
86	1	-0.77	-0.77 0.00	-0.02 0.00	-0.62 0.00	-0.04
TOP :	SMAX= -0.16	SMIN= -6.69	TMAX= 3.26	ANGLE= -3.8		
BOTT:	SMAX= 6.69	SMIN= 0.16	TMAX= 3.26	ANGLE= -3.8		
87	1	0.11	-0.65 0.00	-0.24 0.00	-0.61 0.00	-0.01
TOP :	SMAX= -2.56	SMIN= -6.51	TMAX= 1.97	ANGLE= -2.0		
BOTT:	SMAX= 6.51	SMIN= 2.56	TMAX= 1.97	ANGLE= -2.0		
88	1	0.26	-0.48 0.00	-0.16 0.00	-0.52 0.00	0.05
TOP :	SMAX= -1.59	SMIN= -5.65	TMAX= 2.03	ANGLE= 8.2		
BOTT:	SMAX= 5.65	SMIN= 1.59	TMAX= 2.03	ANGLE= 8.2		
89	1	0.23	-0.47 0.00	-0.10 0.00	-0.40 0.00	0.09
TOP :	SMAX= -0.76	SMIN= -4.54	TMAX= 1.89	ANGLE= 15.3		
BOTT:	SMAX= 4.54	SMIN= 0.76	TMAX= 1.89	ANGLE= 15.3		
90	1	0.23	-0.31 0.00	-0.05 0.00	-0.26 0.00	0.10
TOP :	SMAX= -0.12	SMIN= -3.19	TMAX= 1.54	ANGLE= 21.7		
BOTT:	SMAX= 3.19	SMIN= 0.12	TMAX= 1.54	ANGLE= 21.7		

ELEMENT FORCES FORCE,LENGTH UNITS= KIP IN

FORCE OR STRESS = FORCE/WIDTH/THICK, MOMENT = FORCE-LENGTH/WIDTH

ELEMENT	LOAD	QX	QY / FX	MX / FY	MY / FXY	MXY
91	1	0.13	-0.32	-0.03	-0.13	0.08
			0.00	0.00	0.00	
TOP :	SMAX=	0.12	SMIN= -1.89	TMAX=	1.01	ANGLE= 28.6
BOTT:	SMAX=	1.89	SMIN= -0.12	TMAX=	1.01	ANGLE= 28.6
92	1	-0.26	-0.41	-0.07	-0.26	-0.15
			0.00	0.00	0.00	
TOP :	SMAX=	0.06	SMIN= -3.61	TMAX=	1.84	ANGLE= -28.9
BOTT:	SMAX=	3.61	SMIN= -0.06	TMAX=	1.84	ANGLE= -28.9
93	1	-0.07	0.21	-0.05	-0.30	-0.18
			0.00	0.00	0.00	
TOP :	SMAX=	0.47	SMIN= -4.22	TMAX=	2.34	ANGLE= -27.5
BOTT:	SMAX=	4.22	SMIN= -0.47	TMAX=	2.34	ANGLE= -27.5
94	1	-0.11	0.62	-0.09	-0.37	-0.17
			0.00	0.00	0.00	
TOP :	SMAX=	-0.05	SMIN= -4.80	TMAX=	2.37	ANGLE= -25.6
BOTT:	SMAX=	4.80	SMIN= 0.05	TMAX=	2.37	ANGLE= -25.6
95	1	-0.29	0.94	-0.06	-0.43	-0.14
			0.00	0.00	0.00	
TOP :	SMAX=	-0.09	SMIN= -5.08	TMAX=	2.50	ANGLE= -18.5
BOTT:	SMAX=	5.08	SMIN= 0.09	TMAX=	2.50	ANGLE= -18.5
96	1	-0.41	0.93	-0.15	-0.61	-0.08
			0.00	0.00	0.00	
TOP :	SMAX=	-1.45	SMIN= -6.64	TMAX=	2.59	ANGLE= -9.9
BOTT:	SMAX=	6.64	SMIN= 1.45	TMAX=	2.59	ANGLE= -9.9
97	1	0.20	0.04	-0.08	-0.87	-0.04
			0.00	0.00	0.00	
TOP :	SMAX=	-0.88	SMIN= -9.29	TMAX=	4.20	ANGLE= -2.8
BOTT:	SMAX=	9.29	SMIN= 0.88	TMAX=	4.20	ANGLE= -2.8
98	1	0.00	-1.21	-0.08	-1.03	0.00
			0.00	0.00	0.00	
TOP :	SMAX=	-0.81	SMIN= -11.03	TMAX=	5.11	ANGLE= 0.0
BOTT:	SMAX=	11.03	SMIN= 0.81	TMAX=	5.11	ANGLE= 0.0
99	1	-0.20	0.04	-0.08	-0.87	0.04
			0.00	0.00	0.00	
TOP :	SMAX=	-0.88	SMIN= -9.29	TMAX=	4.20	ANGLE= 2.8
BOTT:	SMAX=	9.29	SMIN= 0.88	TMAX=	4.20	ANGLE= 2.8
100	1	0.41	0.93	-0.15	-0.61	0.08
			0.00	0.00	0.00	
TOP :	SMAX=	-1.45	SMIN= -6.64	TMAX=	2.59	ANGLE= 9.9
BOTT:	SMAX=	6.64	SMIN= 1.45	TMAX=	2.59	ANGLE= 9.9

ELEMENT FORCES FORCE,LENGTH UNITS= KIP IN

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ELEMENT	LOAD	QX	QY FX	MX FY	MY FXY	MXY
101	1	0.29	0.94	-0.06	-0.43	0.14
			0.00	0.00	0.00	
TOP :	SMAX=	-0.09	SMIN= -5.08	TMAX=	2.50	ANGLE= 18.5
BOTT:	SMAX=	5.08	SMIN= 0.09	TMAX=	2.50	ANGLE= 18.5
102	1	0.11	0.62	-0.09	-0.37	0.17
			0.00	0.00	0.00	
TOP :	SMAX=	-0.05	SMIN= -4.80	TMAX=	2.37	ANGLE= 25.6
BOTT:	SMAX=	4.80	SMIN= 0.05	TMAX=	2.37	ANGLE= 25.6
103	1	0.07	0.21	-0.05	-0.30	0.18
			0.00	0.00	0.00	
TOP :	SMAX=	0.47	SMIN= -4.22	TMAX=	2.34	ANGLE= 27.5
BOTT:	SMAX=	4.22	SMIN= -0.47	TMAX=	2.34	ANGLE= 27.5
104	1	0.26	-0.41	-0.07	-0.26	0.15
			0.00	0.00	0.00	
TOP :	SMAX=	0.06	SMIN= -3.61	TMAX=	1.84	ANGLE= 28.9
BOTT:	SMAX=	3.61	SMIN= -0.06	TMAX=	1.84	ANGLE= 28.9
105	1	-0.31	-0.09	-0.10	-0.28	-0.13
			0.00	0.00	0.00	
TOP :	SMAX=	-0.30	SMIN= -3.71	TMAX=	1.70	ANGLE= -27.9
BOTT:	SMAX=	3.71	SMIN= 0.30	TMAX=	1.70	ANGLE= -27.9
106	1	0.93	2.16	0.09	0.09	-0.08
			0.00	0.00	0.00	
TOP :	SMAX=	1.84	SMIN= 0.11	TMAX=	0.87	ANGLE= 90.0
BOTT:	SMAX=	-0.11	SMIN= -1.84	TMAX=	0.87	ANGLE= 90.0
107	1	0.77	4.21	0.14	0.54	-0.08
			0.00	0.00	0.00	
TOP :	SMAX=	5.94	SMIN= 1.36	TMAX=	2.29	ANGLE= 10.9
BOTT:	SMAX=	-1.36	SMIN= -5.94	TMAX=	2.29	ANGLE= 10.9
108	1	0.35	5.25	0.26	0.74	-0.07
			0.00	0.00	0.00	
TOP :	SMAX=	8.01	SMIN= 2.71	TMAX=	2.65	ANGLE= 8.1
BOTT:	SMAX=	-2.71	SMIN= -8.01	TMAX=	2.65	ANGLE= 8.1
109	1	-0.02	6.27	0.20	0.74	-0.15
			0.00	0.00	0.00	
TOP :	SMAX=	8.33	SMIN= 1.73	TMAX=	3.30	ANGLE= 14.0
BOTT:	SMAX=	-1.73	SMIN= -8.33	TMAX=	3.30	ANGLE= 14.0
110	1	-0.51	4.02	0.11	-0.30	-0.36
			0.00	0.00	0.00	
TOP :	SMAX=	3.39	SMIN= -5.39	TMAX=	4.39	ANGLE= -30.2
BOTT:	SMAX=	5.39	SMIN= -3.39	TMAX=	4.39	ANGLE= -30.2

ELEMENT FORCES FORCE,LENGTH UNITS= KIP IN

FORCE OR STRESS = FORCE/WIDTH/THICK, MOMENT = FORCE-LENGTH/WIDTH

ELEMENT	LOAD	QX	QY FX	MX FY	MY FXY	MXY
111	1	0.00	1.50	-0.02	-1.27	0.00
			0.00	0.00	0.00	
TOP :	SMAX=	-0.21	SMIN= -13.57	TMAX=	6.68	ANGLE= 0.0
BOTT:	SMAX=	13.57	SMIN= 0.21	TMAX=	6.68	ANGLE= 0.0
112	1	0.51	4.02	0.11	-0.30	0.36
			0.00	0.00	0.00	
TOP :	SMAX=	3.39	SMIN= -5.39	TMAX=	4.39	ANGLE= 30.2
BOTT:	SMAX=	5.39	SMIN= -3.39	TMAX=	4.39	ANGLE= 30.2
113	1	0.02	6.27	0.20	0.74	0.15
			0.00	0.00	0.00	
TOP :	SMAX=	8.33	SMIN= 1.73	TMAX=	3.30	ANGLE= -14.0
BOTT:	SMAX=	-1.73	SMIN= -8.33	TMAX=	3.30	ANGLE= -14.0
114	1	-0.35	5.25	0.26	0.74	0.07
			0.00	0.00	0.00	
TOP :	SMAX=	8.01	SMIN= 2.71	TMAX=	2.65	ANGLE= -8.1
BOTT:	SMAX=	-2.71	SMIN= -8.01	TMAX=	2.65	ANGLE= -8.1
115	1	-0.77	4.21	0.14	0.54	0.08
			0.00	0.00	0.00	
TOP :	SMAX=	5.94	SMIN= 1.36	TMAX=	2.29	ANGLE= -10.9
BOTT:	SMAX=	-1.36	SMIN= -5.94	TMAX=	2.29	ANGLE= -10.9
116	1	-0.93	2.16	0.09	0.09	0.08
			0.00	0.00	0.00	
TOP :	SMAX=	1.84	SMIN= 0.11	TMAX=	0.87	ANGLE= 90.0
BOTT:	SMAX=	-0.11	SMIN= -1.84	TMAX=	0.87	ANGLE= 90.0
117	1	0.31	-0.09	-0.10	-0.28	0.13
			0.00	0.00	0.00	
TOP :	SMAX=	-0.30	SMIN= -3.71	TMAX=	1.70	ANGLE= 27.9
BOTT:	SMAX=	3.71	SMIN= 0.30	TMAX=	1.70	ANGLE= 27.9
118	1	-0.35	-0.18	-0.11	-0.26	-0.16
			0.00	0.00	0.00	
TOP :	SMAX=	-0.06	SMIN= -3.85	TMAX=	1.89	ANGLE= -31.9
BOTT:	SMAX=	3.85	SMIN= 0.06	TMAX=	1.89	ANGLE= -31.9
119	1	2.69	3.05	0.45	0.71	0.31
			0.00	0.00	0.00	
TOP :	SMAX=	9.79	SMIN= 2.56	TMAX=	3.61	ANGLE= -33.6
BOTT:	SMAX=	-2.56	SMIN= -9.79	TMAX=	3.61	ANGLE= -33.6
120	1	3.80	5.90	0.51	1.99	0.38
			0.00	0.00	0.00	
TOP :	SMAX=	22.18	SMIN= 4.41	TMAX=	8.89	ANGLE= -13.6
BOTT:	SMAX=	-4.41	SMIN= -22.18	TMAX=	8.89	ANGLE= -13.6

ELEMENT FORCES FORCE,LENGTH UNITS= KIP IN

FORCE OR STRESS = FORCE/WIDTH/THICK, MOMENT = FORCE-LENGTH/WIDTH

ELEMENT	LOAD	QX	QY / FX	MX / FY	MY / FXY	MXY
121	1	2.54	7.18	0.64	2.42	0.34
			0.00	0.00	0.00	
TOP :	SMAX=	26.42	SMIN= 6.14	TMAX=	10.14	ANGLE= -10.4
BOTT:	SMAX=	-6.14	SMIN= -26.42	TMAX=	10.14	ANGLE= -10.4
122	1	2.76	9.63	0.76	3.08	0.28
			0.00	0.00	0.00	
TOP :	SMAX=	33.23	SMIN= 7.75	TMAX=	12.74	ANGLE= -6.7
BOTT:	SMAX=	-7.75	SMIN= -33.23	TMAX=	12.74	ANGLE= -6.7
123	1	0.63	5.67	0.17	0.96	-0.70
			0.00	0.00	0.00	
TOP :	SMAX=	14.56	SMIN= -2.51	TMAX=	8.53	ANGLE= 30.2
BOTT:	SMAX=	2.51	SMIN= -14.56	TMAX=	8.53	ANGLE= 30.2
124	1	0.00	3.38	1.17	-1.20	0.00
			0.00	0.00	0.00	
TOP :	SMAX=	12.45	SMIN= -12.85	TMAX=	12.65	ANGLE= 0.0
BOTT:	SMAX=	12.85	SMIN= -12.45	TMAX=	12.65	ANGLE= 0.0
125	1	-0.63	5.67	0.17	0.96	0.70
			0.00	0.00	0.00	
TOP :	SMAX=	14.56	SMIN= -2.51	TMAX=	8.53	ANGLE= -30.2
BOTT:	SMAX=	2.51	SMIN= -14.56	TMAX=	8.53	ANGLE= -30.2
126	1	-2.76	9.63	0.76	3.08	-0.28
			0.00	0.00	0.00	
TOP :	SMAX=	33.23	SMIN= 7.75	TMAX=	12.74	ANGLE= 6.7
BOTT:	SMAX=	-7.75	SMIN= -33.23	TMAX=	12.74	ANGLE= 6.7
127	1	-2.54	7.18	0.64	2.42	-0.34
			0.00	0.00	0.00	
TOP :	SMAX=	26.42	SMIN= 6.14	TMAX=	10.14	ANGLE= 10.4
BOTT:	SMAX=	-6.14	SMIN= -26.42	TMAX=	10.14	ANGLE= 10.4
128	1	-3.80	5.90	0.51	1.99	-0.38
			0.00	0.00	0.00	
TOP :	SMAX=	22.18	SMIN= 4.41	TMAX=	8.89	ANGLE= 13.6
BOTT:	SMAX=	-4.41	SMIN= -22.18	TMAX=	8.89	ANGLE= 13.6
129	1	-2.69	3.05	0.45	0.71	-0.31
			0.00	0.00	0.00	
TOP :	SMAX=	9.79	SMIN= 2.56	TMAX=	3.61	ANGLE= 33.6
BOTT:	SMAX=	-2.56	SMIN= -9.79	TMAX=	3.61	ANGLE= 33.6
130	1	0.35	-0.18	-0.11	-0.26	0.16
			0.00	0.00	0.00	
TOP :	SMAX=	-0.06	SMIN= -3.85	TMAX=	1.89	ANGLE= 31.9
BOTT:	SMAX=	3.85	SMIN= 0.06	TMAX=	1.89	ANGLE= 31.9

ELEMENT FORCES FORCE,LENGTH UNITS= KIP IN

FORCE OR STRESS = FORCE/WIDTH/THICK, MOMENT = FORCE-LENGTH/WIDTH

ELEMENT	LOAD	QX	QY FX	MX FY	MY FXY	MXY
131	1	0.28	0.12	-0.07	0.00	-0.09
			0.00	0.00	0.00	
TOP :	SMAX=	0.63	SMIN= -1.34	TMAX=	0.98	ANGLE= 33.6
BOTT:	SMAX=	1.34	SMIN= -0.63	TMAX=	0.98	ANGLE= 33.6
132	1	1.20	0.60	0.20	-0.13	-0.02
			0.00	0.00	0.00	
TOP :	SMAX=	2.17	SMIN= -1.39	TMAX=	1.78	ANGLE= -4.1
BOTT:	SMAX=	1.39	SMIN= -2.17	TMAX=	1.78	ANGLE= -4.1
133	1	3.72	3.58	-0.06	-0.57	-0.38
			0.00	0.00	0.00	
TOP :	SMAX=	1.60	SMIN= -8.27	TMAX=	4.93	ANGLE= -28.1
BOTT:	SMAX=	8.27	SMIN= -1.60	TMAX=	4.93	ANGLE= -28.1
134	1	2.29	3.67	-0.14	-0.58	-0.30
			0.00	0.00	0.00	
TOP :	SMAX=	0.09	SMIN= -7.86	TMAX=	3.98	ANGLE= -26.9
BOTT:	SMAX=	7.86	SMIN= -0.09	TMAX=	3.98	ANGLE= -26.9
135	1	2.96	4.54	-0.27	-0.85	-0.41
			0.00	0.00	0.00	
TOP :	SMAX=	-0.63	SMIN= -11.31	TMAX=	5.34	ANGLE= -27.2
BOTT:	SMAX=	11.31	SMIN= 0.63	TMAX=	5.34	ANGLE= -27.2
136	1	6.11	3.60	-0.14	-0.53	-1.05
			0.00	0.00	0.00	
TOP :	SMAX=	7.84	SMIN= -14.93	TMAX=	11.39	ANGLE= -39.7
BOTT:	SMAX=	14.93	SMIN= -7.84	TMAX=	11.39	ANGLE= -39.7
137	1	0.00	-1.60	1.74	0.51	0.00
			0.00	0.00	0.00	
TOP :	SMAX=	18.55	SMIN= 5.47	TMAX=	6.54	ANGLE= 0.0
BOTT:	SMAX=	-5.47	SMIN= -18.55	TMAX=	6.54	ANGLE= 0.0
138	1	-6.11	3.60	-0.14	-0.53	1.05
			0.00	0.00	0.00	
TOP :	SMAX=	7.84	SMIN= -14.93	TMAX=	11.39	ANGLE= 39.7
BOTT:	SMAX=	14.93	SMIN= -7.84	TMAX=	11.39	ANGLE= 39.7
139	1	-2.96	4.54	-0.27	-0.85	0.41
			0.00	0.00	0.00	
TOP :	SMAX=	-0.63	SMIN= -11.31	TMAX=	5.34	ANGLE= 27.2
BOTT:	SMAX=	11.31	SMIN= 0.63	TMAX=	5.34	ANGLE= 27.2
140	1	-2.29	3.67	-0.14	-0.58	0.30
			0.00	0.00	0.00	
TOP :	SMAX=	0.09	SMIN= -7.86	TMAX=	3.98	ANGLE= 26.9
BOTT:	SMAX=	7.86	SMIN= -0.09	TMAX=	3.98	ANGLE= 26.9

ELEMENT FORCES FORCE,LENGTH UNITS= KIP IN

FORCE OR STRESS = FORCE/WIDTH/THICK, MOMENT = FORCE-LENGTH/WIDTH

ELEMENT	LOAD	QX	QY FX	MX FY	MY FXY	MXY
141	1	-3.72	3.58 0.00	-0.06 0.00	-0.57 0.00	0.38
TOP :	SMAX=	1.60	SMIN=	-8.27	TMAX= 4.93	ANGLE= 28.1
BOTT:	SMAX=	8.27	SMIN=	-1.60	TMAX= 4.93	ANGLE= 28.1
142	1	-1.20	0.60 0.00	0.20 0.00	-0.13 0.00	0.02
TOP :	SMAX=	2.17	SMIN=	-1.39	TMAX= 1.78	ANGLE= 4.1
BOTT:	SMAX=	1.39	SMIN=	-2.17	TMAX= 1.78	ANGLE= 4.1
143	1	-0.28	0.12 0.00	-0.07 0.00	0.00 0.00	0.09
TOP :	SMAX=	0.63	SMIN=	-1.34	TMAX= 0.98	ANGLE= -33.6
BOTT:	SMAX=	1.34	SMIN=	-0.63	TMAX= 0.98	ANGLE= -33.6

**********END OF ELEMENT FORCES**********

78. PRINT DISPLACEMENTS

JOINT DISPLACEMENT (INCH RADIANS) STRUCTURE TYPE = SPACE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
1	1	0.00000	0.00000	0.00011	-0.00017	-0.00028	0.00000
2	1	0.00000	0.00000	0.00054	-0.00033	-0.00038	0.00000
3	1	0.00000	0.00000	0.00104	-0.00018	-0.00038	0.00000
4	1	0.00000	0.00000	0.00144	-0.00026	-0.00023	0.00000
5	1	0.00000	0.00000	0.00172	-0.00022	-0.00019	0.00000
6	1	0.00000	0.00000	0.00210	-0.00041	-0.00029	0.00000
7	1	0.00000	0.00000	0.00295	-0.00185	-0.00015	0.00000
8	1	0.00000	0.00000	0.00295	-0.00185	0.00015	0.00000
9	1	0.00000	0.00000	0.00210	-0.00041	0.00029	0.00000
10	1	0.00000	0.00000	0.00172	-0.00022	0.00019	0.00000
11	1	0.00000	0.00000	0.00144	-0.00026	0.00023	0.00000
12	1	0.00000	0.00000	0.00104	-0.00018	0.00038	0.00000
13	1	0.00000	0.00000	0.00054	-0.00033	0.00038	0.00000
14	1	0.00000	0.00000	0.00011	-0.00017	0.00028	0.00000
15	1	0.00000	0.00000	0.00004	-0.00014	-0.00030	0.00000
16	1	0.00000	0.00000	0.00038	-0.00037	-0.00039	0.00000
17	1	0.00000	0.00000	0.00088	0.00000	0.00000	0.00000
18	1	0.00000	0.00000	0.00124	0.00000	0.00000	0.00000
19	1	0.00000	0.00000	0.00151	0.00000	0.00000	0.00000
20	1	0.00000	0.00000	0.00178	0.00000	0.00000	0.00000
21	1	0.00000	0.00000	0.00214	-0.00181	-0.00016	0.00000
22	1	0.00000	0.00000	0.00214	-0.00181	0.00016	0.00000
23	1	0.00000	0.00000	0.00178	0.00000	0.00000	0.00000
24	1	0.00000	0.00000	0.00151	0.00000	0.00000	0.00000
25	1	0.00000	0.00000	0.00124	0.00000	0.00000	0.00000
26	1	0.00000	0.00000	0.00088	0.00000	0.00000	0.00000
27	1	0.00000	0.00000	0.00038	-0.00037	0.00039	0.00000
28	1	0.00000	0.00000	0.00004	-0.00014	0.00030	0.00000
29	1	0.00000	0.00000	-0.00005	-0.00010	-0.00020	0.00000
30	1	0.00000	0.00000	0.00019	-0.00024	-0.00026	0.00000
31	1	0.00000	0.00000	0.00048	-0.00048	-0.00028	0.00000
32	1	0.00000	0.00000	0.00066	-0.00063	-0.00026	0.00000
33	1	0.00000	0.00000	0.00084	-0.00077	-0.00018	0.00000
34	1	0.00000	0.00000	0.00093	-0.00089	-0.00014	0.00000
35	1	0.00000	0.00000	0.00104	-0.00102	-0.00001	0.00000
36	1	0.00000	0.00000	0.00104	-0.00102	0.00001	0.00000
37	1	0.00000	0.00000	0.00093	-0.00089	0.00014	0.00000
38	1	0.00000	0.00000	0.00084	-0.00077	0.00018	0.00000
39	1	0.00000	0.00000	0.00066	-0.00063	0.00026	0.00000
40	1	0.00000	0.00000	0.00048	-0.00048	0.00028	0.00000
41	1	0.00000	0.00000	0.00019	-0.00024	0.00026	0.00000
42	1	0.00000	0.00000	-0.00005	-0.00010	0.00020	0.00000
43	1	0.00000	0.00000	-0.00006	-0.00002	-0.00008	0.00000
44	1	0.00000	0.00000	0.00002	-0.00011	-0.00009	0.00000
45	1	0.00000	0.00000	0.00009	-0.00027	-0.00007	0.00000
46	1	0.00000	0.00000	0.00014	-0.00038	-0.00007	0.00000
47	1	0.00000	0.00000	0.00020	-0.00044	-0.00007	0.00000
48	1	0.00000	0.00000	0.00030	-0.00045	-0.00015	0.00000

JOINT DISPLACEMENT (INCH RADIANS) STRUCTURE TYPE = SPACE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
49	1	0.00000	0.00000	0.00050	0.00000	0.00000	0.00000
50	1	0.00000	0.00000	0.00050	0.00000	0.00000	0.00000
51	1	0.00000	0.00000	0.00030	-0.00045	0.00015	0.00000
52	1	0.00000	0.00000	0.00020	-0.00044	0.00007	0.00000
53	1	0.00000	0.00000	0.00014	-0.00038	0.00007	0.00000
54	1	0.00000	0.00000	0.00009	-0.00027	0.00007	0.00000
55	1	0.00000	0.00000	0.00002	-0.00011	0.00009	0.00000
56	1	0.00000	0.00000	-0.00006	-0.00002	0.00008	0.00000
57	1	0.00000	0.00000	-0.00004	0.00000	-0.00001	0.00000
58	1	0.00000	0.00000	-0.00003	-0.00003	-0.00001	0.00000
59	1	0.00000	0.00000	-0.00004	-0.00008	0.00000	0.00000
60	1	0.00000	0.00000	-0.00004	-0.00011	0.00000	0.00000
61	1	0.00000	0.00000	-0.00002	-0.00012	-0.00008	0.00000
62	1	0.00000	0.00000	0.00014	-0.00010	-0.00023	0.00000
63	1	0.00000	0.00000	0.00040	0.00000	0.00000	0.00000
64	1	0.00000	0.00000	0.00040	0.00000	0.00000	0.00000
65	1	0.00000	0.00000	0.00014	-0.00010	0.00023	0.00000
66	1	0.00000	0.00000	-0.00002	-0.00012	0.00008	0.00000
67	1	0.00000	0.00000	-0.00004	-0.00011	0.00000	0.00000
68	1	0.00000	0.00000	-0.00004	-0.00008	0.00000	0.00000
69	1	0.00000	0.00000	-0.00003	-0.00003	0.00001	0.00000
70	1	0.00000	0.00000	-0.00004	0.00000	0.00001	0.00000
71	1	0.00000	0.00000	-0.00004	-0.00001	0.00001	0.00000
72	1	0.00000	0.00000	-0.00005	-0.00001	0.00001	0.00000
73	1	0.00000	0.00000	-0.00006	0.00000	0.00002	0.00000
74	1	0.00000	0.00000	-0.00008	0.00000	0.00001	0.00000
75	1	0.00000	0.00000	-0.00006	-0.00001	-0.00008	0.00000
76	1	0.00000	0.00000	0.00010	-0.00002	-0.00024	0.00000
77	1	0.00000	0.00000	0.00036	0.00000	0.00000	0.00000
78	1	0.00000	0.00000	0.00036	0.00000	0.00000	0.00000
79	1	0.00000	0.00000	0.00010	-0.00002	0.00024	0.00000
80	1	0.00000	0.00000	-0.00006	-0.00001	0.00008	0.00000
81	1	0.00000	0.00000	-0.00008	0.00000	-0.00001	0.00000
82	1	0.00000	0.00000	-0.00006	0.00000	-0.00002	0.00000
83	1	0.00000	0.00000	-0.00005	-0.00001	-0.00001	0.00000
84	1	0.00000	0.00000	-0.00004	-0.00001	-0.00001	0.00000
85	1	0.00000	0.00000	-0.00007	-0.00001	-0.00002	0.00000
86	1	0.00000	0.00000	-0.00004	0.00004	-0.00002	0.00000
87	1	0.00000	0.00000	-0.00004	0.00011	0.00000	0.00000
88	1	0.00000	0.00000	-0.00004	0.00015	-0.00001	0.00000
89	1	0.00000	0.00000	-0.00002	0.00017	-0.00007	0.00000
90	1	0.00000	0.00000	0.00011	0.00015	-0.00020	0.00000
91	1	0.00000	0.00000	0.00034	0.00000	0.00000	0.00000
92	1	0.00000	0.00000	0.00034	0.00000	0.00000	0.00000
93	1	0.00000	0.00000	0.00011	0.00015	0.00020	0.00000
94	1	0.00000	0.00000	-0.00002	0.00017	0.00007	0.00000
95	1	0.00000	0.00000	-0.00004	0.00015	0.00001	0.00000
96	1	0.00000	0.00000	-0.00004	0.00011	0.00000	0.00000

JOINT DISPLACEMENT (INCH RADIANS) STRUCTURE TYPE = SPACE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
97	1	0.00000	0.00000	-0.00004	0.00004	0.00002	0.00000
98	1	0.00000	0.00000	-0.00007	-0.00001	0.00002	0.00000
99	1	0.00000	0.00000	-0.00009	0.00007	-0.00013	0.00000
100	1	0.00000	0.00000	0.00004	0.00019	-0.00013	0.00000
101	1	0.00000	0.00000	0.00015	0.00040	-0.00011	0.00000
102	1	0.00000	0.00000	0.00022	0.00054	-0.00010	0.00000
103	1	0.00000	0.00000	0.00030	0.00066	-0.00009	0.00000
104	1	0.00000	0.00000	0.00039	0.00067	-0.00014	0.00000
105	1	0.00000	0.00000	0.00059	0.00062	-0.00006	0.00000
106	1	0.00000	0.00000	0.00059	0.00062	0.00006	0.00000
107	1	0.00000	0.00000	0.00039	0.00067	0.00014	0.00000
108	1	0.00000	0.00000	0.00030	0.00066	0.00009	0.00000
109	1	0.00000	0.00000	0.00022	0.00054	0.00010	0.00000
110	1	0.00000	0.00000	0.00015	0.00040	0.00011	0.00000
111	1	0.00000	0.00000	0.00004	0.00019	0.00013	0.00000
112	1	0.00000	0.00000	-0.00009	0.00007	0.00013	0.00000
113	1	0.00000	0.00000	-0.00002	0.00027	-0.00033	0.00000
114	1	0.00000	0.00000	0.00032	0.00043	-0.00036	0.00000
115	1	0.00000	0.00000	0.00072	0.00070	-0.00032	0.00000
116	1	0.00000	0.00000	0.00098	0.00088	-0.00032	0.00000
117	1	0.00000	0.00000	0.00123	0.00109	-0.00023	0.00000
118	1	0.00000	0.00000	0.00140	0.00129	-0.00018	0.00000
119	1	0.00000	0.00000	0.00151	0.00156	0.00001	0.00000
120	1	0.00000	0.00000	0.00151	0.00156	-0.00001	0.00000
121	1	0.00000	0.00000	0.00140	0.00129	0.00018	0.00000
122	1	0.00000	0.00000	0.00123	0.00109	0.00023	0.00000
123	1	0.00000	0.00000	0.00098	0.00088	0.00032	0.00000
124	1	0.00000	0.00000	0.00072	0.00070	0.00032	0.00000
125	1	0.00000	0.00000	0.00032	0.00043	0.00036	0.00000
126	1	0.00000	0.00000	-0.00002	0.00027	0.00033	0.00000
127	1	0.00000	0.00000	0.00010	0.00036	-0.00040	0.00000
128	1	0.00000	0.00000	0.00055	0.00056	-0.00044	0.00000
129	1	0.00000	0.00000	0.00114	0.00051	-0.00033	0.00000
130	1	0.00000	0.00000	0.00151	0.00064	-0.00031	0.00000
131	1	0.00000	0.00000	0.00188	0.00076	-0.00025	0.00000
132	1	0.00000	0.00000	0.00219	0.00103	-0.00027	0.00000
133	1	0.00000	0.00000	0.00236	0.00210	-0.00010	0.00000
134	1	0.00000	0.00000	0.00236	0.00210	0.00010	0.00000
135	1	0.00000	0.00000	0.00219	0.00103	0.00027	0.00000
136	1	0.00000	0.00000	0.00188	0.00076	0.00025	0.00000
137	1	0.00000	0.00000	0.00151	0.00064	0.00031	0.00000
138	1	0.00000	0.00000	0.00114	0.00051	0.00033	0.00000
139	1	0.00000	0.00000	0.00055	0.00056	0.00044	0.00000
140	1	0.00000	0.00000	0.00010	0.00036	0.00040	0.00000
141	1	0.00000	0.00000	0.00024	0.00036	-0.00044	0.00000
142	1	0.00000	0.00000	0.00072	0.00070	-0.00049	0.00000
143	1	0.00000	0.00000	0.00135	0.00000	0.00000	0.00000
144	1	0.00000	0.00000	0.00182	0.00000	0.00000	0.00000

JOINT DISPLACEMENT (INCH RADIANS) STRUCTURE TYPE = SPACE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
145	1	0.00000	0.00000	0.00222	0.00000	0.00000	0.00000
146	1	0.00000	0.00000	0.00269	0.00000	0.00000	0.00000
147	1	0.00000	0.00000	0.00317	0.00256	-0.00032	0.00000
148	1	0.00000	0.00000	0.00317	0.00256	0.00032	0.00000
149	1	0.00000	0.00000	0.00269	0.00000	0.00000	0.00000
150	1	0.00000	0.00000	0.00222	0.00000	0.00000	0.00000
151	1	0.00000	0.00000	0.00182	0.00000	0.00000	0.00000
152	1	0.00000	0.00000	0.00135	0.00000	0.00000	0.00000
153	1	0.00000	0.00000	0.00072	0.00070	0.00049	0.00000
154	1	0.00000	0.00000	0.00024	0.00036	0.00044	0.00000
155	1	0.00000	0.00000	0.00042	0.00041	-0.00039	0.00000
156	1	0.00000	0.00000	0.00102	0.00063	-0.00050	0.00000
157	1	0.00000	0.00000	0.00154	0.00022	-0.00047	0.00000
158	1	0.00000	0.00000	0.00201	0.00025	-0.00033	0.00000
159	1	0.00000	0.00000	0.00243	0.00021	-0.00033	0.00000
160	1	0.00000	0.00000	0.00302	0.00045	-0.00044	0.00000
161	1	0.00000	0.00000	0.00423	0.00253	-0.00014	0.00000
162	1	0.00000	0.00000	0.00423	0.00253	0.00014	0.00000
163	1	0.00000	0.00000	0.00302	0.00045	0.00044	0.00000
164	1	0.00000	0.00000	0.00243	0.00021	0.00033	0.00000
165	1	0.00000	0.00000	0.00201	0.00025	0.00033	0.00000
166	1	0.00000	0.00000	0.00154	0.00022	0.00047	0.00000
167	1	0.00000	0.00000	0.00102	0.00063	0.00050	0.00000
168	1	0.00000	0.00000	0.00042	0.00041	0.00039	0.00000

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

79. PLOT STRESS FILE
80. PLOT DISPLACEMENT FILE
81. PLOT SECTION FILE
82. FINISH

********** END OF STAAD-III **********

DATE= JUN 21,1996 TIME= 15: 5:33 ******

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*       For questions on STAAD-III/ISDS, contact:            *
*       RESEARCH ENGINEERS, Inc at (714) 974-2500            *
*       Telex:  4994385      Fax:  (714) 974-4771            *
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