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 50-362 San Onofre Nuclear Station, Unit 3, Southern California 05000362
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 DIETCH, R. Southern California Edison Co.
 RECIP. NAME RECIPIENT AFFILIATION
 EISENHUT, D.G. Division of Licensing

SUBJECT: Forwards legible copies of certain pages from 51 potential finding repts, in response to 820209 request. Repts originally transmitted on 820129, 0204 & 05.

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	LIC BR #3 LA	1 0	ROOD, H.	01 1 1		ROOD, H.	01 1 1					
INTERNAL:	ELD	1 0	IE	06 3 3	INTERNAL:	IE	06 3 3	INTERNAL:	IE			
	IE/DEP/EPDB 35	1 1	IE/DEP/EPLB 36	3 3		IE/DEP/EPLB 36	3 3					
	MPA	1 0	NRR/DE/CEB 11	1 1		NRR/DE/CEB 11	1 1					
	NRR/DE/eqb 13	3 3	NRR/DE/GB 28	2 2		NRR/DE/GB 28	2 2					
	NRR/DE/HGEB 30	2 2	NRR/DE/MEB 18	1 1		NRR/DE/MEB 18	1 1					
	NRR/DE/MTEB 17	1 1	NRR/DE/QAB 21	1 1		NRR/DE/QAB 21	1 1					
	NRR/DE/SAB 24	1 1	NRR/DE/SEB 25	1 1		NRR/DE/SEB 25	1 1					
	NRR/DHFS/HFEB40	1 1	NRR/DHFS/LQB 32	1 1		NRR/DHFS/LQB 32	1 1					
	NRR/DHFS/OLB 34	1 1	NRR/DHFS/PTRB20	1 1		NRR/DHFS/PTRB20	1 1					
	NRR/DSI/AEB 26	1 1	NRR/DSI/ASB 27	1 1		NRR/DSI/ASB 27	1 1					
	NRR/DSI/CPB 10	1 1	NRR/DSI/CSB 09	1 1		NRR/DSI/CSB 09	1 1					
	NRR/DSI/ETSB 12	1 1	NRR/DSI/ICSB 16	1 1		NRR/DSI/ICSB 16	1 1					
	NRR/DSI/PSB 19	1 1	NRR/DSI/RAB 22	1 1		NRR/DSI/RAB 22	1 1					
	NRR/DSI/RSB 23	1 1	NRR/DST/LGB 33	1 1		NRR/DST/LGB 33	1 1					
	REG FILE 04	1 1										
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		FEMA-REP DIV 39	1 1	LPDR 03		1 1			LPDR 03	1 1		
NRC PDR 02		1 1	NSIC 05	1 1	NSIC 05	1 1						
NTIS		1 1										

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Southern California Edison Company

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ROSEMEAD, CALIFORNIA 91770

ROBERT DIETCH
VICE PRESIDENT

February 19, 1982

TELEPHONE
213-572-4144

SCE

Director, Office of Nuclear Reactor Regulation
Attention: Mr. Darrell G. Eisenhut, Director
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555



Gentlemen:

Subject: Docket 50-361 and 50-362
San Onofre Nuclear Generating Station
Units 2 and 3

With letters dated January 29, February 4 and February 5, 1982, we transmitted to you 51 Potential Finding Reports (PFRs) which were fully processed by General Atomic.

During the review of the PFRs with your staff on February 9, 1982, Mr. Lipinsky requested more legible copies of certain pages from the referenced transmittals and further clarification on some of the PFRs.

Enclosed are documents that respond to the specific action items on the respective PFRs.

To obtain more legible copies of certain documents took longer than we anticipated. I hope this has not inconvenienced you.

If you need further information on any of these items, please advise.

Very truly yours,

Robert Dietch

Enclosures

cc: NRC Region V, R. H. Engelken (w encl)
ETECH, H. R. Fleck (w encl)
NRC, Division of Licensing, H. Rood (w encl)

Boo!
s
1/1

8202230156 820219
PDR ADOCK 05000361
PDR

2408-PFR-0009

Request: Provide more legible copy of BPC calculation sheet (lower right hand corner).

Response: More legible copy attached.

CALCULATION SHEET

PFR-0009

CALC. NO. C270-01-E

SIGNATURE J.M. Murphy DATE 8-20-75

CHECKED T. Housh DATE 11-8-76

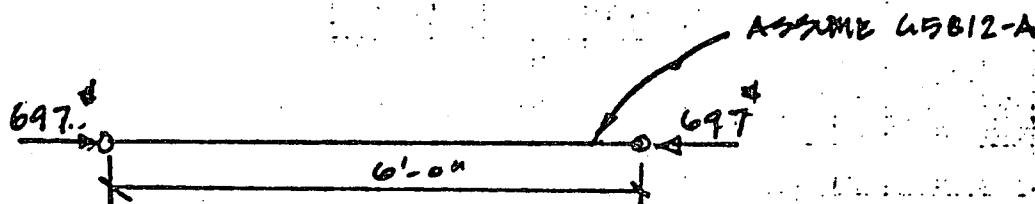
PROJECT SONGS #2 & #3

JOB NO. 10079-003

SUBJECT SEISMIC CLASS I CABLE TRAY SUPPORTS

SHEET 364 OF 371 SHEETS

CHECK LOADING TO LONGITUDINAL BRACING.
@ PT. B. TWO BRACES EFFECTIVE. ASSUME
COMPRESSION. MAX. LENGTH APPROX. 6'



$$\frac{KL}{r_y} = \frac{(1.0)(6')12}{0.59"} = 122.0 < 200 \text{ O.K.}$$

$$F_a = 0.522 F_y - \left(\frac{F_y \times KL/r_y}{1494} \right)$$

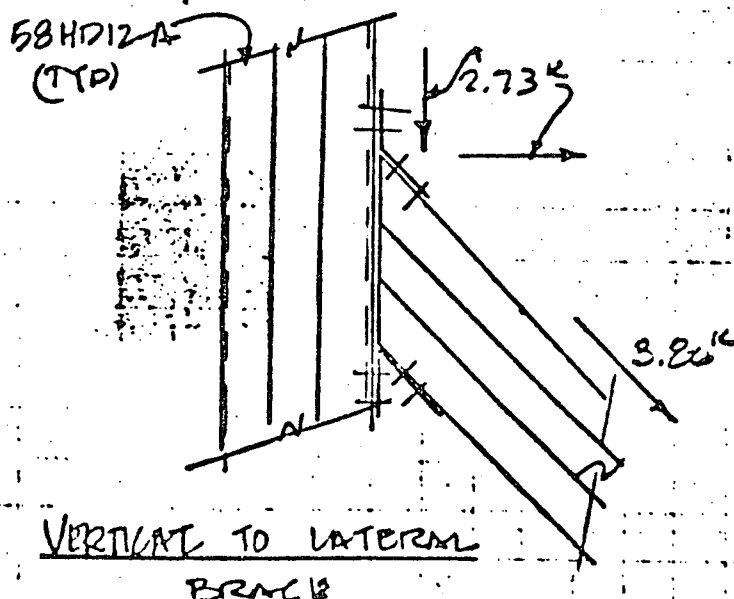
$$= 0.522 \times 33 - \left(\frac{33 \times 122}{1494} \right)$$

$$= 9.96 \text{ ksi}$$

$$f_a = \frac{697}{1.04 \text{ in}^2} = 670 \text{ psi} < 9,960 \text{ psi O.K.}$$

USE 45B12-A FOR LONGITUDINAL BRACING.

CHECK CONNECTIONS



SLIP RESISTANCE

$$45B12 \text{ W/ } 1/2" \phi \text{ BOLT} = 1121 \text{ #/BOLT} \times 1.33$$

$$= 1491 \text{ #/BOLT}$$

$$\frac{3860}{1491 \text{ #/BOLT}} = 2.59 = 3 - \text{BOLT OK}$$

BY INSPECTION VERTICAL AND
HORIZ. LOADS OK. FOR
CONNECTION.

FLOOR CONNECTION SIMILAR.

$$\text{PULL-OUT C13B12} = 2474 \text{ #} \times 1.33$$

$$\text{IN ANY 12" LENGTH. } 3,290 \text{ #}$$

$$3,290 \text{ #} > \text{ # OK}$$

2408-PFR-0013

For clarification of the mass distribution at nodes 10, 2 and 3 the following tabulation is submitted:

Node No.		<u>H</u>	<u>V</u>	
10		11002	6073	(See encircled mass values in sheet 10 of enclosure)
2	$26056/2 =$	13028	9317	
3		13028	9317	
		<u>37058k</u>	<u>24707k</u>	

Summation of masses at nodes 10, 2 and 3 (vertical weighed array) = $24707 \pm 2/3 (37058) = 24705k.$

2408-PFR-0039

Request: Define what additional information was reviewed in 1 and 2.

Response: Additional information related to the concrete expansion anchor design, installation, and testing were obtained from Bechtel. This information was given in the following two references:

- (1) Bechtel Specification No. CS-C8, Rev. 10, May 20, 1981
- Design, Installation, and Testing of Concrete Expansion Anchors.
- (2) Bechtel Interoffice Memorandum from A. J. Arnold to W. G. Gordon, "Expansion Anchor Stiffness Properties," May 5, 1980, Calc. No. C258-7.04, sheet 201 of 204.

Request: Why the heavier Section ($I=21.9 \text{ in}^4$) replaced the ($I=17.3 \text{ in}^4$)?

Response: The moment of inertia, I_B , used in sheets 24 and 27, Calc. No. C258-10.05, considers the lightest section for 12"x4" tube series, that is 12"x4"x3/16" with $I_B=17.3 \text{ in}^4$. However, the final design uses a heavier section with 12"x4"x1/4" tube section ($I_B=21.9 \text{ in}^4$). This is to give an additional conservatism in the natural frequency calculation. (For explanation see Bechtel memorandum from H. Nazarian to J. Hempe, "Item No. 7, TPT Review of I&C Equipment Field Mounting Design", January 19, 1982.)

2408-PFR-0040

Request: Why maximum load on calc. sheet 21 is 200 lbs, but sheet 23 calls for 125 lbs?

Response: The 200 lb maximum load (seismic acceleration of 2.5 g horizontal and 1.5 g vertical) shown on calculation sheet 21 is the load used to obtain the 3/4" ϕ concrete expansion anchors at full embedment depth of 3-1/2". However, as an alternative to 3/4" ϕ concrete anchor at full embedment, this maximum load can be reduced to 125 lbs (seismic acceleration of 2.0 g horizontal and vertical) if the minimum embedment depth is 3" (see note on sheet 15 of drawing number 56275 in calculation file).

Request: Why 2.5 g - page 21 and 2.0 g in page 23?

Response: The 2.5 g specified in page 21 applies to design of floor mounting stand located in the containment building, whereas the 2.0 g specified on page 23 applies to design of floor mounting stand in the safety equipment building.

2408-PFR-0042

Request: For S2-51-002-H-020, Item 1, what is the basis for accepting the change welding the base plate to the wall as better?

Response: A more accurate statement which should have been made here is:

"The addition of the weld would at least not degrade the structural capability of the connection and could even improve it."

Request: Copy of construction spec and drawing to clarify S2-SI-004-H-013.

Response: The applicable construction spec. is Section 5.4.5 of CS-P207. This section and the drawing clarification are attached.

5.4 Structural

5.4.1 Deviation from specified member sizes shall be acceptable, provided that the substituted member thickness or section modulus is increased. A decrease in section properties is not acceptable.

5.4.2 Deviation from specified loaded lengths of the structural steel members shall be acceptable if the lengths are reduced. Structural steel members may be lengthened up to a maximum of 15 percent or 2 inch whichever is the lesser, of the design length.

5.4.3 Angle irons may be rotated such that the function of the member remains the same.

5.4.4 Additional plates may be used to strengthen an anchor plate after relocation of a concrete fastener. The only size plate used which need not be shown on the drawing is 1-1/2 x 1-1/2" x anchor plate thickness with a 1/4 inch weld all-around.

5.4.5 Structural steel members welded to insert plates or anchor plates may deviate from the specified location on the insert plate provided that the center of gravity of the member falls within the allowable load area of the insert as specified in Drawing 20010.

5.4.6 Pipe supports in which a requirement for rockbolts or concrete fasteners have been eliminated need not have the holes plugged in the anchor plate. Holes also need not be plugged which are not a drawing requirement but which are required in the grouting of rockbolts.

5.4.7 Grout and/or an expansive epoxy filler is required for anchor plates mounted to walls, ceiling or Q-decking where a gap 1/8 inch exists for more than 20 percent of the anchor plate area.

5.4.8 Field supplied vertical angles attached to structural steel and used as transverse restraints only may be longer than that specified on the drawing provided the angles do not interfere with other pipe, components or structures.

5.4.9 Oversized baseplates to walls, ceilings or floors may be field trimmed as long as minimum dimensions of the drawing or applicable specifications are not violated.

5.4.10 Bolting for pipe support structural steel joints shall be ASTM A-307 except as follows:

1. Connections with slotted or oversized holes not specified on the drawing where the slot or hole oversizing is in loaded direction shall be ASTM A-325 bolts.

Connections using ASTM A-325 bolts shall be made in accordance with AISC "Specification for Structural Joints using ASTM A-325 or A-490 Bolts," Construction Specification CS-C5 and this specification.

2. Connections described in (1) above, may be welded instead of bolted provided the original support configuration is maintained. Weld size and length shall be as shown in Table II. See Figure 6 for example.
3. When drawing requirements specify otherwise, only one end of structural steel spans with slotted bolt holes having loads in direction of slots need be connected as in (1) or (2) above.

TABLE II - WELD SIZE AND LENGTHS FOR
STRUCTURAL STEEL JOINTS

Nominal Bolt Diameter	Number of Bolts	Weld Linear Length	Size
5/8"	1	3	1/4
	2	5-1/2"	1/4
	3	8"	1/4
	4	10-1/2"	1/4
3/4"	1	4"	1/4
	2	7-1/2"	1/4
	3	9"	5/16
	4	12"	5/16
1"	1	5-1/2"	5/16
	2	11"	5/16
	3	13-1/2"	3/8
	4	17-1/2"	3/8

5.4.11 Bolt size may be increased within AISC limitations.

5.4.12 Open ends of structural tubing shall be capped as in Figure 7, Details a and b, in lieu of details shown on pipe support drawings. Cap plates shall be installed in all areas and need not be shown on pipe support drawings.

5.4.12.1 A partial penetration square groove weld with 1/8 inch weld penetration may be used in place of the full penetration square groove weld called for in Figure 7, Detail C.

5.4.12.2 Cap plates shall be purchased as Quality Class II material, but installation is Quality Class IV. Seismic class is not applicable.

5.4.13 Drilling of weep holes shown on drawings for structural tubing inside the containment shall be optional. If weep holes are determined necessary during the welding process, then structural tubing shall be provided with one weep hole of 1/4 inch in diameter. Existing weep holes ranging in size from 1/8 to 1/2 inch are permissible and need not be 1/4 inch.

5.14.13.1 Holes shall be located on or near the lower side of the member or end cap. See Figure 7.

5.14.13.2 Floor mounted vertical members shall have the hole drilled on one side as low as practical on the tube steel.

5.4.14 Structural tubing outside the containment may have weep holes (or vent holes) per the same location and dimensions as in the containment to facilitate welding.

5.4.15 Structural steel may be radiused when it is outside of the load bearing area of that member to eliminate sharp edges. In addition, edges may be "broken" or chamfered up to 1/32 inch under any loading application.

5.5 Structural Welding

Field welding of the structural portion of pipe supports shall be in accordance with this specification, the applicable sections of Construction Specification CS-C16 and AISC standards. Table I is duplicated from AISC and shall be used whenever member sizes are substituted necessitating weld increases.

5.5.1 An additional weld may be made to facilitate installation provided the movement of the piping system is not impaired.

5.5.2 A weld may be relocated to the opposite side of a structural member provided:

- a. The transverse relocation of the weld is not greater than 1/2 inch.
- b. Movement of the piping system is not impaired.
- c. The length of the weld (except where reduced by structural limitations) and the size of the weld is not less than specified on the drawing.

5.5.3 Pipe support drawings for Quality Classes III and IV, non-Code, need not be revised to show a field weld in place of a shop weld.

2408-PFR-0057

A more clear and legible copy of the computer input sheet attached to the original PFR response is enclosed (sheet 1).

ADDSTF K50 K48 79 00
 DELETE KM
 REMARK
 FORM VERTICAL SOIL SPRINGS FOR ONE
 TRUSSE KV
 0.0 100.0 3970.0 31057.94
 DUPL KV KV1
 SCALE KV1 0.237
 ADDSTF K50 KV1 2
 57 1 79 80
 DUPL KV KV4
 SCALE KV4 0.104
 ADDSTF K50 KV4 3
 2 3 79 80
 ADDSTF K50 KV4 2
 2 5 79 80
 DUPL KV KV6
 SCALE KV6 0.128
 ADDSTF K50 KV6 3
 6 7 79 80
 ADDSTF K50 KV6 2
 9 16 79 80
 DUPL KV KV8
 SCALE KV8 0.8699
 ADDSTF K50 KV8 3
 12 13 79 80
 ADDSTF K50 KV8 2
 12 15 79 80
 DELETE KV
 REMARK
 FORM COIL SPRING AT NODE 1 FOR ONE
 LOAD KR(1F12.0) 1 1
 1.589E9
 PRINT KR
 STOSH K50 KR 50 50
 DELETE KR
 RENTND 2
 WRITE K50 2
 DELETE K50
 CENSUS
 REMARK 2
 FORM GLOBAL STIFFNESS MATRIX AND GLOBAL CONSISTENT MASS MATRIX
 FOR *BASE ONLY
 ZERO KST 00 00
 ZERO KST 00 00
 GENTCE K0201 M0201
 4.770 0.0 0.0 0.22 1260.0 1260.0
 639800.0 1512.0 10205.0 10205.0 1.0 0.0
 0.00812
 ADDSTF K51 K0201 3
 57 59 57 1 59
 ADDSTF K51 M0201 3
 57 59 57 1 59
 ADDSTF K51 K0201 2
 57 1 57 57 60 5
 ADDSTF K51 M0201 2
 57 1 57 57 60 5
 GENTCE K0402 M0402
 27.607 0.0 0.0 0.22 1260.0 1260.0
 639800.0 1512.0 10205.0 10205.0 1.0 0.0
 0.00792
 ADDSTF K51 K0402 3
 2 3 57 59 59
 ADDSTF K51 M0402 3
 2 3 57 59 59

MAY23 65
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 MAY23 70
 OBE 9
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 MAY23 128
 MAY23 129
 MAY23 130

Re submittal (for
 legibility) of computer
 input sheet attached to
 the original response to
 PFR-0057.

Enclosure (1)
 for Supplementary
 Response to
 PFRs - 0013, -0057 & -0058
 sheet 1 of 10

DUPL KV YEV
 INVERT IEV
 MULT DUHM IEV ALPHA
 DELETE IEV

MAY23 1282
 MAY23 1291
 MAY23 1294



CALCULATION SHEET

BECHTEL CORPORATION
15000 IMPERIAL HWY.
NORWALK, CALIFORNIA

Sheet 10 of 10

SIGNATURE S. BORNZ DATE 6/16/72 CHECKED R. Kane DATE 12/15/72
 PROJECT SONGS UNITS 2 & 3 JOB NO. 1304-750
 SUBJECT 150' CONTAINMENT STICK MODEL SHEET 10-E OF 16-E SHEETS

TABULATION OF NODAL MASSES (KIPS) TO BE CONSIDERED AS THE WEIGHTING ARRAY FOR THE HORIZONTAL AND VERTICAL EARTHQUAKE EXCITATION.

TOTAL WEIGHT = 150,874 K

VERTICAL MASSES = 2/3 OF HORIZONTAL MASSES IN ORDER TO SCALE THE VERTICAL E.Q. AS 2/3 OF THE HORIZONTAL. ROTATIONAL MASSES IGNORED.

D.O.F. No	Node No & Direction	Hor V or R	Mass (K)	D.O.F. No	Node No & Direction	Hor V or R	Mass (K)
1	X ₁	H	16008	26	0 ₁₀	R	0
2	Y ₁	V	10672	27	X ₁₁	H	3192
3	0 ₁	R	0	28	Y ₁₁	V	2128
4	X ₂ , X ₃	H	26056	29	0 ₁₁	R	0
5	Y ₂	V	9317	30	X ₁₂	H	7524
6	0 ₁ , 0 ₂	R	0	31	Y ₁₂	V	5016
7	Y ₃	V	9317	32	0 ₁₂	R	0
8	X ₄	H	8161	33	X ₁₃	H	7488
9	Y ₄	V	5441	34	Y ₁₃	V	4992
10	0 ₄	R	0	35	0 ₁₃	R	0
11	X ₅	H	8161	36	X ₁₄	H	7488
12	Y ₅	V	5441	37	Y ₁₄	V	4992
13	0 ₅	R	0	38	0 ₁₄	R	0
14	X ₆ , X ₇	H	81620	39	X ₁₅	H	8303
15	Y ₆	V	2873	40	Y ₁₅	V	5535
16	0 ₆ , 0 ₇	R	0	41	0 ₁₅	R	0
17	Y ₇	V	2873	42	X ₁₆	H	8153
18	X ₈	H	9961	43	Y ₁₆	V	5435
19	Y ₈	V	6641	44	0 ₁₆	R	0
20	0 ₈	R	0	45	X ₁₇	H	9362
21	X ₉	H	11,395	46	Y ₁₇	V	6241
22	Y ₉	V	7,597	47	0 ₁₇	R	0
23	0 ₉	R	0	48	X ₁₈	H	0
24	X ₁₀	H	11,002	49	Y ₁₈	V	0
25	Y ₁₀	V	6073	50	0 ₁₈	R	0
				51	DUMMY		1

2408-PFR-0058

A more clear and legible copy of the computer input sheet attached to the original PFR response is enclosed (sheet 2).

The corresponding printout from computer run with the given input is also enclosed (sheets 3 & 4). It is evident that the correct numerical values for I_y and I_z , as entered in input, were processed, as shown in printout.

It is reiterated that the tabulation of Figure A-~~5~~⁶ should have read " I_y or I_z " as the heading for the " I_y " column. Four element entries with $I_y = I_z = 2,340,000$ are shown in the table because the "subelement" 10A-10 was included in the table for clarity and consistency with the schematic representation of the model. Mathematically, however, the subelement 10A-10 is not included, therefore in the input only the three elements 10-11, 11-12 and 12-13 are included as shown in the listing of input (sheet 2).

The geometry, section properties and orientation of the general tridimensional element, GENTDE, as used in the SUPERSMIS computer program, are uniquely specified by the input format defined in the User's Manual pages 2-14 through 2-17. Copies of these pages are enclosed as sheets 5 through 9.

MULT	DUM	TEE	M0010						
PRINT	M0010								
ADDSTF	KST	M0010		2					
ADDSTF	KST	M0010		2		16	60	17	
ADDSTF	KST	M0010		2		16	60	17	
STOQW	TEE	TO		2					
DUPL	M0010	HRAR							
SCALE	M0010								
DUPL	M0010	HRAR				0.136			
SCALE	M0010					0.136			
TRANS	TEE	TYEE							
MULT	TYEE	HRAR	DUM						
MULT	DUM	TEE	M0010						
MULT	TYEE	HRAR	DUM						
MULT	DUM	TEE	M0010						
ADDSTF	KST	M0010		2					
ADDSTF	KST	M0010		2		16	60	17	
ADDSTF	KST	M0010		2		16	60	17	
SCALE	TA								
STOQW	TEE	TO		2					
TRANS	TEE	TYEE							
MULT	TYEE	HRAR	DUM						
MULT	DUM	TEE	M0010						
MULT	TYEE	HRAR	DUM						
MULT	DUM	TEE	M0010						
ADDSTF	KST	M0010		2					
ADDSTF	KST	M0010		2		16	60	17	
ADDSTF	KST	M0010		2		16	60	17	
GENTRN	M1011	M1011				16	60	17	
0.0	2.125	0.0	0.22			1132.0		1132.0	
0.00574	2021.0	0.0	2340000.0			1.0		0.0	
ADDSTF	KST	M1011		2					
ADDSTF	KST	M1011		2		16	19	20	
ADDSTF	KST	M1011		2		16	19	20	
GENTRN	M1112	M1112				16	19	20	
0.0	10.177	0.0	0.22			1132.0		1132.0	
0.00574	2021.0	0.0	2340000.0			1.0		0.0	
ADDSTF	KST	M1112		2					
ADDSTF	KST	M1112		2		21	22	23	
ADDSTF	KST	M1112		2		21	22	23	
GENTRN	M1213	M1213				21	22	23	
0.0	6.023	0.0	0.22			1132.0		1132.0	
0.00574	2021.0	0.0	2340000.0			1.0		0.0	
ADDSTF	KST	M1213		2					
ADDSTF	KST	M1213		2		24	25	26	
ADDSTF	KST	M1213		2		24	25	26	
GENTRN	M1314	M1314				24	25	26	
0.0	5.075	0.0	0.22			1160.0		1160.0	
0.00574	2117.0	0.0	2242000.0			1.0		0.0	
ADDSTF	KST	M1314		2					
ADDSTF	KST	M1314		2		27	28	29	
ADDSTF	KST	M1314		2		27	28	29	
GENTRN	M1415	M1415				27	28	29	
0.0	12.025	0.0	0.22			1160.0		1160.0	
0.00574	2117.0	0.0	2242000.0			1.0		0.0	

JUN13 266
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Resubmittal (for
legibility) of computer
input sheet attached to
the original response to
PFR-0058

Listing of
Input for
SUPERSMIS
computer program.

DELETE TEST
MULT YTF1 ALPHA DIST
DELETE STP;
TRANS DIST TRIST
ADD DIST TRIST
DELETE TRIST

JUN13 1183
JUN13 1184
JUN13 1184
JUN13 1184
JUN13 1184
JUN13 1187

```

MULT DUM TEE M0610
MULT TTEE M0610 DUM
MULT DUM TEE M0610
ADDSTF MST M0610
  -0  0  10  11  -0  -0  -0  10  00  17  -0  -0
ADDSTF MST M0610
  -0  0  10  11  -0  -0  -0  10  00  17  -0  -0
SENTRY K1011 M1011
  1P ROWS.  12 COLUMNS
  LA= 0.000000, LV= 7.125000, LZ= 0.000000, L= 2.125000
  A= 2021.000000, Av= 1132.000000, Az= 1132.000000, TMEY= 0.0000
  E= 0.3580E+05, U= .220, I= 2.3400E+06, I2= 2.3400E+06
  J= 1.0000E+00
  RW0= .0057500
ADDSTF MST K1011
  -0  10  00  17  -0  -0  -0  10  10  20  -0  -0
ADDSTF MST K1011
  -0  10  00  17  -0  -0  -0  10  10  20  -0  -0
SENTRY K1112 M1112
  1P ROWS.  12 COLUMNS
  LA= 0.000000, LV= 10.177000, LZ= 0.000000, L= 10.177000
  A= 2021.000000, Av= 1132.000000, Az= 1132.000000, TMEY= 0.0000
  E= 0.3580E+05, U= .220, I= 2.3400E+06, I2= 2.3400E+06
  J= 1.0000E+00
  RW0= .0057500
ADDSTF MST K1112
  -0  10  10  20  -0  -0  -0  21  22  23  -0  -0
ADDSTF MST K1112
  -0  10  10  20  -0  -0  -0  21  22  23  -0  -0
SENTRY K1213 M1213
  1P ROWS.  12 COLUMNS
  LA= 0.000000, LV= 6.823000, LZ= 0.000000, L= 6.823000
  A= 2021.000000, Av= 1132.000000, Az= 1132.000000, TMEY= 0.0000
  E= 0.3580E+05, U= .220, I= 2.3400E+06, I2= 2.3400E+06
  J= 1.0000E+00
  RW0= .0057500
ADDSTF MST K1213
  -0  21  22  23  -0  -0  -0  24  25  26  -0  -0
ADDSTF MST K1213
  -0  21  22  23  -0  -0  -0  24  25  26  -0  -0

```

Printout from computer
run with previous input,
indicating that numerical
values for I_y & I_z were
properly entered

POINT 3407F
PERCENTAGE OF DUMPING PER HOUR
DELETE 3407F
DELETE COAMP
DELETE CISTAR
DELETE DUMPH

JUN13 1244
JUN13 1240
JUN13 1250
JUN13 1251
JUN13 1252
JUN13 1253

GENYDE #1314 #1314
12 ROWS. 12 COLUMNS
L# 0.00000. LV# 5.87500. LZ# 0.00000. L# 5.87500
A# 2117.00000. AY# 1169.00000. AZ# 1169.00000. T#ETA# 0.0000
E# 0.3580E+05. U# .220. LV# 2.2420E+06. LZ# 2.2420E+06

J# 1.0000E+00

B#0# .0057500

ADDSTF NST #1314
-n 24 25 26 -0 -0 -0 27 28 29 -0 -0

ADDSTF NST #1314
-n 24 25 26 -0 -0 -0 27 28 29 -0 -0

GENYDE #1415 #1415
12 ROWS. 12 COLUMNS
L# 0.00000. LV# 12.62500. LZ# 0.00000. L# 12.62500

A# 2117.00000. AY# 1169.00000. AZ# 1169.00000. T#ETA# 0.0000

E# 6.3580E+05. U# .220. LV# 2.2420E+06. LZ# 2.2420E+06

J# 1.0000E+00

B#0# .0057500

ADDSTF NST #1415
-n 27 28 29 -0 -0 -0 30 31 32 -0 -0

ADDSTF NST #1415
-n 27 28 29 -0 -0 -0 30 31 32 -0 -0

GENYDE #1516 #1516
12 ROWS. 12 COLUMNS
L# 0.00000. LV# 14.14500. LZ# 0.00000. L# 14.14500

A# 1031.00000. AY# 638.00000. AZ# 638.00000. T#ETA# 0.0000

E# 6.3580E+05. U# .220. LV# 5.1400E+05. LZ# 5.1400E+05

J# 1.0000E+00

B#0# .0057500

ADDSTF NST #1516
-n 30 31 32 -0 -0 -0 33 34 35 -0 -0

ADDSTF NST #1516
-n 30 31 32 -0 -0 -0 33 34 35 -0 -0

GENYDE #1617 #1617
12 ROWS. 12 COLUMNS
L# 0.00000. LV# 2.85500. LZ# 0.00000. L# 2.85500

A# 1031.00000. AY# 638.00000. AZ# 638.00000. T#ETA# 0.0000

E# 6.3580E+05. U# .220. LV# 5.1400E+05. LZ# 5.1400E+05

J# 1.0000E+00

B#0# .0057500

sheet 4 of 10

The computer will print out the principal characteristics of the member.

The area of the element will be computed by:

$$A = \frac{a_3 b_2 - a_2 b_3}{2} \quad (\text{must be greater than } 0)$$

(counterclockwise enumeration of nodes)

2.3.4 General Tridimensional Element

GENTDE

In this operation the 12 x 12 stiffness matrix of a general tridimensional element is generated in the general coordinates system and loaded into core storage. Figure 2-4 shows the general tridimensional element in global (X, Y, Z) and local (u, v, w) coordinates.

Field A = Name of the generated matrix.

The two (2) cards that follow this operation contain the following information:

(i) First Card [Format (6F12.1)]:

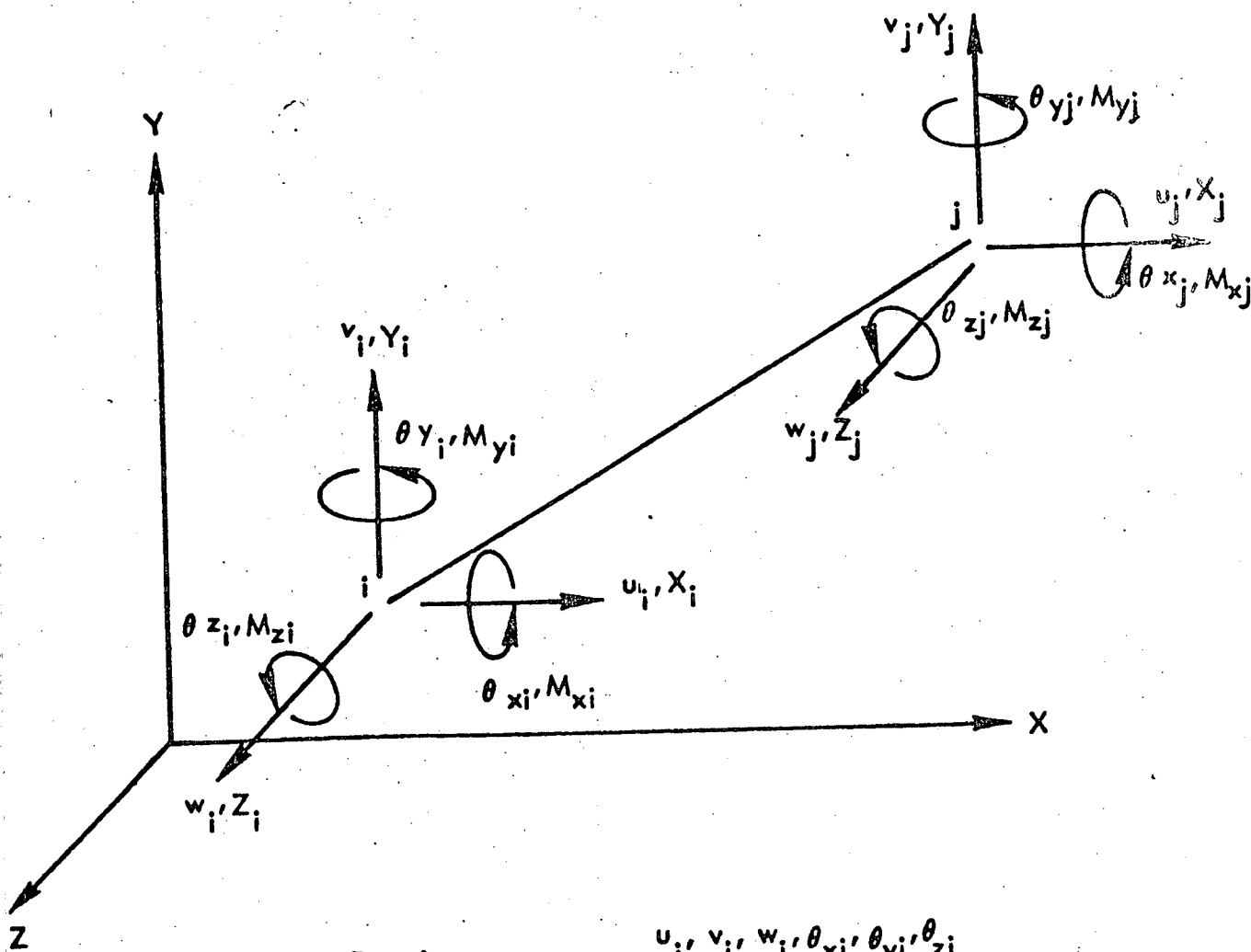
Columns:

- 1-12 Projection length over X axis, L_x
- 13-24 Projection length over Y axis, L_y
- 25-36 Projection length over Z axis, L_z
- 37-48 Poisson's ratio, ν
- 49-60 Shear area in \bar{y} axis direction, A_{vy}
- 61-72 Shear area in \bar{z} axis direction, A_{vz}

(ii) Second Card [Format (6F12.1)]:

Columns:

- 1-12 Modulus of elasticity, E
- 13-24 Area of the element, A



Equation sequence $u_i, v_i, w_i, \theta_{xi}, \theta_{yi}, \theta_{zi}$
 $u_j, v_j, w_j, \theta_{xj}, \theta_{yj}, \theta_{zj}$

Figure 2-4
 GENERAL TRIDMENSIONAL ELEMENT

- 25-36 Moment of inertia about \bar{y} axis, $I_{\bar{y}}$
- 37-48 Moment of inertia about \bar{z} axis, $I_{\bar{z}}$
- 49-60 Torsional moment of inertia of the element cross section about the \bar{x} axis, J
- 61-72 The angle of inclination θ , as shown in Figure 2-5, represents the righthanded rotation about the local x -axis [$(i \rightarrow j)$ = positive sense] that satisfies the following definitions.

Angle of Inclination

The local x-axis of a beam is defined by the coordinates of the nodes I and J (Figure 2-5). The orientation of the transverse axes (local y and local z) with respect to the global system is defined by the angle of inclination (θ) between the local y-axis and the global X-Z plane. It is important to understand the θ -angle since the beam output is referenced to the local coordinate system. In addition, section properties and beam loads are referenced to the local system.

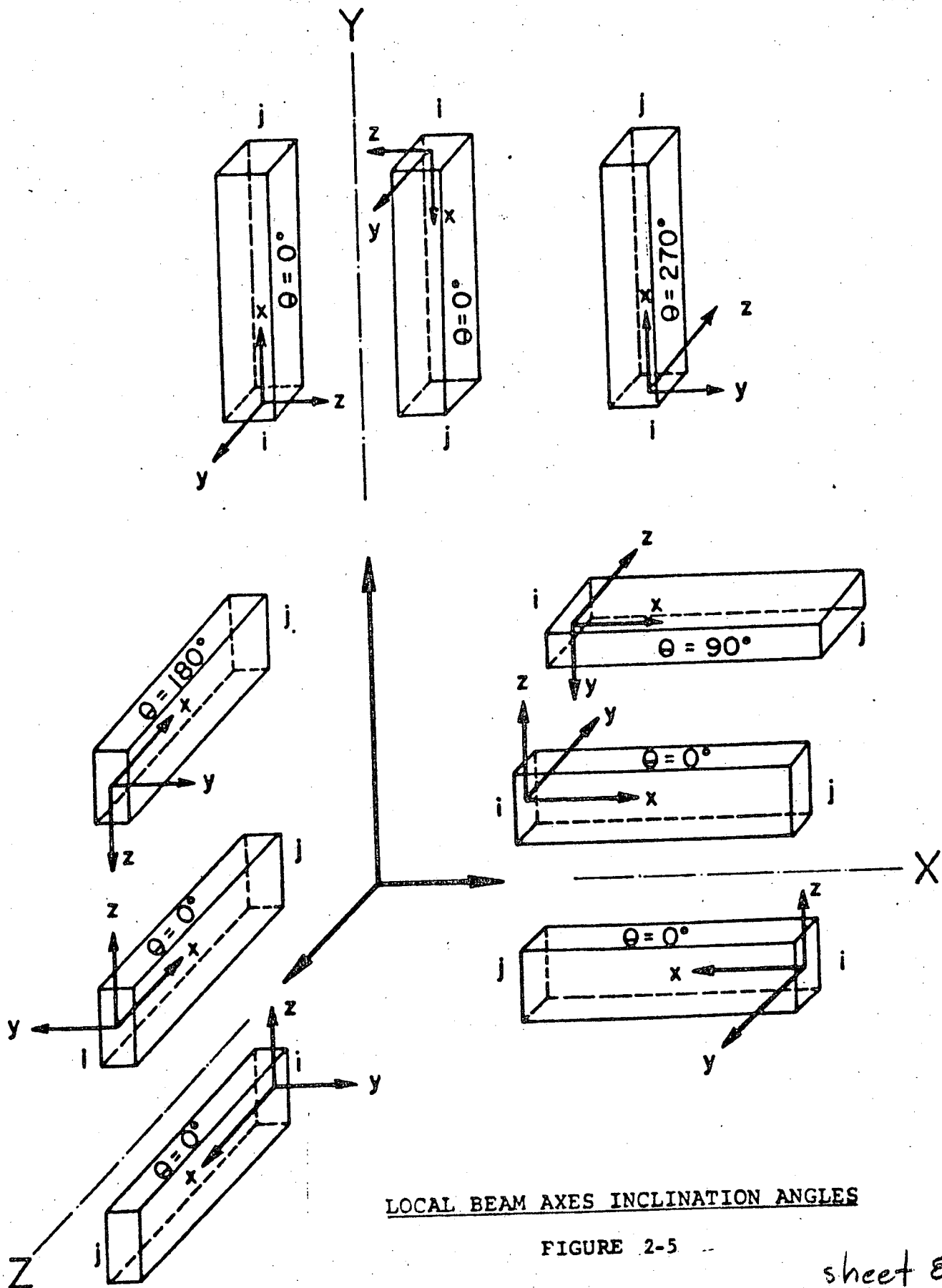
Once the user has specified the global and local axes on a sketch or drawing, the angle θ is determined as follows:

θ is the right-handed rotation about the x-axis required to bring the local y-axis (from its actual position) into a plane parallel to the global X-Z plane with the local z-axis (in the rotated position) projecting positively onto the global Y-axis.

For beams parallel to the global Y-axis, the local y-axis is always in a plane parallel to the global X-Z plane. In this case the following definition applies:

θ is the right-handed rotation about the local x-axis to make the local y-axis parallel to, and have a positive projection on, the global Z-axis.

Figure 2-5 shows some angles of inclination for beams aligned with the global axes. For truss members (axial loads only) θ need not be specified. For circular members every transverse axis is a principal axis, and θ is important only for interpreting the directions of output member end forces and moments.



LOCAL BEAM AXES INCLINATION ANGLES

FIGURE 2-5

The computer will print out the principal characteristics of the member. Bending, torsion, shear, and axial deformations are taken into consideration. The relative position of the forces and displacements is similar to the FRAMEL operation. The sign convention is the right-hand rule.

2.3.5 Tridimensional Truss Element

TDTREL

In this operation the 6×6 stiffness matrix of a tridimensional truss element is generated in the general coordinates system and loaded into core storage.

Figure 2-6 shows a tridimensional truss element in global (X, Y, Z) and local (u, v, w) coordinates.

Field A = Name of the generated matrix.

The card that follows this operation must correspond to format (5F12.1) and is filled out as follows:

Columns:

1-12	Projection length over X axis, L_x
13-24	Projection length over Y axis, L_y



CALCULATION SHEET

BECHTEL CORPORATION
18000 IMPERIAL HWY.
NORWALK, CALIFORNIA

sheet 10 of 10

SIGNATURE S. BOENEL DATE 6/16/72 CHECKED R. Kane DATE 12/18/72
 PROJECT SONGS UNITS 2 & 3 JOB NO. 1304-750
 SUBJECT 150' CONTAINMENT STICK MODEL SHEET 10-E OF 10-E SHEETS

TABULATION OF NODAL MASSES (KIPS) TO BE CONSIDERED AS THE WEIGHTING ARRAY FOR THE HORIZONTAL AND VERTICAL EARTHQUAKE EXCITATION.

TOTAL WEIGHT = 150,814 K

VERTICAL MASSES = $\frac{2}{3}$ OF HORIZONTAL MASSES IN ORDER TO SCALE THE VERTICAL E.Q. AS $\frac{2}{3}$ OF THE HORIZONTAL. ROTATIONAL MASSES IGNORED.

D.O.F. NR	Node No & Direction	Horiz or R	MASS (K)
1	X ₁	H	16008
2	Y ₁	V	10672
3	0 ₁	R	0
4	X ₂ , X ₃	H	26056
5	Y ₂	V	9317
6	0 ₂ , 0 ₃	R	0
7	Y ₃	V	9317
8	X ₄	H	8141
9	Y ₄	V	5441
10	0 ₄	R	0
11	X ₅	H	8161
12	Y ₅	V	5441
13	0 ₅	R	0
14	X ₆ , X ₇	H	8,620
15	Y ₆	V	2,873
16	0 ₆ , 0 ₇	R	0
17	Y ₇	V	2,873
18	X ₈	H	9,961
19	Y ₈	V	6,641
20	0 ₈	R	0
21	X ₉	H	11,395
22	Y ₉	V	7,597
23	0 ₉	R	0
24	X ₁₀	H	11,002
25	Y ₁₀	V	6,073

D.O.F. No	Node No & Direction	Horiz or R	MASS (K)
26	0 ₁₀	R	0
27	X ₁₁	H	3,192
28	Y ₁₁	V	2,128
29	0 ₁₁	R	0
30	X ₁₂	H	7,524
31	Y ₁₂	V	5,016
32	0 ₁₂	R	0
33	X ₁₃	H	7,488
34	Y ₁₃	V	4,992
35	0 ₁₃	R	0
36	X ₁₄	H	7,488
37	Y ₁₄	V	4,992
38	0 ₁₄	R	0
39	X ₁₅	H	8,303
40	Y ₁₅	V	5,535
41	0 ₁₅	R	0
42	X ₁₆	H	8,153
43	Y ₁₆	V	5,435
44	0 ₁₆	R	0
45	X ₁₇	H	9,362
46	Y ₁₇	V	6,241
47	0 ₁₇	R	0
48	Y ₁₈	V	0
49	Y ₁₉	V	0
50	0 ₁₈	R	0
51	DUMMY		1

INITIATOR'S INTERPRETATION OF BPC'S SECOND RESPONSE

I have studied the contents in the BPC's second package of clarifying documents and have re-examined the other relevant data. My interpretations of the BPC's explanations in regard to PFR-0058 are presented as follows:

At the input stage, the user of the SMIS code is requested to enter a general set of input data defining a three-dimensional system. Therefore, input values of both I_x and I_z , angle of orientation θ plus other geometrical data were specified by the user (Sheet 2 and Sheet 6 of BPC's Resubmittal).

Through the use of the command ADDSTF, the system is reduced to a two-dimensional model (page 2-20 of SUPERSMIS User's Manual) by suppressing some degrees of freedom at each node. The stiffness matrix for a two-dimensional model is then formed in the following manner for the case with zero angle of orientation ($\theta = 0$):

For horizontal elements (6-4, 5-7, 8-6, 7-9, etc.), the stiffness data associated with I_x are retained. The data computed with I_z are not incorporated in the system matrix due to two-dimensional specialization.

For vertical elements (10-11, 11-12, 12-13, 13-14, etc.), the stiffness data associated with I_z are retained. The data computed with I_x are not incorporated in the system matrix due to two-dimensional specialization.

In view of the above, I have no doubt that the coefficients in the system matrix formed by SUPERSMIS have the correct numerical values because the incorrect symbol designation only appeared in the table. The data processed by the computer were not affected by such wrong designation.

BY: T. H. Lee *TH Lee* DATE: 2-18-82

The designation of a vertical or horizontal element is established from the location of the element endpoints, which are input by the user.

25-36 Length of the member, L

37-48 Modulus of elasticity, E

The shear modulus, G, is assumed to be equal to E/2.4. The elements of this matrix are calculated from the following equations:

$$A_{11} = A_{22} = \frac{2EI}{L} \left(\frac{2 + \beta}{1 + 2\beta} \right)$$

$$A_{12} = A_{21} = \frac{2EI}{L} \left(\frac{1 - \beta}{1 + \beta} \right)$$

where

$$\beta = \frac{6EI}{L^2 AG}$$

2.4 MANIPULATIVE OPERATIONS

These operations perform manipulations on the matrices.

2.4.1 General Stiffness Matrix

ADDSTF

This operation places the element stiffness matrix into the general stiffness matrix of the assembled structure. This general stiffness matrix must be defined previously by a ZERO command.

Field A = Name of the previously defined general stiffness matrix.

Field B = Name of the element stiffness matrix to be placed.

Field N1 :

N1=0 Normal Option. The element stiffness matrix is deleted after the ADDSTF operation. Operations are performed on Tape 1 (Tape 1 is used in stress calculations)

N1=1 The element stiffness matrix is retained after the ADDSTF operation and operations are performed on Tape 1. Therefore it is not necessary to recreate the element stiffness matrix each time members with the same properties are to be added to the Global Stiffness Matrix. But all members with the same properties as the retained member should be added at this time.

N1=2 The element stiffness matrix is deleted after the ADDSTF operation. No operations are performed on Tape 1.

N1=3 The element stiffness matrix is retained after the ADDSTF operation. No operations are performed on Tape 1.

The card that follows this operation must contain, in a 1216 format, the unknown displacement column number, in the general stiffness matrix, that corresponds to the displacement column of the element stiffness. That is, a minimum of 4 for a plane truss element through a maximum of 12 for a general tridimensional element. (LM(i))

Columns:

- 1- 6 First displacement unknown in element stiffness
- 7-12 Second displacement unknown in element stiffness
- 13-18 Third displacement unknown in element stiffness

- 19-24 Fourth displacement unknown in element stiffness
- 25-30 Fifth displacement unknown in element stiffness
- 31-36 Sixth displacement unknown in element stiffness
- 37-42 Seventh displacement unknown in element stiffness
- 43-48 Eighth displacement unknown in element stiffness
- 49-54 Ninth displacement unknown in element stiffness
- 55-60 Tenth displacement unknown in element stiffness
- 61-66 Eleventh displacement unknown in element stiffness
- 67-72 Twelfth displacement unknown in element stiffness

In this operation after placing matrix B into A, the column numbers, $LM(i)$, are written on disc (tape) number 1. The computer will print out for checking purposes the $LM(i)$ values. Once the ADDSTF operation is applied, the element stiffness matrix it is working on is destroyed, unless the flag (N1) is set.

2.4.2 Boundary Conditions and External Loadings

BOUNDC

The principal purposes of this operation are:

- (1) The column matrix of external joint loads is generated and loaded into core storage.
- (2) The specified displacement boundary conditions (fixed conditions only) of the assembled structure are taken into consideration to modify the general stiffness matrix and the load matrix.

Field A = Name of the general stiffness matrix.

Field B = Name of the generated load matrix.

Field N3 = Numbers of boundary conditions, including specified external loads and specified displacements.

We will have as many cards as boundary conditions following this operation, and each one corresponds to format (116,2F12.1) and is filled out as follows: