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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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INTERNAL:	ELD		1	0	IE	06	3	3
	IE/DEP/EPDB	35	1	1	IE/DEP/EPLB	36	3	3
	MPA		1	0	NRR/DE/CEB	11	1	1
	NRR/DE/EQB	13	3	3	NRR/DE/GB	28	2	2
	NRR/DE/HGEB	30	2	2	NRR/DE/MEB	18	1	1
	NRR/DE/MTEB	17	1	1	NRR/DE/QAB	21	1	1
	NRR/DE/SAB	24	1	1	NRR/DE/SEB	25	1	1
	NRR/DHFS/HFEB	40	1	1	NRR/DHFS/LQB	32	1	1
	NRR/DHFS/OLB	34	1	1	NRR/DHFS/PTRB	20	1	1
	NRR/DSI/AEB	26	1	1	NRR/DSI/ASB	27	1	1
	NRR/DSI/CPB	10	1	1	NRR/DSI/CSB	09	1	1
	NRR/DSI/ETSB	12	1	1	NRR/DSI/ICSB	16	1	1
	NRR/DSI/PSB	19	1	1	NRR/DSI/RAB	22	1	1
	NRR/DSI/RSB	23	1	1	NRR/DST/LGB	33	1	1
	REG FILE	04	1	1				
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	NRC PDR	02	1	1	NSIC	05	1	1
	NTIS		1	1				

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ROBERT DIETCH
VICE PRESIDENT

TELEPHONE
213-572-4144

February 19, 1982

RECEIVED
FEB 22 1982
US NUCLEAR REGULATORY COMMISSION
DOCUMENT MANAGEMENT BR
TIDC

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)

B001
S
1/1

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

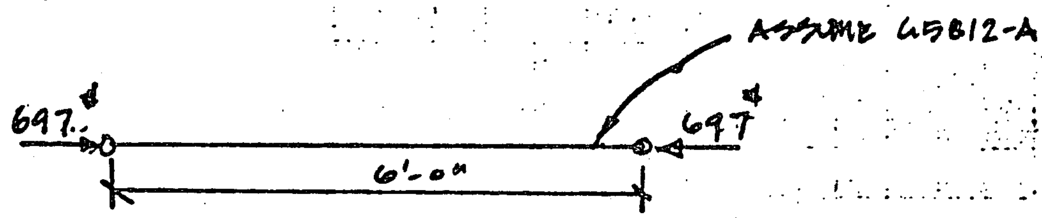
CALC. NO. C270-01-E

SIGNATURE J.M. Murphy Jr. DATE 8-20-75 CHECKED Takeuchi 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'



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

$$F_a = 0.522 F_y - \left(\frac{F_y \times Kl/r_y}{1494}\right)^2$$

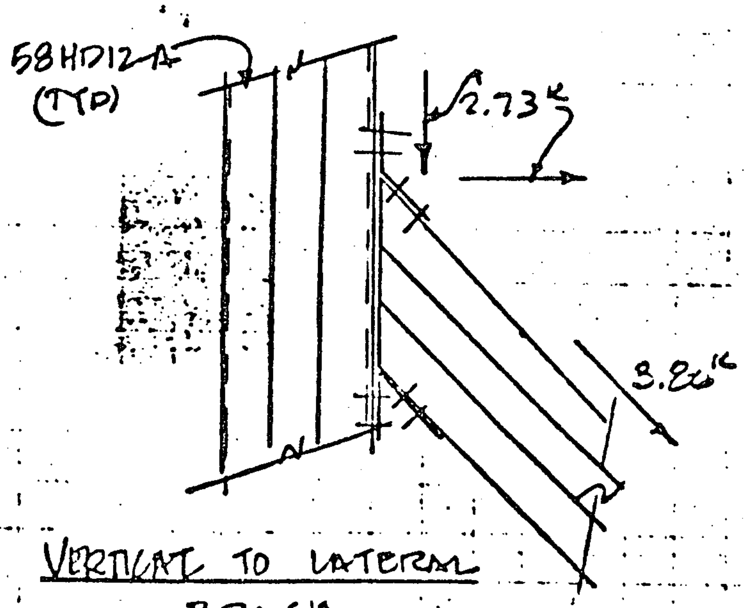
$$= 0.522 \times 33 - \left(\frac{33 \times 122}{1494}\right)^2$$

$$= 9.96 \text{ KSI}$$

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

USE G5812-A FOR LONGITUDINAL BRACING

CHECK CONNECTIONS



VERTICAL TO LATERAL BRACE

SLIP RESISTANCE

G5812 W/ 1/2"Φ BOLT = 1121#/BOLT × 1.33 = 1491 #/BOLT

$$\frac{3{,}860^{\#}}{1491^{\#}/\text{BOLT}} = 2.59 = 3\text{-BOLT OK}$$

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

FLOOR CONNECTION SIMILAR.

PULL-OUT C1 3812 = 2474#×1.33 IN ANY 12" LENGTH. 3,290#

3,290# > ... # OK

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

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

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

2408-PFR-0039

<u>Request:</u> Define what additional information was reviewed in 1 and 2.

<u>Response:</u> 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.

<u>Request:</u> Why the heavier Section ($I=21.9$ in^4) replaced the ($I=17.3$ in^4)?

<u>Response:</u> 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 $I_B=17.3$ in^4. However, the final design uses a heavier section with 12"x4"x1/4" tube section ($I_B=21.9$ 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. 9

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:

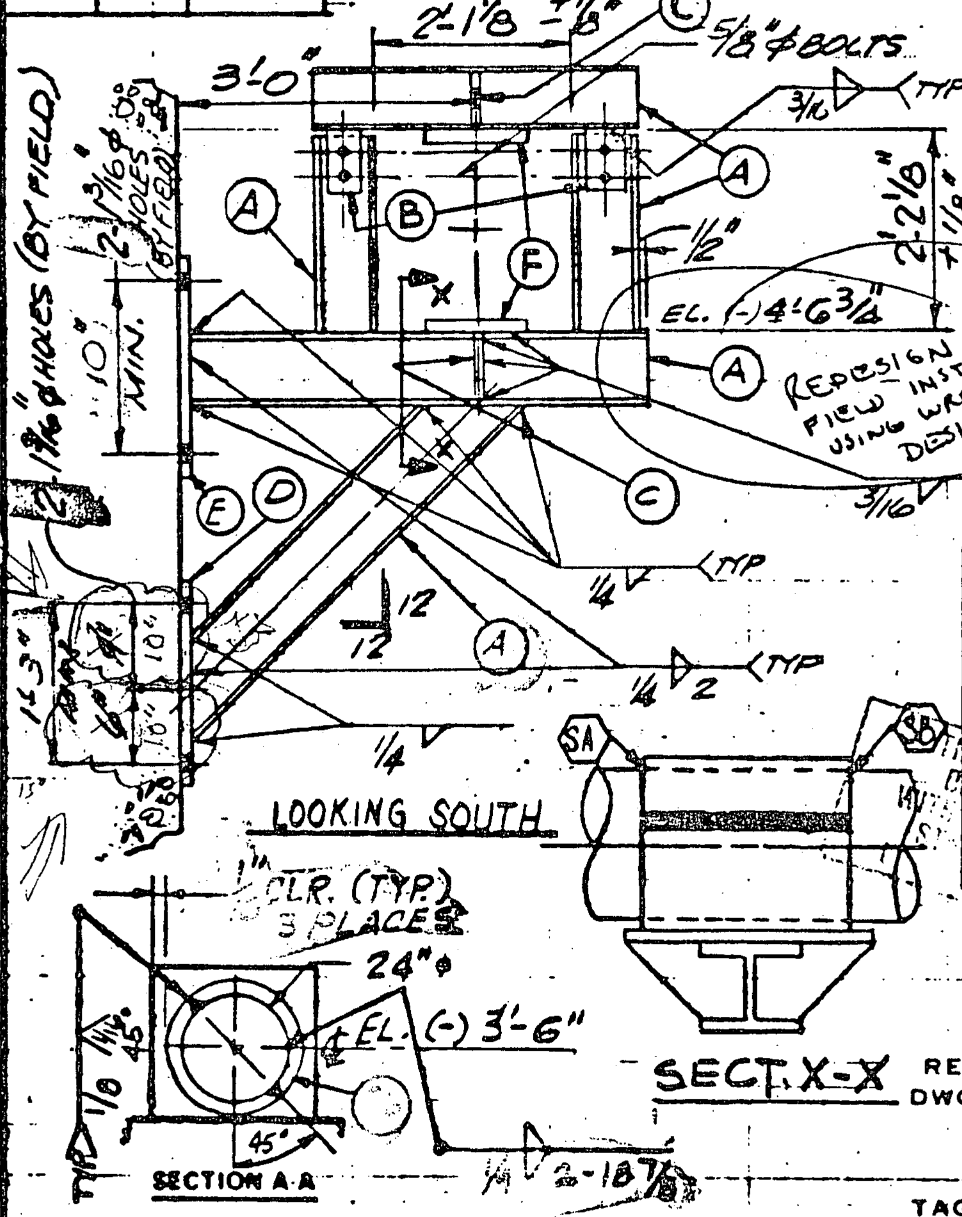
a. The transverse relocation of the weld is not greater than 1/2 inch.

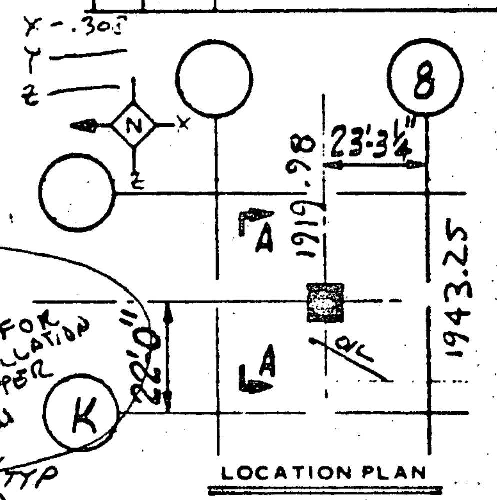
b. Movement of the piping system is not impaired.

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.

ITEM NO.	NO. REQ'D	PART NO	SIZE	DESCRIPTION	F	AISC	NOTES
A	5		W4x13	REF. MATERIAL ONLY		X	
B	2		PL 3/8 x 2 1/2 x 0'-6"			X	SPEC.
C	4		3/8" STIFF. PL	SHEET 14 OF 17		X	5023-206-18
D	1		PL 1" x 13 x 2'-2"			X	
E	1		PL 1" x 13 x 1'-9"	CALC # P 150-1.44-211		X	
F	2		PL 1/2 X 12 X 1'-0"			X	
	4		US-8-HC-LCSF-175				"BY FIELD"
						-	
56	2	—	CURVED PLATE 1/4 x 10" LG. SS		*		BY KELLOGG
			* INTERL ATTACHMENT USE SUBSECTION NI MATERIAL				





AREA NO. 2C02-1

PI...		TYPE 2	
PROJ CL	PIPE C(QC II)		MAX. TEMP
QUAL CL	STEEL		300 °F
	X	Y	Z
M	—	—	—
	—	—	—
(FT/LBS) P	0	6491	3591
(LBS)	0	9230	2820

[S] PROB. NO. 82 ST. NO. 93

SPOOL NO. 2-SI-004-6

REF. DWGS.
ISO 1204-004-1
PIPE 40366
STEEL —

TAG NO S2-SI-004-H-013

NO.	REVISIONS	DATE	DR.	CHK.	E.G.S.	P.E.	QAE
2	ADDED WELDS & WELD IDENTIFIER	6-2-78		FDL		RLR/SLS	
3	REVISED JOB NUMBER	8-4-78		NL		RLR/SLS	
0	ISSUED FOR CONSTRUCTION	7-14-77		RP/RD		RRC	JRM

BECHTEL POWER CORPORATION
NORWALK, CALIFORNIA

JOB NO. 10079 | DATE | APPROVED | J.O. NO.

SAN ONOFRE NUCLEAR GENERATING STATION
PIPE SUPPORT ASSEMBLY 348-9299
SOUTHERN CALIFORNIA EDISON COMPANY
SCALE: NTS
LOS ANGELES, CALIF.

SITE FILE COPY

N.C. 6-20-77

PL # 2059 / 1480
FCR # 18367
CALC. C-270-3.0

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    KSO   KH8                 2                                        MAY23   65
    12     15    79     80                                                   MAY23   66
DELETE    KH                                                                 MAY23   67
REMARK                              1                                        MAY23   68
  FORM VERTICAL SOIL SPRINGS FOR OBE                                         OBE      4
TRUSSE    KV                                                                 MAY23   70
          0.0        100.0       3978.0     31057.94                         OBE      5
DUPL      KV    KV1                                                          MAY23   72
SCALE     KV1                                          0.237                 MAY23   7.
ADDSTF    KSO   KV1                 2                                        MAY23   74
    57      1    79     80                                                   MAY23   75
DUPL      KV    KV4                                                          MAY23   76
SCALE     KV4                                          0.189                 MAY23   77
ADDSTF    KSO   KV4                 3                                        MAY23   78
     2      3    79     80                                                   MAY23   79
ADDSTF    KSO   KV4                 2                                        MAY23   80
     2      5    79     80                                                   MAY23   81
DUPL      KV    KV6                                                          MAY23   82
SCALE     KV6                                          0.128                 MAY23   83
ADDSTF    KSO   KV6                 3                                        MAY23   84
     6      7    79     80                                                   MAY23   85
ADDSTF    KSO   KV6                 2                                        MAY23   86
     9     16    79     80                                                   MAY23   87
DUPL      KV    KV8                                                          MAY23   88
SCALE     KV8                                          0.0699                MAY23   89
ADDSTF    KSO   KV8                 3                                        MAY23   90
    12     13    79     80                                                   MAY23   91
ADDSTF    KSO   KV8                 2                                        MAY23   92
    12     15    79     80                                                   MAY23   93
DELETE    KV                                                                 MAY23   94
REMARK                              1                                        MAY23   95
  FORM COIL SPRING AT NODE 1 FOR OBE                                         OBE      6
LOAD      KR(1F12.0)                1      1                                 MAY23   97
     1.589E9                                                                 OBE      7
PRINT     KR                                                                 MAY23   99
STOSM     KSO   KR                  56     58                                MAY23  100
DELETE    KR                                                                 MAY23  101
REWIND                              2                                        MAY23  102
WRITE     KSO                       2                                        MAY23  103
DELETE    KSO                                                                MAY23  104
CENSUS                                                                       MAY23  105
REMARK                              2                                        MAY23  106
  FORM GLOBAL STIFFNESS MATRIX AND GLOBAL CONSISTENT MASS MATRIX             MAY23  107
  FOR **BASE ONLY                                                            MAY23  108
ZERO      KST                       80     80                                MAY23  109
ZERO      MST                       80     80                                MAY23  110
GENTDE K0201 M0201                                                           MAY23  111
     4.730       0.0         0.0         0.22        1260.0      1260.0      MAY23  112
   635800.0   1512.0     10205.0     10205.0           1.0         6.0       MAY23  113
     0.00812                                                                 MAY23  114
ADDSTF    KST K0201                 3                                        MAY23  115
    57     59                       58     57      1             59          MAY23  116
ADDSTF    MST M0201                 3                                        MAY23  117
    57     59                       59     57      1             60          MAY23  118
ADDSTF    KST K0201                 2                                        MAY23  119
    57      1                       58     57     60             5           MAY23  120
ADDSTF    MST M0201                 2                                        MAY23  121
    57      1                       58     57     60             5.          MAY23  122
GENTDE K0402 M0402                                                           MAY23  123
    27.607       0.0         0.0         6.22        1260.0      1260.0      MAY23  124
   635800.0   1512.0     10205.0     10205.0           1.0         6.0       MAY23  125
     0.00792                                                                 MAY23  126
ADDSTF    KST K0402                 3                                        MAY23  127
     2      3                        4     57     59             5.          MAY23  128
ADDSTF    MST M0402                 3                                        MAY23  129
     2      3                        6     57     59             59          MAY23  130
```

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

Enclosure (1) for Supplementary Response to PFR's-0013, -0057, -0058

sheet 1 of 10

```
DUPL      FV    IEV                                                          MAY23 1292
INVERT    IEV                                                                MAY23 1293
MULT      DUMM  IEV ALPHA                                                    MAY23 1294
DELETE    IEV
```

CALCULATION SHEET
BECHTEL CORPORATION
NORWALK, CALIFORNIA

SIGNATURE S. BOENZI DATE 10/16/72 CHECKED R. Kane DATE 12/18/72
PROJECT SONGS UNITS 2 & 3 JOB NO. 1304-750
SUBJECT 150' ϕ 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 = 150,874 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	H or V or R	MASS (K)
1	X_1	H	16008
2	Y_1	V	10672
3	θ_1	R	0
4	X_2, X_3	H	26056
5	Y_2	V	9317
6	θ_2, θ_3	R	0
7	Y_3	V	9317
8	X_4	H	8161
9	Y_4	V	5441
10	θ_4	R	0
11	X_5	H	8161
12	Y_5	V	5441
13	θ_5	R	0
14	X_6, X_7	H	8,620
15	Y_6	V	2,873
16	θ_6, θ_7	R	0
17	Y_7	V	2873
18	X_8	H	9,961
19	Y_8	V	6641
20	θ_8	R	0
21	X_9	H	11,395
22	Y_9	V	7,597
23	θ_9	R	0
24	X_{10}	H	11,002
25	Y_{10}	V	6,073

D.O.F. No	NODE No & DIRECTION	H or V or R	MASS (K)
26	θ_{10}	R	0
27	X_{11}	H	3,192
28	Y_{11}	V	2,128
29	θ_{11}	R	0
30	X_{12}	H	7524
31	Y_{12}	V	5016
32	θ_{12}	R	0
33	X_{13}	H	7488
34	Y_{13}	V	4992
35	θ_{13}	R	0
36	X_{14}	H	7488
37	Y_{14}	V	4992
38	θ_{14}	R	0
39	X_{15}	H	8303
40	Y_{15}	V	5535
41	θ_{15}	R	0
42	X_{16}	H	8153
43	Y_{16}	V	5435
44	θ_{16}	R	0
45	X_{17}	H	9362
46	Y_{17}	V	6241
47	θ_{17}	R	0
48	X_6	H	0
49	Y_6	V	0
50	θ_6	R	0
51	DUMMY	—	—

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  M0610                                                                   JUN13 264
PRINT   M0610                                                                              JUN13 265
ADDSTF  KST  K0610                  2                                                      JUN13 266
          5     3     4                        16     60     17                            JUN13 267
ADDSTF  MST  M0610                  2                                                      JUN13 268
          5     3     4                        16     60     17                            JUN13 269
STOSM   TEE   T6                    2     4                                                JUN13 270
DUPL    K10610  KBAR                                                                       JUN13 271
SCALE   KBAR                                                0.136                          JUN13 272
DUPL    M10610  MBAR                                                                       JUN13 273
SCALE   MBAR                                                0.136                          JUN13 274
TRANS   TEE   TTEE                                                                         JUN13 275
MULT    TTEE  KBAR  DUM                                                                    JUN13 276
MULT    DUM   TEE  K0610                                                                   JUN13 277
MULT    TTEE  MBAR  DUM                                                                    JUN13 278
MULT    DUM   TEE  M0610                                                                   JUN13 279
ADDSTF  KST  K0610                  2                                                      JUN13 280
          6     7     8                        16     60     17                            JUN13 281
ADDSTF  MST  M0610                  2                                                      JUN13 282
          6     7     8                        16     60     17                            JUN13 283
SCALE   T6                                                  -1.0                           JUN13 284
STOSM   TEE   T6                    2     4                                                JUN13 285
TRANS   TEE   TTEE                                                                         JUN13 286
MULT    TTEE  KBAR  DUM                                                                    JUN13 287
MULT    DUM   TEE  K0610                                                                   JUN13 288
MULT    TTEE  MBAR  DUM                                                                    JUN13 289
MULT    DUM   TEE  M0610                                                                   JUN13 290
ADDSTF  KST  K0610                  2                                                      JUN13 291
          9    10    11                        16     60     17                            JUN13 292
ADDSTF  MST  M0610                  2                                                      JUN13 293
          9    10    11                        16     60     17                            JUN13 294
BENTDE  K1011  M1011                                                                       JUN13 295
      0.0         2.125        0.0          0.22        1132.0        1132.0               JUN13 296
   635800.0    2021.0   ==>  2340000.0   2340000.0        1.0           0.0                JUN13 297
      0.00575                                                                              JUN13 298
ADDSTF  KST  K1011                  2                                                      JUN13 299
         16    60    17                        18     19     20                            JUN13 300
ADDSTF  MST  M1011                  2                                                      JUN13 301
         16    60    17                        18     19     20                            JUN13 302
BENTDE  K1112  M1112                                                                       JUN13 303
      0.0        10.177        0.0          0.22        1132.0        1132.0               JUN13 304
   635800.0    2021.0   ==>  2340000.0   2340000.0        1.0           0.0                JUN13 305
      0.00575                                                                              JUN13 306
ADDSTF  KST  K1112                  2                                                      JUN13 307
         18    19    20                        21     22     23                            JUN13 308
ADDSTF  MST  M1112                  2                                                      JUN13 309
         18    19    20                        21     22     23                            JUN13 310
BENTDE  K1213  M1213                                                                       JUN13 311
      0.0         6.823        0.0          0.22        1132.0        1132.0               JUN13 312
   635800.0    2021.0   ==>  2340000.0   2340000.0        1.0           0.0                JUN13 313
      0.00575                                                                              JUN13 314
ADDSTF  KST  K1213                  2                                                      JUN13 315
         21    22    23                        24     25     26                            JUN13 316
ADDSTF  MST  M1213                  2                                                      JUN13 317
         21    22    23                        24     25     26                            JUN13 318
BENTDE  K1314  M1314                                                                       JUN13 319
      0.0         5.875        0.0          0.22        1169.0        1169.0               JUN13 320
   635800.0    2117.0   ==>  2262000.0   2262000.0        1.0           0.0                JUN13 321
      0.00575                                                                              JUN13 322
ADDSTF  KST  K1314                  2                                                      JUN13 323
         24    25    26                        27     28     29                            JUN13 324
ADDSTF  MST  M1314                  2                                                      JUN13 325
         24    25    26                        27     28     29                            JUN13 326
BENTDE  K1415  M1415                                                                       JUN13 327
      0.0        12.625        0.0          0.22        1169.0        1169.0               JUN13 328
   635800.0    2117.0   ==>  2262000.0   2262000.0        1.0           0.0                JUN13 329
```

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

Listing of Input for SUPERSMIS computer program.

sheet 2 of 10

```
DELETE TSTF1
MULT     STF1 ALPHA  DIST
DELETE   STF1
TRANS    DIST TDIST
ADD      DIST TDIST
DELETE TDIST
```

JUN13 1183
JUN13 1183
JUN13 1184
JUN13 1185
JUN13 1186
JUN13 1187

```
MULT       DUM    TEE K0610
MULT      TTEE   MBAR    DUM
MULT       DUM    TEE M0610
ADDSTF    KST K0610
   -0       9    10    11    -0    -0    -0    16    60    17    -0    -0
ADDSTF    MST M0610
   -0       9    10    11    -0    -0    -0    16    60    17    -0    -0
BENTOE K1011 M1011
  12 ROWS.    12 COLUMNS
 LX=    0.00000, LY=    2.12500, LZ=     0.00000,  L=     2.12500
  A=  2021.00000, AY=  1132.00000, AZ=  1132.00000, THETA=   0.0000
  E=  6.3500E+05,  U=        .220, IY=  2.3400E+06, IZ=  2.9400E+06
  J=  1.0000E+00
RHO=     .0057500
ADDSTF    KST K1011
   -0      16    60    17    -0    -0    -0    18    19    20    -0    -0
ADDSTF    MST M1011
   -0      16    60    17    -0    -0    -0    18    19    20    -0    -0
BENTOE K1112 M1112
  12 ROWS.    12 COLUMNS
 LX=    0.00000, LY=   10.17700, LZ=     0.00000,  L=    10.17700
  A=  2021.00000, AY=  1132.00000, AZ=  1132.00000, THETA=   0.0000
  E=  6.3500E+05,  U=        .220, IY=  2.3400E+06, IZ=  2.9400E+06
  J=  1.0000E+00
RHO=     .0057500
ADDSTF    KST K1112
   -0      18    19    20    -0    -0    -0    21    22    23    -0    -0
ADDSTF    MST M1112
   -0      18    19    20    -0    -0    -0    21    22    23    -0    -0
BENTOE K1213 M1213
  12 ROWS.    12 COLUMNS
 LX=    0.00000, LY=    4.82300, LZ=     0.00000,  L=     4.82300
  A=  2021.00000, AY=  1132.00000, AZ=  1132.00000, THETA=   0.0000
  E=  6.3500E+05,  U=        .220, IY=  2.3400E+06, IZ=  2.9400E+06
  J=  1.0000E+00
RHO=     .0057500
ADDSTF    KST K1213
   -0      21    22    23    -0    -0    -0    24    25    26    -0    -0
ADDSTF    MST M1213
   -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

sheet 3 of 10

```
POINT DMODE                         1                                    JUN13 1248
  PERCENTAGE OF DAMPING PER MODE                                          JUN13 1249
DELETE DMODE                                                             JUN13 1250
DELETE CDAMP                                                             JUN13 1251
DELETECISTAR                                                             JUN13 1252
DELETE DUMM                                                              JUN13 1253
```

```
GENTDE K1314 M1314
   12 ROWS.    12 COLUMNS
 LX=      0.00000, LY=      5.87500, LZ=      0.00000,  L=      5.87500
  A=  2117.00000, AY=  1169.00000, AZ=  1169.00000, THETA=   0.0000
  E=  6.3580E+05,  U=        .220, IY=  2.2420E+06, IZ=  2.2420E+06
  J=  1.0000E+00
RHO=     .0057500
ADDSTF   KST K1314              2
   -0    24    25    26    -0    -0    -0    27    28    29    -0    -0
ADDSTF   MST M1314              2
   -0    24    25    26    -0    -0    -0    27    28    29    -0    -0
GENTDE K1415 M1415
   12 ROWS.    12 COLUMNS
 LX=      0.00000, LY=     12.62500, LZ=      0.00000,  L=     12.62500
  A=  2117.00000, AY=  1169.00000, AZ=  1169.00000, THETA=   0.0000
  E=  6.3580E+05,  U=        .220, IY=  2.2420E+06, IZ=  2.2420E+06
  J=  1.0000E+00
RHO=     .0057500
ADDSTF   KST K1415              2
   -0    27    28    29    -0    -0    -0    30    31    32    -0    -0
ADDSTF   MST M1415              2
   -0    27    28    29    -0    -0    -0    30    31    32    -0    -0
GENTDE K1516 M1516
   12 ROWS.    12 COLUMNS
 LX=      0.00000, LY=     14.14500, LZ=      0.00000,  L=     14.14500
  A=  1031.00000, AY=   638.00000, AZ=   638.00000, THETA=   0.0000
  E=  6.3580E+05,  U=        .220, IY=  5.1400E+05, IZ=  5.1400E+05
  J=  1.0000E+00
RHO=     .0057500
ADDSTF   KST K1516              2
   -0    30    31    32    -0    -0    -0    33    67    34    -0    -0
ADDSTF   MST M1516              2
   -0    30    31    32    -0    -0    -0    33    67    34    -0    -0
GENTDE K1617 M1617
   12 ROWS.    12 COLUMNS
 LX=      0.00000, LY=      2.85500, LZ=      0.00000,  L=      2.85500
  A=  1031.00000, AY=   638.00000, AZ=   638.00000, THETA=   0.0000
  E=  6.3580E+05,  U=        .220, IY=  5.1400E+05, IZ=  5.1400E+05
  J=  1.0000E+00
RHO=     .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	Posson's ratio, v
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

sheet 5 of 10

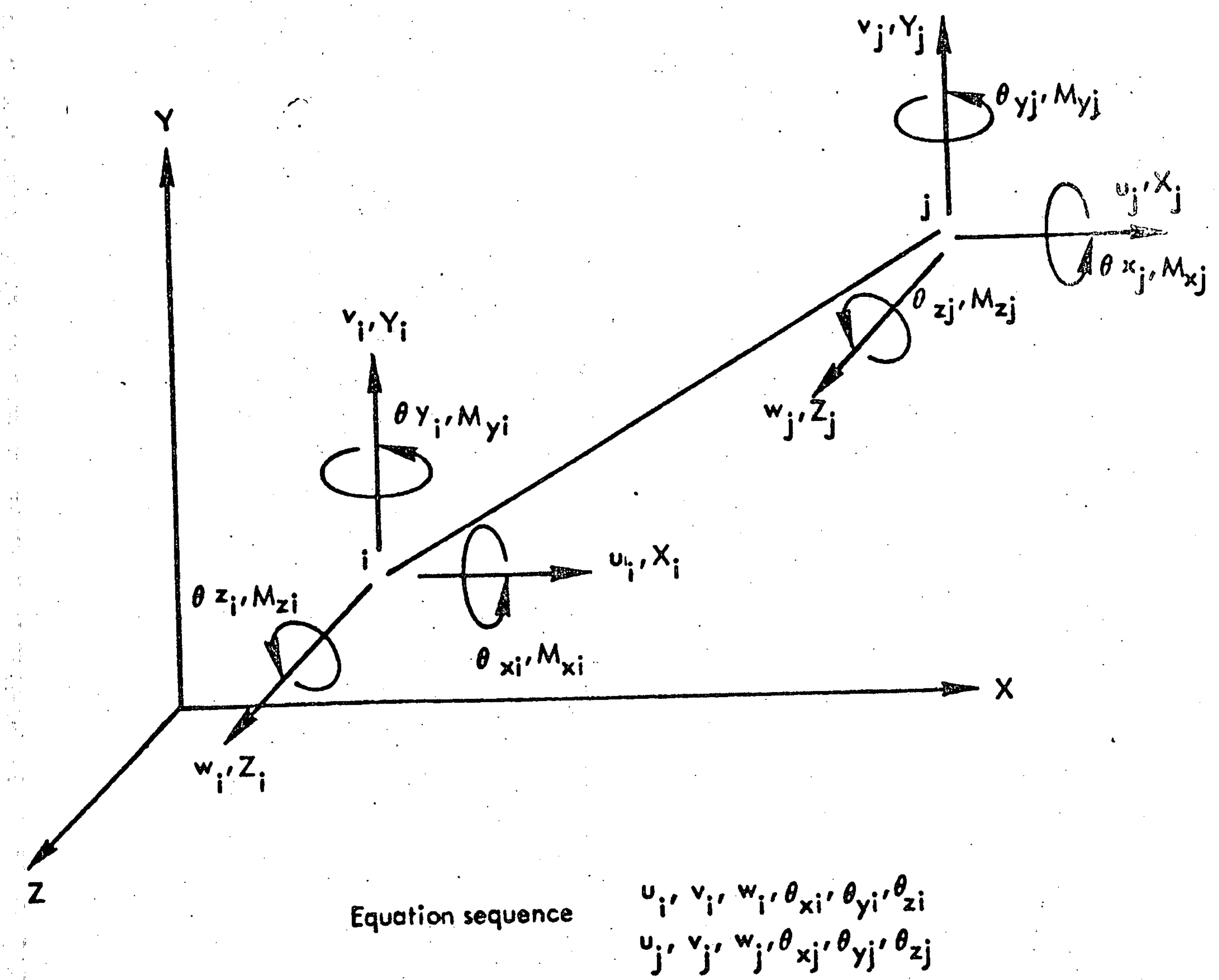


Figure 2-4

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→j)= positive sense] that satisfies the following definations.

sheet 6 of 10

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:

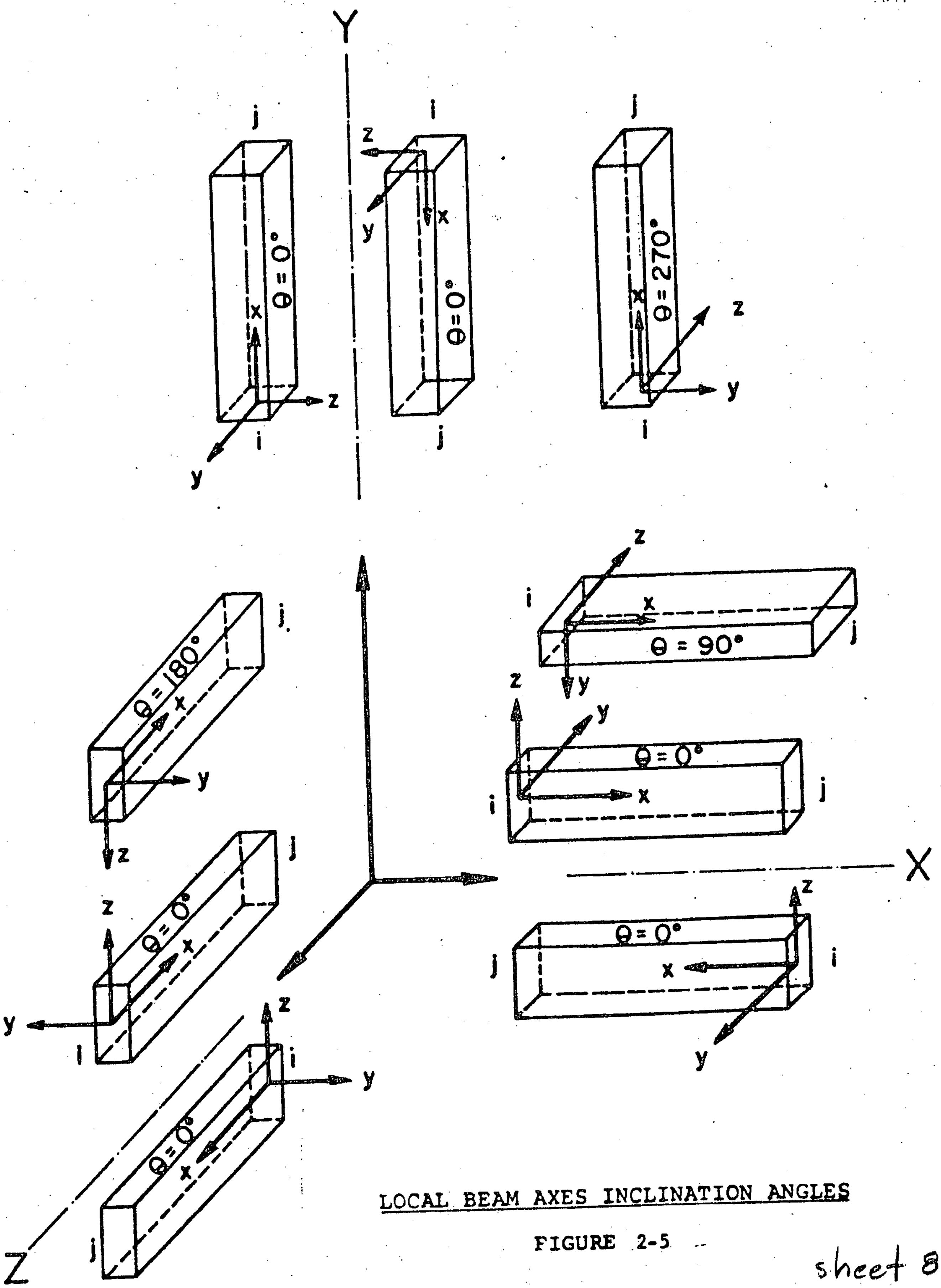
> θ is the right-handed rotation about the x-axis required to bring the local y-axis (from its actual position) into a plane parallel to the global X-Z plane with the local z-axis (in the rotated position) projecting positively onto the global Y-axis.

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.

sheet 7 of 10



LOCAL BEAM AXES INCLINATION ANGLES

FIGURE 2-5

sheet 8 of 10

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 x 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

sheet 9 of 10

CALCULATION SHEET
BECHTEL CORPORATION
NORWALK, CALIFORNIA

SIGNATURE S. BORNZI DATE 10/16/72 CHECKED R. Kane DATE 12/18/72
PROJECT SONGS UNITS 2 & 3 JOB NO. 1304-750
SUBJECT 150' ϕ 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 = 150,874 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	H or V or R	MASS (K)
1	X_1	H	16008
2	Y_1	V	10672
3	θ_1	R	0
4	X_2, X_3	H	26056
5	Y_2	V	9317
6	θ_2, θ_3	R	0
7	Y_3	V	9317
8	X_4	H	8161
9	Y_4	V	5441
10	θ_4	R	0
11	X_5	H	8161
12	Y_5	V	5441
13	θ_5	R	0
14	X_6, X_7	H	8,620
15	Y_6	V	2,873
16	θ_6, θ_7	R	0
17	Y_7	V	2873
18	X_8	H	9,961
19	Y_8	V	6641
20	θ_8	R	0
21	X_9	H	11,395
22	Y_9	V	7,597
23	θ_9	R	0
24	X_{10}	H	11,002
25	Y_{10}	V	6,073
26	θ_{10}	R	0
27	X_{11}	H	3,192
28	Y_{11}	V	2,128
29	θ_{11}	R	0
30	X_{12}	H	7524
31	Y_{12}	V	5016
32	θ_{12}	R	0
33	X_{13}	H	7488
34	Y_{13}	V	4992
35	θ_{13}	R	0
36	X_{14}	H	7488
37	Y_{14}	V	4992
38	θ_{14}	R	0
39	X_{15}	H	8303
40	Y_{15}	V	5535
41	θ_{15}	R	0
42	X_{16}	H	8153
43	Y_{16}	V	5435
44	θ_{16}	R	0
45	X_{17}	H	9362
46	Y_{17}	V	6241
47	θ_{17}	R	0
48	X_0	H	0
49	Y_0	V	0
50	θ_0	R	0
51	DUMMY	—	—

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_y 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_y 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_y 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 *T H 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

$$\beta = \frac{6EI}{L^2 \bar{A} G}$$

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 12I6 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 (I16,2F12.1) and is filled out as follows: