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TEXAS UTILITIES GENERATING COMPANY
COMANCHE PEAK UNIT NO. 2

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	Rev 4 Date 12/11/85	
3. General Instructions for Cable Tray Hanger Analysis for Comanche Peak Steam Electrical Station No. 1 and No. 2		
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* This section to be provided at a later time.

** From MCAUTO

○ Tables not included in this BOOK 2A.

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BY S P Lu DATE 6/28/85 SHEET 1 OF 2

CHKD. BY JILTS DATE 6/28/85 OFS NO. 3317.002 DEPT. NO. 549

CLIENT TEXAS UTILITIES GENERATING CO.

PROJECT COMANCHE PEAK UNIT 2
CABLE TRAY HANGERS

SUBJECT PRYING ACTION FACTORS & FORMULAS FOR EVALUATING ANCHOR BOLTS

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PROJECT COMANCHE PEAK UNIT 2
CABLE TRAY HANGERS

SUBJECT PRYING ACTION FACTORS & FORMULAS FOR EVALUATING ANCHOR BOLTS

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II Procedure for Grouping Cable Tray Hangers

III Groups

Geometry Code	Volume I Book	Group Numbers
U1	4	U1-1, U1-2, U1-3, U1-4, U1-5, U1-6, U1-7, U1-8, U1-9, U1-10, U1-11, U1-12, U1-13, U1-14, U1-15, U1-16, U1-17, U1-18, U1-19, U1-20, U1-21, U1-22, U1-23
U1T1	4	U1T1-1, U1T1-2, U1T1-3, U1T1-4, U1T1-5, U1T1-6, U1T1-7, U1T1-8, U1T1-9, U1T1-10, U1T1-11
U1T2	4	U1T2-1
U1B1	4	U1B1-1, U1B1-2, U1B1-3, U1B1-4, U1B1-5, U1B1-6, U1B1-7, U1B1-8, U1B1-9, U1B1-10
U1B2	4	U1B2-1, U1B2-2, U1B2-3
U1B3	4	U1B3-1, U1B3-2
U1T1B1	4	U1T1B1-1, U1T1B1-2
U2	4	U2-1, U2-2, U2-3, U2-4, U2-5, U2-6, U2-7, U2-8, U2-9, U2-10
U2T1	4	U2T1-1, U2T1-2, U2T1-3, U2T1-4 U2T1-5, U2T1-6, U2T1-7, U2T1-8
U2T2	4	U2T2-1, U2T2-2
U2B1	4	U2B1-1, U2B1-2, U2B1-3, U2B1-4, U2B1-5, U2B1-7, U2B1-8, U2B1-9, U2B1-10, U2B1-11, U2B1-12, U2B1-13, U2B1-14, U2B1-15, U2B1-16

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III Groups

Geometry Code	Volume I Book	Group Numbers
U2B2	4A	U2B2-1, U2B2-2, U2B2-3, U2B2-4, U2B2-5, U2B2-6, U2B2-7, U2B2-8, U2B2-9, U2B2-10, U2B2-11, U2B-12, U2B2-13, U2B2-14
U2B3	4A	U2B3-1, U2B3-2
U2T1B1	4A	U2T1B1-1
U2T2B1	4A	U2T2B1-1
U3	4A	U3-1, U3-2, U3-3
U3B1	4A	U3B1-1, U3B1-2, U3B1-3, U3B1-4, U3B1-5, U3B1-6
U3B2	4A	U3B2-1
U3T1B1	4A	U3T1B1-1, U3T1B1-2
U4B1	4A	U4B1-1, U4B1-2, U4B1-3
U4B2	4A	U4B2-1, U2B2-2
U4B3	4A	U4B3-1
U5B2	4A	U5B2-1

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III Groups

Geometry Code	Volume I Book	Group Numbers
UW	4B	UW-1, UW-2, UW-3, UW-4, UW-5, UW-6, UW-7, UW-8, UW-9, UW-10, UW-11, UW-12, UW-13, UW-14, UW-15
UBW	4B	UBW-1, UBW-2, UBW-3, UBW-4, UBW-5, UBW-6, UBW-7, UBW-8, UBW-9, UBW-10, UBW-11, UBW-12, UBW-13, UBW-15, UBW-17, UBW-18, UBW-19, UBW-20, UBW-21
U2W	4B	U2W-1
SPEC	4B	SP-1, SP-2, SP-3, SP-4, SP-5, SP-6, SP-7, SP-8, SP-9, SP-10 SP-11, SP-12, SP-13, SP-14, SP-15, SP-16
L3W	4B	LW3-1, LW3-2
U1Z2B1	4B	U1Z2B1-1
U1BL	4B	U1BL-1, U1BL-2

IV Memos to Design

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CABLE TRAY HANGER GEOMETRY GROUPING - (12/20/85) R2

V Additional Groups

Geometry Code	Volume I Book	Group Numbers
CANT	4C	CANT-1, CANT-3, CANT-4, CANT-5 CANT-6, CANT-7, CANT-8, CANT-9 CANT-10, CANT-11, CANT-12, CANT-13, CANT-14, CANT-15, CANT-16, CANT-17, CANT-18, CANT-19, CANT-20, CANT-21, CANT-22, CANT-23, CANT-24, CANT-25, CANT-26, CANT-27, CANT-28, CANT-29, CANT-30, CANT-31, CANT-32, CANT-33, CANT-34, CANT-35, CANT-36, CANT-37, CANT-38, CANT-39, CANT-40, CANT-41, CANT-42, CANT-43, CANT-44, CANT-45, CANT-46, CANT-47, CANT-48, CANT-49, CANT-50, CANT-51, CANT-52, CANT-53, CANT-54, CANT-55, CANT-57, CANT-59, CANT-60, CANT-61, CANT-62, CANT-66, CANT-67, CANT-68, CANT-69, CANT-70, CANT-73, CANT-75, CANT-76, CANT-77, CANT-78, CANT-79, CANT-80, CANT-81, CANT-82, CANT-83, CANT-84, CANT-85, CANT-86, CANT-87, CANT-88, CANT-89, CANT-90, CANT-91, CANT-92

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V Additional Groups

Geometry Code	Volume I Book	Group Numbers
BEAM	4D	BEAM-1, BEAM-2, BEAM-3, BEAM-4 BEAM-5, BEAM-6, BEAM-7, BEAM-8 BEAM-9, BEAM-10, BEAM-11, BEAM-12,
WALL	4D	WALL-1, WALL-2, WALL-3, WALL-4 WALL-5, WALL-6, WALL-7, WALL-8 WALL-9, WALL-10
L	4D	L-1, L-2, L-3, L-4, L-5, L-6, L-7, L-8, L-9, L-10, L-11, L-12, L-13, L-14, L-15, L-16, L-17, L-18, L-19 L-20, L-21, L-22
L2	4D	L2-1, L2-2, L2-3, L2-4, L2-5
LW	4D	LW-1, LW-2, LW-3
L2W	4D	LW2-2, LW2-3, LW2-4

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CABLE TRAY HANGER GEOMETRY GROUPING - (12/20/85) R2

V Additional Groups

Geometry Code	Volume I Book	Group Numbers
TRIA	4E	TRIA-1, TRIA-2, TRIA-3, TRIA-4 TRIA-5, TRIA-6, TRIA-7, TRIA-8 TRIA-9, TRIA-10, TRIA-11, TRIA-12, TRIA-13, TRIA-14, TRIA-15, TRIA-16, TRIA-17, TRIA-18, TRIA-19, TRIA-20, TRIA-21, TRIA-22, TRIA-23, TRIA-24, TRIA-25, TRIA-26, TRIA-27, TRIA-28, TRIA-29, TRIA-30, TRIA-31, TRIA-32, TRIA-33, TRIA-34, TRIA-35, TRIA-36, TRIA-37, TRIA-40, TRIA-41, TRIA-43,
U1L	4E	U1L-1, U1L-2
U1B1BL	4E	U1B1BL-1
U1T1BL	4E	U1T1BL-1
U2L	4E	U2L-1
U2T1BL	4E	U2T1BL-1
U2Z1	4E	U2Z1-1

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Warping Stresses for Single Channels		II
Warping Stresses for Composite Channels		III

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7. Computer Run Summary	43

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BUCKLING STUDY COMPUTER PRINTOUT

RUN NO.	DATE	CTH DESCRIPTION				
		TRAPEZE TYPE	LENGTH, FT.	WIDTH, FT.	LOADING	COMMENTS
DOLSCZJ	6/11/85	U1	5.0	3.0	I - OBE	
DOLTA67	6/12/85				II - OBE	
DOLTBBZ	6/12/85				I - SSE	
DOLTCVR	6/12/85		5.0		II - SSE	
DOLUA8V	6/27/85		5.5		I	
DOLUBON	6/27/85			3.0	II	
DOL3B7Z	6/7/85			4.0	I	
DOL3C5F	6/7/85				II	
DOLRDXZ	6/11/85				II	LOAD RATIO EFFECT
DOLRCKR	6/10/85	U1	5.5	4.0	II	"
DOLUCC3	6/13/85	U2	5.0	3.0	I - OBE	
DOLUCQ7	6/13/85		5.0		II - OBE	
DOLRDR3	6/24/85		6.2		I - OBE	
DOLSAQV	6/25/85			3.0	II - OBE	
DOLRDEB	6/24/85			4.0	I - OBE	
DOLRDOB	6/24/85	U2	6.2	4.0	II - OBE	
DOL2C4B	6/20/85	U1Z1	5.0	3.0	I - SSE	
DOL2DJZ	6/20/85				II - SSE	
DOL2CEV	6/17/85				I - OBE	
DOL2C9F	6/17/85				II - OBE	
DOL2C1F	6/17/85	U1Z1	5.0		I - OBE	
DOLSCEF	6/25/85	U1B1	6.2		I - OBE	
DOLTA3V	6/26/85			3.0	II - OBE	
DOLSCFV	6/25/85			4.0	I - OBE	
DOLSDIJ	6/25/85	U1B1			II - OBE	
DOLTC2Z	6/26/85	U2B1			I - OBE	
DOLTDPZ	6/26/85	U2B1	6.2	4.0	II - OBE	

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II Procedure for Grouping Cable Tray Hangers

III Groups

Geometry Code	Volume I Book	Group Numbers
BEAM	8	BEAM-300
CANT	8	CANT-300, CANT-301, CANT-302, CANT-303, CANT-304, CANT-305, CANT-306, CANT-307, CANT-308, CANT-309, CANT-310, CANT-311, CANT-313, CANT-314, CANT-315, CANT-316, CANT-317, CANT-318, CANT-319, CANT-320, CANT-321, CANT-322, CANT-323, CANT-324, CANT-325, CANT-326, CANT-327, CANT-328, CANT-329, CANT-330

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III Groups

Geometry Code	Volume I Book	Group Numbers
L	8A	L-300, L-301, L-302, L-304, L-305, L-306, L-307, L-308, L-309
SPEC	8A	SPEC-300, SPEC-301, SPEC-302, SPEC-303, SPEC-304
TRIA	8A	TRIA-300, TRIA-301, TRIA-302, TRIA-303, TRIA-304, TRIA-305
U1	8A	U1-300, U1-301, U1-302, U1-303, U1-304, U1-305, U1-306, U1-307, U1-308, U1-309, U1-310, U1-311, U1-312, U1-313, U1-314

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III Groups

Geometry Code	Volume I Book	Group Numbers
U1B1	8B	U1B1-300, U1B1-301, U1B1-302
U1B2	8B	U1B2-300
U1T1	8B	U1T1-300, U1T1-301, U1T1-302, U1T1-303, U1T1-304
U1Z1B2	8B	U1Z1B2-300
U2	8B	U2-300, U2-301, U2-302
U2B1	8B	U2B1-300
U2T1	8B	U2T1-300, U2T1-301
U2T1B1	8B	U2T1B1-300, U2T1B1-301
U3	8B	U3-300, U3-301, U3-302
U3B2	8B	U3B2-300, U3B2-301
U3B3	8B	U3B3-300
U3Z1B1	8B	U3Z1B1-300

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WALL	8C	WALL-300, WALL-301
Z1	8C	Z1-300

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3-D RESPONSE SPECTRUM ANALYSIS AND VERIFICATION
OF A MULTIMODE RESPONSE MULTIPLIER EQUAL TO 1.25

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	2b. Response Spectra Plots & Values	8
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	4c. Spring Boundary Models 1 & 2 R.S.	65
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	2b. Boundary Condition	8
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COMPUTER RUN ID.	DATE OF RUN	TITLE	pg
DOLVCNR	8/16/85	BASEANGLE FLEXIBILITY ANALYSIS FOR MODEL 1	
DOLVCNZ	8/16/85	BASEANGLE FLEXIBILITY ANALYSIS FOR MODEL 1	
DOLVCN7	8/16/85	BASEANGLE FLEXIBILITY ANALYSIS FOR MODEL 1	
DOLVCOJ	8/16/85	BASEANGLE FLEXIBILITY ANALYSIS FOR MODEL 1	
DOLVCQZ	8/16/85	BASEANGLE FLEXIBILITY ANALYSIS FOR MODEL 1	
DOLVCO7	8/16/85	BASEANGLE FLEXIBILITY ANALYSIS FOR MODEL 1	
DOLVBK3	8/16/85	BASEANGLE FLEXIBILITY ANALYSIS FOR MODEL 1	
DOLVCL7	8/16/85	BASEANGLE FLEXIBILITY ANALYSIS FOR MODEL 1	
DOLVCMJ	8/16/85	BASEANGLE FLEXIBILITY ANALYSIS FOR MODEL 1	
DOLVCMV	8/16/85	BASEANGLE FLEXIBILITY ANALYSIS FOR MODEL 1	
DOLVCM3	8/16/85	BASEANGLE FLEXIBILITY ANALYSIS FOR MODEL 1	
DOLVCNJ	8/16/85	BASEANGLE FLEXIBILITY ANALYSIS FOR MODEL 1	
DOLWA03	8/17/85	BASEANGLE FLEXIBILITY ANALYSIS FOR MODEL 1	
DOLWAPF	8/17/85	BASEANGLE FLEXIBILITY ANALYSIS FOR MODEL 1	
DOLWAPN	8/17/85	BASEANGLE FLEXIBILITY ANALYSIS FOR MODEL 1	
DOLWAPZ	8/17/85	BASEANGLE FLEXIBILITY ANALYSIS FOR MODEL 1	
DOLWAP7	8/17/85	BASEANGLE FLEXIBILITY ANALYSIS FOR MODEL 1	
DOLWAQF	8/17/85	BASEANGLE FLEXIBILITY ANALYSIS FOR MODEL 1	
DOLZAZJ	8/14/85	BASEANGLE STIFFNESS MATRIX.	
DOLVDD7	8/31/85	SYSTEM FREQUENCIES, MODEL 1 FIXED BASE	
DOLTC4Z	9/10/85	HANGER FREQUENCIES, MODEL 1 FIXED BASE	
DOLRDE7	8/28/85	SYSTEM FREQUENCIES, MODEL 1 SPRING BASE	
DOLTECJ	8/28/86	HANGER FREQUENCIES, MODEL 1 SPRING BASE	
DOLRBNJ	9/16/86	HANGER FREQUENCIES, MODEL 1 HINGED BASE	
DOLSCGZ	8/27/86	SP 7 FREQUENCIES, MODEL 1 FIXED BASE	
DOLTC3V	9/11/86	SP 7 FREQUENCIES, MODEL 1 SPRING BASE	
DOLTBCN	8/28/86	SP 7 FREQUENCIES, MODEL 1 HINGED BASE	

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Multimode response multiplier study - computer runs for seismic analysis of Model No. 1 for fixed base

COMPUTER RUN ID.	DATE OF RUN	TITLE	9B-1
DOLWATJ	8/31/85	MODEL 1 FIXED BASE INTERNAL BLDG. OBE 4% RSS = 6	
DOLWA3Z	9/14/85	MODEL 1 FIXED BASE INTERNAL BLDG. OBE 4% RSS = 1	
DOLTBKZ	9/11/85	MODEL 1 FIXED BASE INTERNAL BLDG. SSE 7% RSS = 6	
DOLWA4V	9/14/85	MODEL 1 FIXED BASE INTERNAL BLDG. SSE 7% RSS = 1	
DOLSD3J	9/10/85	MODEL 1 FIXED BASE R/B BLDG. OBE 4% RSS = 6	
DOLWA4N	9/14/85	MODEL 1 FIXED BASE R/B BLDG. OBE 4% RSS = 1	
DOLSDKB	9/10/85	MODEL 1 FIXED BASE R/B BLDG. SSE 7% RSS = 6	
DOLWA47	9/14/85	MODEL 1 FIXED BASE R/B BLDG. SSE 7% RSS = 1	
DOLTAYV	9/11/85	MODEL 1 FIXED BASE AUX1. BLDG. OBE 4% RSS = 6	
DOLWA53	9/14/85	MODEL 1 FIXED BASE AUX1. BLDG. OBE 4% RSS = 1	
DOLSDKV	9/10/85	MODEL 1 FIXED BASE AUX1. BLDG. SSE 7% RSS = 6	
DOLWA5F	9/14/85	MODEL 1 FIXED BASE AUX1. BLDG. SSE 7% RSS = 1	
DOLSD07	9/10/85	MODEL 1 FIXED BASE ELEC. BLDG. OBE 4% RSS = 6	
DOLWAXB	9/14/85	MODEL 1 FIXED BASE ELEC. BLDG. OBE 4% RSS = 1	
DOLSA37	9/10/85	MODEL 1 FIXED BASE ELEC. BLDG. OBE 4% RSS = 6	
DOLVB7R	9/13/85	MODEL 1 FIXED BASE ELEC. BLDG. SSE 7% RSS = 1	
DOLSDPB	9/10/85	MODEL 1 FIXED BASE SAFEG BLDG. OBE 4% RSS = 6	
DOLWA4Z	9/14/85	MODEL 1 FIXED BASE SAFEG BLDG. OBE 4% RSS = 1	
DOLSD03	9/10/85	MODEL 1 FIXED BASE SAFEG BLDG. SSE 7% RSS = 6	
DOLWA5V	9/14/85	MODEL 1 FIXED BASE SAFEG BLDG. SSE 7% RSS = 1	
DOLVAZZ	9/20/85	MODEL 1 SPRING BASE REACT. BLDG. OBE 4% RSS = 1	
DOLVCDZ	9/20/85	MODEL 1 SPRING BASE REACT BLDG. SSE 7% RSS = 1	
DOLUA5R	9/19/85	MODEL 1 SPRING BASE REACT. BLDG. OBE 4% RSS = 1	
DOLVAZ3	9/20/85	MODEL 1 SPRING BASE REACT. BLDG. SSE 7% RSS = 1	
DOLVAON	9/20/85	MODEL 1 SPRING BASE AUX1. BLDG. OBE 4% RSS = 1	
DOLVA07	9/20/85	MODEL 1 SPRING BASE AUX1. BLDG. SSE 7% RSS = 1	
DOLVAIN	9/20/85	MODEL 1 SPRING BASE ELETC. BLDG. OBE 4% RSS = 1	

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Multimode response multiplier study - computer runs for seismic analysis of Model No. 1 for fixed base

COMPUTER RUN ID.	DATE OF RUN	TITLE	
DOLVA1V	9/20/85	MODEL 1 SPRING BASE ELEC. BLDG. SSE 7% RSS=1	
DOLVA2B	9/20/85	MODEL 1 SPRING BASE SFGD. BLDG. OBE 4% RSS=1	
DOLVA2N	9/20/85	MODEL 1 SPRING BASE SFGD BLDG. SSE 7% RSS=1	
DOLTC4B	9/25/85	MODEL 1 SPRING BASE MRM CAL	

Multimode response multiplier study - computer runs for base angle flexibility and seismic analysis of Model No. 2

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COMPUTER RUN ID.	DATE OF RUN	TITLE	%
DOL2C8N	9/5/85	MODEL 2 SPRING BASE, BASEANGLE FLEXIBILITY	Fx=1.0
DOL2D1B	9/6/85	MODEL 2 SPRING BASE, BASEANGLE FLEXIBILITY	Fy=1.0
DOL2D1V	9/6/85	MODEL 2 SPRING BASE, BASEANGLE FLEXIBILITY	Fz=1.0
DOL2D13	9/6/85	MODEL 2 SPRING BASE, BASEANGLE FLEXIBILITY	Mx=1.0
DOL2D2V	9/6/85	MODEL 2 SPRING BASE, BASEANGLE FLEXIBILITY	My=1.0
DOL2D3F	9/6/85	MODEL 2 SPRING BASE, BASEANGLE FLEXIBILITY	Mz=1.0
DOL2DXB	9/6/85	MODEL 2 SPRING BASE, BASEANGLE FLEXIBILITY	Fx=1.0
DOL2DYB	9/6/85	MODEL 2 SPRING BASE, BASEANGLE FLEXIBILITY	Fy=1.0
DOL2DZN	9/6/85	MODEL 2 SPRING BASE, BASEANGLE FLEXIBILITY	Fz=1.0
DOL2DZ7	9/6/85	MODEL 2 SPRING BASE, BASEANGLE FLEXIBILITY	Mx=1.0
DOL2DON	9/6/85	MODEL 2 SPRING BASE, BASEANGLE FLEXIBILITY	My=1.0
DOL2DV3	9/6/85	MODEL 2 SPRING BASE, BASEANGLE FLEXIBILITY	Mz=1.0
DOL2C8F	9/5/85	MODEL 2 SPRING BASE, BASEANGLE FLEXIBILITY	Fx=1.0
DOL3DLN	9/6/85	MODEL 2 SPRING BASE, BASEANGLE FLEXIBILITY	Fy=1.0
DOLSA03	9/10/85	MODEL 2 SPRING BASE, BASEANGLE FLEXIBILITY	Fz=1.0
DOL3DL7	9/6/85	MODEL 2 SPRING BASE, BASEANGLE FLEXIBILITY	Mx=1.0
DOL2DXJ	9/6/85	MODEL 2 SPRING BASE, BASEANGLE FLEXIBILITY	My=1.0
DOL2DZF	9/6/85	MODEL 2 SPRING BASE, BASEANGLE FLEXIBILITY	Mz=1.0
DOL2DZZ	9/6/85	MODEL 2 SPRING BASE, BASEANGLE FLEXIBILITY	Fz=1.0
DOL2DOF	9/6/85	MODEL 2 SPRING BASE, BASEANGLE FLEXIBILITY	Mx=1.0
DOL2DOZ	9/6/85	MODEL 2 SPRING BASE, BASEANGLE FLEXIBILITY	My=1.0
DOL2D1J	9/6/85	MODEL 2 SPRING BASE, BASEANGLE FLEXIBILITY	Mz=1.0
DOLTAZR	9/11/85	MODEL 2 SPRING BASE, STIFFNESS MATRIX	
DOLSBL7	9/10/85	MODEL 2 SPRING BASE, STIFFNESS MATRIX	
DOLVBF3	9/20/85	MODEL 2 SPRING BASE, SEISMIC RESPONSE ANALYSIS	
DOLSFOF	9/17/85	MODEL 2 SPRING BASE, SEISMIC RESPONSE ANALYSIS	
DOLSGXJ	9/17/85	MODEL 2 SPRING BASE, SEISMIC RESPONSE ANALYSIS	

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Multimode response multiplier study - computer runs for base angle flexibility and seismic analysis of Model No. 2

COMPUTER RUN ID.	DATE OF RUN	TITLE	9C-2
DOLSFOR	9/17/85	MODEL 2 SPRING BASE SEISMIC RESPONSE ANALYSIS	
DOLSE4V	9/17/85	MODEL 2 SPRING BASE SEISMIC RESPONSE ANALYSIS	
DOLAAXR	9/29/85	DYNAMIC ANALYSIS & MRM CAL REACTOR BLDG EL 907.75	OBE
DOLAA2J	9/29/85	DYNAMIC ANALYSIS & MRM CAL. REACTOR BLDG. EL. 907.75	SSE
DOLAA5F	9/29/85	DYNAMIC ANALYSIS & MRM CAL. AUXI. BLDG. EL. 810.5	OBE
DOLAA3F	9/29/85	DYNAMIC ANALYSIS & MRM CAL. AUXI. BLDG EL 810.5	SSE
DOLAA2V	9/29/85	DYNAMIC ANALYSIS & MRM CAL. AUXI. BLDG. EL. 899.5	OBE
DOLAA3J	9/29/85	DYNAMIC ANALYSIS & MRM CAL. AUXI. BLDG EL. 899.5	SSE
DOLAA4F	9/29/85	DYNAMIC ANALYSIS & MRM CAL. ELEC. BLDG. EL. 873.33	OBE
DOLAA4R	9/29/85	DYNAMIC ANALYSIS & MRM CAL ELEC. BLDG. EL. 873.33	SSE
DOLAA4Z	9/29/85	DYNAMIC ANALYSIS & MRM CAL. SAFEG. BLDG. EL. 896.5	OBE
DOLAA43	9/29/85	DYNAMIC ANALYSIS & MRM CAL. SAFEG. BLDG. EL. 896.5	SSE

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Multimode response multiplier study - computer runs for seismic analysis of Model No. 2, fixed base.

COMPUTER RUN ID.	DATE OF RUN	TITLE	9D
DOLUARN	9/12/85	MODEL 2 SYSTEM FREQUENCIES ANALYSIS, FIXED BASE	
DOLSCM7	9/10/85	MODEL 2 HANGER FREQUENCIES ANALYSIS, FIXED BASE	
DOLUBFJ	9/12/85	MODEL 2 HANGER FREQUENCIES ANALYSIS, FIXED BASE	
DOLUDMJ	9/12/85	INTER BLDG. OBE RSS = 6	
DOLUDMN	9/12/85	INTER BLDG. SSE RSS = 6	
DOLWBA7	9/14/85	AUXILIARY BLDG. OBE RSS = 6 @ EL. 810.5'	
DOLWBAZ	9/14/85	AUXILIARY BLDG. SSE RSS = 6 @ EL. 810.5'	
DOLUDUB	9/12/85	AUXILIARY BLDG OBE RSS = 6	
DOLUDT3	9/12/85	AUXILIARY BLDG SSE RSS = 6	
DOLUDMB	9/12/85	ELETC. BLDG. OBE RSS = 6	
DOLUDMF	9/12/85	ELETC. BLDG. SSE RSS = 6	
DOLVDZ7	9/13/85	SAFEG. BLDG. OBE RSS = 6	
DOLVDXJ	9/13/85	SAFEG. BLDG SSE RSS = 6	
DOLSBBZ	9/17/85	INTER. BLDG. OBE RSS = 1	
DOLSBCF	9/17/85	INTER. BLDG SSE RSS = 1	
DOLSBAZ	9/17/85	AUXILIARY BLDG, OBE RSS = 1 @ EL 810.5'	
DOLSBBN	9/17/85	AUXILIARY BLDG. SSE RSS = 1 @ EL. 810.5'	
DOLSBCV	9/17/85	AUXILIARY BLDG. OBE RSS = 1	
DOLRHON	9/16/85	AUXILIARY BLDG. SSE RSS = 1	
DOLSBCJ	9/17/85	ELETC. BLDG. OBE RSS = 1	
DOLSBCR	9/17/85	ELETC. BLDG. SSE RSS = 1	
DOLSAVB	9/17/85	SAFEG. BLDG OBE RSS = 1	
DOLSBC3	9/17/85	SAFEG. BLDG. SSE RSS = 1	

Multimode response multiplier study - computer runs for seismic analysis of Model No. 1 &2 for spring base.

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COMPUTER RUN ID.	DATE OF RUN	TITLE	9E
DOLVCP3	10/11/85	VERTICAL SPECTRUM, OBE, DYNRE 5	
DOLVCS7	10/11/85	HORIZONTAL SPECTRUM, OBE, DYNRE 5	
DOLVCOB	10/11/85	VERTICAL SPECTRUM, SSE, DYNRE 5	
DOLVCL3	10/11/85	HORIZONTAL SPECTRUM, SSE, DYNRE 5	
DOLTFIN	10/16/85	MODEL 1, SPRING BASE, OBE, DYNRE 4	
DOLSHFV	10/16/85	MODEL 1, SPRING BASE, OBE, DYNRE 1, VERTI.	
DOLTGAZ	10/17/85	MODEL 1, SPRING BASE, OBE, DYNRE 1, VERTI.	
DOLSHE3	10/16/85	MODEL 1, SPRING BASE, OBE, DYNRE 1, TRANS.	
DOLTGCV	10/17/85	MODEL 1, SPRING BASE, OBE, DYNRE 1, TRANS.	
DOLSHFN	10/16/85	MODEL 1, SPRING BASE, OBE, DYNRE 1, LONGI	
DOLTGEB	10/17/85	MODEL 1, SPRING BASE, OBE, DYNRE 1, LONGI.	
DOLIIENF	10/17/85	MODEL 1, SPRING BASE, SSE, DYNRE 4,	
DOLSHBN	10/16/85	MODEL 1, SPRING BASE, SSE, DYNRE 1, VERTI.	
DOLTGGR	10/17/85	MODEL 1, SPRING BASE, SSE, DYNRE 1, VERTI.	
DOLSHDR	10/16/85	MODEL 1, SPRING BASE, SSE, DYNRE 1, TRANS.	
DOLTGF7	10/17/85	MODEL 1, SPRING BASE, SSE, DYNRE 1, TRANS.	
DOLSHC3	10/16/85	MODEL 1, SPRING BASE, SSE, DYNRE 1, LONGI.	
DOLTGFN	10/17/85	MODEL 1, SPRING BASE, SSE, DYNRE 1, LONGI.	
DOLTB9B	10/16/85	MODEL 2, SPRING BASE, OBE, DYNRE 4	
DOLUFKN	10/18/85	MODEL 2, SPRING BASE, OBE, DYNRE 1, VERTI.	
DOLUFLB	10/18/85	MODEL 2, SPRING BASE, OBE, DYNRE 1, TRANS.	
DOLUFL7	10/18/85	MODEL 2, SPRING BASE, OBE, DYNRE 1, LONGI.	
DOLUFN7	10/16/85	MODEL 2, SPRING BASE, SSE, DYNRE 4	
DOLUFIJ	10/18/85	MODEL 2, SPRING BASE, SSE, DYNRE 1, VERTI.	
DOLUFGF	10/18/85	MODEL 2, SPRING BASE, SSE, DYNRE 1, TRNIS.	
DOLUFGN	10/18/85	MODEL 2, SPRING BASE, SSE, DYNRE 1, LONGI	

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Multimode response multiplier study - computer runs for base angle flexibility analysis for Model No. 3.

COMPUTER RUN ID.	DATE OF RUN	TITLE		9F
DOLSC6B	9/10/85	FLEXIBILITY MATRIX		
DOLSC6J	9/10/85	FLEXIBILITY MATRIX		
DOLRDNF	9/10/85	BASE ANGLE ANALYSIS	∠6x6x3/4 x 37.33	NODE = 28 Mz = 1.0 k
DOLRDM3	9/10/85	BASE ANGLE ANALYSIS	∠6x6x3/4 x 37.33	NODE = 28 My = 1.0 k
DOLRDMR	9/10/85	BASE ANGLE ANALYSIS	∠6x6x3/4 x 37.33	NODE = 28 Mx = 1.0 k
DOLRDMB	9/10/85	BASE ANGLE ANALYSIS	∠6x6x3/4 x 37.33	NODE = 28 Fz = 1.0 k
DOLRDLZ	9/10/85	BASE ANGLE ANALYSIS	∠6x6x3/4 x 37.33	NODE = 28 Fy = 1.0
DOLRDLB	9/10/85	BASE ANGLE ANALYSIS	∠6x6x3/4 x 37.33	NODE = 28 Fx = 1.0 k
DOLRDKN	9/10/85	BASE ANGLE ANALYSIS	∠6x6x3/4 x 37.33	NODE = 13 Mz = 1.0 k
DOLRDG7	9/10/85	BASE ANGLE ANALYSIS	∠6x6x3/4 x 37.33	NODE = 13 Fx = 1.0 k
DOLRDHV	9/10/85	BASE ANGLE ANALYSIS	∠6x6x3/4 x 37.33	NODE = 13 Fz = 1.0 k
DOLRDIR	9/10/85	BASE ANGLE ANALYSIS	∠6x6x3/4 x 37.33	NODE = 13 Mx = 1.0 k
DOLRDJV	9/10/85	BASE ANGLE ANALYSIS	∠6x6x3/4 x 37.33	NODE = 13 My = 1.0 k
DOLRDA7	9/10/85	BASE ANGLE ANALYSIS	∠6x6x3/4 x 37.33	NODE = 13 Fx = 1.0 k

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Multimode Response Multiplier Study - Computer Analysis for Cable Tray System Runs with a Bend, Model Nos. 1A & 1B

LIST OF COMPUTER RUNS				
RUN I.D.	DATE	TYPE OF RUN (✓)		DESCRIPTION
		FREQUENCY	STATIC	
DOL2CVR	11-11-85			FORTRAN – SUBROUTINE PICK
DOL2DC7	11-11-85			DYNRE4 – MODEL 1, OBE, FIXED
DOLOAXN	11-12-85			DYNRE4 – MODEL 1, SSE, FIXED
DOL2DNJ	11-11-85			DYNRE4 – MODEL 1, OBE, SPRING
DOLOAXB	11-12-85			DYNRE4 – MODEL 1, SSE, SPRING
DOLOA4Z	11-12-85			DYNRE4 – MODEL 2, OBE, FIXED
DOLOA2J	11-12-85			DYNRE4 – MODEL 2, SSE, FIXED
DOLOA2Z	11-12-85			DYNRE4 – MODEL 2, OBE, SPRING
DOLOA3Z	11-12-85			DYNRE4 – MODEL 2, SSE, SPRING

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Multimode Response Multiplier Study - Computer Analysis for Cable Tray System Runs with a Bend, Model Nos. 1A & 1B

LIST OF COMPUTER RUNS				
RUN I.D.	DATE	TYPE OF RUN (✓)		DESCRIPTION
		FREQUENCY	STATIC	
DRY RA 53	12-30-85	✓		MODEL "1-A" - 3-D FREQ.
DRY TB NZ	1-8-86	✓		MODEL "1-B" - 3-D FREQ
DRY SA 2F	12-31-85	✓		MODEL "1-A" - 2-D FREQ
DRY UB QV	1-10-86	✓		MODEL "1-B" - 2-D FREQ
DRY TC DB	1-15-86		✓	MODEL "1-A" - 2-D STATIC
DRY VC QJ	1-31-86		✓	MODEL "1-B - 2-D - STATIC (FACTOR MOMENT)
DRY SC TR	1-28-86		✓	MODEL "1-B" - 2-D - STATIC - REF
DRY TD E7	1-29-86		✓	MODEL "1-B" - 2-D STATIC (UNBAL. MOMENT) - REF

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COMANCHE PEAK UNIT NO. 2

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LIST OF COMPUTER RUNS

RUN I.D.	DATE	TYPE OF RUN (I/) FREQ.	TYPE OF RUN (I/) STATIC	DESCRIPTION
DRY UD QF	1-16-86			"1-A" - MRM - 860.00 - OBE (RSS=6)
DRY UD V7	1-16-86			"1-A" - MRM - 860.00 - SSE (RSS=6)
DRY UD WN	1-16-86			"1-A" - MRM - 905.75' - OBE (RSS=6)
DRY UD W7	1-16-86			"1-A" - MRM - 905.75' - SSE (RSS=6)
DRY UD XJ	1-16-86			"1-A" - MRM - 899.50' - OBE (RSS=6)
DRY UD X3	1-16-86			"1-A" - MRM - 899.50' - SSE (RSS=6)
DRY UD YB	1-16-86			"1-A" - MRM - 873.33' - OBE (RSS=6)
DRY UD YN	1-16-86			"1-A" - MRM - 873.33' - SSE (RSS=6)
DRY UD ZB	1-16-86			"1-A" - MRM - 896.5' - OBE (RSS=6)
DRY UD ZF	1-16-86			"1-A" - MRM - 896.5' - SSE (RSS=6)
DRY VB PR	1-17-86			"1-B - MRM - 860.5' - OBE (RSS=6)
DRY VB P3	1-17-86			"1-B" - MRM - 860.0' - SSI (RSS=6)
DRY VB QN	1-17-86			"1-B" - MRM - 905.75 - OBE (RSS=6)
DRY VB RB	1-17-86			"1-B" - MRM - 905.75 - SSE (RSS=6)
DRY VB RJ	1-17-86			"1-B" - MRM - 899.5 - OBE (RSS=6)
DRY VB RZ	1-17-86			"1-B" - MRM - 899.5 SSE (RSS=6)
DRY VB SB	1-17-86			"1-B" - MRM - 873.33 - OBE (RSS=6)
DRY VB SR	1-17-86			"1-B" - MRM - 873.33 - SSE (RSS=6)
DRY VB SV	1-17-86			"1-B" - MRM - 896.5 - OBE (RSS=6)
DRY VB S7	1-17-86			"1-B" - MRM - 896.5 - SSE (RSS=6)

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Multimode Response Multiplier Study - Computer Analysis for Cable Tray System Runs with a Bend, Model Nos. 1A & 1B

LIST OF COMPUTER RUNS

RUN I.D.	DATE	TYPE OF RUN (X)		DESCRIPTION
		FREQ.	STATIC	
DRY UD 2F	1-16-86			"1-A"-MRM-860.00'OBE (RSS=14) IRSSXI=1
DRY UE GR	1-17-86			"1-A"-MRM-860.00'SSE (RSS=14) IRSSXI=1
DRY UE G3	1-17-86			"1-A"-MRM-905.75'OBE (RSS=14) IRSSXI=1
DRY UE HJ	1-17-86			"1-A"-MRM-905.75'SSE (RSS=14) IRSSXI=1
DRY UE IB	1-17-86			"1-A-MRM-899.50'-OBE(RSS=14)IRSSXI=1
DRY UE IJ	1-17-86			"1-A"-MRM-899.50'SSE (RSS=14) IRSSXI=1
DRY UE IV	1-17-86			"1-A"-MRM-873.33'-OBE (RSS=14) IRSSXI=1
DRY UE JJ	1-17-86			"1-A"-MRM-873.33'-SSE (RSS=14) IRSSXI=1
DRY UE JR	1-17-86			"1-A"-MRM-896.50'-OBE (RSS=14) IRSSXI=1
DRY UE JV	1-17-86			"1-A"-MRM-896.50'-SSE (RSS=14) IRSSXI=1
DRY VB GF	1-17-86			"1-B"-MRM-860.00' OBE (RSS=14) IRSSXI=1
DRY VB JN	1-17-86			"1-B"-MRM-860.00'SSE (RSS=14) IRSSXI=1
DRY VB J3	1-17-86			"1-B"-MRM-905.75' OBE (RSS=14) IRSSXI=1
DRY VB KN	1-17-86			"1-B"-MRM-905.75' SSE (RSS=14) IRSSXI=1
DRY VB KV	1-17-86			"1-B"-MRM-899.5' OBE (RSS=14) IRSSXI=1
DRY VB LN	1-17-86			"1-B"-MRM-899.5' SSE (RSS=14) IRSSXI=1
DRY VB MN	1-17-86			"1-B"-MRM-873.33 OBE (RSS=14) IRSSXI=1
DRY VB NB	1-17-86			"1-B"-MRM-873.33 SSE (RSS=14) IRSSXI=1
DRY VB NR	1-17-86			"1-B"-MRM-896.5 OBE (RSS=14) IRSSXI=1
DRY DA 5R	1-21-86			"1-B"-MRM-896.5 SSE (RSS=14) IRSSXI=1

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LIST OF COMPUTER RUNS

RUN I.D.	DATE	TYPE OF RUN (X)		DESCRIPTION
		FREQ.	STATIC	
DRY SB P3	1-7-86			EL 860 - R.I BLDG - OBE
DRY SD YZ	1-7-86			EL 860 - R.I. BLDG - SSE
DRY SD 47	1-7-86			EL 905.75 R.I. BLDG OBE
DRY SD 6Z	1-7-86			EL 905.75 R.I BLDG SSE
DRY VC 7N	1-15-86			EL 899.5 - R.A.B. OBE. M.1A.
DRY SD 9F	1-7-86			EL 899.5 - R.A.B. SSE - 1A
DRY SE AF	1-7-86			EL 873.33 - ELECT BLDG - OBE
DRY SE AV	1-7-86			EL 873.33 - ELECT BLDG - SSE
DRY VC 23	1-15-86			EL 896.5 - SAFEGUARD BLDG - OBE - M.1A
DRY SE BJ	1-15-86			EL 896.5 - SAFEGUARD BLDG - SSE - M.1A
DRY VC RR	1-17-86			EL 860.0 - MRM - 1B - OBE - RSS=1
DRY VC RZ	1-17-86			EL 860.0 - MRM - 1B - SSE - RSS=1
DRY VC R3	1-17-86			EL 905.75 - MRM - 1B - OBE - RSS=1
DRY VC 9B	1-17-86			EL 905.75 - MRM - 1B - SSE - RSS=1
DRY VC 1KN	1-10-86			EL 899.5 - R.A.B - OBE - M.1B
DRY VC SN	1-17-86			EL 899.5 - MRM - 1B - SSE - RSS=1
DRY VC SR	1-17-86			EL 873.33 - MRM - 1B - OBE - RSS=1
DRY YU QZ	1-10-86			EL 873.33 - ELECT BLDG - SSE M.1B RSS=1
DRY VC S7	1-17-86			EL 896.5 - MRM - 1B - OBE - RSS=1
DRY VC TF	1-17-86			EL 896.5 - MRM - 1B - SSE - RSS=1

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COMANCHE PEAK UNIT NO. 2

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Multimode Response Multiplier Study - Computer Analysis for Cable Tray System Runs with a Bend, Model Nos. 1A & 1B

LIST OF COMPUTER RUNS

RUN I.D.	DATE	TYPE OF RUN (✓)		DESCRIPTION
		FREQUENCY	STATIC	
DRY ID WV	1-22-86		✓	MODEL "1-A" - MISSING WT. RATIO (3-D)
DCL IC 9E	1-22-86		✓	MODEL "1-B" MISSING WT. RATIO (3-D)
DRY IE JB	1-30-86		✓	MODEL "1-A" - RIGID MOTION (3-D)
DRY IE HV	1-29-86		✓	MODEL "1-B" RIGID MOTION (3-D)
DRY SA UN	12-31-85		✓	MODEL "1-A" - ½-D" MISSIN WT RATIO RAT. BLDG. 860.0' O.B.E. (REF)
DRY UD 2J	1-16-86		✓	MODEL "1-A" - MRM (RSS 14, IRSS XI: 10) RAT BLDG 860.0' O.B.E. (REF)
DRY ZB 9J	1-27-86		✓	MODEL "1-B" - 3-D" STATIC INERTIA FORCE
DRY 3DVN	2-21-86		✓	MODEL "1-A" 3-D STATIC INERTIA FORCE

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Multimode Response Multiplier Study - Computer Analysis for Cable Tray System Runs with a Bend, Model Nos. 1A & 1B

LIST OF COMPUTER RUNS				
RUN I.D.	DATE	TYPE OF RUN (✓)		DESCRIPTION
		FREQUENCY	STATIC	
DRYZDMN	2-3-86			MODEL "1-A" OBE "BEST ESTIMATE EQ."
DRYZDGJ	2-4-86			MODEL "1-A" SSE "BEST ESTIMATE EQ" 1/2
DRYODA3	2-4-86			MODEL "1A" SSE "BEST ESTIMATE EQ" 1/2
DRYZDXF	2-4-86			MODEL "1-B" OBE "BEST ESTIMATE EQ" 1/2
DRYODOJ	2-5-86			MODEL "1B" OBE "BEST ESTIMATE EQ" 1/2
DRYZDXJ	2-4-86			MODEL "1-B" SSE "BEST ESTIMATE EQ" 1/2
DRYODTR	2-5-86			MODEL "1-B" SSE "BEST ESTIMATE EQ" 1/2
DRYZCL3	2-3-86			MODEL "1A" OBE "RESPONCE SPECTRA
DRYZA4B	2-3-86			MODEL "1A" SSE "RESPONCE SPECTRA
DRYZC67	2-3-86			MODEL "1-B" OBE "RESPONCE SPECTRA
DRYZDF7	2-3-86			MODEL "1B" SSE "RESPONCE SPECTRA

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COMPUTER RUNS - MULTIMODE RESPONSE MULTIPLIER - STUDIES

RUN I.D.	DATE	DESCRIPTION
DOL UD JB	9/12/85	Frequency Anal. 2-D Fixed B.C. CTH-2-11099
DOL RF 67	10/25/85	Frequency Anal. 3-D Fixed B.C. Tape 23495
DOL SI MF	10/29/85	Response Spectra - Fixed B.C. - OBE Safeguard Bldg EL 852.5
DOL SI M3	10/29/85	Response Spectra - Fixed B.C. - OBE Safeguard Bldg EL 896.5
CLØ RD I3	11/4/85	Response Spectra - Fixed B.C. - OBE Safeguard Bldg El 896.5
DOL SI NN	10/29/85	Response Spectra - Fixed B.C. - OBE Auxiliary Bldg EL 899.5
CLØ RD I7	11/4/85	Response Spectra - Fixed B.C. - OBE Auxiliary Bldg EL 899.5
DOL SI NV	10/29/85	Response Spectra - Fixed B.C. - OBE Electric Bldg EL 873.33
DOL SI N7	10/29/85	Response Spectra - Fixed B.C. - OBE R.B. Internals EL 905.75
DOL SI QJ	10/29/85	Response Spectra - Fixed B.C. - SSE Safeguard Bldg EL 852.5
CLØ RD OV	11/4/85	Response Spectra - Fixed B.C. - SSE Safeguard Bldg EL 896.5
DOL SI ØR	10/29/85	Response Spectra - Fixed B.C. - SSE Auxiliary Bldg EL 899.5
CLØ RD L7	11/4/85	Response Spectra - Fixed B.C. - SSE Auxiliary Bldg EL 899.5
DOL SI PF	10/29/85	Response Spectra - Fixed B.C. - SSE Electric BLDG EL 873.33
DOL SI QN	10/29/85	Response Spectra - Fixed B.C. - SSE R.B. Internals EL 905.75

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COMPUTER RUNS - MULTIMODE RESPONSE MULTIPLIER - STUDIES

RUN I.D.	DATE	DESCRIPTION
DOL WB CJ	10/26/85	2-D Flexible B.C. CTH-2-11012
DOL VC F3	10/25/85	3-D Flexible B.C. Tape 13720
DOL TB 1B	10/30/85	Response Spectra Anal. Flexible B.C. - OBE Safeguard Bldg EL 852.5
DOL VI 9J	11/1/85	Response Spectra Anal. Flexible B.C. - OBE Safeguard Bldg EL 896.5
DOL VJ FJ	11/1/85	Response Spectra Anal. Flexible B.C. - OBE Auxiliary Bldg EL 899.5
DOL TB 23	10/30/85	Response Spectra Anal. Flexible B.C. - OBE Electric Bldg EL 873.33
DOL TB 3B	10/30/85	Response Spectra Anal. Flexible B.C. - OBE R.B. Internals EL 905.75
DOL TB 3V	10/30/85	Response Spectra Anal. Flexible B.C. - SSE Safeguard Bldg EL 852.5
DOL VI 7N	11/1/85	Response Spectra Anal. Flexible B.C. - SSE Safeguard Bldg EL 896.5
DOL VJ CZ	11/1/85	Response Spectra Anal. Flexible B.C. - SSE Auxiliary Bldg EL 899.5
DOL TB 5V	10/30/85	Response Spectra Anal. Flexible B.C. - SSE Electric Bldg EL 873.33
DOL TB 0J	10/30/85	Response Spectra Anal. Flexible B.C. - SSE R.B. Internals EL 905.75

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Computer Runs - Multimode Response Multiplier - Studies

RUN I.D.	DATE	DESCRIPTION
DOL RB IB	9/23/85	Q/A Dump of DYNRE 4 Run's Tape 80
DOL NB RF	9/26/85	Q/A of Post Processor From P.F.X3 = Longitudinal
DOL UB 47	9/26/85	Q/A of Post Processor From Deck X3 = Longitude
DOL UC N7	9/26/85	Q/A of Post Processor Form Deck X1 = Longitude
DOL UC XR	9/26/85	Q/A Created P.F. of Post Processor
DOL RE MB	9/30/85	Q/A of Actual Case Using P.F.

EBASCO SERVICES INCORPORATED

CALCULATION COVER SHEET

CLIENT: TEXAS UTILITIES GENERATING CO

PROJECT: COMANCHE PEAK UNIT 2
CABLE TRAY HANGERS

OFS NO. TU4C3306.221

DEPT NO. 550

SUBJECT: MULTIPLE RESPONSE MULTIPLIER - STUDY FOR CABLE TRAY SYSTEM RUNS WITH A BEND MODELS 1A & 1B

CALCULATION NO. VOLUME I - BOOK 9 (PART 4)

NUMBER OF SHEETS 102

PROBLEM

The verification of a Multiple Response Multiplier - (MRM) was extended to cover the cable tray - hanger system with a bend.

It was found that the previous finding for the straight run system is valid also for the cable tray - hanger system with bend, namely An MRM of 1.25 is adequate to cover the multiple modes and system effect by Equivalent Static Analysis (ESA) method.

CONTAINS ASSUMPTIONS WHICH REQUIRE CONFIRMATION YES _____ NO ✓

ASSUMPTIONS CONFIRMED ON _____ BY _____

REV. NO.	SHEET NOS.	NAME	DATE	NAME	DATE	OPTIONAL	NAME	DATE
0	102	I H CHOU	2/11/88	C.H. Yeh / K.L. Wu	2/11/88			
		CALCULATION BY		CHECKED BY			REVIEWED OR APPROVED BY	

PRELIMINARY ☐ FINAL ☑ SUPERSEDES CALC NO. _____

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EBASCO SERVICES INCORPORATED

BY Z H CHU DATE 1/27/86 SHEET 1 OF 402

CHKD. BY YEH DATE 1/25/86 OFS NO. 3306.221 DEPT. NO. 550

CLIENT TEXAS UTILITIES GENERA...G CO.

PROJECT COMANCHE PEAK UNIT 2

SUBJECT CABLE TRAY HANGERS

1 Introduction

The verification of a Multimode Response Multiplier (MRM) was extended to investigate a cable tray-hanger system with bent. The study followed the same procedures as in the straight run cases, namely:

A). 2-D hanger study:

i) frequency analysis for hanger with tray weight added at the tier locations,

ii) system frequency computation through Dunkerley's formula to combine the frame and cable frequencies

iii) acceleration level in three directions from the corresponding floor response spectrum curves for the three fundamental system frequencies obtained in step ii of (A).

581/8-81

iv) static analysis to find the reactions at the supports of the hanger using acceleration level obtained from (iii) of (A)

B) 3-D cable hanger - tray system

Two systems were investigated, one with a symmetrical setting (model 1-A) and the other with tray terminating at one end (model 1-B). Both systems used the longitudinal and transverse hangers as those of model 1 in previous straight run study, with the same cable tray arrangement.

i) Frequency analysis:

cut off frequency of 33 Hz is used

ii) Modal response analysis:

STARDYNE system, DYNRE 4 code was used in the study with three

distinctive options

a) RSS = 1. purely SRSS for modal superposition

b) RSS = 14 and IRSS×I = 1, CQC

c) RSS = 6. SRSS with 10% close mode provision

The responses obtained were modal accelerations as well as reactions at the support.

iii) static analysis to find the support reactions due to missing weight.

c) The comparison of results from A & B was then performed on both the accelerated level as well as hanger support reactions.

It should be noted that in the modal analysis ~~the~~ structural response up to 33 Hz

were combined. To account for the contribution due to the higher modes, a residual-load-method was used. It was obvious from this study, that the contribution is substantial, especially at the pedal points of the hanger.

The results of this study further support and substantiate the amplification factor of 1.25 is adequate and conservative, both for the acceleration and hanger reaction consideration.

2 STRUCTURAL MODELS

Two cable tray - hanger systems with bend were constructed, designated as models 1-A and 1-B. Both the transverse / longitudinal hanger and cable tray used the same configuration as those of model 1 in the previous straight run study. Model 1-A had symmetrical setting with longitudinal supports at both ends, whereas model 1-B has trays terminated at one end.

The support hangers were assumed fixed at the support points. An additional cable tray weight was added at the tray nodal points at the end support hangers, to account for the tray load beyond the end support hanger.

The cross-sectional properties were

identical to the previous study. However, it is included for easy reference. The tray weight assumed a maximum of 35 #/ft² as in the previous study.

BY C.H. Hsu DATE 12-17-85 SHEET 7 OF 102

CHKD. BY C.W.U DATE 12-17-85 OFS NO. 306 221 DEPT. NO. 550

CLIENT TEXAS UTILITIES GENERATING CO.

PROJECT COMANCHE PEAK UNIT 2

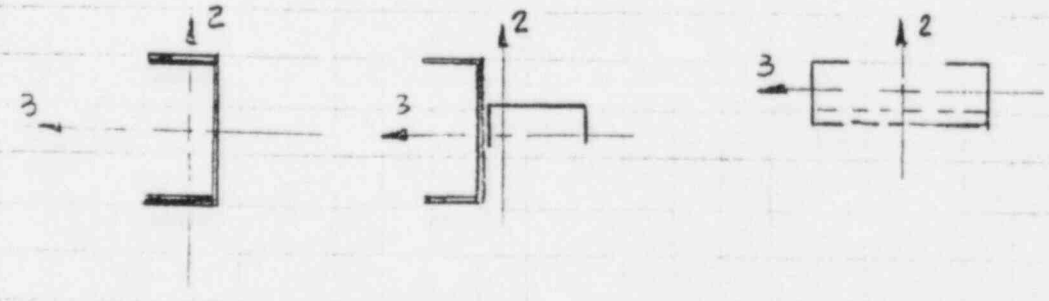
SUBJECT CABLE TRAY HANGERS

2a. BEAM PROPERTY

BEAM I.D.	PROP I.D	A	J	I_3	I_2	S_2	S_3
C6x8.2	1	2.4	.075	13.1	.692	.5	.5
C4x7.25	2	2.13	.082	459	.432	.61	.39
L3x3x3/8	3	2.11	—	—	—	—	—
COMPOSIT MC6x12/C6x8.2	4	5.88	0.22	19.719	4.985	0.5	0.5
MC 6x12	5	3.53	.155	18.7	1.87	.53	.47
12x4 TRAY	6	1.102	.099	1.465	5.793	0.5	0.5
RIGID BAR	7	50.0	200.0	2000.0	2,000.0	1.0	1.0

NOTES:

1. UNIT IN INCH-KIP,
2. ELASTIC PROPERTIES $E = 29 \times 10^3$,
3. POISSON RATIO $\nu = 0.3$
4. CRITICAL DAMPING RATIO : OBE 4%, SSE 7%



2b. Boundary Condition

The support hangers were assumed fixed at the support points. An additional cable tray weight was added at the transitional points at the end support hangers to account for the tray load beyond the end support hangers

2C. TRAY WEIGHT

I. TRAY LOAD FOR FREQUENCY ANALYSIS INPUT (MODEL 1-A)

1. EXTRA-LOAD FOR SUPT #1, PT ①, ㉛, ㊶ (3-D INPUT)

LONG. $35 \times 20' = 700^{\#}$ ($W_1 = .7^{K}$)

VERT. $35 \times 45' = 158^{\#}$ ($W_2 = .158^{K}$)

TRAN. $35 \times 45' = 158^{\#}$ ($W_3 = .158^{K}$)

2. EXTRA-LOAD FOR SUPT #6 PT ㉓, ㊸, ㊾ (3-D INPUT)

LONG $W_3 = .7^{K}$

VERT $W_2 = .158^{K}$

TRAN $W_1 = .158^{K}$

3. NODAL LOAD FOR 2-D (SINGLE FRAME) FREQUENCY ANALYSIS

SUPT # 3, PT ㉚㊺, ㉚㊻, ㉚㊼

LONG. $W_1 = 0$

VERT. $W_2 = 35 \times (\frac{108}{2} + 24 + \frac{1}{4} \times \pi \times 30)/12 = 296^{\#} = .296^{K}$

TRANS. $W_3 = 35 \times (108 \times 3 + 24\sqrt{2} + \frac{1}{2} \times \pi \times 30)/12 \times 2 = 611^{\#} = .611^{K}$

II. TRAY LOAD FOR FREQ. ANAL. (MODEL 1-B)

1. EXTRA-LOAD FOR EXTERIA SUP'T (3-D FREQ. ANAL.)

FOR SUP'T 1, PT ①, ㉛, ㊶

LONG = $35 \times 9' = 315^{\#}$ ($W_1 = .315$)

$\ell = 40 - 9x3 - 4.5 = 8.5'$

VERT = $35 \times 9'/2 = 158^{\#}$ ($W_2 = .158$)

TRAN = $158^{\#}$ ($W_3 = .158$)

FOR SUP'T 6, PT ㉓, ㊸, ㉝

LONG. = 0 ($W_3 = 0$)

VERT = $35 \times 9/2 = 158^{\#}$ ($W_2 = .158$)

TRAN = $158^{\#}$ ($W_1 = .158$)

2. NODAL LOAD FOR 2-D SINGLE FRAME FREQUENCY ANALYSIS

SUP'T 4, NODAL 405, 406, 407

LONG. $W_1 = 0$.

VERT $W_2 = 35 \times (\frac{108}{2} + 24 + \frac{1}{4}\pi \times 30)/12 = 296^{\#} = .296^{K}$

TRAN. $W_3 = W_2 \times 2 + 35 \times 4.5 = 750^{\#}$

EBASCO SERVICES INCORPORATED

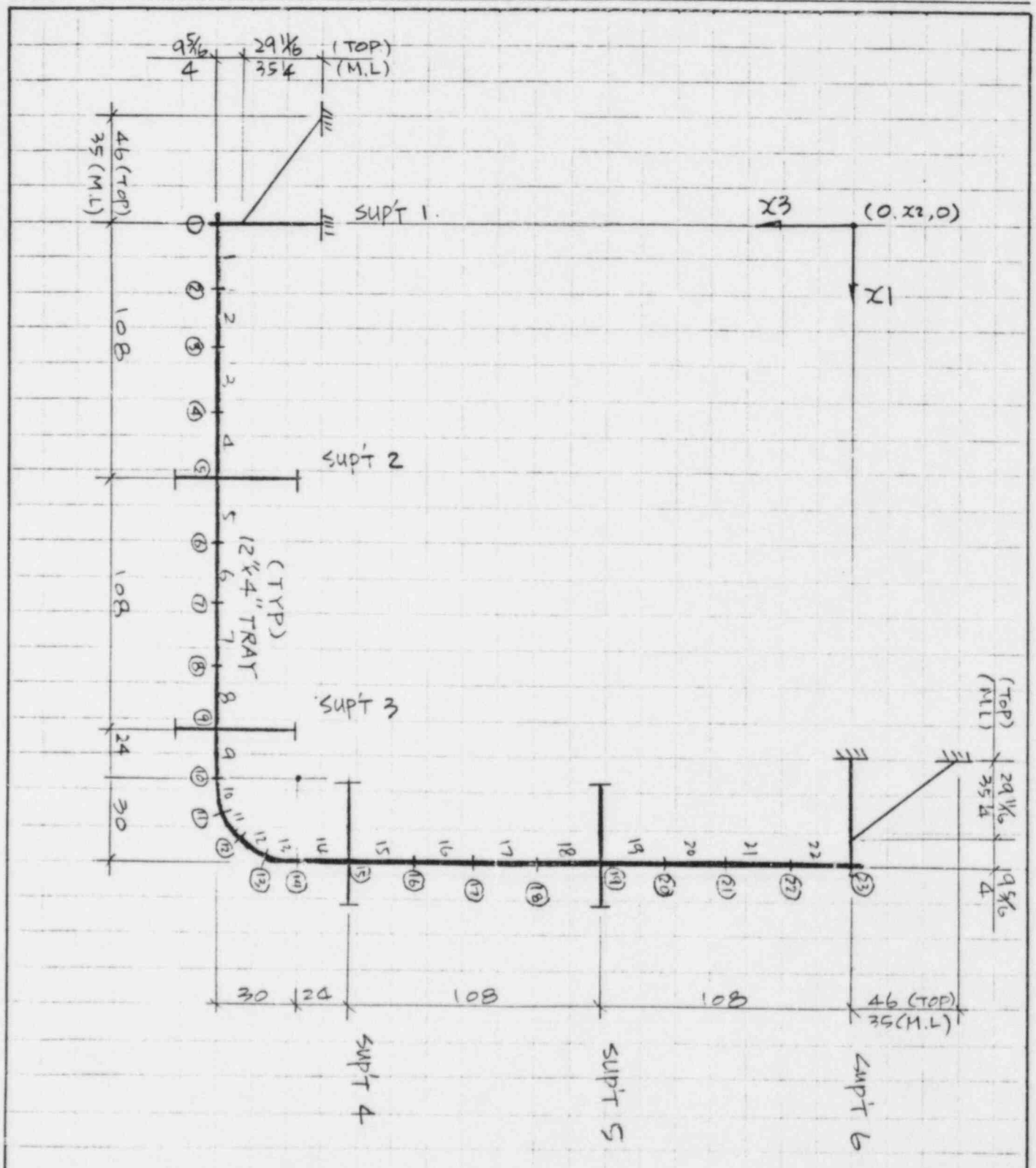
BY C.H. Yeh DATE 12-24-85 SHEET 11 OF 102

CHKD. BY C.W.H DATE 1-16-86 OFS NO. 3306.221 DEPT. NO. 550

CLIENT TEXAS UTILITIES GENERATING CO.

PROJECT COMANCHE PEAK UNIT 2
CABLE TRAY HANGERS

SUBJECT MODEL. 1-A



PLAN VIEW OF MODEL (1-A)

581/8-81

EBASCO SERVICES INCORPORATED

BY C.H. Yeh DATE 12-16-85 SHEET 12 OF 107

CHKD. BY C.W.U DATE 1-16-86 OFS NO. 3306.221 DEPT. NO. 550

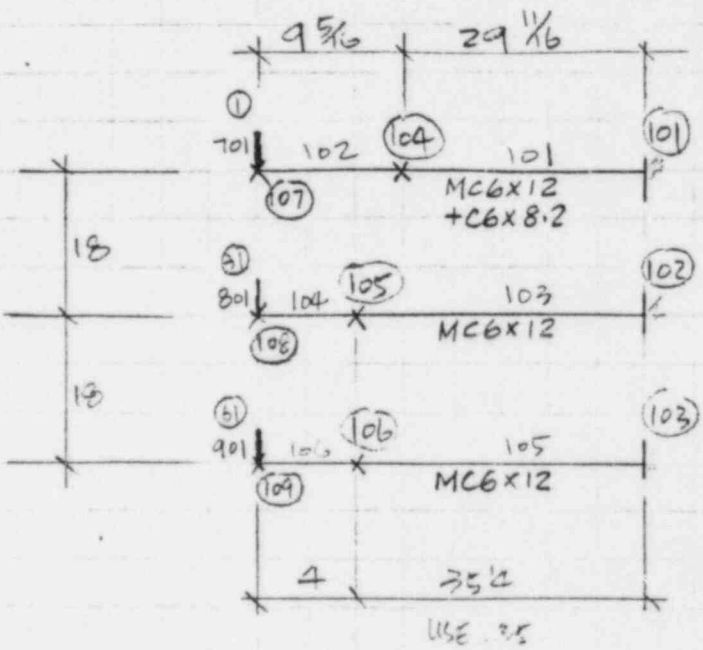
CLIENT TEXAS UTILITIES GENERATING CO.

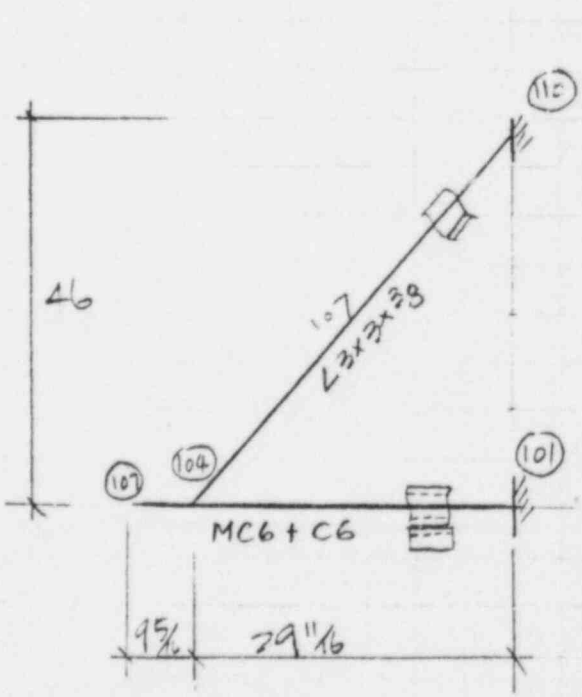
PROJECT COMANCHE PEAK UNIT 2
CABLE TRAY HANGERS

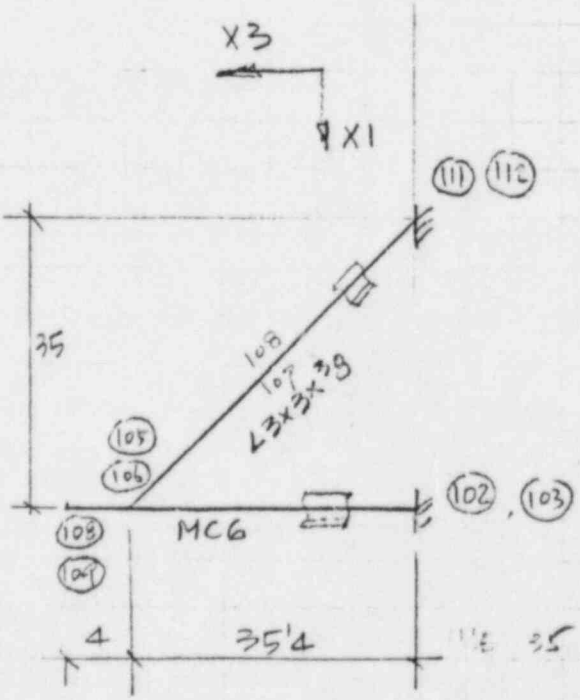
SUBJECT MODEL "1-A"

MODEL OF SUPT 1

(X1 = 0.0)







UPPER FRAME (X_2 = 36.0, X_3' = 28.875)

MID. LOWER FRAME (X_2 = 18.0 / 0.0, X_2' = 10.875 / 4.0)

581/8-81

EBASCO SERVICES INCORPORATED

BY C.H. Yeh DATE 12-16-85 SHEET 13 OF 102

CHKD. BY C.W.U DATE 1-16-86 OFS NO. 3306.221 DEPT. NO. 550

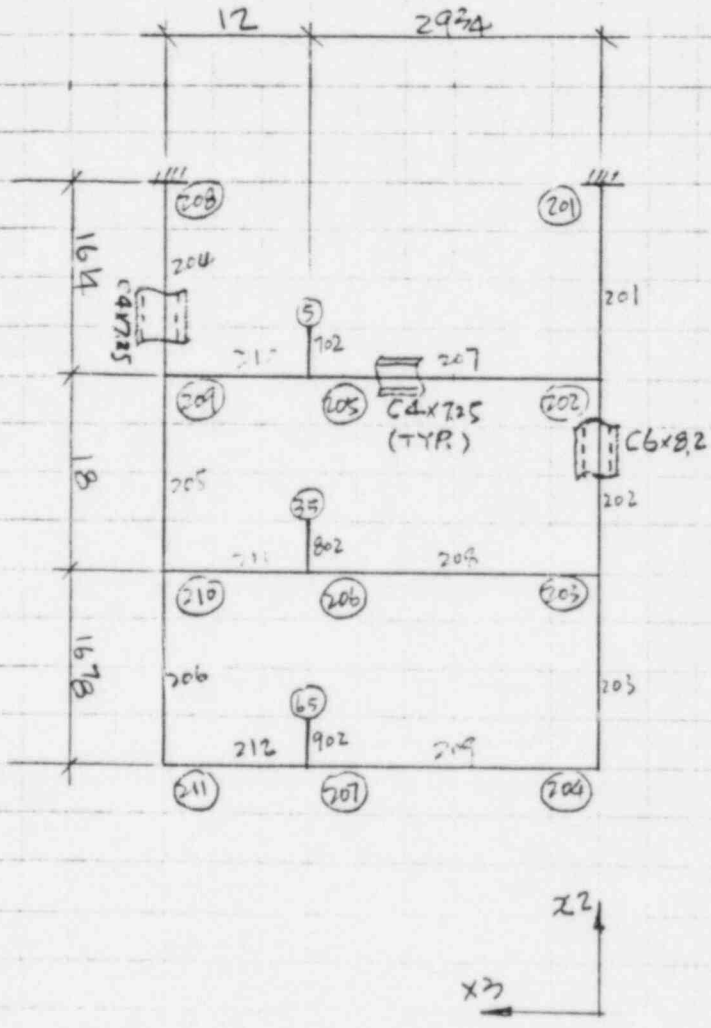
CLIENT TEXAS UTILITIES GENERATING CO.

PROJECT COMANCHE PEAK UNIT 2
CABLE TRAY HANGERS

SUBJECT MODEL 1-5

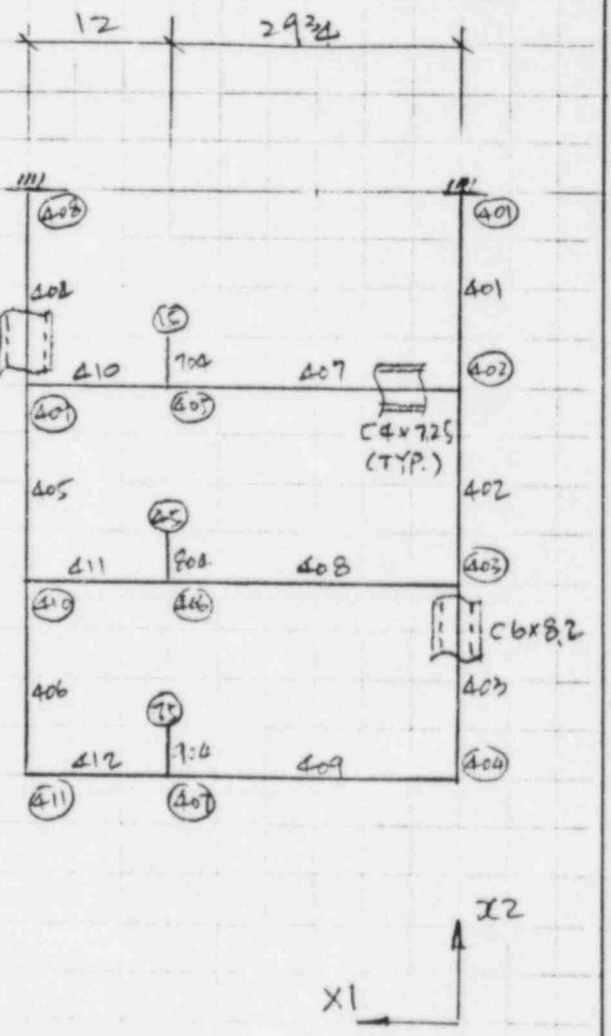
MODEL OF SUP'T 2. (X1=108)

MODEL OF SUP'T 3 (X1=216)



MODEL OF SUP'T 5 (X3=108)

MODEL OF SUP'T 4 (X3=216)



X_1	108.0 —> 216.0				
X_3	282.0	270.	240.25		
X_2'	4.0	20.875	38.875		
X_2	0.0	16.875	34.875	51.125	

282.0	270	240.25			X_1
108.0 ~ 216.0					X_3
4.0	20.875	38.875			X_2'
0.0	16.875	34.875	51.125		X_2

EBASCO SERVICES INCORPORATED

BY C.H. Yeh DATE 12-16-85 SHEET 14 OF 102

CHKD. BY C.L.W.U DATE 1-16-86 OFS NO. 3306.221 DEPT. NO. 550

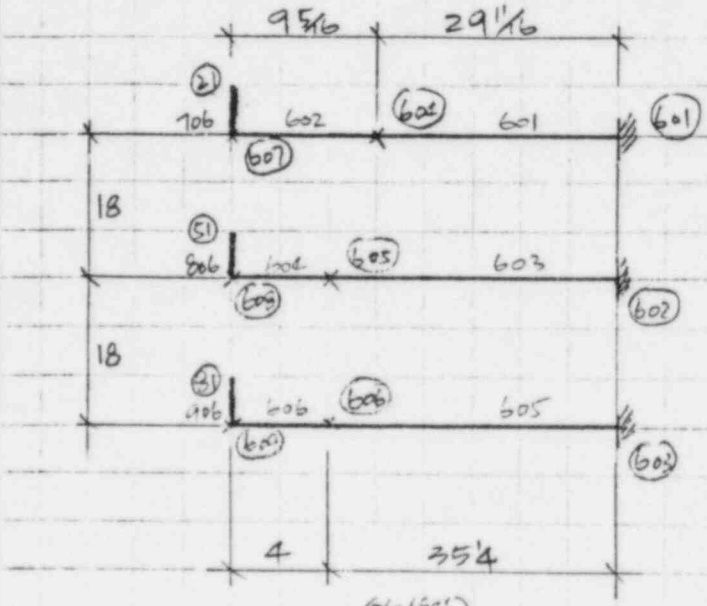
CLIENT TEXAS UTILITIES GENERATING CO.

PROJECT COMANCHE PEAK UNIT 2
CABLE TRAY HANGERS

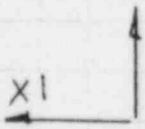
SUBJECT MODEL 1-A

MODEL OF SUPT 6

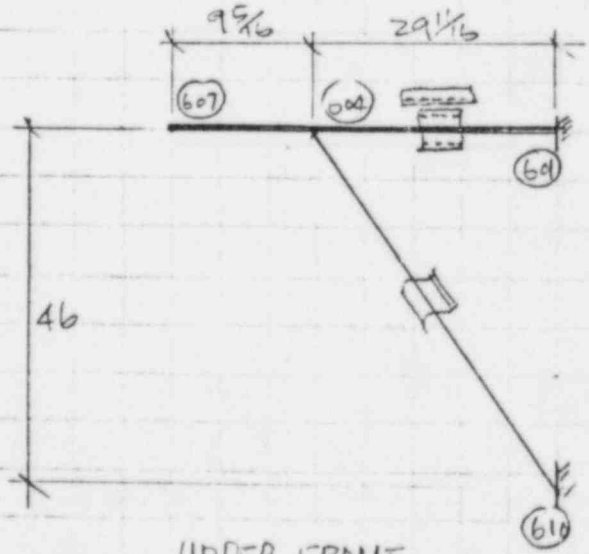
(X3=0.0)



ELV. OF MODEL



x_1 270.0 266.0 (266.5??) 231.0

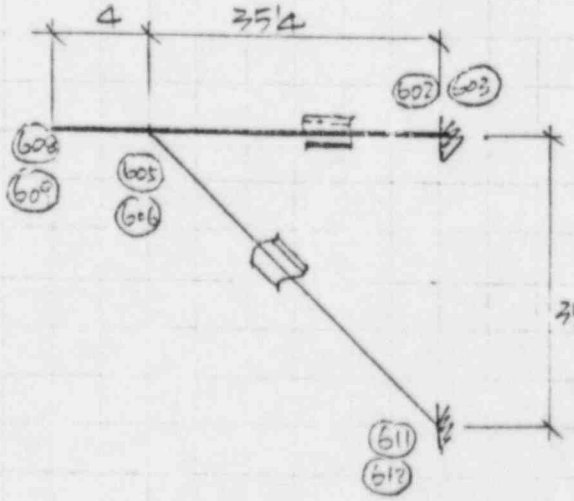


UPPER FRAME

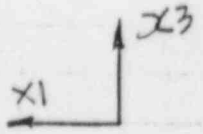
$x_2 = 36.0$

$x_1' = 38.875$

USE 35.



MID LOW FRAME $x_2 = 18.0$ / 0.0 $x_1' = 20.875$ / 4.0

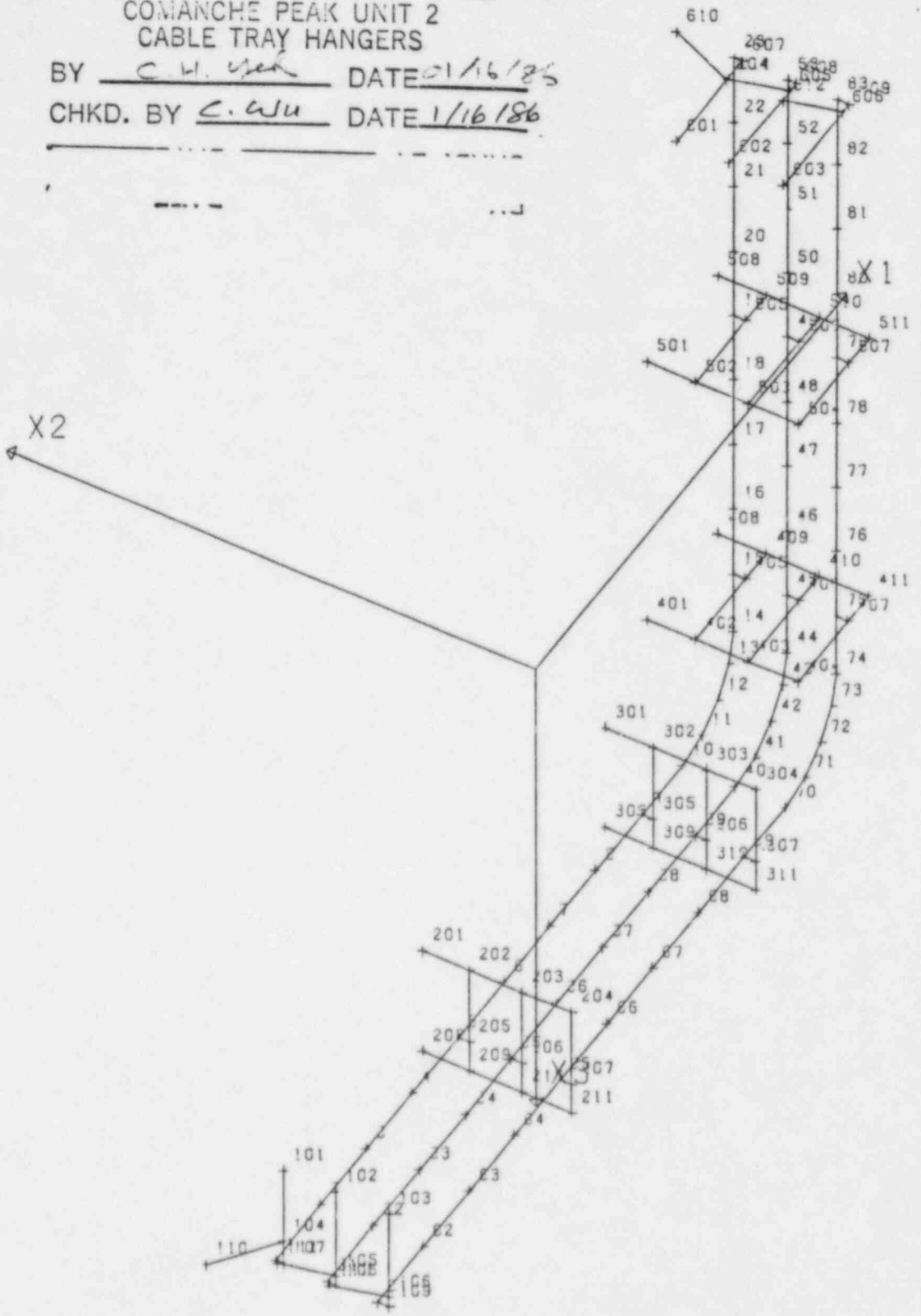


COMANCHE PEAK CABLE TRAY WITH BENT MODEL 1-A SHT. 15 OF 102

TEXAS UTILITIES GENERATING CO.
COMANCHE PEAK UNIT 2
CABLE TRAY HANGERS

BY C. H. Yeh DATE 1/16/86

CHKD. BY C. Wu DATE 1/16/86

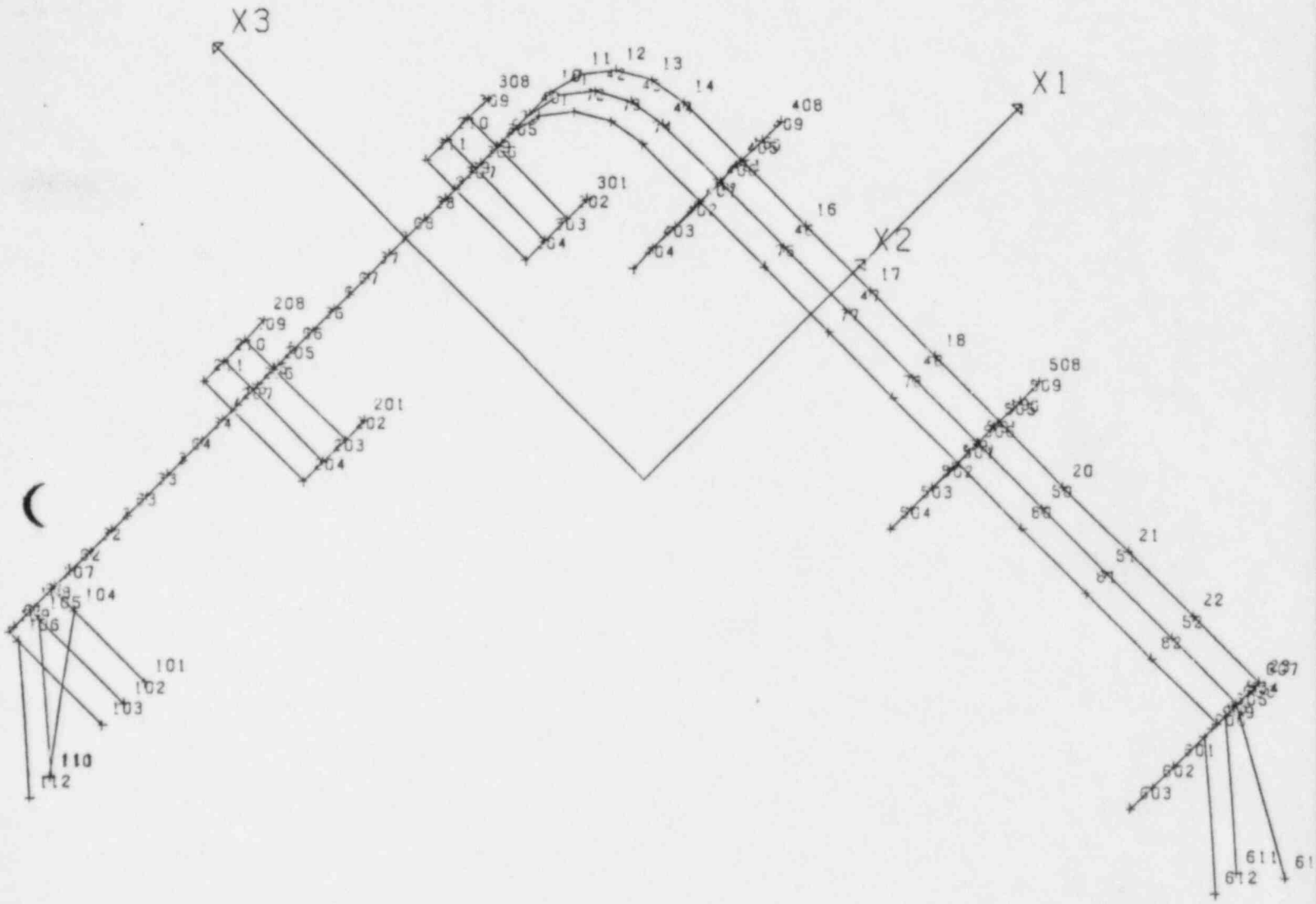


STARDYNE FINITE ELEMENT MODEL PROJECTION ON X2-X3 PLANE CASE NO. 1

TEXAS UTILITIES GENERATING CO.
COMANCHE PEAK UNIT 2
CABLE TRAY HANGERS

BY C. H Yeh DATE 01/16/86

CHKD. BY C. Wu DATE 1/16/86

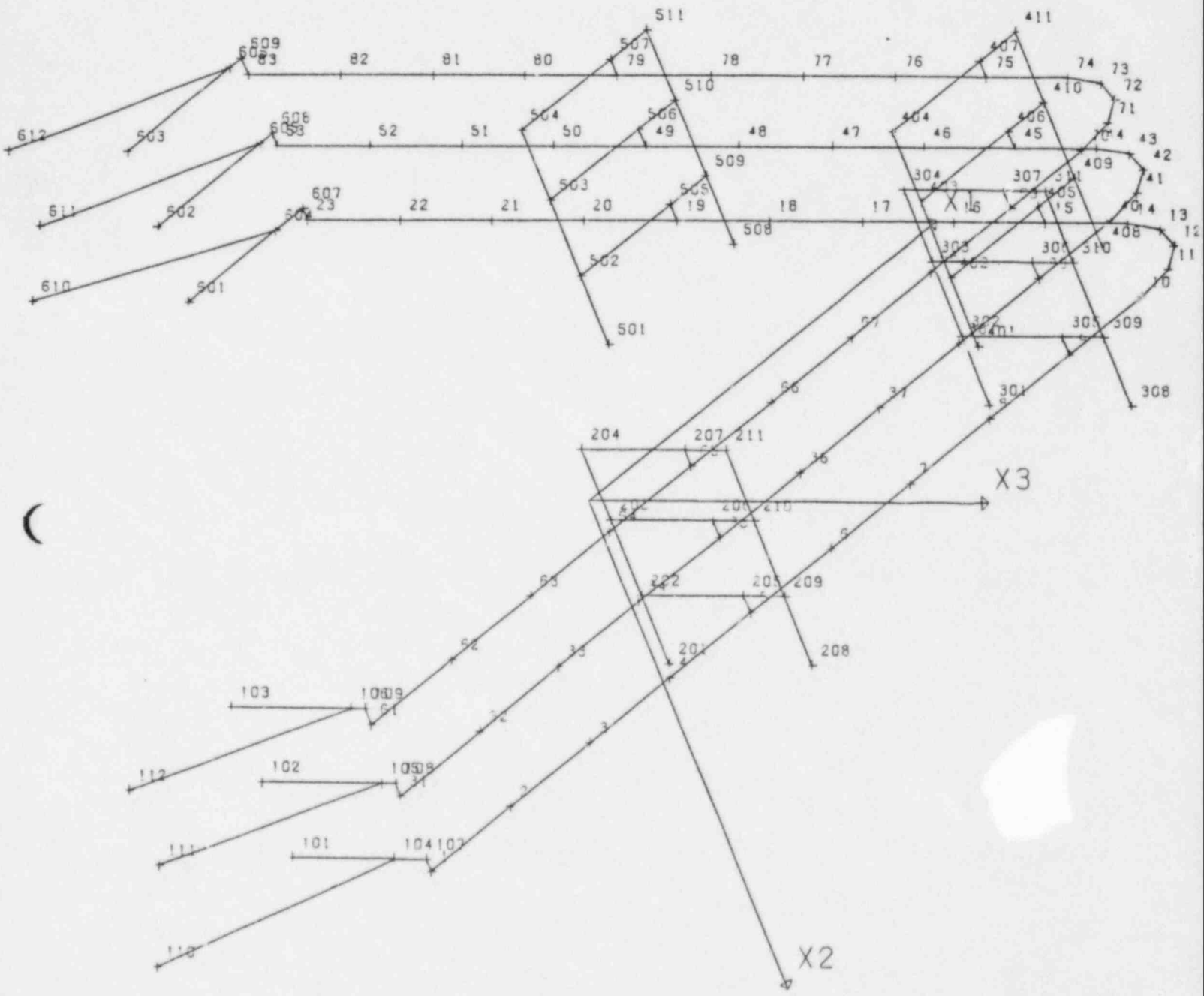


STARDYNE FINITE ELEMENT MODEL PROJECTION ON X3-X1 PLANE CASE NO. 1

COMANCHE PEAK CABLE TRAY WITH BENT MODEL 1-A

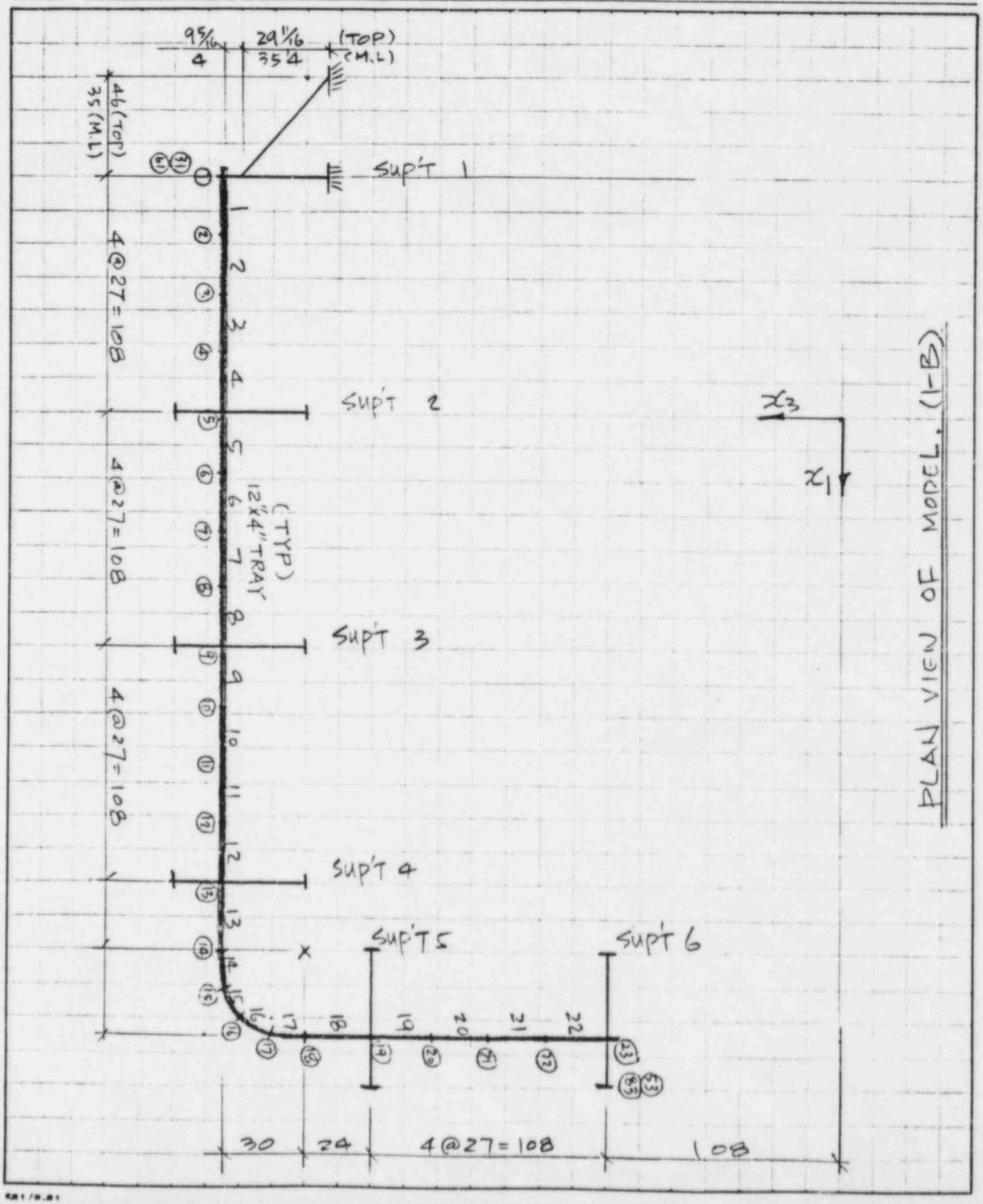
TEXAS UTILITIES GENERATING CO.
COMANCHE PEAK UNIT 2
CABLE TRAY HANGERS

BY C.H. Yeh DATE 01/16/86
CHKD. BY C.W.U DATE 1/16/86



STARDYNE FINITE ELEMENT MODEL PROJECTION ON X1-X2 PLANE CASE NO. 1

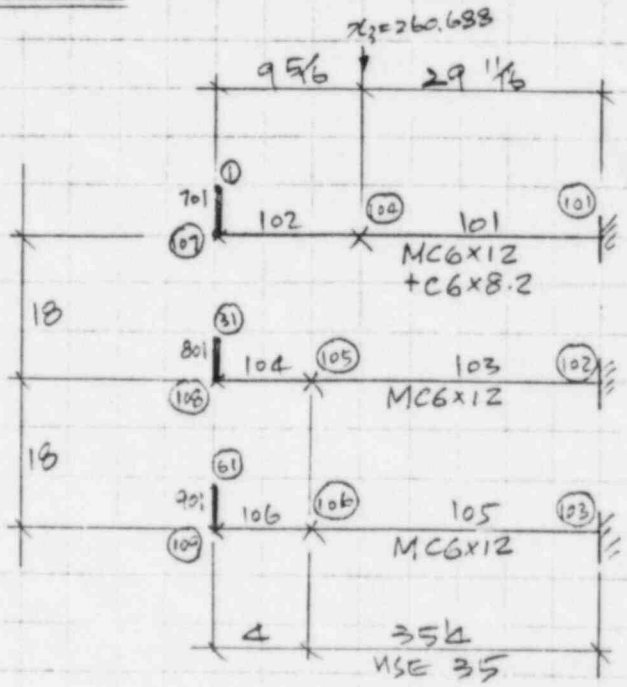
BY C.H Yeh DATE 01/06/85
CHKD. BY C.Wu DATE 1-16-86
SHEET 19 OF 102
OFS NO. 3306.221 DEPT. NO. 550
CLIENT TEXAS UTILITIES GENERATING CO.
PROJECT COMANCHE PEAK UNIT 2
CABLE TRAY HANGERS
SUBJECT MODEL. 1-B



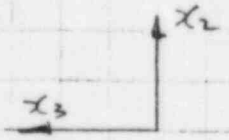
BY C.H. Yeh DATE 01/06/86
CHKD. BY C. Wu DATE 1-16-86
SHEET 19 OF 102
OFS NO. 3306 221 DEPT. NO. 550
CLIENT TEXAS UTILITIES GENERATING CO.
PROJECT COMANCHE PEAK UNIT 2
CABLE TRAY HANGERS
SUBJECT MODEL 1-B

MODEL OF SUB'T 1

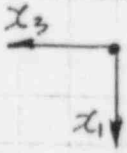
($x_1 = -108.0$)

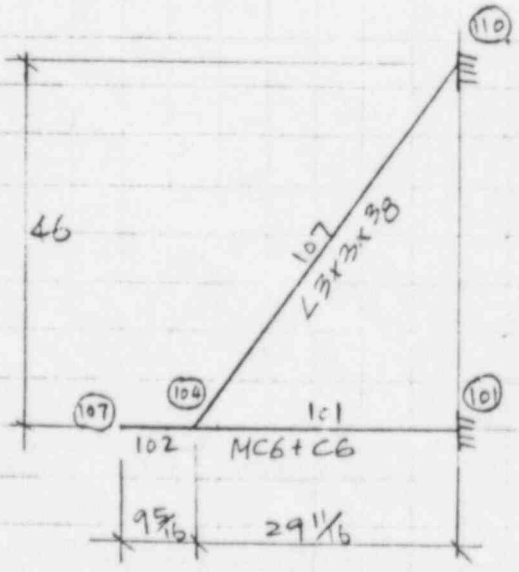


ELEV. OF MODEL



x_3 = 279.0 266.0 231.0

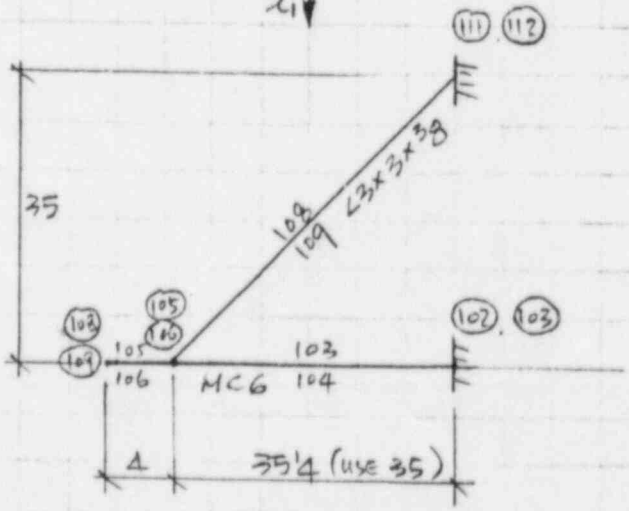




UPPER FRAME

x_2 = 36.0

x_2' = 33.875



MID. FRAME (x_2 = 18.0 / 0.0 x_2' = 20.875 / 4.0)
LOW

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BY C.H Yeh DATE 01/06/86 SHEET 20 OF 102

CHKD. BY C.W.H DATE 1-16-86 OFS NO. 3206 221 DEPT. NO. 550

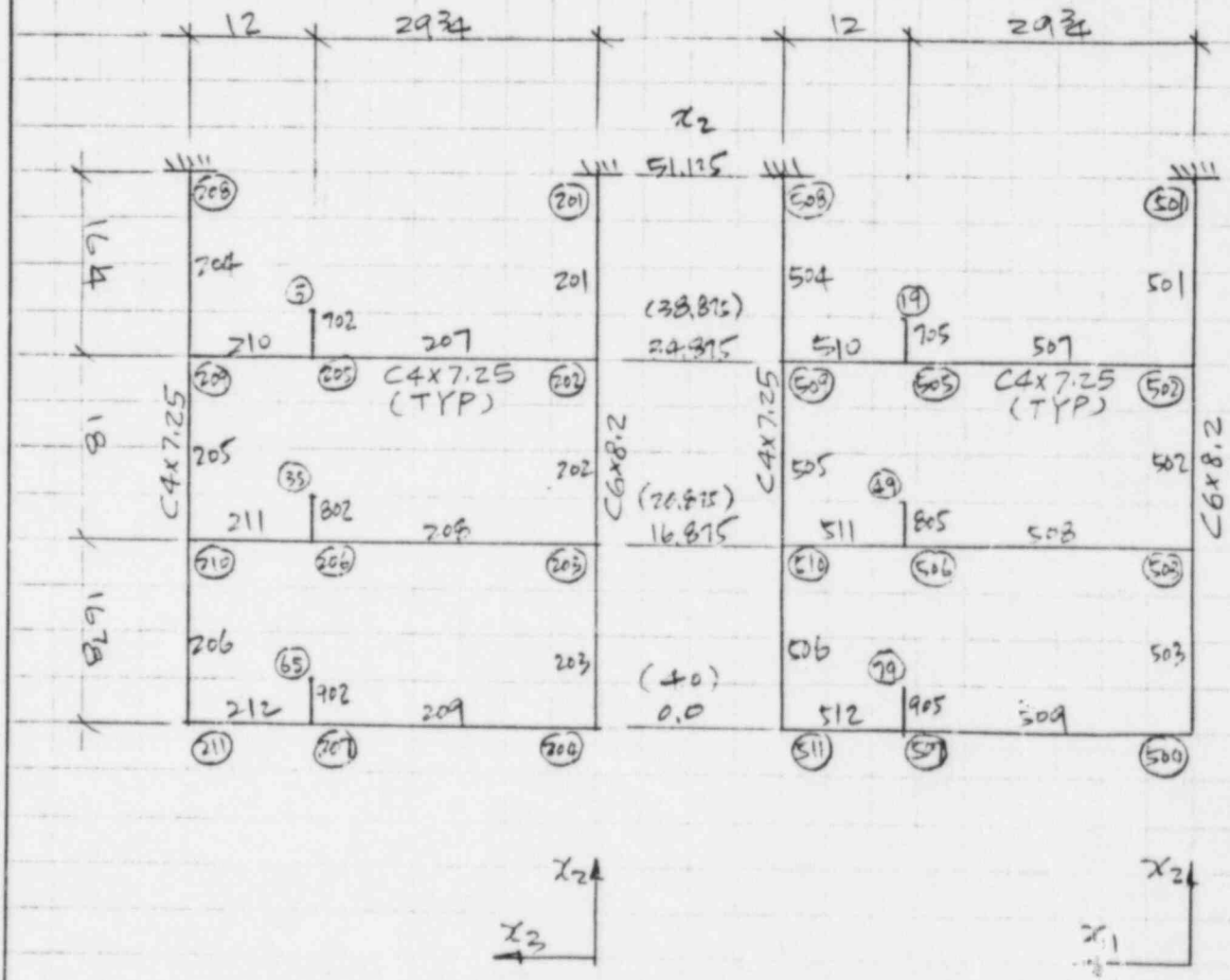
CLIENT TEXAS UTILITIES GENERATING CO.

PROJECT COMANCHE PEAK UNIT 2
CABLE TRAY HANGERS

SUBJECT MODEL 1-B

MODEL OF SUP'T 2, 3, 4 $\{ x_1 = 0.0, 108.0, 216.0 \}$

MODEL OF SUP'T 5, 6 $\{ x_3 = 216.0, 108.0 \}$



$(x_1 = 0.0,\ 108.0,\ 216.0)$ $(x_3 = 216.0\ \ 108.0)$

$x_3 = 282.0\ \ 270.0\ \ 240.25$ $x_1 = 282.0\ \ 270.0\ \ 240.25$

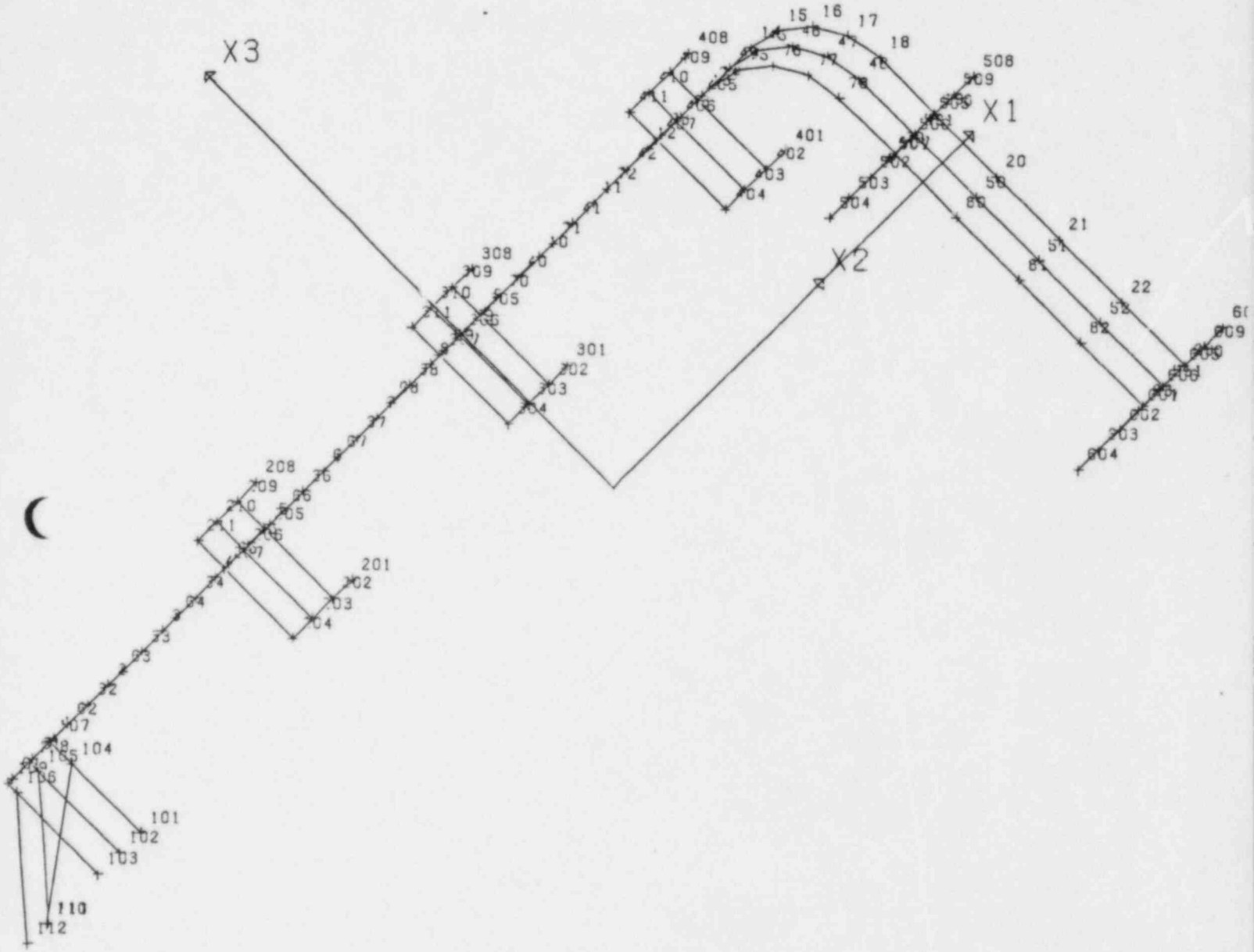
COMANCHE PEAK CABLE TRAY WITH BENT MODEL 1-B

SHT. 21 OF 102

TEXAS UTILITIES GENERATING CO.
COMANCHE PEAK UNIT 2
CABLE TRAY HANGERS

BY C.H. Yeh DATE 01/16/86

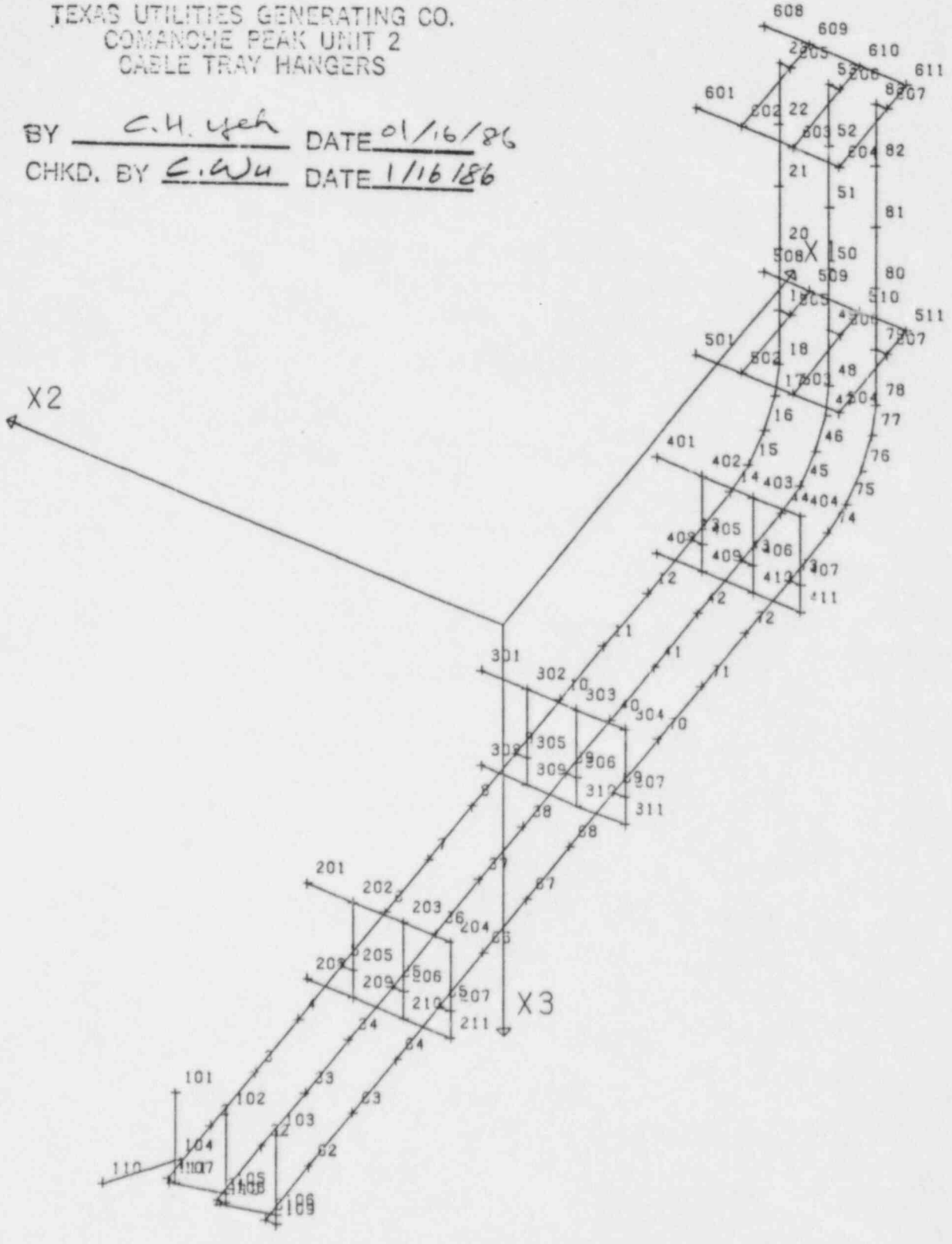
CHKD. BY C.Wu DATE 1/16/86



STARDYNE FINITE ELEMENT MODEL PROJECTION ON X3-X1 PLANE CASE NO. 1

TEXAS UTILITIES GENERATING CO.
COMANCHE PEAK UNIT 2
CABLE TRAY HANGERS

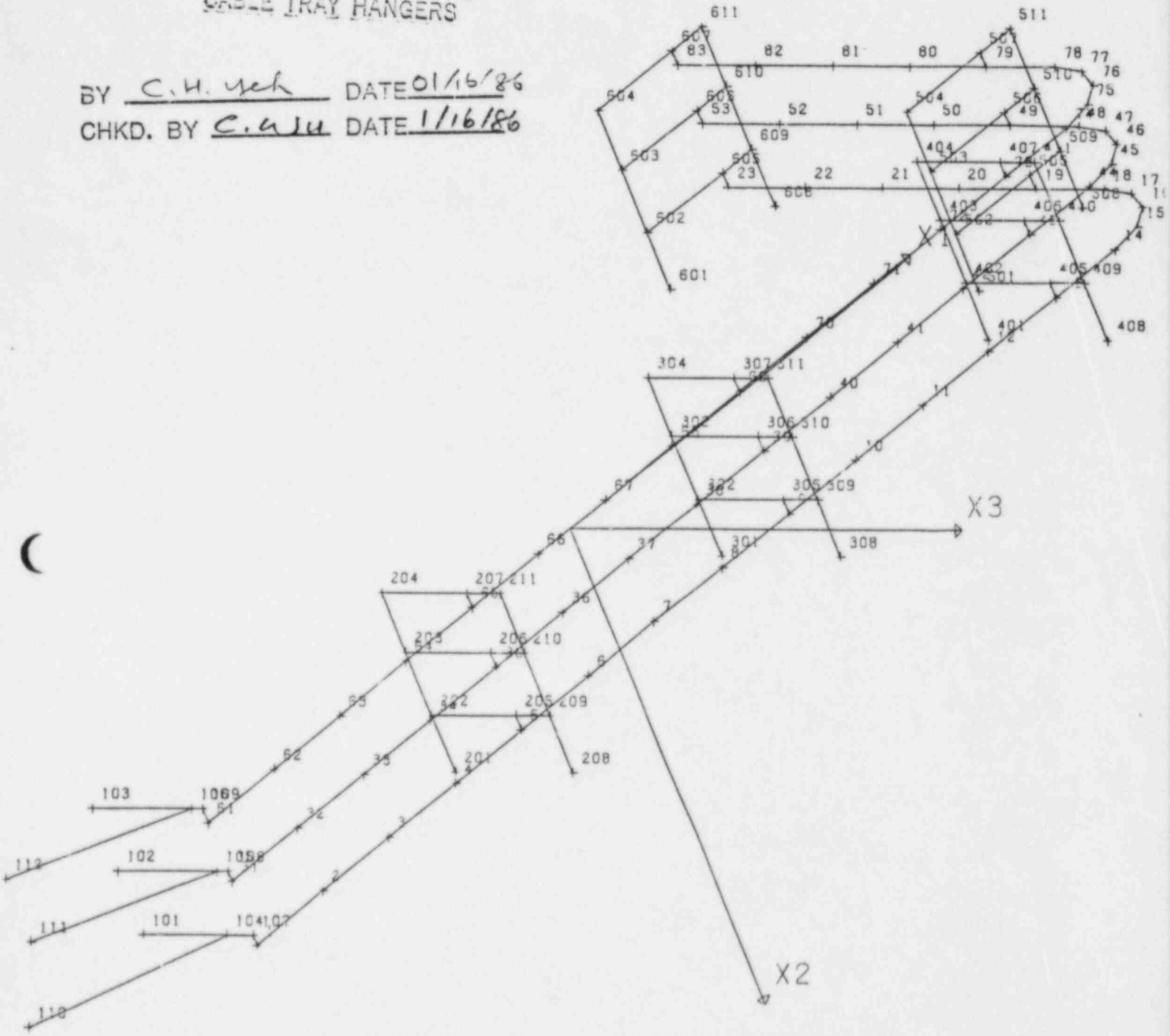
BY C.H. Yeh DATE 01/16/86
CHKD. BY C.W.H DATE 1/16/86



STARDYNE FINITE ELEMENT MODEL PROJECTION ON X2-X3 PLANE CASE NO. 1

TEXAS UTILITIES GENERATING CO.
COMANCHE PEAK UNIT 2
CABLE TRAY HANGERS

BY C.H. Yeh DATE 01/16/86
CHKD. BY C.W.H DATE 1/16/86



STARDYNE FINITE ELEMENT MODEL PROJECTION ON X1-X2 PLANE CASE NO. 1

3 FREQUENCY ANALYSIS

The eigen vector characteristics were extracted, using the Lanczos procedure in the STARDYNE computer code. Both models 1-A & 1-B plus corresponding 2-D single frame models with corresponding cable tray weights were studied.

The Dunkerley formula was utilized to calculate the approximate system frequency which was subsequently used to find the acceleration level in the corresponding direction.

BY C.H.YEH DATE 12.31.85 SHEET 25 OF 102

CHKD. BY C.W.U DATE 1-3-86 OFS NO. 3306.221 DEPT. NO. 550

CLIENT TEXAS UTILITIES GENERATING CO.

PROJECT COMANCHE PEAK UNIT 2
CABLE TRAY HANGERS

SUBJECT SYSTEM FREQ. FOR "2-D" MODEL "1-A"

3a. SYSTEM FREQ FOR "2-D" MODE 1-A

FROM: MODEL NO.1 W/ 90° BEND
FRAME NO. 3.

AV. SPAN = (108+95.1)/2 /12 = 101.55"/12 = 8.4625'

FROM: ATT. C2 / GENERAL INSTRUCTION FOR CTH ANALYSIS
PAGE 26. (DATE 6/4/85)

$I_V = 1.465$, $I_H = 5.795$, $f = \frac{\pi}{2}\left[\frac{EI}{w/g \times l^4}\right]^{1/2}$

$\Rightarrow f_V = 11.42$ $f_H = 22.72$

$f_L = 67.76$ (PAGE 27. ATT. C2/GENERAL INSTRUCTION)

FROM COMPUTER RUN "DRYSA2F"
FREQUENCY OF FRAME NO.3

$f_V = 79.93$, $f_H = 23.06$, $f_L = 11.44$

DIRECTION	TRAY FREQ. f_T	FRAME FREQ. f_F	SYSTEM FREQ. f_S
LONG.	67.76	11.44	11.28
TRAN.	22.72	23.06	16.18
VERT.	11.42	79.93	11.31

$\star$ $f_S = \left[1/\{(1/f_T)^2 + (1/f_F)^2\}\right]^{1/2}$

EBASCO SERVICES INCORPORATED

BY C.H. Yeh DATE 01/26/83 SHEET 26 OF 102

CHKD. BY C.H. Yeh DATE 1/7/83 OFS NO. 3306.221 DEPT. NO. 570

CLIENT TEXAS UTILITIES GENERATING CO.

PROJECT COMANCHE PEAK UNIT 2 CABLE TRAY SUPPORTS

SUBJECT ACCEL. LEVEL FOR MODEL "1-A"

CALCULATION OF ACCELERATION LEVEL FOR MODEL "1-A"

BLDG. ID.	ELV.	DIRECT	SYST. FREQ f_s	OBE					SSE				
				f_1	f_2	A_1	A_2	* A_{OBE}	f_3	f_4	A_3	A_4	** A_{SSE}
REACTOR (INT.)	860'	L	11.28	11.2	11.9	.61	.61	.61	8.0	11.39	1.34	.84	.854
		V	11.31	7.92	15.72	.92	.92	.92	8.3	15.16	1.18	1.15	1.18
		T	16.18	13.96	40.0	.47	.32	.449	14.83	27.5	.68	.47	.65
REACTOR (INT.)	905.75'	L	11.28	10.64	13.75	1.088	.7	1.0	9.167	13.75	1.807	1.050	1.42
		V	11.31	7.18	15.03	1.328	1.328	1.328	8.076	15.03	1.712	1.712	1.712
		T	16.18	13.75	27.5	.7	.5	.653	13.75	27.5	1.05	.737	.977
REACTOR (AUX.)	899.5'	L	11.28	10.494	13.212	.968	.89	.944	11.0	12.104	1.184	1.141	1.173
		V	11.31	5.774	12.447	1.631	1.713	1.713	7.601	12.32	1.851	1.851	1.851
		T	16.18	16.148	16.742	.89	.865	.89	16.148	16.742	1.141	1.111	1.139
ELECT.	873.3'	L	11.28	10.49	11.86	.68	.40	.514	10.19	12.32	.93	.60	.781
		V	11.31	9.27	13.7	1.12	1.15	1.15	10.49	13.21	1.5	1.56	1.56
		T.	16.18	16.15	16.74	.40	.39	.399	14.91	18.55	.51	.51	.51
SAFGD	896.5'	L	11.28	11.0	11.65	1.4	1.1	1.27	10.53	11.65	2.01	1.46	1.636
		V.	11.31	10.05	13.44	1.31	1.5	1.50	9.24	14.19	1.83	2.01	2.01
		T.	16.18	15.66	16.42	.73	.71	.713	14.66	16.42	1.11	1.05	1.058

* $A_{OBE} = A_1 + (A_2 - A_1)\frac{\ln f_s - \ln f_1}{\ln f_2 - \ln f_1}$

** $A_{SSE} = A_3 + (A_4 - A_3)\frac{\ln f_s - \ln f_3}{\ln f_4 - \ln f_3}$

BY C.Li Uyeh DATE 1/16/86 SHEET 27 OF 102

CHKD. BY C.W.Li DATE 1/16/86 OFS NO. 3306.221 DEPT. NO. 550

CLIENT TEXAS UTILITIES GENERATING CO.

PROJECT COMANCHE PEAK UNIT 2
CABLE TRAY HANGERS

SUBJECT SYSTEM. FREQ. FOR "2-D" MODEL. "1-B"

3b. SYSTEM FREQ. FOR "2-D" MODEL. 1-B

FROM: MODEL "1-B" FRAME NO. 4

AV. SPAN = (108+95.1)/2 /12 = 101.55"/12 = 8.4625'

FROM: ATT. C2 / GENERAL INSTRUCTION FOR CTH ANALYSIS
PAGE 26. (DATE: 6/14/85)

$I_V = 1.465$, $I_H = 5.795$, $f = \frac{\pi}{2}\left[\frac{EI}{W/g \times l^4}\right]^{1/2}$

$\Rightarrow f_V = 11.42$ $f_H = 10.43$ *

$f_L = 67.76$ (PAGE 27. ATT C2/GENERAL INSTRUCTION)

FROM COMPUTER RUN "DRYUBQV"
FREQUENCY OF FRAME. NO. 4:

$f_V = 87.44$, $f_H = 20.93$, $f_L = 11.44$

DIRECTION	FREQUENCY		
	TRAY (f_T)	FRAME (f_f)	** SYSTEM (f_s)
LONG.	67.76	11.44	11.28
VERT.	11.42	87.44	11.32
TRAN.	10.43 *	20.93	9.34

NOTES:

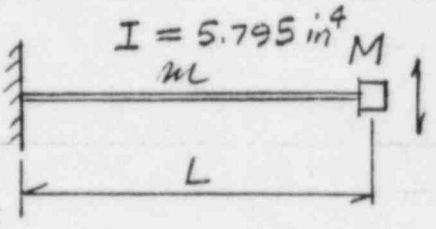
* SEE NEXT SHEET

** $f_s = \left[(f_T)^{-2} + (f_f)^{-2}\right]^{-0.5}$

581/8-81

$L = 24 + 30 \times \sin 45^\circ$

$= 45.21''$



$m = \frac{45.21}{12} \times 35 = 131.83\ \#g$

$M = \frac{108 + 24\times2 + \pi\times60/4 - 45.21}{12} \times 35$

$= 460.51\ \#g$

$k = \frac{3EI}{L^3} = \frac{3\times29\times10^6\times5.795}{(45.21)^3} = 5455.94\ \#/''$

$\omega_n = \sqrt{\frac{k}{M + 0.23m}} = \sqrt{\frac{5455.94\times386.4}{460.51 + 0.23\times131.83}} = 65.54$ rps

$f_n = \frac{\omega_n}{2\pi} = \frac{65.54}{2\pi} = 10.43$ HZ

ADDITIONAL MOMENT (APPLIED AT PT (13))

$M_2 = 460.51 \times 45.21 + \frac{1}{2}\times131.83\times45.21 = 23803\ ''\# = 23{,}803\ <''$

FACTOR OF UNBALANCE MOMENT APPLIED ON FRAME NO. 4

$R = \frac{0.0715^{*}\times41.75}{23{,}803\times3} = .042$

$\therefore M_2 = 23{,}803\times.042 = 1.0$

NOTE: REF. TO COMPUTER RUN I.D. DRYZB9J, THE x_1-REACTION DUE TO x_3-INERTIA FORCE = 0.0715 *

** SEE NEXT PAGE.

EBASCO SERVICES INCORPORATED

BY C.H. Yeh DATE 01/31/86 SHEET 29 OF 102

CHKD. BY C. Wu DATE 1/31/86 OFS NO. 3306 221 DEPT. NO. 550

CLIENT TEXAS UTILITIES GENERATING CO.

PROJECT COMANCHE PEAK UNIT 2

SUBJECT CABLE TRAY HANGERS

REACTION COMPARISON FOR 3-D/2-D (1.0g) INERTIA FORCE INPUT

MODEL : 1-B

COMPUTER RUN ID

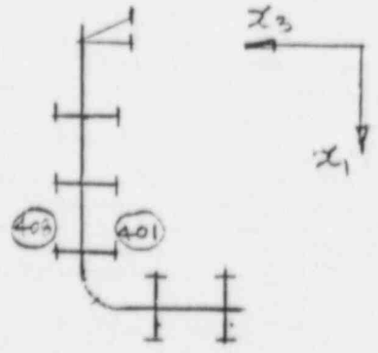
BLDG : ELECT.

3-D: DRYZB9J

ELEV : 873.33'

2-D: DRYSCTR

INPUT FORCE	MODEL TYPE	X_1		X_2		X_3	
		401	403	401	403	401	403
X_1	3-D	-.0741	-.0674	-.0060	.0176	.0141	.0096
	2-D	-.0730	-.0685	—	—	—	—
X_2	3-D	-.0017	.0017	-.3119	-.7033	.0475	-.0490
	2-D	—	—	-.3198	-.7098	.0473	-.0473
X_3	3-D	-.0715	.0715	.9487	-.9515	-1.629	-1.0066
	2-D	—	—	1.0795	-1.0795	-1.4984	-.8931



PLAN OF MODEL 1-B

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BY C.H. Chiu DATE 01/16/86 SHEET 30 OF 102

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CLIENT TEXAS UTILITIES GENERATING CO.

PROJECT COMANCHE PEAK UNIT 2
CABLE TRAY HANGERS

SUBJECT ACCL. LEVEL FOR MODEL "1-B"

CALCULATION OF ACCELERATION LEVEL. MODEL "1-B"

BLDG. ID.	ELEV.	DIR.	SYS. FREQ f_s	OBE f_1	OBE f_2	OBE A_1	OBE A_2	OBE $*A_{OBE}$	SSE f_3	SSE f_4	SSE A_3	SSE A_4	SSE $**A_{SSE}$
REACTOR (INT.)	860.0'	L	11.28	11.2	11.9	.61	.61	.61	8.0	11.39	1.34	.84	.854
		V	11.32	7.92	15.22	.92	.92	.92	8.3	15.16	1.18	1.18	1.18
		T	9.34	9.2	11.2	.95	.61	.924	8.0	11.39	1.34	.84	1.121
REACTOR (INT.)	905.75'	L	11.28	10.64	13.75	1.088	.7	1.0	9.167	13.75	1.807	1.050	1.42
		V	11.32	7.18	15.03	1.328	1.328	1.328	8.076	15.03	1.712	1.712	1.712
		T	9.34	8.48	10.64	1.717	1.088	1.449	9.167	13.75	1.807	1.050	1.772
REACTOR (AUX)	899.5'	L	11.28	10.494	13.212	.968	.89	.944	11.0	12.104	1.184	1.141	1.173
		V	11.32	5.724	12.447	1.631	1.713	1.713	7.601	12.32	1.851	1.851	1.851
		T	9.34	9.273	10.494	1.209	.968	1.195	9.273	10.494	1.591	1.346	1.577
ELEC.	873.3'	L	11.28	10.49	11.86	.68	.40	.514	10.49	12.32	.93	.60	.781
		V	11.32	9.27	13.7	1.12	1.15	1.15	10.49	13.21	1.5	1.56	1.56
		T	9.34	9.27	10.49	.83	.68	.821	9.27	10.49	1.14	.93	1.127
SFGD	396.5'	L	11.28	11.0	11.65	1.4	1.1	1.27	10.53	11.65	2.01	1.46	1.636
		V	11.32	10.05	13.44	1.31	1.50	1.50	8.24	14.19	1.83	2.01	2.01
		T	9.34	8.24	10.08	2.19	2.19	2.19	9.16	10.05	2.42	2.12	2.357

NOTES:

$$A_{OBE} = A_1 + (A_2 - A_1)\frac{\ln f_s - \ln f_1}{\ln f_2 - \ln f_1}$$

$$A_{SSE} = A_3 + (A_4 - A_3)\frac{\ln f_s - \ln f_3}{\ln f_4 - \ln f_3}$$

SG1/8-81

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PROJECT COMANCHE PEAK UNIT 2
CABLE TRAY HANGERS

SUBJECT MISSING WT. RATIO MODEL 1-A

3C. FREQ. SUMMARY TABLE

1. FREQ FOR MODEL "1-A" FIXED BOUNDARY

COMPUTER RUN ID: DRYRA53
12-30-85

MODE NO.	FREQUENCY Hz	DIRECTION	MODE NO	FREQUENCY Hz	DIRECTION
1	8.28	V	20	21.41	T
2	8.30	V	21	22.09	T
3	8.31	V	22	23.44	T
4	10.36	V	23	24.19	T
5	10.60	V	24	24.86	T
6	10.64	V	25	25.20	T
7	11.80	L	26	26.58	T
8	11.80	L	27	27.79	T
9	11.81	L	28	28.34	T
10	11.81	L	29	28.67	T
11	12.12	V	30	29.44	T
12	12.39	V	31	29.76	V
13	12.44	V	32	29.83	V
14	15.59	V	33	30.03	T
15	15.92	V	34	30.24	V
16	15.97	V	35	31.14	V
17	19.25	V	36	31.48	T
18	19.53	V	37	32.79	V
19	19.57	V	38	32.95	V

Note: L - longitudinal, V - Vertical, T - Transverse

DIRECTION	L	V	T
MODEL WT. TO 33 Hz.	5.52356	4.276	5.52356
MISSING WT. RATIO	* 0.328	† 0.352	* 0.328

* $1 - \frac{5.52356}{8.2213} = 0.328$, † $1 - \frac{4.276}{6.5953} = 0.352$

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PROJECT COMANCHE PEAK STA. 2 CABLE TRAY HANGERS

SUBJECT MISSING WT. RATIO. MODEL. 1-B

2. FREQUENCY FOR MODEL 1B, FIXED BOUNDARY

COMPUTER RUN ID: DRYTBNZ
DATE = 01/03/85

MODE NO.	FREQUENCY Hz	DIRECTION	MODE NO.	FREQUENCY Hz	DIRECTION
1	8.07	V	21	19.48	V
2	8.09	V	22	19.70	V
3	8.08	V	23	19.74	V
4	8.63	L	24	20.72	T
5	9.96	V	25	21.10	T
6	10.15	V	26	23.02	T
7	10.54	V	27	23.37	T
8	10.96	V	28	25.13	T
9	11.06	V	29	25.34	T
10	11.80	L	30	26.15	T
11	11.80	L	31	26.77	T
12	11.81	L	32	28.15	T
13	11.81	L	33	29.23	T
14	11.81	L	34	29.79	V
15	12.75	V	35	29.81	V
16	12.90	V	36	29.84	V
17	12.93	V	37	30.07	T
18	15.99	V	38	31.53	T
19	16.17	V	39	32.72	V
20	16.20	V	40	32.85	V

ITEM NO.		WEIGHT LONG.	VERT.	TRAN.
①	MODEL. WT. TO 33 Hz	5.3055	3.73555	4.17533
②	TOTAL. MODEL. WT	6.9724	6.5014	6.0274
③	MISSING WT. RATIO	23.9 %	42.54 %	30.68 %

MISSING WT. RATIO = $1 - \frac{① \text{ WT.}}{② \text{ WT}}$

581/8-81

4 RESPONSE SPECTRA ANALYSIS and MRM for "9".

The frequency response analyses were performed through STARDYNE's DYNRE4 computer code. The directional effects of seismic excitation in three orthogonal directions were combined by SRSS approach. However, the modal combinations were carried out through several options available in the DYNRE4 program.

The model 1-A under seismic OBE at the reactor building elevation 860' was studied first. The results for various modal combination options were summarized in Table The results confirmed ~~the~~ the complete quadratic combination (CQC) method (RSS=14)

That the previous study of the straight run used the appropriate option (RSS = 1), and the 10% correction (RSS=6) overestimated

DYNRE4 OPTION	VERT.	TRANS.	LONG.	RUN ID	
RSS = 6	0.879	1.129	1.384	DRYUD QF	RSS WITH 10%
RSS = 14 |RSSX1 = 1	0.731	0.704	0.935	DRYUD 2F	CQC WITH RSS ON DIR'S
RSS = 1	0.721	0.793	0.898	DRYSB P3	RSS WITHOUT 10%
RSS = 14 |RSSX1 = 10	0.527	0.801	0.831	DRYUD 2J	CQC WITH ALG ON DIR'S

MRM COMPARISION BETWEEN OPTIONS IN DYNRE 4

MODEL 1-A

SEISMIC OBE, REACTOR INTERNAL 860' EL

the structural response by a large margin. ~~However~~, further confirmation of the usage of option (RSS = 1) by the time history approach as performed in the previous ~~straight~~ run study was ~~presented in~~ section 6.

However, for illustrative purposes, all three options (RSS = 6, RSS = 14 with |RSSxI=1, and RSS = 1) were performed for all the cases. In addition, RSS = 14 with |RSSxI=10 was also performed for the pilot case - Model 1-A, OBE REACTOR INTERNAL SSE 'EL. as shown on ~~Page~~ page 34. It was found that the algebraic summation for directional effect might yield erroneous results.

SUBJECT MULTIPLE RESPONSE MULTIPLIER FOR C.T.H. SYSTEM W/90° BENT (RSS=6)

MODEL	BUILDING	ELEVATION (FT)	RANGE OF AMPLIFICATION FACTOR OBE (4%) VERT.	TRANS.	LONG.	RUN ID	SSE (7%) VERT.	TRANS.	LONG.	RUN ID
	REACTOR INTERNAL	860.00*	0.88	1.13	1.38	DRYUDQF	0.92	1.05	1.33	DRYUDV7
		905.75	0.93	1.11	1.26	DRYUDWN	0.98	1.09	1.26	DRYUDW7
1A	REACTOR AUXILIARY	899.50	0.64	0.69	1.33	DRYUDXJ	0.80	0.82	1.36	DRYUDX3
	ELECTRICAL	873.33	0.86	1.10	1.17	DRYUDYB	0.85	1.23	1.23	DRYUDYN
	SAFE GUARD	896.50	0.90	1.05	1.13	DRYUDZB	0.90	0.98	1.19	DRYUDZF
	REACTOR INTERNAL	860.00*	0.88	0.60	1.21	DRYVBPR	0.92	0.65	1.16	DRYVBP3
		905.75	0.94	0.58	1.11	DRYVBQN	0.98	0.65	1.10	DRYVBRB
1B	REACTOR AUXILIARY	899.50	0.66	0.61	1.15	DRYVBRJ	0.79	0.65	1.19	DRYVBRE
	ELECTRICAL	873.33	0.86	0.62	1.04	DRYVBSB	0.85	0.63	1.08	DRYVBSR
	SAFE GUARD	896.50	0.89	0.46	1.00	DRYVBSV	0.88	0.53	1.04	DRYVBS7

* THE FLOOR ELEVATION WHERE THE HANGER FOR STRUCTURAL MODEL IS LOCATED.

** M.R.M. RESULTS FOR CABLE TRAY HANGER SYSTEM WITH 90° BENT

*** MRM SUMMARY FOR "RSS=6"

SUBJECT MULTIPLE RESPONSE MULTIPLIER FOR C.T.H. SYSTEM W/90° BENT (RSS=14)

MODEL	BUILDING	ELEVATION (FT)	RANGE OF AMPLIFICATION FACTOR OBE (4%) VERT.	TRANS.	LONG.	RUN ID	SSE (7%) VERT.	TRANS.	LONG.	RUN ID
	REACTOR INTERNAL	860.00*	0.73	0.70	0.94	DRYUD2F	0.77	0.66	0.91	DRYUEGR
		905.75	0.78	0.70	0.85	DRYUEG3	0.82	0.68	0.86	DRYUEHJ
1A	REACTOR AUXILIARY	899.50	0.53	0.43	0.88	DRYUEIB	0.66	0.52	0.92	DRYUEIJ
	ELECTRICAL	873.33	0.71	0.68	0.72	DRYUEIV	0.70	0.76	0.79	DRYUEJJ
	SAFE GUARD	896.50	0.74	0.64	0.76	DRYUEJR	0.74	0.60	0.81	DRYUEJV
	REACTOR INTERNAL	860.00*	0.70	0.45	0.68	DRYVBGF	0.74	0.49	0.65	DRYVBJJ
		905.75	0.75	0.44	0.63	DRYVBJ3	0.79	0.49	0.62	DRYVBKN
1B	REACTOR AUXILIARY	899.50	0.52	0.46	0.63	DRYVBKV	0.63	0.49	0.66	DRYV3JN
	ELECTRICAL	873.33	0.68	0.46	0.63	DRYVBMN	0.68	0.46	0.62	DRYVBNB
	SAFE GUARD	896.50	0.70	0.35	0.56	DRYVBNR	0.70	0.40	0.58	DRYOA5R

* THE FLOOR ELEVATION WHERE THE HANGER FOR STRUCTURAL MODEL IS LOCATED.

IRSS = 14

IRSSX1 = 1

** M.R.M. RESULTS FOR CABLE TRAY HANGER SYSTEM WITH 90° BENT

*** MRM SUMMARY FOR "RSS=14" IRSSX1 = 1

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PROJECT COMANCHE PEAK UNIT 2
CABLE TRAY HANGERS

SUBJECT MULTIPLE RESPONSE MULTIPLIER FOR C.T.H. SYSTEM W/ 90° BENT (RSS=1)

TABLE. 4-3 MRM FOR RSS=1

MODEL	BUILDING	FLOOR ELEVATION (FT)	RANGE OF AMPLIFICATION FACTOR							
			OBE (4%)				SSE (7%)			
			VERT.	TRANS.	LONG.	RUN ID	VERT.	TRANS.	LONG.	RUN ID
1A	REACTOR INTERNAL	860.00	0.72*	0.79*	0.90*	DRYSBP3	0.76	0.75	0.87	DRYSDYZ
		905.75	0.77	0.79	0.82	DRYSD47	0.81	0.77	0.82	DRYSD6Z
	REACTOR AUXILIARY	899.50	0.52	0.49	0.85	DRYVC2N	0.65	0.58	0.89	DRYSD9F
	ELECTRICAL	873.33	0.70	0.78	0.77	DRYSEAF	0.70	0.88	0.80	DRYSEAV
	SAFE GUARD	896.50	0.73	0.73	0.71	DRYVC23	0.73	0.69	0.76	DRYSEBJ
1B	REACTOR INTERNAL	860.00	0.69	0.47	0.95	DRYVCRR	0.73	0.51	0.91	DRYVCRZ
		905.75	0.74	0.47	0.87	DRYVCR3	0.78	0.51	0.86	DRYVCSB
	REACTOR AUXILIARY	899.50	0.51	0.48	0.90	DRYVCKN	0.62	0.51	0.93	DRYVCSN
	ELECTRICAL	873.33	0.67	0.49	0.83	DRYVCSR	0.67	0.49	0.85	DRYUDQZ
	SAFE GUARD	896.50	0.69	0.37	0.79	DRYVCS7	0.69	0.42	0.81	DRYVCTF

NOTES:

① MRM SUMMARY FOR RSS=1

② FL. ELEV. WHERE THE HANGER STRUCTURAL MODEL IS LOCATED

③ MRM RESULTS FOR CABLE TRAY HANGER SYST. W/ 90° BENT

*. SEE ALSO NEXT 3 PAGES.

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PROJECT COMANCHE PEAK UNIT 2

SUBJECT CABLE TRAY HANGERS

OFS NO. TUGC 3346.221

BLDG: REACTOR (INTER) ELE 660'-0

DIRECTION: VERT. OBE 4%, FIXED BOUNDARY, COMPUTER RUN ID = DRYSAUN

TRAY													SUPPORT				
	UPPER				MIDDLE				LOWER								
WEIGHT	NODE	a	F_M^*	a_T	NODE	a	F_M^*	a_T	NODE	a	F_M^*	a_T	WEIGHT	NODE	a	F_M^*	a_T
0.039	7	.762	0.0	.762	37	1.095	0.0	1.095	67	1.219	0.0	1.219	0.021	302	.002	.999	.39
0.079	8	.428	.231	.437	38	.60	.347	.615	68	.693	.321	.704	0.021	303	.004	.998	.389
0.074	9	.019	.968	.378	39	.026	.971	.38	69	.031	.962	.376	0.015	304	.004	.997	.389
0.052	10	.543	.379	.563	40	.696	.390	.712	70	.792	.382	.806	0.013	305	.019	.968	.378
0.034	11	.826	0.0	.826	41	1.103	0.0	1.103	71	1.282	0.0	1.282	0.013	306	.026	.971	.38
0.017	12	.923	0.0	.923	42	1.261	0.0	1.261	72	1.496	0.0	1.496	0.013	307	.031	.962	.376
													0.014	309	.003	.995	.388
													0.014	310	.006	.991	.387
													0.009	311	.007	.989	.386

* F_M — MISSING WEIGHT RATIO

TOTAL ACC. $a_T = \sqrt{a^2 + (F_M \cdot ZPA)^2}$, $ZPA = 0.39$

TRAY $\Sigma W_i = .885$ $\Sigma W_i a_{Ti} = .623$

SUPPORT $\Sigma W_i = .133$ $\Sigma W_i a_{Ti} = .051$

$\Sigma W = 1.018$ $\Sigma W a_T = .674$

$ave\ g = \frac{\Sigma W_i a_{Ti}}{\Sigma W_i} = .662$

PREVIOUS DESIGN PROCEDURE SYSTEM FREQ. = 11.31 ACC. LEVEL = .92

MULTIPLE-MODE RESPONSE MULTIPLIER $MRM = \frac{ave\ g}{ACC.\ LEVEL} = \frac{.662}{.92} = .72$

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CLIENT [illegible] COMANCHE PEAK UNIT 2

PROJECT CABLE TRAY HANGERS RSS = 1

SUBJECT

BLDG: INTER STRUCTURE ELE 860'-0

DIRECTION: TRANS. OBE 4%, FIXED BOUNDARY, COMPUTER RUN ID = DRYSAUN

TRAY													SUPPORT				
	UPPER				MIDDLE				LOWER								
WEIGHT	NODE	a	F_M^*	a_T	NODE	a	F_M^*	a_T	NODE	a	F_M^*	a_T	WEIGHT	NODE	a	F_M^*	a_T
0.039	7	.54	.511	.51	37	.564	.047	.564	67	.854	0.0	.854	0.021	302	.053	.82	.268
0.079	8	.354	.736	.425	38	.407	.233	.414	68	.634	0.0	.634	0.021	303	.151	.508	.222
0.074	9	.058	.804	.264	39	.156	.488	.221	69	.24	.244	.252	0.015	304	.232	.266	.247
0.052	10	.164	.473	.223	40	.262	.333	.283	70	.227	.154	.232	0.013	305	.054	.816	.267
0.034	11	.209	.289	.229	41	.314	.22	.322	71	.269	.046	.269	0.013	306	.153	.502	.222
0.017	12	.228	.167	.234	42	.334	.144	.337	72	.289	0.0	.289	0.013	307	.234	.261	.248
													0.014	309	.054	.817	.267
													0.014	310	.153	.502	.222
													0.009	311	.233	.264	.248

* F_M — MISSING WEIGHT RATIO

TOTAL ACC. $a_T = \sqrt{a^2 + (F_M \cdot ZPA)^2}$, ZPA = 0.32

TRAY ΣW_i = 0.895 $\Sigma W_i a_{Ti}$ = .329

SUPPORT ΣW_i = 0.133 $\Sigma W_i a_{Ti}$ = .033

$a_{ve}g = \frac{\Sigma W_i a_{Ti}}{\Sigma W_i} = .356$

PREVIOUS DESIGN PROCEDURE SYSTEM FREQ. = 16.18 ACC. LEVEL = .449

MULTIPLE-MODE RESPONSE MULTIPLIER $MRM = \frac{ave\,g}{ACC.\ LEVEL} = \frac{.356}{.449} = .793$

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PROJECT COMANCHE PEAK UNIT 2

SUBJECT CABLE TRAY HANGERS RSS = 1

BLDG : INTER STRUCTURE EL 860'-0

DIRECTION : LONG. OBE 4 %, FIXED BOUNDARY, COMPUTER RUN ID = ORYSAUN

TRAY													SUPPORT				
	UPPER				MIDDLE				LOWER								
WEIGHT	NODE	a	F_M^*	a_T	NODE	a	F_M^*	a_T	NODE	a	F_M^*	a_T	WEIGHT	NODE	a	F_M^*	a_T
	7				37				67				0.021	302	.136	.776	.283
	8				38				68				0.021	303	.495	.212	.50
	9				39				69				0.015	304	.912	0.0	.912
	10				40				70				0.013	305	.146	.777	.288
	11				41				71				0.013	306	.503	.271	.51
	12				42				72				0.013	307	.928	0.0	.928
													0.014	309	.145	.838	.305
													0.014	310	.519	.34	.53
													0.009	311	.95	0.0	.95

* F_M — MISSING WEIGHT RATIO

TOTAL ACC. $a_T = \sqrt{a^2 + (F_M \cdot ZPA)^2}$, ZPA = 0.32

TRAY $\Sigma W_i = 0$ $\Sigma W_i a_{Ti} = 0$

SUPPORT $\Sigma W_i = 0.133$ $\Sigma W_i a_{Ti} = 073$

$a_{ave} g = \frac{\Sigma W_i a_{Ti}}{\Sigma W_i} = \frac{.073}{.133} = .547$

PREVIOUS DESIGN PROCEDURE SYSTEM FREQ. = 11.28 ACC. LEVEL = .61

MULTIPLE-MODE RESPONSE MULTIPLIER $MRM = \frac{a_{ave} g}{ACC.\ LEVEL} = \frac{.547}{.61} = .897$

561/8-81

5. REACTIONS & MRM

The comparision between the cable tray - hanger system and the one frame hanger with concentrated cable weight at the tier was performed.

The static analysis for the one frame hange was straight forward, with the acceleration levels obtained through system frequency and corresponding floor response spectrum. However, the analysis for the cable tray-hanger system needs further consideration.

Since the STARDYNE's "DYNRL4" codes combined the structural responses up to the frequency defined (in our study, 33 Hz), the remaining contribution due to higher modes was obtained through the calculating of missing weight with a rigid mode.

The tabulation of the missing weight for models 1-A & 1-B was first compiled from the computer run for the missing weight ratio through the residual load method. The reactions were then obtained through "POST" code in STARDYNE system to perform SRSS in three directions. These results were added to DYNREA reactions ~~results~~ to complete the dynamic analysis.

The MRMs for the reaction ~~were~~ were summarized ~~in~~ ~~Table~~ on page 68. It was noted that the MRM values for the reaction were relatively smaller ~~than~~ than those for the "j"s, because the conservative assumption in the latter case that all modes were acting in the same phase.

It was found that the contribution due to missing weight is less than 10% for the support reactions. In some cases, almost no contribution at all. This is due to the fact that the support weight is relatively small compared to the tray weight.

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CHKD. BY C.W.Y DATE 1/23/86 OFS NO. 3306.221 DEPT. NO. 550

CLIENT TEXAS UTILITIES GENERATING CO

PROJECT COMANCHE PEAK UNIT 2 / CABLE TRAY HANGERS

SUBJECT MODEL "1-A"

COMPUTER RUN I.D

NODAL WT: DRYRA53

MISS. RATIO: DRY1DWV

MISSING WT OF MODEL "1-A"

NODE ID	NODAL WEIGHTS	X_1 MISSING RATIO	X_1 MISS. WT.	X_2 MISSING RATIO	X_2 MISS. WT.	X_3 MISSING RATIO	X_3 MISS. WT.
1	.7394 (X1) .1974 (X2,3)	.324	.2396	.619	.1222	.978	.1931
2	.0788	.283	.0223	—	—	.905	.0713
3	=	.247	.0195	—	—	.868	.0684
4	=	.214	.0169	.318	.0251	.847	.0667
5	=	.185	.0146	.969	.0764	.783	.0617
6	=	.162	.0128	.245	.0193	.610	.0481
7	=	.142	.0112	—	—	.577	.0455
8	=	.127	.0100	.231	.0182	.736	.0580
9	.0744	.117	.0087	.968	.0720	.804	.0598
10	.0521	.113	.0059	.379	.0197	.473	.0246
11	.0341	.118	.0040	—	—	.289	.0099
12	.0342	.167	.0057	—	—	.167	.0057
13	.0341	.289	.0099	—	—	.118	.0040
14	.0521	.473	.0246	.379	.0197	.113	.0059
15	.0744	.804	.0598	.968	.072	.117	.0087
16	.0788	.736	.0580	.231	.0182	.127	.010
17	=	.577	.0455	—	—	.142	.0112
18	=	.610	.0481	.245	.0193	.162	.0128
19	=	.783	.0617	.969	.0764	.185	.0146
20	=	.847	.0667	.318	.0251	.214	.0169
		.746		.541		.717	

EBASCO SERVICES INCORPORATED

BY C H Yeh DATE 01/23/86 SHEET 46 OF 102

CHKD. BY C.W.H DATE 1/23/86 OFS NO. 3306.221 DEPT. NO. 550

CLIENT TEXAS UTILITIES GENERATING CO

PROJECT COMANCHE PEAK UNIT 2
CABLE TRAY HANGERS

SUBJECT MODEL "1-A"

MISSING WT OF MODEL "1-A"

COMPUTER RUN I.D
NODAL WT: DRY RA53
MISS. RATIO: DRY IDWV

NODE ID	NODAL WEIGHTS	X1		X2		X3	
		MISSING RATIO	MISS. WT.	MISSING RATIO	MISS. WT.	MISSING RATIO	MISS. WT
21	.0755	.868	.0654	—	—	.247	.0195
22	=	.905	.0713	—	—	.283	.0223
23	.1974 (X1,2) .7391 (X2)	.978	.1931	.619	.1222	.324	.2396
31	.7394 (X1) .1971 (X2)	.323	.2388	.183	.0361	.964	.1903
32	.0755	.294	.0224	—	—	.361	.0274
33	=	.248	.0195	—	—	—	—
34	=	.215	.0169	.631	.0497	.116	.0091
35	=	.187	.0147	.976	.0769	.389	.0307
36	=	.163	.0128	.192	.0151	.195	.0154
37	=	.143	.0113	—	—	.047	.0037
38	=	.128	.0101	.347	.0273	.233	.0184
39	.0744	.117	.0087	.971	.0722	.488	.0363
40	.0521	.112	.0058	.390	.0203	.333	.0173
41	.0341	.114	.0039	—	—	.220	.0075
42	.0342	.144	.0049	—	—	.144	.0049
43	.0341	.220	.0075	—	—	.114	.0039
44	.0521	.333	.0173	.390	.0203	.112	.0058
45	.0744	.488	.0363	.971	.0722	.117	.0087
46	.0788	.233	.0184	.347	.0273	.128	.0101
47	=	.047	.0037	—	—	.143	.0113

.796 .710 .683

EBASCO SERVICES INCORPORATED

BY C.H. Yeh DATE 01/23/86 SHEET 47 OF 102

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CLIENT TEXAS UTILITIES GENERATING CO

PROJECT COMANCHE PEAK UNIT 2 CABLE TRAY HANGERS

SUBJECT MODEL. 1-A

COMPUTER RUN I.D

NODAL WT: DRYRAS3

MISS. RATIO: DRY1DWV

MISSING WT OF MODEL "1-A"

NODE ID	NODAL WEIGHTS	X1		X2		X3	
		MISSING RATIO	MISS. WT.	MISSING RATIO	MISS. WT.	MISSING RATIO	MISS. WT
48	.0788	.195	.0154	.192	.0151	.163	.0128
49	"	.389	.0307	.976	.0769	.187	.0147
50	"	.116	.0091	.631	.0497	.215	.0169
51	"	—	—	—	—	.248	.0195
52	"	.361	.0284	—	—	.284	.0224
53	.1974 (X1,2) .7394 (X3)	.964	.1903	.183	.0361	.323	.2388
61	.7394 (X1) .1974 (X2,3)	.153	.1131	.164	.0324	.978	.1931
62	.0788	.117	.0092	—	—	.050	.0039
63	"	.084	.0066	—	—	—	—
64	"	.054	.0043	.552	.0435	—	—
65	"	.029	.0023	.963	.0759	.084	.0066
66	"	.008	.0006	.195	.0154	—	—
67	"	—	—	—	—	—	—
68	"	—	—	.321	.0253	—	—
69	.0744	—	—	.962	.0716	.244	.0182
70	.0521	—	—	.382	.0199	.154	.0080
71	.0341	—	—	—	—	.046	.0016
72	.0342	—	—	—	—	—	—
73	.0341	.046	.0016	—	—	—	—
74	.0521	.154	.0080	.382	.0199	—	—
			.420		.4812		.557

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EBASCO SERVICES INCORPORATED

BY C.H Yeh DATE 01/23/86 SHEET 42 OF 102

CHKD. BY C.W.H DATE 1/23/86 OFS NO. 3306.221 DEPT. NO. 550

CLIENT TEXAS UTILITIES GENERATING CO

PROJECT COMANCHE PEAK UNIT 2 CABLE TRAY HANGERS

SUBJECT MODEL. 1-A

COMPUTER RUN I.D

NODAL WT: DRYRA53

MISS. RATIO: DRY1DWV

MISSING WT OF MODEL. 1-A

NODE ID	NODAL WEIGHTS	X1		X2		X3	
		MISSING RATIO	MISS. WT.	MISSING RATIO	MISS. WT.	MISSING RATIO	MISS. WT
75	.0744	.244	.0182	.962	.0716	—	—
76	.0785	—	—	.321	.0253	—	—
77	≈	—	—	—	—	—	—
78	≈	—	—	.195	.0154	.008	.0006
79	≈	.034	.0066	.963	.0759	.029	.0023
80	≈	—	—	.552	.0435	.054	.0043
81	≈	—	—	—	—	.084	.0066
82	≈	.050	.0039	—	—	.117	.0092
83	.1474 (X1.2) .7394 (X3)	.918	.1931	.164	.0324	.153	.113
104	.0490	.854	.0418	.751	.0368	.998	.0489
105	.0344	.822	.0283	.305	.0105	.998	.0343
106	.0344	.834	.0287	.289	.0099	.999	.0344
107	.0078	.677	.0053	.619	.0048	.998	.0078
108	.0020	.665	.0013	.183	.0004	.998	.0020
109	.0020	.725	.0015	.164	.0003	.999	.0020
202	.0207	.866	.0179	.999	.0207	.795	.0165
203	.0209	.485	.0101	.998	.0209	.415	.0087
204	.0148	.021	.0003	.998	.0148	.112	.0017
205	.0126	.760	.0096	.969	.0122	.792	.010
206	≈	.139	.0018	.976	.0123	.407	.0051

EBASCO SERVICES INCORPORATED

BY C.H. Yeh DATE 01/23/86 SHEET 49 OF 102

CHKD. BY C.W.H DATE 1/24/86 OFS NO. 3306.221 DEPT. NO. 550

CLIENT TEXAS UTILITIES GENERATING CO

PROJECT COMANCHE PEAK UNIT 2
CABLE TRAY HANGERS

SUBJECT MODEL. 1-A

COMPUTER RUN I.D
NODAL WT: DRYRA53
MISS. RATIO: DRY1DWV

MISSING WT OF MODEL. 1-A

NODE ID	NODAL WEIGHTS	X1 MISSING RATIO	X1 MISS. WT.	X2 MISSING RATIO	X2 MISS. WT.	X3 MISSING RATIO	X3 MISS. WT
207	.0126	—	—	.963	.0121	.106	.0013
209	.0140	.758	.0106	.994	.0139	.792	.0111
210	.0142	.118	.0017	.991	.0141	.407	.0058
211	.0097	—	—	.939	.0086	.110	.0010
302	.0207	.776	.0161	.999	.0207	.820	.017
303	.0209	.212	.0044	.995	.0209	.503	.0106
304	.0148	—	—	.997	.0148	.265	.0039
305	.0126	.777	.0098	.968	.0122	.816	.0103
306	=	.271	.0034	.971	.0122	.502	.0063
307	=	—	—	.962	.0121	.261	.0033
309	.0140	.838	.0117	.995	.0139	.817	.0114
310	.0142	.340	.0048	.991	.0141	.502	.0071
311	.0097	—	—	.989	.0086	.264	.0023
402	.0207	.820	.0170	.999	.0207	.776	.0161
403	.0209	.503	.0106	.948	.0209	.212	.0044
404	.0148	.265	.0039	.997	.0148	—	—
405	.0126	.816	.0103	.968	.0122	.777	.0098
406	=	.502	.0063	.971	.0122	.271	.0034
407	=	.261	.0033	.962	.0121	—	—
409	.0140	.817	.0114	.995	.0139	.838	.0117
			.125		.285		.137

EBASCO SERVICES INCORPORATED

BY C.H. Yeh DATE 01/23/86 SHEET 50 OF 102

CHKD. BY C.W.U DATE 1/24/86 OFS NO. 3306.221 DEPT. NO. 550

CLIENT TEXAS UTILITIES GENERATING CO

PROJECT COMANCHE PEAK UNIT 2
CABLE TRAY HANGERS

SUBJECT MODEL. 1-A

MISSING WT OF MODEL. 1-A

COMPUTER RUN I.D
NODAL WT: DRYRA53
MISS. RATIO: DRY1DWV

NODE ID	NODAL WEIGHTS	X_1		X_2		Y_3	
		MISSING RATIO	MISS. WT.	MISSING RATIO	MISS. WT.	MISSING RATIO	MISS. WT
410	.0142	.502	.0071	.991	.0141	.340	.0048
411	.0057	.264	.0023	.989	.0086	—	—
502	.0207	.795	.0165	.999	.0207	.866	.0179
503	.0209	.415	.0087	.998	.0209	.485	.0101
504	.0148	.112	.0017	.995	.0148	.021	.0003
505	.0126	.792	.010	.969	.0122	.760	.0096
506	≈	.407	.0051	.976	.0123	.139	.0018
507	≈	.106	.0013	.963	.0121	—	—
509	.0140	.792	.0111	.994	.0139	.758	.0106
510	.0142	.407	.0058	.991	.0141	.118	.0017
511	.0037	.110	.0010	.989	.0086	—	—
604	.0490	.996	.0489	.751	.0368	.854	.0418
605	.0344	.999	.0343	.305	.0105	.822	.0283
606	≈	.999	.0344	.289	.0099	.834	.0287
607	.0078	.998	.0078	.619	.0048	.677	.0053
608	.0020	.998	.0020	.183	.0004	.665	.0013
609	≈	.999	.0020	.164	.0003	.725	.0015

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.20 .215 .164

EBASCO SERVICES INCORPORATED

BY C.H. Yeh DATE 01/22/86 SHEET 51 OF 102

CHKD. BY C.W.H DATE 1/22/86 CFS NO. 3306.221 DEPT. NO. 550

CLIENT TEXAS UTILITIES GENERATING CO

PROJECT COMANCHE PEAK UNIT 2
CABLE TRAY HANGERS

SUBJECT MODEL "1-B"

MISSING WT OF MODEL "1-B"

COMPUTER RUN I.D
NODAL WT: DRYTBNZ (01/05
MISS. RATIO: DCL1C9Z (01/22)

NODE ID	NODAL WEIGHTS	X1		Y2		X3	
		MISSING RATIO	MISS. WT.	MISSING RATIO	MISS. WT.	MISSING RATIO	MISS. WT
1	.35438 (X1) .19733 (X2.3)	.3721	.1319	.6865	.1355	.9940	.1962
2	.078759	.3155	.0249	—	—	.8332	.0657
3	"	.2624	.0207	—	—	.6815	.0537
4	"	.2129	.0168	.3525	.0278	.6833	.0539
5	"	.1673	.0132	.9653	.0763	.7821	.0616
6	"	.1260	.0099	.2145	.0169	.7902	.0622
7	"	.0890	.0070	—	—	.7903	.0622
8	"	.0568	.0045	.2636	.0208	.8120	.0640
9	"	.0293	.0023	.9607	.0757	.7552	.0618
10	"	.0067	.0005	.2360	.0186	.6175	.0486
11	"	—	—	—	—	.5779	.0455
12	"	—	—	.2600	.0205	.7413	.0584
13	.074383	—	—	.9651	.0718	.8160	.0607
14	.052074	—	—	.3112	.0162	.4494	.0234
15	.034145	—	—	—	—	.2326	.0079
16	.034149	.0148	.0005	—	—	.0869	.0030
17	.034145	.1729	.0059	—	—	.0301	.0010
18	.052074	.4224	.022	.4595	.0239	.0240	.0013
19	.074383	.772	.0574	.9786	.0728	.0206	.0015
20	.078759	.2463	.0194	.4276	.0337	.0177	.0014

EBASCO SERVICES INCORPORATED

BY C.H. Yeh DATE 1/22/86 SHEET 52 OF 102

CHKD. BY C.W.H DATE 1/22/86 OFS NO. 3306.221 DEPT. NO. 550

CLIENT TEXAS UTILITIES GENERATING CO

PROJECT COMANCHE PEAK UNIT 2
CABLE TRAY HANGERS

SUBJECT MODEL. 1-B

COMPUTER RUN I.D

MISSING WT OF MODEL. 1-B

NODAL WT: DRYTBNI (c' 66

MISS. RATIO:

NODE ID	NODAL WEIGHTS	X1 MISSING RATIO	X1 MISS. WT.	X2 MISSING RATIO	X2 MISS. WT.	X3 MISSING RATIO	X3 MISS. WT
21	.078759	—	—	—	—	.0155	.0012
22	=	.0126	.0010	—	—	.0142	.0011
23	.19738 (X1,2) .039379 (X3)	.9143	.1805	.9927	.1959	.0133	.0005
31	.35433 (X1) .19738 (X2,3)	.3579	.1268	.2038	.0402	.9330	.1950
32	.078759	.2971	.0234	—	—	.3487	.0275
33	=	.2395	.0189	—	—	—	—
34	=	.1856	.0146	.6595	.0520	.0995	.0078
35	=	.1355	.0107	.9741	.0767	.3856	.0304
36	=	.0897	.0071	.1551	.0122	.1717	.0135
37	=	.0483	.0038	—	—	.0059	.0005
38	=	.0116	.0009	.3807	.030	.1864	.0147
39	=	—	—	.9674	.0758	.4013	.0316
40	=	—	—	.2315	.0182	.0991	.0077
41	=	—	—	—	—	—	—
42	=	—	—	.2937	.0231	.1748	.0138
43	.074383	—	—	.9656	.0718	.5246	.0390
44	.052074	—	—	.3574	.0186	.3258	.017
45	.034145	—	—	—	—	.1543	.0053
46	.034149	—	—	—	—	.0286	.0010
47	.034145	.0574	.0020	—	—	—	—

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.290 .615 .408

EBASCO SERVICES INCORPORATED

BY C.H. Yeh DATE 01/22/86 SHEET 53 OF 102

CHKD. BY C.W.H DATE 1/22/86 OFS NO. 3306.221 DEPT. NO. 550

CLIENT TEXAS UTILITIES GENERATING CO

PROJECT COMANCHE PEAK UNIT 2
CABLE TRAY HANGERS

SUBJECT MODEL. 1-B

COMPUTER RUN I.D

MISSING WT OF MODEL. 1-B

NODAL WT: DRYTBNZ (01/02)

MISS. RATIO:

NODE ID	NODAL WEIGHTS	X1		X2		X3	
		MISSING RATIO	MISS. WT	MISSING RATIO	MISS. WT.	MISSING RATIO	MISS. WT
48	.052074	.2311	.0120	.4143	.0216	—	—
49	.074383	.4635	.0345	.9761	.0726	—	—
50	.078759	.0364	.0029	.4421	.0348	—	—
51	=	—	—	—	—	—	—
52	=	—	—	—	—	—	—
53	.19733 (X1.2) .039379 (X3)	.7935	.1576	.9919	.1953	—	—
61	.35438 (X1) .19733 (X2.3)	.2303	.0993	.1952	.0385	.9906	.1955
62	.078759	.2370	.0183	—	—	.0802	.0063
63	=	.1564	.0147	—	—	—	—
64	=	.1433	.0113	.6150	.0484	—	—
65	=	.1043	.0082	.9644	.0760	.0795	.0063
66	=	.0681	.0054	.1540	.0121	—	—
67	=	.0354	.0028	—	—	—	—
68	=	.0063	.0005	.3660	.0288	—	—
69	=	—	—	.9542	.0752	.1050	.0083
70	=	—	—	.2261	.0178	—	—
71	=	—	—	—	—	—	—
72	=	—	—	.2862	.0225	—	—
73	.074383	—	—	.9581	.0713	.3102	.0231
74	.052074	—	—	.3503	.0182	.2332	.0121
			.369		.734		.252

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EBASCO SERVICES INCORPORATED

BY C.H. Yeh DATE 01/22/86 SHEET 54 OF 102

CHKD. BY C.W.U DATE 1/22/86 OFS NO. 3306.221 DEPT. NO. 550

CLIENT TEXAS UTILITIES GENERATING CO

PROJECT COMANCHE PEAK UNIT 2
CABLE TRAY HANGERS

SUBJECT MODEL.1-B

COMPUTER RUN I.D

NODAL WT: DRYTBNZ (01/08)

MISS. RATIO:

MISSING WT OF MODEL.1-B

NODE ID	NODAL WEIGHTS	X1		X2		X3	
		MISSING RATIO	MISS. WT.	MISSING RATIO	MISS. WT.	MISSING RATIO	MISS. WT
75	.034145	—	—	—	—	.0931	.0032
76	.034149	—	—	—	—	—	—
77	.034145	.0041	.0001	—	—	—	—
78	.052074	.1093	.0057	.4115	.0214	—	—
79	.074383	.2551	.0190	.9699	.0721	—	—
80	.078759	—	—	.4361	.0344	—	—
81	=	—	—	—	—	—	—
82	=	—	—	—	—	—	—
83	.19738 (X1,2) .039379 (X3)	.7210	.1423	.9903	.1955	—	—
104	.048967	.8603	.0421	.7951	.0390	.9933	.0489
105	.03438	.8194	.0281	.3231	.0111	.9974	.0343
106	=	.8554	.0294	.3159	.0109	.9979	.0343
107	.00778	.6899	.0054	.6865	.0053	.9952	.0075
108	.00201	.681	.0014	.2039	.0004	.9972	.0020
109	.00201	.7534	.0015	.1953	.0004	.9975	.0020
202	.02067	.8526	.0176	.9939	.0210	.7941	.0164
203	.02088	.4505	.0094	.1981	.0208	.4111	.0086
204	.01475	—	—	.9976	.0147	.1071	.0016
205	.01263	.7330	.0093	.9664	.0122	.7916	.010
206	.01263	.1767	.0023	.9741	.0123	.4028	.0051
			.214		.477		.174

EBASCO SERVICES INCORPORATED

BY C.H. Lin DATE 1/23/86 SHEET 55 OF 102

CHKD. BY C.W.H DATE 1/23/86 OFS NO. 3306.221 DEPT. NO. 550

CLIENT TEXAS UTILITIES GENERATING CO

PROJECT COMANCHE PEAK UNIT 2
CABLE TRAY HANGERS

SUBJECT MODEL. 1-B

COMPUTER RUN I.D

MISSING WT OF MODEL. 1-B

NODAL WT: DRYTBNZ (01/09)

MISS. RATIO:

NODE ID	NODAL WEIGHTS	X1 MISSING RATIO	X1 MISS. WT.	X2 MISSING RATIO	X2 MISS. WT.	X3 MISSING RATIO	X3 MISS. WT
207	.01263	—	—	.9644	.0122	.1013	.0013
209	.01399	.7691	.0108	.9946	.0139	.7915	.0111
210	.01418	.1433	.0020	.9911	.0141	.4032	.0057
211	.00873	—	—	.9895	.0086	.1049	.0009
302	.02067	.8075	.0167	.9979	.0206	.7991	.0165
303	.02088	.3059	.0064	.9964	.0208	.4259	.0089
304	.01475	—	—	.9957	.0147	.1314	.0019
305	.01263	.7637	.0096	.9607	.0121	.7953	.010
306	.01263	.2542	.0032	.9624	.0122	.4179	.0053
307	.01263	—	—	.9542	.0121	.1257	.0016
309	.01399	.8059	.0113	.9941	.0139	.7954	.0111
310	.01418	.2556	.0036	.9899	.0140	.4184	.0059
311	.00873	—	—	.9860	.0086	.1291	.0011
402	.02067	.7695	.0163	.9982	.0206	.8320	.0172
403	.02088	.2456	.0051	.9969	.0208	.5451	.0114
404	.01475	—	—	.9962	.0147	.3206	.0048
405	.01263	.7855	.0099	.9652	.0122	.9276	.0125
406	=	.2565	.0032	.9657	.0172	.5354	.0068
407	=	—	—	.9581	.0121	.3248	.0041
409	.01399	.9250	.0115	.9946	.0140	.8283	.0116
			.110		.2554		.148

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EBASCO SERVICES INCORPORATED

BY C.H. Yeh DATE 01/23/86 SHEET 56 OF 102

CHKD. BY C.Wu DATE 1/24/86 OFS NO. 3306.221 DEPT. NO. 550

CLIENT TEXAS UTILITIES GENERATING CO

PROJECT COMANCHE PEAK UNIT 2
CABLE TRAY HANGERS

SUBJECT MODEL. 1-B

COMPUTER RUN I.D
NODAL WT: DRYTBNZ (01/23)
MISS. RATIO:

MISSING WT OF MODEL. 1-B

NODE ID	NODAL WEIGHTS	X1		X2		X3	
		MISSING RATIO	MISS. WT.	MISSING RATIO	MISS. WT.	MISSING RATIO	MISS. WT
410	.01418	.3129	.0044	.9907	.0140	.5390	.0076
411	.00873	—	—	.9859	.0086	.3273	.0029
502	.02067	.7984	.0165	.9990	.0206	.7874	.0163
503	.02088	.4874	.0102	.9932	.0208	.2278	.0048
504	.01475	.2710	.0040	.9975	.0147	—	—
505	.01263	.7903	.010	.9786	.0124	.7886	.0100
506	=	.4795	.0061	.9762	.0123	.2823	.0036
507	=	.2631	.0034	.9699	.0122	—	—
509	.01398	.7919	.0111	.9959	.0139	.8260	.0115
510	.01418	.4804	.0068	.9929	.0141	.3269	.0046
511	.00873	.2704	.0024	.9916	.0087	—	—
602	.02067	.9242	.0191	.9996	.0207	.8194	.0170
603	.02088	.8076	.0169	.9993	.0209	.3213	.0067
604	.01475	.7269	.0107	.9991	.0147	—	—
605	.01263	.9212	.0116	.9927	.0125	.8040	.0102
606	=	.8045	.0102	.9919	.0125	.2475	.0031
607	=	.7258	.0092	.9903	.0125	—	—
609	.01398	.9218	.0129	.9938	.0140	.7912	.0111
610	.01418	.8019	.0114	.9979	.0142	.2370	.0034
611	.00873	.7266	.0063	.9975	.0087	—	—
			1.42		.293		.113

EBASCO SERVICES INCORPORATED

BY C.H.Yeh DATE 01/23/86 SHEET 57 OF 102

CHKD. BY C.Wu DATE 2/10/86 OFS NO. 3306.221 DEPT. NO. 550

CLIENT TEXAS UTILITIES GENERATING CO.

PROJECT COMANCHE PEAK UNIT 2

SUBJECT CABLE TRAY HANGERS

SUMMARY OF MISSING WT.

MISS. WT. FOR MODEL 1-A

PAGE	X1	X2	X3
1	.746	.584	.797
2	.786	.540	.683
3	.420	.482	.557
4	.368	.408	.306
5	.125	.285	.137
6	.200	.215	.164
Σ	2.645	2.514	2.644
TOTAL WT.	8,221	6,595	8,221
MISS. RATIO	.322	.381	.322

MISS WT FOR MODEL 1-B

PAGE	X1	X2	X3
1	.337	.611	.934
2	.390	.615	.408
3	.368	.734	.252
4	.314	.472	.174
5	.110	.284	.148
6	.183	.283	.113
Σ	1.702	2.999	2.029
TOTAL WT.	6.9724	6.5014	6.0274
MISS RATIO	.244	.461	.337

EBASCO SERVICES INCORPORATED

BY C.H. Yeh DATE 01/27/86 SHEET 58 OF 102

CHKD. BY C. Wu DATE 1/30/86 OFS NO. 3306.221 DEPT. NO. 550

CLIENT ~~TEXAS UTILITIES GENERATING CO.~~

PROJECT COMANCHE PEAK UNIT 2
CABLE TRAY HANGERS

SUBJECT

REACTION RATIO OF 3-D SYSTEM TO 2-D SINGLE HANGER. (MRM)

MODEL. 1-A

BLDG. REACTOR (INT.)

ELEV. 860.0'

COMP. RUN ID.
3-D DYNAMIC: OBE. DRYSBP3
(DYNRE4. RSS=1) SSE. DRYSDY3
3-D RIGID MODE: DRYTFJB (CASE 1/6)
2-D STATIC: DRYTCDB (CASE 1/6)

SEISMIC EVENTS	NODE ID	REACT \ COMPONENT ID.		X_1		X_2		X_3	
OBE	301	3-D SYST.	DYNAM.	.037	SRSS	.169	SRSS	.165	SRSS
			RIGID MODE	.008	.038	.068	.182	.072	.180
		2-D SINGLE HANGER		.045		.496		.557	
		MRM		.84		.37		.32	
	308	3-D SYST.	DYNAM	.026	SRSS	.268	SRSS	.101	SRSS
			RIGID MODE	.008	.027	.120	.294	.045	.111
		2-D SINGLE HANGER		.042		.766		.334	
		MRM		.65		.38		.33	
SSE	301	3-D SYST	DYNAM	.050	SRSS	.225	SRSS	.219	SRSS
			RIGID MODE	.012	.051	.097	.245	.105	.243
		2-D SINGLE HANGER		.062		.691		.806	
		MRM		.83		.35		.30	
	308	3-D SYST.	DYNAM	.035	SRSS	.359	SRSS	.134	SRSS
			RIGID MODE	.012	.037	.170	.397	.066	.149
		2-D SINGLE HANGER		.059		1.018		.483	
		MRM		.63		.39		.31	

EBASCO SERVICES INCORPORATED

BY C.H yeh DATE 01/27/86 SHEET 59 OF 102

CHKD. BY C.Wu DATE 1/30/86 OFS NO. 3306.221 DEPT. NO. 550

CLIENT ~~TEXAS UTILITIES GENERATING CO.~~

PROJECT COMANCHE PEAK UNIT 2

SUBJECT CABLE TRAY HANGERS

REACTION RATIO OF 3-D SYSTEM TO 2-D SINGLE HANGER. (MRM)

MODEL. 1-A

BLDG. REACTOR (INT.)

ELEV. 905.75'

COMP. RUN ID.

3-D DYNAMIC: OBE DRYSD47

(DYNRE4 RSS=1) SSE DRYSD6Z

3-D RIGID MODE: DRYTFJB (CASE 2/7)

2-D STATIC: DRYTCDB (CASE 2/7)

SEISMIC EVENTS	NODE ID	REACT \ COMPONENT ID.		X_1		X_2		X_3	
OBE	301	3-D SYST.	DYNAM.	.055	SRSS	.247	SRSS	.235	SRSS
			RIGID MODE	.012	.056	.113	.272	.110	.259
		2-D SINGLE HANGER		.073		.720		.810	
		MRM		.77		.38		.32	
	308	3-D SYST.	DYNAM	.039	SRSS	.397	SRSS	.143	SRSS
			RIGID MODE	.012	.041	.201	.445	.069	.159
		2-D SINGLE HANGER		.069		1.107		.486	
		MRM		.59		.40		.33	
SSE	301	3-D SYST	DYNAM.	.078	SRSS	.345	SRSS	.338	SRSS
			RIGID MODE	.018	.080	.162	.381	.161	.374
		2-D SINGLE HANGER		.104		1.027		1.211	
		MRM		.77		.37		.31	
	308	3-D SYST.	DYNAM	.055	SRSS	.544	SRSS	.206	SRSS
			RIGID MODE	.018	.058	.288	.616	.101	.229
		2-D SINGLE HANGER		.097		1.494		.725	
		MRM		.60		.41		.32	

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EBASCO SERVICES INCORPORATED

BY C.H. Yeh DATE 01/27/86 SHEET 60 OF 102

CHKD. BY C.Wu DATE 1/30/86 OFS NO. 3306.221 DEPT. NO. 550

CLIENT ~~TEXAS UTILITIES GENERATING CO.~~

PROJECT COMANCHE PEAK UNIT 2
CABLE TRAY HANGERS

SUBJECT

REACTION RATIO OF 3-D SYSTEM TO 2-D SINGLE HANGER. (MRM)

MODEL. 1-A

BLDG. REACTOR (AUX.)

ELEV. 899.5'

COMP. RUN ID.

3-D DYNAMIC: OBE DRYVC2N

(DYNRE4 RSS=1) SSE DRYSD9F

3-D RIGID MODE: DRYTFJB (CASE 3/8)

2-D STATIC: DRYTCDB (CASE 3/8)

SEISMIC EVENTS	NODE ID	REACT \ COMPONENT ID.		X_1		X_2		X_3	
OBE	301	3-D SYST.	DYNAM.	.056	SRSS	.225	SRSS	.211	SRSS
			RIGID MODE	.010	.057	.067	.235	.089	.229
		2-D SINGLE HANGER		.069		.963		1.104	
		MRM		.82		.24		.21	
	308	3-D SYST.	DYNAM	.040	SRSS	.383	SRSS	.131	SRSS
			RIGID MODE	.010	.041	.115	.400	.056	.142
		2-D SINGLE HANGER		.065		1.451		.661	
		MRM		.63		.28		.22	
SSE	301	3-D SYST	DYNAM	.07	SRSS	.318	SRSS	.309	SRSS
			RIGID MODE	.016	.072	.103	.334	.139	.339
		2-D SINGLE HANGER		.086		1.174		1.412	
		MRM		.83		.28		.24	
	308	3-D SYST.	DYNAM	.050	SRSS	.511	SRSS	.189	SRSS
			RIGID MODE	.015	.052	.176	.54	.087	.208
		2-D SINGLE HANGER		.080		1.659		.845	
		MRM		.65		.33		.25	

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EBASCO SERVICES INCORPORATED

BY C.H. yeh DATE 01/27/86 SHEET 61 OF 102

CHKD. BY C.W.U DATE 1/30/86 OFS NO. 3306.221 DEPT. NO. 550

CLIENT ~~TEXAS UTILITIES GENERATING CO.~~

PROJECT COMANCHE PEAK UNIT 2

SUBJECT CABLE TRAY HANGERS

REACTION RATIO OF 3-D SYSTEM TO 2-D SINGLE HANGER. (MRM)

MODEL. 1-A

BLDG. ELECT.

ELEV. 873.33'

COMP. RUN ID.

3-D DYNAMIC: OBE DRYSEAF

(DYNRE4. RSS=1) SSE DRYSEAV

3-D RIGID MODE: DRYTFJB (CASE 4/9)

2-D STATIC: DRYTCDB (CASE 4/9)

SEISMIC EVENTS	NODE ID	COMPONENT ID. / REACT		X_1		X_2		X_3	
OBE	301	3-D SYST.	DYNAM.	.026	SRSS	.194	SRSS	.154	SRSS
			RIGID MODE	.006	.027	.054	.201	.056	.164
		2-D SINGLE HANGER		.038		.511		.497	
		MRM		.70		.39		.33	
	308	3-D SYST.	DYNAM	.019	SRSS	.332	SRSS	.094	SRSS
			RIGID MODE	.006	.020	.096	.346	.035	.100
		2-D SINGLE HANGER		.035		.89		.299	
		MRM		.57		.39		.34	
SSE	301	3-D SYST	DYNAM	.042	SRSS	.262	SRSS	.218	SRSS
			RIGID MODE	.010	.043	.087	.276	.085	.234
		2-D SINGLE HANGER		.057		.674		.635	
		MRM		.76		.41		.37	
	308	3-D SYST.	DYNAM	.030	SRSS	.441	SRSS	.133	SRSS
			RIGID MODE	.009	.031	.154	.467	.054	.144
		2-D SINGLE HANGER		.054		1.197		.383	
		MRM		.58		.39		.37	

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EBASCO SERVICES INCORPORATED

BY C.H. Yeh DATE 01/27/86 SHEET 62 OF 102

CHKD. BY C.W.U DATE 1/30/86 OFS NO. 3306.221 DEPT. NO. 550

CLIENT ~~TEXAS UTILITIES GENERATING CO.~~

PROJECT COMANCHE PEAK UNIT 2

SUBJECT CABLE TRAY HANGERS

REACTION RATIO OF 3-D SYSTEM TO 2-D SINGLE HANGER. (MRM)

MODEL. 1-A

BLDG. SFGD.

ELEV. 896.5'

COMP. RUN ID.

3-D DYNAMIC: OBE DRYVC23

(DYNRE4 RSS=1) SSE DRYSEBJ

3-D RIGID MODE: DRYTFJB (CASE 5/10)

2-D STATIC: DRYTCDB (CASE 5/10)

SEISMIC EVENTS	NODE ID	COMPONENT ID. / REACT		X_1		X_2		X_3	
OBE	301	3-D SYST.	DYNAM.	.065	SRSS	.297	SRSS	.267	SRSS
			RIGID MODE	.009	.066	.069	.305	.083	.280
		2-D SINGLE HANGER		.093		.795		.885	
		MRM		.71		.38		.32	
	308	3-D SYST.	DYNAM	.046	SRSS	.476	SRSS	.162	SRSS
			RIGID MODE	.009	.047	.121	.491	.052	.170
		2-D SINGLE HANGER		.087		1.240		.531	
		MRM		.54		.40		.32	
SSE	301	3-D SYST	DYNAM	.086	SRSS	.379	SRSS	.344	SRSS
			RIGID MODE	.016	.087	.118	.397	.141	.372
		2-D SINGLE HANGER		.119		1.14		1.312	
		MRM		.74		.35		.28	
	308	3-D SYST.	DYNAM	.061	SRSS	.615	SRSS	.209	SRSS
			RIGID MODE	.016	.063	.205	.648	.089	.227
		2-D SINGLE HANGER		.112		1.709		.786	
		MRM		.56		.38		.29	

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EBASCO SERVICES INCORPORATED

BY C.H. Yeh DATE 01/29/86 SHEET 63 OF 102

CHKD. BY C.Wu DATE 1/30/86 OFS NO. 3306.221 DEPT. NO. 550

CLIENT ~~TEXAS UTILITIES GENERATING CO.~~

PROJECT COMANCHE PEAK UNIT 2

SUBJECT CABLE TRAY HANGERS "1-B" (FACTOR. UNBALANCE MOMENT)

REACTION RATIO OF 3-D SYSTEM TO 2-D SINGLE HANGER. (MRM)

MODEL. 1-B

BLDG. REACTOR (INT)

ELEV. 860.0'

COMP. RUN ID.

3-D DYNAMIC: OBE: DRYVCRR

(DYNRE4. RSS=1) SSE: DRYVCRZ

3-D RIGID MODE: DRYTEHV (CASE 1/6)

2-D STATIC: DRYVCQJ (CASE 1/6)

SEISMIC EVENTS	NODE ID	COMPONENT ID. / REACT		X_1		X_2		X_3	
OBE	401	3-D SYST.	DYNAM.	.050	SRSS	.654	SRSS	.813	SRSS
			RIGID MODE	.008	.051	.067	.657	.073	.816
		2-D SINGLE HANGER		.079		1.040		1.385	
		MRM		.65		.63		.59	
	408	3-D SYST.	DYNAM	.049	SRSS	.729	SRSS	.491	SRSS
			RIGID MODE	.008	.050	.121	.739	.046	.493
		2-D SINGLE HANGER		.077		1.192		.826	
		MRM		.65		.62		.60	
SSE	401	3-D SYST	DYNAM	.066	SRSS	.817	SRSS	1.014	SRSS
			RIGID MODE	.012	.067	.095	.823	.107	1.020
		2-D SINGLE HANGER		.100		1.268		1.681	
		MRM		.67		.65		.61	
	408	3-D SYST.	DYNAM	.063	SRSS	.913	SRSS	.613	SRSS
			RIGID MODE	.012	.064	.171	.929	.068	.617
		2-D SINGLE HANGER		.098		1.472		1.003	
		MRM		.65		.63		.62	

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EBASCO SERVICES INCORPORATED

BY C.H. Yeh DATE 01/29/86 SHEET 64 OF 102

CHKD. BY C.W.H DATE 1/30/86 OFS NO. 3306.221 DEPT. NO. 550

CLIENT ~~TEXAS UTILITIES GENERATING CO.~~

PROJECT COMANCHE PEAK UNIT 2

SUBJECT CABLE TRAY HANGERS "1-B"

REACTION RATIO OF 3-D SYSTEM TO 2-D SINGLE HANGER (MRM)

MODEL. 1-B

BLDG. REACTOR (INT)

ELEV. 905.75'

COMP. RUN ID.

3-D DYNAMIC: OBE DRY VCR3

(DYNRE4, RSS=1) SSE DRY VCSB

3-D RIGID MODE: DRYTEHV (CASE 2/7)

2-D STATIC: DRYVCQT (CASE 2/7)

SEISMIC EVENTS	NODE ID	REACT \ COMPONENT ID.		X_1		X_2		X_3	
OBE	401	3-D SYST.	DYNAM.	.078	SRSS	1.104	SRSS	1.374	SRSS
			RIGID MODE	.013	.079	.111	1.110	.111	1.378
		2-D SINGLE HANGER		.125		1.621		2.172	
		MRM		.63		.68		.63	
	408	3-D SYST.	DYNAM	.080	SRSS	1.226	SRSS	.830	SRSS
			RIGID MODE	.012	.081	.202	1.243	.070	.833
		2-D SINGLE HANGER		.123		1.826		1.296	
		MRM		.66		.68		.64	
SSE	401	3-D SYST	DYNAM	.105	SRSS	1.339	SRSS	1.665	SRSS
			RIGID MODE	.018	.106	.160	1.349	.163	1.673
		2-D SINGLE HANGER		.162		1.99		2.656	
		MRM		.65		.68		.63	
	408	3-D SYST.	DYNAM	.102	SRSS	1.491	SRSS	1.006	SRSS
			RIGID MODE	.018	.104	.289	1.519	.104	1.011
		2-D SINGLE HANGER		.158		2.266		1.585	
		MRM		.66		.67		.64	

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EBASCO SERVICES INCORPORATED

BY C.H. Yeh DATE 01/29/86 SHEET 65 OF 102
CHKD. BY C.Wu DATE 1/30/86 OFS NO. 3306.221 DEPT. NO. 550
CLIENT ~~TEXAS UTILITIES GENERATING CO.~~
PROJECT COMANCHE PEAK UNIT 2
SUBJECT CABLE TRAY HANGERS "1-B"

REACTION RATIO OF 3-D SYSTEM TO 2-D SINGLE HANGER (MRM)

MODEL. 1-B
BLDG. REACTOR (AUX.)
ELEV. 899.5'

COMP. RUN ID.
3-D DYNAMIC: OBE: DRYVCKN
(DYNRE4, RSS=1) SSE: DRYVCSN
3-D RIGID MODE: DRYTEHV (CASE 3/8)
2-D STATIC: DRYVCQJ (CASE 3/8)

SEISMIC EVENTS	NODE ID	REACT \ COMPONENT ID.		X_1		X_2		X_3	
OBE	401	3-D SYST.	DYNAM.	.074	SRSS	.956	SRSS	1.187	SRSS
			RIGID MODE	.010	.075	.067	.958	.091	1.19
		2-D SINGLE HANGER		.109		1.401		1.792	
		MRM		.69		.68		.66	
	408	3-D SYST.	DYNAM	.072	SRSS	1.065	SRSS	.717	SRSS
			RIGID MODE	.010	.073	.116	1.07	.057	.719
		2-D SINGLE HANGER		.106		1.773		1.070	
		MRM		.69		.60		.67	
SSE	401	3-D SYST.	DYNAM	.093	SRSS	1.190	SRSS	1.477	SRSS
			RIGID MODE	.016	.094	.103	1.194	.141	1.484
		2-D SINGLE HANGER		.140		1.802		2.365	
		MRM		.67		.66		.63	
	408	3-D SYST.	DYNAM	.091	SRSS	1.327	SRSS	.893	SRSS
			RIGID MODE	.016	.092	.178	1.339	.089	.897
		2-D SINGLE HANGER		.137		2.15		1.411	
		MRM		.67		.62		.64	

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BY C.H.Yeh DATE 01/29/86 SHEET 66 OF 102

CHKD. BY C.Wu DATE 1/30/86 OFS NO. 3306.221 DEPT. NO. 550

CLIENT ~~TEXAS UTILITIES GENERATING CO.~~

PROJECT COMANCHE PEAK UNIT 2

SUBJECT CABLE TRAY HANGERS "1-B"

REACTION RATIO OF 3-D SYSTEM TO 2-D SINGLE HANGER (MRM)

MODEL. 1-B

BLDG. ELECT.

ELEV. 873.33'

COMP. RUN ID.

3-D DYNAMIC: OBE DRYVCSR

(DYNRE4 RSS=1) SSE DRYVDQZ

3-D RIGID MODE: DRYTEHV (CASE 4/9)

2-D STATIC: DRYVCQJ (CASE 4/9)

SEISMIC EVENTS	NODE ID	COMPONENT ID. / REACT		X_1		X_2		X_3	
OBE	401	3-D SYST.	DYNAM.	.042	SRSS	.672	SRSS	.828	SRSS
			RIGID MODE	.006	.042	.053	.674	.057	.830
		2-D SINGLE HANGER		.069		.96		1.231	
		MRM		.61		.70		.67	
	408	3-D SYST.	DYNAM	.046	SRSS	.766	SRSS	.500	SRSS
			RIGID MODE	.006	.046	.096	.772	.036	.501
		2-D SINGLE HANGER		.068		1.205		.735	
		MRM		.68		.64		.68	
SSE	401	3-D SYST	DYNAM	.060	SRSS	.865	SRSS	1.067	SRSS
			RIGID MODE	.010	.061	.085	.869	.086	1.070
		2-D SINGLE HANGER		.098		1.315		1.69	
		MRM		.62		.66		.63	
	408	3-D SYST.	DYNAM	.062	SRSS	.987	SRSS	.645	SRSS
			RIGID MODE	.009	.063	.155	.999	.055	.647
		2-D SINGLE HANGER		.095		1.645		1.009	
		MRM		.66		.61		.64	

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EBASCO SERVICES INCORPORATED

BY C.H. Yeh DATE 01/29/86 SHEET 67 OF 102
CHKD. BY C.W.H DATE 1/30/86 OFS NO. 3306.221 DEPT. NO. 550
CLIENT ~~TEXAS UTILITIES GENERATING CO.~~
PROJECT COMANCHE PEAK UNIT 2
SUBJECT CABLE TRAY HANGERS "1-B"

REACTION RATIO OF 3-D SYSTEM TO 2-D SINGLE HANGER (MRM)

MODEL. 1-B
BLDG. SF.GD
ELEV. 896.5'

COMP. RUN ID.
3-D DYNAMIC: OBE DRYVCS7
(DYNRE4 RSS=1) SSE DRYVCTF
3-D RIGID MODE: DRYTEHV (CASE 5/10)
2-D STATIC: DRYVCQT (CASE 5/10)

SEISMIC EVENTS	NODE ID	REACT \ COMPONENT ID.		X_1		X_2		X_3	
OBE	401	3-D SYST.	DYNAM.	.105	SRSS	1.458	SRSS	1.820	SRSS
			RIGID MODE	.009	.105	.069	1.46	.084	1.822
		2-D SINGLE HANGER		.179		2.412		3.282	
		MRM		.59		.61		.56	
	408	3-D SYST.	DYNAM	.109	SRSS	1.608	SRSS	1.100	SRSS
			RIGID MODE	.009	.109	.122	1.613	.053	1.101
		2-D SINGLE HANGER		.177		2.593		1.957	
		MRM		.62		.62		.56	
SSE	401	3-D SYST	DYNAM	.124	SRSS	1.635	SRSS	2.036	SRSS
			RIGID MODE	.016	.125	.117	1.639	.143	2.041
		2-D SINGLE HANGER		.204		2.624		3.533	
		MRM		.61		.62		.58	
	408	3-D SYST.	DYNAM	.124	SRSS	1.818	SRSS	1.230	SRSS
			RIGID MODE	.016	.125	.207	1.84	.090	1.233
		2-D SINGLE HANGER		.200		2.917		2.107	
		MRM		.63		.63		.59	

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CLIENT TEXAS UTILITIES GENERATING CO.

PROJECT COMANCHE PEAK UNIT 2 CABLE TRAY HANGERS MRM FOR REACTION).

SUBJECT MULTIPLE RESPONSE MULTIPLIER FOR C.T.H. SYSTEM W/90° BENT (RSS=1)

MODEL	BUILDING	ELEVATION (FT)	RANGE OF AMPLIFICATION FACTOR							
			OBE (4%)				SSE (7%)			
			VERT.	TRANS.	LONG.	RUN ID	VERT.	TRANS.	LONG.	RUN ID
1A	REACTOR INTERNAL	860.00*	.38	.33	.84	DRY SBP3 TFJB TCDB	.39	.31	.83	DRY SDYZ TFJB TCDB
		905.75	.40	.33	.77	DRY SD47 TFJB TCDB	.41	.32	.77	DRY SD6Z TFJB TCDB
	REACTOR AUXILIARY	899.50	.28	.22	.82	DRY VC2N TFJB TCDB	.33	.25	.83	DRY SD9F TFJB TCDB
	ELECTRICAL	873.33	.39	.34	.70	DRY SEAF TFJB TCDB	.41	.37	.76	DRY SEAV TFJB TCDB
	SAFE GUARD	896.50	.40	.32	.71	DRY VC23 TFJB TCDB	.38	.29	.74	DRY SEBJ TFJB TCDB
1B**	REACTOR INTERNAL	860.00*	.63	.60	.65	DRY VCRR TEHV VCQJ	.65	.62	.67	DRY VCR2 TEHV VCQJ
		905.75	.68	.64	.66	DRY VCR3 TEHV VCQJ	.68	.64	.66	DRY VCSB TEHV VCQJ
	REACTOR AUXILIARY	899.50	.68	.67	.69	DRY VCKN TEHV VCQJ	.66	.64	.67	DRY VCSN TEHV VCQJ
	ELECTRICAL	873.33	.70	.68	.68	DRY VCSR TEHV VCQJ	.66	.64	.66	DRY VDQZ TEHV VCQJ
	SAFE GUARD	896.50	.62	.56	.62	DRY VCST TEHV VCQJ	.63	.59	.63	DRY VCTC TEHV VCQJ

* THE FLOOR ELEVATION WHERE THE HANGER FOR STRUCTURAL MODEL IS LOCATED.

** USE FACTOR UNBALANCE MOMENT IN "2-D" STATIC ANALYSIS

M.R.M. RESULTS FOR CABLE TRAY HANGER SYSTEM WITH 90° BENT

(FOR SUPPORT REACTION ENVELOP)

6 The time History vs Response Spectra Approach

In order to verify the validity of selecting option RSS = 1 in the dynamic analysis using modal response (DYNRE4), a comparison between the MRMs through both the time history analysis (DYNRE1) and the response spectra approach (DYNRE4 with RSS = 1) was performed.

The floor response spectra were obtained through DYNRE5 ~~for~~ at selected frequencies ~~for~~ the time histories. Four sets of time histories were used, horizontal and vertical earthquakes for both OBE and SSE. Damping values were assumed 4% and 7% for OBE and SSE respectively.

In the time history approach (DYNRE1),

structural responses were obtained by SRSS of the peak values corresponding to three individual, seperate seismic excatations. Since the rigid-mode response is included in the program formulation, the missing mass adjustment is not necessary.

~~For the response spectra~~

For the response spectra approach. (DYNRE4 with RSS = 1), however, the rigid-~~body~~ mode responses were obtained through the missing mass computation. The MRM's were listed on ~~table~~ page 100 for both approaches and both models.

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CLIENT TEXAS UTILITIES GENERATING CO.

PROJECT COMANCHE PEAK UNIT 2
CABLE TRAY HANGERS

SUBJECT Calculation of Acceleration Level from Time History

MODEL	DIRECT.	SYSTEM FREQUENCY f_s	OBE (4% DAMPING)					SSE (7% DAMPING)				
			f_1	f_2	A_1	A_2	*A_{OBE}	f_3	f_4	A_3	A_4	**A_{SSE}
	L	11.28	11.211	11.307	0.427	0.417	0.420	11.211	11.307	0.679	0.671	0.673
1-A	V	11.31	11.307	11.397	0.974	0.954	0.973	11.307	11.397	1.374	1.358	1.373
	T	16.18	14.870	16.966	0.328	0.306	0.314	14.870	16.966	0.541	0.483	0.504
	L	11.28	11.211	11.307	0.427	0.417	0.420	11.21!	11.307	0.679	0.671	0.673
1-B	V	11.32	11.307	11.397	0.974	0.954	0.971	11.307	11.397	1.374	1.358	1.372
	T	9.34	8.251	9.659	0.951	0.664	0.725	8.251	9.659	1.369	1.006	1.083

2-D MODEL ACCELERATION LEVEL FOR BEST ESTIMATE TIME HISTORY

$$* \quad A_{OBE} = A_1 + (A_2 - A_1)\frac{Ln\, f_3 - Ln\, f_1}{Ln\, f_2 - Ln\, f_1}$$

$$** \quad A_{SSE} = A_3 + (A_4 - A_3)\frac{Ln\, f_3 - Ln\, f_3}{Ln\, f_4 - Ln\, f_3}$$

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CLIENT TEXAS UTILITIES GENERATING CO.

PROJECT COMANCHE PEAK UNIT 2

SUBJECT CABLE TRAY HANGERS

COMPARISON OF TIME HISTRY (DYNRE 1)/ RESPONSE SPECTRA (DYNRE 4)

MODEL: 1-A

SEISMIC: OBE

COMPUTER RUN ID.

DYNRE 1 : DRYZDMN

DYNRE 4 : DRYZCL3

RESPONSE @		DYNRE 1				DYNRE 4	
NODE	DIRECT.	X_1	X_2	X_3	SRSS (Q_T)	RSS = 1	
7	2	.163	.399	.123	.448	.375	
	3	.188	.018	.221	.291	.595	
8	2	.126	.304	.080	.339	.235	
	3	.118	.014	.218	.248	.466	
9	2	.004	.180	.008	.180	.191	
	3	.019	.004	.218	.219	.336	
10	2	.125	.234	.121	.292	.418	
	3	.050	.026	.227	.234	.248	
11	2	.136	.318	.169	.385	.536	
	3	.055	.034	.231	.240	.227	
12	2	.154	.367	.154	.427	.519	
	3	.057	.036	.241	.250	.225	
37	2	.156	.402	.118	.447	.517	
	3	.170	.034	.362	.401	.525	
38	2	.130	.305	.083	.342	.320	
	3	.126	.025	.310	.336	.386	
39	2	.004	.180	.005	.180	.192	
	3	.056	.012	.229	.236	.247	

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PROJECT COMANCHE PEAK UNIT 2

SUBJECT CABLE TRAY HANGERS

COMPARISON OF TIME-HISTRY (DYNRE1)/RESPONSE-SPECTRA (DYNRE4)

MODEL: 1-A

SEISMIC: OBE

COMPUTER RUN ID.
DYNRE 1: DRYZDMN
DYNRE 4: DRYZCL3

RESPONSE @		DYNRE 1.				DYNRE 4.	
NODE	DIRECT.	X_1	X_2	X_3	SRSS(a_T)	RSS=1	
40	2	.103	.230	.106	.273	.494	
	3	.072	.029	.228	.241	.286	
41	2	.124	.313	.159	.372	.658	
	3	.076	.036	.231	.246	.313	
42	2	.156	.364	.156	.426	.662	
	3	.075	.039	.233	.248	.326	
67	2	.207	.401	.169	.482	.613	
	3	.363	.054	.522	.638	.772	
68	2	.154	.301	.124	.360	.395	
	3	.262	.039	.431	.506	.570	
69	2	.007	.180	.004	.180	.190	
	3	.089	.018	.270	.285	.241	✓
70	2	.150	.218	.176	.318	.505	
	3	.058	.044	.247	.258	.202	✓
71	2	.221	.339	.222	.462	.757	
	3	.063	.056	.258	.271	.221	✓
72	2	.217	.394	.217	.499	.855	
	3	.069	.059	.267	.282	.236	✓

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PROJECT TEXAS UTILITIES GENERATING CO. COMANCHE PEAK UNIT 2

SUBJECT CABLE TRAY HANGERS

COMPARISON OF TIME-HISTRY (DYNRE1) / RESPONSE-SPECTRA (DYNRE4)

MODEL: 1-A

SEISMIC OBE

COMPUTER RUN ID.
DYNRE 1 : DRYZDMN
DYNRE 4 : DRYZCL3

RESPONSE @		DYNRE 1				DYNRE 4	
NODE	DIRECT.	X_1	X_2	X_3	SRSS	RSS=1	
302	1	.244	.007	.022	.245	.334	
	2	.001	.180	.001	.180	.197	
	3	.018	.004	.217	.218	.342	
303	1	.327	.025	.078	.337	.343	
	2	.001	.180	.002	.180	.197	
	3	.054	.011	.229	.236	.251	
304	1	.425	.043	.136	.448	.607	
	2	.001	.180	.003	.180	.197	
	3	.086	.018	.265	.279	.238	
305	1	.247	.007	.019	.248	.337	
	2	.004	.180	.008	.180	.191	
	3	.018	.004	.217	.218	.341	
306	1	.333	.022	.028	.335	.343	
	2	.004	.180	.005	.180	.192	
	3	.055	.012	.229	.236	.250	
307	1	.436	.040	.060	.442	.594	
	2	.007	.180	.004	.180	.190	
	3	.086	.018	.266	.280	.239	✓

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SUBJECT CABLE TRAY HANGERS

COMPARISON OF TIME-HISTRY (DYNRE1) / RESPONSE-SPECTRA (DYNRE4)

MODEL : 1-A

SEISMIC : OBE

COMPUTER RUN ID.

DYNRE 1 : DRYZDMN

DYNRE 4 : DRYZCL3

RESPONSE @		DYNRE 1				DYNRE 4	
NODE	DIRECT.	X_1	X_2	X_3	SRSS	RSS=1	
309	1	.244	.008	.019	.245	.360	
	2	.001	.180	.002	.180	.196	
	3	.018	.004	.217	.218	.341	
310	1	.331	.028	.066	.339	.369	
	2	.002	.180	.003	.180	.195	
	3	.055	.012	.229	.236	.250	
311	1	.434	.051	.109	.450	.619	
	2	.002	.180	.004	.180	.195	
	3	.086	.018	.266	.280	.239	✓

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PROJECT COMANCHE PEAK UNIT 2

SUBJECT CABLE TRAY HANGERS

COMPARISON OF TIME-HISTRY (DYNRE 1) / RESPONSE SPECTRA (DYNRE 4)

MODEL: 1-A

SEISMIC: SSE

COMPUTER RUN ID.

DYNRE 1 : DRYZDGJ/DRYODA3

DYNRE 4 : DRYZA4B

RESPONSE @		DYNRE 1				DYNRE 4	
NODE	DIRECT.	X_1	X_2	X_3	SRSS	RSS=1	
7	2	.18	.678	.137	.715	.608	✓
	3	.033	.021	.356	.358	.617	
8	2	.116	.562	.105	.583	.375	✓
	3	.021	.017	.356	.357	.464	
9	2	.002	.345	.002	.345	.361	
	3	.005	.006	.357	.357	.299	✓
10	2	.112	.391	.118	.423	.565	
	3	.011	.038	.366	.368	.242	✓
11	2	.161	.503	.165	.553	.794	
	3	.013	.050	.374	.378	.240	✓
12	2	.172	.576	.172	.625	.86	
	3	.014	.053	.378	.382	.244	✓
37	2	.189	.680	.146	.721	.853	
	3	.045	.027	.406	.409	.584	
38	2	.124	.564	.112	.588	.511	✓
	3	.033	.019	.393	.395	.430	
39	2	.002	.345	.002	.345	.362	
	3	.014	.015	.369	.370	.241	✓

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PROJECT TEXAS UTILITIES GENERATING CO. COMANCHE PEAK UNIT 2

SUBJECT CABLE TRAY HANGERS

COMPARISON OF TIME-HISTRY (DYNRE 1) / RESPONSE SPECTRA (DYNRE 4)

MODEL: 1-A

SEISMIC: SSE

COMPUTER RUN ID.
DYNRE 1 : DRYZDGJ/DRYODA3
DYNRE 4 : DRYZA4B

RESPONSE @		DYNRE 1				DYNRE 4	
NODE	DIRECT.	X_1	X_2	X_3	SRSS	RSS=1	
40	2	.119	.390	.125	.426	.682	
	3	.014	.042	.370	.373	.295	✓
41	2	.170	.497	.175	.554	.997	
	3	.017	.052	.375	.379	.332	✓
42	2	.182	.569	.182	.625	1.103	
	3	.019	.055	.379	.383	.347	✓
67	2	.271	.672	.217	.756	1.002	
	3	.078	.040	.438	.447	.887	
68	2	.188	.568	.163	.620	.626	
	3	.058	.029	.416	.421	.657	
69	2	.002	.345	.002	.345	.359	
	3	.022	.023	.383	.384	.265	✓
70	2	.174	.380	.169	.451	.786	
	3	.018	.063	.393	.398	.237	✓
71	2	.242	.471	.238	.581	1.200	
	3	.025	.078	.404	.412	.272	✓
72	2	.258	.542	.258	.653	1.376	
	3	.031	.082	.412	.421	.293	✓

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SUBJECT CABLE TRAY HANGERS

COMPARISON OF TIME-HISTRY (DYNRE 1) / RESPONSE SPECTRA (DYNRE 4)

MODEL : 1-A

SEISMIC : SSE

COMPUTER RUN ID.
DYNRE 1 : DRYZDGJ/DRYODA3
DYNRE 4 : DRYZA4B

RESPONSE @		DYNRE 1				DYNRE 4	
NODE	DIRECT.	X_1	X_2	X_3	SRSS	RSS = 1	
302	1	.401	.008	.008	.401	.316	✓
	2	.0002	.343	.0004	.343	.372	
	3	.005	.006	.357	.357	.304	✓
303	1	.538	.025	.027	.539	.516	✓
	2	.0003	.343	.001	.343	.371	
	3	.014	.015	.368	.369	.243	✓
304	1	.699	.043	.049	.702	.939	
	2	.0004	.344	.001	.344	.371	
	3	.021	.022	.382	.383	.260	✓
305	1	.406	.007	.005	.406	.321	✓
	2	.002	.345	.002	.345	.361	
	3	.005	.006	.357	.357	.302	✓
306	1	.551	.025	.014	.552	.527	✓
	2	.002	.345	.002	.345	.362	
	3	.014	.015	.368	.369	.242	✓
307	1	.722	.043	.023	.724	.955	
	2	.002	.345	.002	.345	.359	
	3	.022	.022	.382	.383	.261	✓

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PROJECT COMANCHE PEAK UNIT 2

SUBJECT CABLE TRAY HANGERS

COMPARISON OF TIME-HISTRY (DYNRE 1) / RESPONSE SPECTRA (DYNRE 4)

MODEL : 1-A

SEISMIC : SSE

COMPUTER RUN ID.

DYNRE 1 : DRYZDGJ/DRYODA3

DYNRE 4 : DRYZA4B

RESPONSE @		DYNRE 1				DYNRE 4	
NODE	DIRECT.	X_1	X_2	X_3	SRSS	RSS = 1	
309	1	.403	.010	.008	.403	.339	✓
	2	.0003	.343	.0005	.343	.370	
	3	.005	.006	.357	.357	.303	✓
310	1	.549	.033	.027	.551	.547	✓
	2	.0005	.344	.001	.344	.369	
	3	.014	.015	.368	.369	.242	✓
311	1	.720	.060	.047	.724	.975	
	2	.001	.344	.001	.344	.368	
	3	.021	.022	.382	.383	.261	✓

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PROJECT COMANCHE PEAK UNIT 2

SUBJECT CABLE TRAY HANGERS

COMPARISON OF TIME-HISTRY (DYNRE 1) / RESPONSE SPECTRA (DYNRE 4)

COMPUTER RUN ID.

MODEL: 1-B

SEISMIC: OBE

DYNRE 1 : DRYZDXF/DRYODUJ

DYNRE 4 : DRYZC67

RESPONSE @		DYNRE 1				DYNRE 4	
NODE	DIRECT.	X_1	X_2	X_3	SRSS (a_T)	RSS = 1	
11	2	.104	.321	.056	.342	.470	
	3	.131	.031	.300	.329	.504	
12	2	.080	.245	.035	.260	.321	
	3	.073	.026	.249	.261	.405	
13	2	.003	.180	.007	.180	.191	
	3	.014	.005	.241	.241	.341	
14	2	.063	.397	.039	.404	.330	✓
	3	.076	.049	.395	.405	.256	✓
15	2	.082	.454	.056	.465	.419	✓
	3	.092	.070	.466	.480	.259	✓
16	2	.095	.394	.072	.412	.310	✓
	3	.081	.081	.512	.525	.282	✓
41	2	.102	.339	.051	.358	.629	
	3	.151	.030	.453	.478	.563	
42	2	.077	.256	.039	.270	.435	
	3	.106	.023	.368	.384	.391	
43	2	.003	.180	.005	.180	.191	
	3	.033	.013	.283	.285	.259	✓

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SUBJECT CABLE TRAY HANGERS

COMPARISON OF TIME-HISTRY (DYNRE 1)/RESPONSE SPECTRA (DYNRE4)

MODEL: 1-B
SEISMIC: OBE

COMPUTER RUN ID.
DYNRE 1 : DRYZDXF/DRYODUJ
DYNRE 4 : DRYZC67

RESPONSE @		DYNRE 1				DYNRE 4	
NODE	DIRECT.	X_1	X_2	X_3	SRSS(a_T)	RSS=1	
44	2	.070	.399	.052	.408	.337	✓
	3	.060	.030	.531	.535	.406	✓
45	2	.085	.459	.073	.472	.419	✓
	3	.063	.038	.645	.649	.519	✓
46	2	.098	.393	.088	.414	.438	
	3	.070	.041	.717	.722	.597	✓
71	2	.143	.357	.078	.392	.772	
	3	.179	.054	.586	.615	.691	
72	2	.092	.266	.060	.288	.537	
	3	.129	.041	.472	.491	.501	
73	2	.003	.180	.001	.180	.189	
	3	.044	.019	.317	.321	.247	✓
74	2	.092	.391	.088	.411	.47	
	3	.077	.052	.646	.653	.618	✓
75	2	.120	.446	.133	.481	.607	
	3	.103	.067	.795	.804	.825	
76	2	.151	.386	.157	.443	.635	
	3	.118	.074	.891	.902	.961	

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PROJECT COMANCHE PEAK UNIT 2
SUBJECT CABLE TRAY HANGERS

COMPARISON OF TIME-HISTRY (DYNRE 1) / RESPONSE SPECTRA (DYNRE 4)

MODEL: 1-B
SEISMIC: OBE

COMPUTER RUN ID.
DYNRE 1 : DRYZDXF/DRYODUJ
DYNRE 4 : DRYZC67

RESPONSE @		DYNRE 1				DYNRE 4	
NODE	DIRECT.	X_1	X_2	X_3	SRSS (a_T)	RSS = 1	
402	1	.239	.006	.043	.243	.339	
	2	.0003	.180	.001	.180	.197	
	3	.012	.004	.239	.239	.347	
403	1	.313	.016	.144	.345	.356	
	2	.001	.180	.002	.180	.196	
	3	.031	.012	.280	.282	.263	✓
404	1	.401	.025	.249	.473	.626	
	2	.001	.180	.002	.180	.196	
	3	.044	.019	.314	.318	.246	✓
405	1	.246	.011	.028	.248	.341	
	2	.003	.180	.007	.180	.191	
	3	.013	.004	.240	.240	.345	
406	1	.340	.023	.109	.358	.369	
	2	.003	.180	.005	.180	.191	
	3	.032	.013	.281	.283	.261	✓
407	1	.450	.041	.202	.495	.652	
	2	.003	.180	.001	.180	.189	
	3	.044	.019	.315	.319	.246	✓

EBASCO SERVICES INCORPORATED

BY C.H.Yeh DATE 02/05/86 SHEET 83 OF 102

CHKD. BY C.Wu DATE 2/7/86 OFS NO. 3306221 DEPT. NO. 550

CLIENT TEXAS UTILITIES GENERATING CO.

PROJECT ~~COMANCHE PEAK UNIT 2~~

SUBJECT CABLE TRAY HANGERS

COMPARISON OF TIME-HISTRY (DYNRE 1) / RESPONSE SPECTRA (DYNRE 4)

MODEL : 1-B

SEISMIC : OBE

COMPUTER RUN ID.

DYNRE 1 : DRYZDXF/DRYODUJ

DYNRE 4 : DRYZC67

RESPONSE @		DYNRE 1				DYNRE 4	
NODE	DIRECT.	X_1	X_2	X_3	SRSS (QT)	RSS = 1	
409	1	.249	.009	.059	.256	.360	
	2	.001	.180	.001	.180	.196	
	3	.013	.004	.240	.240	.346	
410	1	.348	.032	.195	.400	.441	
	2	.001	.180	.002	.180	.195	
	3	.032	.013	.280	.282	.262	✓
411	1	.461	.059	.351	.582	.769	
	2	.001	.180	.003	.180	.195	
	3	.043	.019	.314	.317	.246	✓

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EBASCO SERVICES INCORPORATED

BY C.H. Yeh DATE 02/05/86 SHEET 84 OF 102

CHKD. BY C.Wu DATE 2/6/86 OFS NO. 3306.221 DEPT. NO. 550

CLIENT TEXAS UTILITIES GENERATING CO.

PROJECT COMANCHE PEAK UNIT 2

SUBJECT CABLE TRAY HANGERS

COMPARISON OF TIME-HISTRY(DYNRE1)/RESPONSE SPECTRA(DYNRE4)

MODEL: 1-B

SEISMIC: SSE

COMPUTER RUN ID.

DYNRE 1 : DRYZDXJ/DRYODIR

DYNRE 4 : DRYZDF7

RESPONSE @		DYNRE 1				DYNRE 4	
NODE	DIRECT.	X_1	X_2	X_3	SRSS (Q_T)	RSS=1	
11	2	.097	.55	.066	.562	.772	
	3	.038	.036	.346	.350	.551	
12	2	.062	.431	.044	.438	.532	
	3	.026	.030	.350	.352	.410	
13	2	.002	.345	.006	.345	.360	
	3	.007	.007	.387	.387	.305	✓
14	2	.077	.686	.047	.692	.465	✓
	3	.046	.066	.616	.621	.304	✓
15	2	.112	.798	.067	.809	.543	✓
	3	.068	.093	.723	.732	.363	✓
16	2	.125	.739	.079	.754	.519	✓
	3	.083	.109	.790	.802	.415	✓
41	2	.102	.563	.058	.575	1.048	
	3	.033	.026	.382	.384	.637	
42	2	.068	.439	.040	.446	.721	
	3	.023	.020	.369	.370	.446	
43	2	.002	.345	.005	.345	.360	
	3	.020	.017	.443	.444	.265	✓

EBASCO SERVICES INCORPORATED

BY C.H. Yeh DATE 02/05/86 SHEET 85 OF 102
CHKD. BY C.W.H DATE 2/6/86 OFS NO. 3306.21 DEPT. NO. 550
CLIENT
PROJECT TEXAS UTILITIES GENERATING CO. COMANCHE PEAK UNIT 2
SUBJECT CABLE TRAY HANGERS

COMPARISON OF TIME-HISTRY(DYNRE1)/RESPONSE SPECTRA(DYNRE 4)

MODEL: 1-B
SEISMIC: SSE

COMPUTER RUN ID.
DYNRE 1: DRYZDXJ/DRYODTR
DYNRE 4: DRYZDF7

RESPONSE @		DYNRE 1				DYNRE 4	
NODE	DIRECT.	X_1	X_2	X_3	SRSS(Q_T)	RSS=1	
44	2	.079	.685	.050	.691	.500	✓
	3	.063	.048	.789	.793	.570	✓
45	2	.115	.795	.075	.807	.640	✓
	3	.082	.061	.951	.956	.754	✓
46	2	.128	.737	.090	.753	.726	✓
	3	.093	.066	1.055	1.061	.874	✓
71	2	.143	.572	.096	.597	1.268	
	3	.060	.048	.445	.452	.833	
72	2	.093	.443	.066	.457	.877	
	3	.044	.036	.424	.428	.606	
73	2	.002	.345	.001	.345	.357	
	3	.030	.025	.484	.486	.298	✓
74	2	.109	.668	.084	.682	.705	
	3	.103	.074	.948	.956	.894	✓
75	2	.159	.775	.127	.801	.925	
	3	.138	.094	1.159	1.171	1.203	
76	2	.186	.720	.151	.759	1.005	
	3	.163	.104	1.294	1.308	1.403	

EBASCO SERVICES INCORPORATED

BY C.H. Yeh DATE 02/05/86 SHEET 86 OF 102
CHKD. BY C. Wu DATE 2/6/86 OFS NO. 3306 221 DEPT. NO. 550
CLIENT
PROJECT TEXAS UTILITIES GENERATING CO. COMANCHE PEAK UNIT 2
SUBJECT CABLE TRAY HANGERS

COMPARISON OF TIME-HISTRY(DYNRE1)/RESPONSE SPECTRA(DYNRE 4)

MODEL : 1-B
SEISMIC : SSE

COMPUTER RUN ID.
DYNRE 1 : DRYZDXJ/DRYODIR
DYNRE 4 : DRYZDF7

RESPONSE @		DYNRE 1				DYNRE 4	
NODE	DIRECT.	X_1	X_2	X_3	SRSS(a-r)	RSS=1	
402	1	.397	.008	.050	.400	.321	✓
	2	.0002	.343	.001	.343	.371	
	3	.007	.006	.384	.384	.309	✓
403	1	.526	.022	.149	.547	.532	✓
	2	.0004	.343	.002	.343	.371	
	3	.019	.016	.439	.440	.265	✓
404	1	.679	.034	.239	.721	.967	
	2	.0004	.344	.002	.344	.371	
	3	.029	.024	.480	.481	.293	✓
405	1	.403	.014	.039	.405	.327	✓
	2	.002	.345	.006	.345	.360	
	3	.007	.006	.385	.385	.308	✓
406	1	.556	.027	.148	.576	.568	✓
	2	.002	.345	.005	.345	.360	
	3	.019	.017	.441	.442	.265	✓
407	1	.732	.051	.285	.787	1.034	
	2	.002	.345	.001	.345	.357	
	3	.029	.024	.481	.482	.294	✓

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EBASCO SERVICES INCORPORATED

BY C.H. Yeh DATE 02/05/86
CHKD. BY C. Wu DATE 2/6/86
SHEET 87 OF 102
OFS NO. 3306.21 DEPT. NO. 550
CLIENT
PROJECT TEXAS UTILITIES GENERATING CO. COMANCHE PEAK UNIT 2
SUBJECT CABLE TRAY HANGERS

COMPARISON OF TIME-HISTRY(DYNRE1)/RESPONSE SPECTRA(DYNRE 4)

MODEL : 1-B
SEISMIC : SSE

COMPUTER RUN ID.
DYNRE 1 : DRYZDXT/DRYODIR
DYNRE 4 : DRYZDF7

RESPONSE @		DYNRE 1				DYNRE 4	
NODE	DIRECT.	X_1	X_2	X_3	SRSS(Q7)	RSS=1	
409	1	.408	.011	.088	.418	.349	✓
	2	.0003	.343	.001	.343	.370	
	3	.007	.006	.384	.384	.308	✓
410	1	.563	.040	.277	.629	.656	
	2	.001	.344	.002	.344	.369	
	3	.019	.017	.440	.441	.265	✓
411	1	.741	.075	.474	.883	1.181	
	2	.001	.344	.003	.344	.368	
	3	.029	.024	.480	.481	.293	✓

581/8-81

EBASCO SERVICES INCORPORATED

BY C.H. Yeh DATE 02/05/86 SHEET 88 OF 102

CHKD. BY C.Wu DATE 2/7/86 OFS NO. 3306.221 DEPT. NO. 550

CLIENT TEXAS UTILITIES GENERATING CO.

PROJECT COMANCHE PEAK UNIT 2

SUBJECT CABLE TRAY HANGERS

MRM FOR TIME HISTRY

MODEL : 1-A

SEISMIC : OBE

BOUNDARY : FIXED

DIRECTION : LONG.

COMPUTER RUN I.D

DYNRE 1: DRYZDMN

DYNRE 4. DRYZCL3

NODE ID.	a_{Ti} @ TRAY UP. (7) ~ (12)	MID. (37) ~ (42)	LOW (67) ~ (72)	Σa_{Ti} (UP+MID+LOW)	W_t @ EACH NODE	$\Sigma a_{Ti} \cdot W_t$
7/37/67					.039	
8/38/68					.079	
9/39/69					.074	
10/40/70			NIL		.052	
11/41/71					.034	
12/42/72					.017	
				Σ	NIL	

NODE ID.	SUPPORT a_T	W_T	$a_T W_T$
302	.245	.021	
303	.337	.021	
304	.448	.015	
305	.248	.013	
306	.335	.013	
307	.442	.013	
309	.245	.014	
310	.339	.014	
311	.450	.009	
	Σ	.133	.0445

	TRAY	SUPT	Σ.
$a_T W_T$	—	.0445	.0445
W_T	—	.133	.133
$a_{vg} = \frac{\Sigma a_T W_T}{\Sigma W_T}$		.335	
A (2-D MODEL ACCL. LEVEL)		.420	
$MRM = \frac{a_{vg}}{A}$		.80	

EBASCO SERVICES INCORPORATED

BY C.H. Yeh DATE 02/05/86 SHEET 89 OF 102
CHKD. BY C.W.H DATE 2/7/86 OFS NO. 3306.221 DEPT. NO. 550

CLIENT TEXAS UTILITIES GENERATING CO.
PROJECT COMANCHE PEAK UNIT 2
SUBJECT CABLE TRAY HANGERS

MRM FOR TIME HISTRY

MODEL : 1-A
SEISMIC : OBE
BOUNDARY : FIXED
DIRECTION : VERT.

COMPUTER RUN I.D
DYNRE 1: DRY2DMN
DYNRE 4. DRYECL3

NODE ID.	a_{Ti} @ TRAY UP. (T) ~ (12)	MID. (37) ~ (42)	LOW (67) ~ (72)	Σa_{Ti} (UP+MID+LOW)	W_t @ EACH NODE	$\Sigma a_{Ti} \cdot W_t$
7/37/67	.448	.447	.482		.039	
8/38/68	.339	.342	.360		.071	
9/39/69	.180	.180	.180		.074	
10/40/70	.292	.273	.318		.052	
11/41/71	.385	.372	.462		.034	
12/42/72	.427	.426	.499		.017	

NODE ID.	SUPPORT a_T	W_T	$a_T W_T$
302	.180	.021	
303	.180	.021	
304	.180	.015	
305	.180	.013	
306	.180	.013	
307	.180	.013	
309	.180	.014	
310	.180	.014	
311	.180	.009	
	Σ	.133	.024

Σ	.295x3 = .885	.286

	TRAY	SUPT	Σ.
$a_T W_T$	.286	.024	.310
W_T	.885	.133	1.018

$avg = \frac{\Sigma a_T W_T}{\Sigma W_T}$	.305
A (2-D MODEL ACCL. LEVEL)	.973
$MRM = \frac{avg}{A}$	.313

EBASCO SERVICES INCORPORATED

BY C.H. Yeh DATE 02/05/86 SHEET 90 OF 102

CHKD. BY C. Wu DATE 2/7/86 OFS NO. 3306.221 DEPT. NO. 550

CLIENT TEXAS UTILITIES GENERATING CO.

PROJECT COMANCHE PEAK UNIT 2

SUBJECT CABLE TRAY HANGERS

MRM FOR TIME HISTRY

MODEL : 1-A

SEISMIC : OBE

BOUNDARY : FIXED

DIRECTION : TRANS.

COMPUTER RUN I.D

DYNRE 1: DRYZDMN

DYNRE 4. DRYZCL3

NODE ID.	a_{Ti} @ TRAY UP. (7) ~ (12)	MID. (37) ~ (42)	LOW (67) ~ (72)	Σa_{Ti} (UP+MID+LOW)	W_t @ EACH NODE	$\Sigma a_{Ti} \cdot W_t$
7/37/67	.291	.401	.638		.039	
8/38/68	.248	.336	.506		.071	
9/39/69	.219	.236	.285		.074	
10/40/70	.234	.241	.258		.052	
11/41/71	.240	.246	.271		.034	
12/42/72	.250	.248	.282		.017	

NODE ID.	SUPPORT a_T	W_T	$a_T W_T$
302	.218	.021	
303	.236	.021	
304	.279	.015	
305	.218	.013	
306	.236	.013	
307	.280	.013	
309	.218	.014	
310	.236	.014	
311	.280	.009	
	Σ	.133	.032

Σ	.295 x 3 = .885	.270

	TRAY	SUPT	Σ.
$a_T W_T$	.270	.032	.302
W_T	.885	.133	1.018
$Avg = \frac{\Sigma a_T W_T}{\Sigma W_T}$			.297
A (2-D MODEL ACCL. LEVEL)			.314
$MRM = \frac{Avg}{A}$			.945

EBASCO SERVICES INCORPORATED

BY C.H. Yeh DATE 02/05/86 SHEET 91 OF 102
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CLIENT TEXAS UTILITIES GENERATING CO.
PROJECT COMANCHE PEAK UNIT 2
SUBJECT CABLE TRAY HANGERS

MRM FOR TIME HISTRY

MODEL : 1-A
SEISMIC : SSE
BOUNDARY : FIXED
DIRECTION : LONG

COMPUTER RUN I.D
DYNRE 1: DRYZDGJ / DRYODA3
DYNRE 4 DRYZA4B

NODE ID.	a_{Ti} @ TRAY UP. (1) ~ (12)	MID. (37) ~ (42)	LOW (61) ~ (72)	Σa_{Ti} (UP+MID+LOW)	W_t @ EACH NODE	$\Sigma a_{Ti} \cdot W_t$
7 / 37 / 67					.039	
8 / 38 / 68					.071	
9 / 39 / 69			NIL		.074	
10 / 40 / 70					.052	
11 / 41 / 71					.034	
12 / 42 / 72					.017	
				Σ	NIL	

NODE ID.	SUPPORT a_T	W_T	$a_T W_T$
302	.401	.021	
303	.539	.021	
304	.702	.015	
305	.406	.013	
306	.552	.013	
307	.724	.013	
309	.403	.014	
310	.551	.014	
311	.724	.009	
	Σ	.133	.072

	TRAY	SUP'T	Σ
$a_T W_T$	—	.072	.072
W_T	—	.133	.133
$avg = \frac{\Sigma a_T W_T}{\Sigma W_T}$		.541	
A (2-D MODEL ACCL. LEVEL)		.673	
$MRM = \frac{avg}{A}$		.804	

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EBASCO SERVICES INCORPORATED

BY C.H. yeh DATE 02/06/86 SHEET 92 OF 102
CHKD. BY C.Wu DATE 2/7/86 OFS NO. 3306.221 DEPT. NO. 550
CLIENT
PROJECT TEXAS UTILITIES GENERATING CO. COMANCHE PEAK UNIT 2
SUBJECT CABLE TRAY HANGERS

MRM FOR TIME HISTRY

MODEL : 1-A
SEISMIC : SSE
BOUNDARY : FIXED
DIRECTION : VERT

COMPUTER RUN I.D
DYNRE 1: DRYZDGJ/DRYODA3
DYNRE 4. DRYZ44B

NODE ID.	a_{Ti} @ TRAY UP. (7) ~ (12)	MID. (37) ~ (42)	LOW (67) ~ (72)	Σa_{Ti} (UP+MID+LOW)	W_t @ EACH NODE	$\Sigma a_{Ti} \cdot W_t$
7/37/67	.715	.721	.756		.039	
8/38/68	.583	.588	.620		.071	
9/39/69	.345	.345	.345		.074	
10/40/70	.423	.426	.451		.052	
11/41/71	.553	.554	.581		.034	
12/42/72	.625	.625	.653		.017	

NODE ID.	SUPPORT a_T	W_T	$a_T W_T$
302	.343	.021	
303	.343	.021	
304	.344	.015	
305	.345	.013	
306	.345	.013	
307	.345	.013	
309	.343	.014	
310	.344	.014	
311	.344	.009	
	Σ	.133	.046

Σ	.295×3 = .885	.461

	TRAY	SUPT	Σ.
$a_T W_T$	.461	.046	.507
W_T	.885	.133	1.018
$avg = \frac{\Sigma a_T W_T}{\Sigma W_T}$			.498
A (2-D MODEL ACCL. LEVEL)			1.373
$MRM = \frac{avg}{A}$			.36

581/8-81

EBASCO SERVICES INCORPORATED

BY C.H. Yeh DATE 02/06/86 SHEET 93 OF 102
CHKD. BY C. Wu DATE 2/7/86 OFS NO. 3306.221 DEPT. NO. 550

CLIENT
PROJECT TEXAS UTILITIES GENERATING CO. COMANCHE PEAK UNIT 2
SUBJECT CABLE TRAY HANGERS

MRM FOR TIME HISTRY

MODEL : 1-A
SEISMIC : SSE
BOUNDARY : FIXED
DIRECTION : TRANS.

COMPUTER RUN I.D
DYNRE 1: DRYZDGJ/DRYODA3
DYNRE 4 DRYZA4B

NODE ID.	a_{Ti} @ TRAY UP. (1) ~ (12)	MID. (37) ~ (42)	LOW (61) ~ (72)	Σa_{Ti} (UP+MID+LOW)	W_t @ EACH NODE	$\Sigma a_{Ti} \cdot W_t$
7/37/67	.358	.409	.447		.039	
8/38/68	.357	.395	.421		.071	
9/39/69	.357	.370	.384		.074	
10/40/70	.368	.373	.398		.052	
11/41/71	.378	.379	.412		.034	
12/42/72	.382	.383	.421		.017	
				Σ	.295x3 = .885	.341

NODE ID.	SUPPORT a_T	W_T	$a_T W_T$
302	.357	.021	
303	.369	.021	
304	.383	.015	
305	.357	.013	
306	.369	.013	
307	.383	.013	
309	.357	.014	
310	.369	.014	
311	.383	.009	
	Σ	.133	.049

	TRAY	SUPT	Σ
$a_T W_T$	.341	.049	.390
W_T	.885	.133	1.018
$avg = \frac{\Sigma a_T W_T}{\Sigma W_T}$			.383
A (2-D MODEL ACCL. LEVEL)			.504
$MRM = \frac{avg}{A}$			.760

581/8-81

EBASCO SERVICES INCORPORATED

BY C.H. Yeh DATE 02/06/86 SHEET 94 OF 102

CHKD. BY C.W.H DATE 2/7/86 OFS NO. 3306.221 DEPT. NO. 550

CLIENT

PROJECT TEXAS UTILITIES GENERATING CO. COMANCHE PEAK UNIT 2

SUBJECT CABLE TRAY HANGERS

MRM FOR TIME HISTRY (DYNRE 1)

MODEL : 1-B

SEISMIC : OBE

BOUNDARY : FIXED

DIRECTION : LONG.

COMPUTER RUN ID

DYNRE 1: DRYZDXF/DRYODUJ

DYNRE 4 —— NIL ——

NODE ID.	a_T @ TRAY UP. (11) ~ (16)	a_T @ TRAY MID. (41) ~ (46)	a_T @ TRAY LOW. (71) ~ (76)	Σa_{Ti} (UP + MID + LOW)	w_t @ EACH NODE	$\Sigma a_{Ti} \cdot w_x$
11/41/71					.039	
12/42/72					.079	
13/43/73					.074	
14/44/74					.052	
15/45/75					.034	
16/46/76					.017	

NIL

NIL

NODE ID.	SUPPORT a_T	w_T	$a_T w_T$
402	.243	.021	.005
403	.345	.021	.007
404	.473	.015	.007
405	.248	.013	.003
406	.358	.013	.005
407	.495	.013	.006
409	.256	.014	.004
410	.40	.014	.006
411	.583	.009	.005
	Σ	.133	.048

Σ NIL

	TRAY	SUPT	Σ
$a_T w_T$		.048	.048
w_T		.133	.133
$avg = \frac{\Sigma a_T w_T}{\Sigma w_T}$		.361	
A (2-D MODEL ACCL. LEVEL)		.420	
$MRM = \frac{avg}{A}$		.86	

EBASCO SERVICES INCORPORATED

BY C.H. Yeh DATE 02/06/86 SHEET 95 OF 102

CHKD. BY C.W.H DATE 2/7/86 OFS NO. 3306.221 DEPT. NO. 550

CLIENT TEXAS UTILITIES GENERATING CO.

PROJECT COMANCHE PEAK UNIT 2

SUBJECT CABLE TRAY HANGERS

MRM FOR TIME HISTRY

MODEL : 1-B

SEISMIC : OBE

BOUNDARY : FIXED

DIRECTION : VERT.

COMPUTER RUN I.D

DYNRE 1: DRYZDXF/DRYODUJ

DYNRE 4. DRYZC67

NODE ID.	a_T @ TRAY			Σa_{Ti}	w_t	$\Sigma a_{Ti} \cdot w_x$
	UP. (11) ~ (16)	MID. (41) ~ (46)	LOW. (71) ~ (76)	(UP+MID+LOW)	@ EACH NODE	
11/41/71	.342	.358	.392		.039	
12/42/72	.260	.270	.288		.079	
13/43/73	.180	.180	.180		.074	
14/44/74	.404	.408	.411		.052	
15/45/75	.465	.472	.481		.034	
16/46/76	.412	.414	.443		.017	

NODE ID.	SUPPORT a_T	SUPPORT w_T	
402	.180	.021	
403	.180	.021	
404	.180	.015	
405	.180	.013	
406	.180	.013	
407	.180	.013	
409	.180	.014	
410	.180	.014	
411	.180	.009	
	Σ	.133	.024

Σ	.295 x 3 = .885	.281	

	TRAY	SUPT	Σ
$a_T w_T$	.281	.024	.305
w_T	.885	.133	1.018
$a_{vg} = \frac{\Sigma a_T w_T}{\Sigma w_T}$			.300
A (2-D MODEL ACCL. LEVEL)			.971
MRM = $\frac{a_{vg}}{A}$			.309

EBASCO SERVICES INCORPORATED

BY C.H.Wei DATE 02/06/86 SHEET 96 OF 102

CHKD. BY C.Wu DATE 2/7/86 OFS NO. 3306.221 DEPT. NO. 550

CLIENT

PROJECT TEXAS UTILITIES GENERATING CO. COMANCHE PEAK UNIT 2

SUBJECT CABLE TRAY HANGERS

MRM FOR TIME HISTRY

MODEL : 1-B
SEISMIC : OBE
BOUNDARY : FIXED
DIRECTION : TRANS.

COMPUTER RUN I.D
DYNRE 1: DRY≡DXF/DRYODUJ
DYNRE 4: DRY≡C67

NODE ID.	a_T @ TRAY UP. (11) ~ (16)	MID. (41) ~ (46)	LOW. (71) ~ (76)	Σa_{Ti} (UP+MID+LOW)	W_t @ EACH NODE	$\Sigma a_{Ti} \cdot W_t$
11/41/71	.329	.478	.615		.039	
12/42/72	.261	.384	.491		.079	
13/43/73	.241	.285	.321		.074	
14/44/74	.405	.535	.653		.052	
15/45/75	.430	.649	.504		.034	
16/46/76	.525	.722	.902		.017	

NODE ID.	SUPPORT a_T	W_T	$a_T W_T$
402	.239	.021	
403	.282	.021	
404	.318	.015	
405	.240	.013	
406	.283	.013	
407	.319	.013	
409	.240	.014	
410	.282	.014	
411	.317	.059	
		.133	.037

Σ	.295 x 3 = .885	.393

	TRAY	SUPT	Σ
$a_T W_T$	.393	.037	.430
W_T	.885	.133	1.018
$a_{vg} = \frac{\Sigma a_T W_T}{\Sigma W_T}$			.422
A (2-D MODEL ACCL. LEVEL)			.725
MRM = $\frac{a_{vg}}{A}$			.582

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CLIENT
PROJECT TEXAS UTILITIES GENERATING CO. COMANCHE PEAK UNIT 2
SUBJECT CABLE TRAY HANGERS

MRM FOR TIME HISTRY

MODEL : 1-B
SEISMIC : SSE
BOUNDARY : FIXED
DIRECTION : LONG

COMPUTER RUN I.D
DYNRE 1: DRY=DXJ / DRY=DTR
DYNRE 4 DRY=DF7

NODE ID.	a_T @ TRAY UP. (11) ~ (15)	MID. (41) ~ (45)	LOW (71) ~ (75)	Σa_T (UP + MID + LOW)	W_t @ EACH NODE	$\Sigma a_T \cdot W_t$
11/41/71					.039	
12/42/72					.079	
13/43/73					.074	
14/44/74					.052	
15/45/75					.034	
16/46/76					.017	

NODE ID.	SUPPORT a_T	W_T	$a_T W_T$
402	.40	.021	
403	.547	.021	
404	.721	.015	
405	.405	.013	
406	.576	.013	
407	.787	.013	
409	.418	.014	
410	.629	.014	
411	.883	.059	
	Σ	.133	.076

Σ — NIL —

	TRAY	SUPT	Σ.
$a_T W_T$	—	.076	.076
W_T	—	.133	.133
$avg = \frac{\Sigma a_T W_T}{\Sigma W_T}$		.574	
A (2-D MODEL ACCL. LEVEL)		.673	
$MRM = \frac{avg}{A}$		.853	

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BY C.H. Yeh DATE 02/06/86 SHEET 98 OF 102

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CLIENT

PROJECT TEXAS UTILITIES GENERATING CO. COMANCHE PEAK UNIT 2

SUBJECT CABLE TRAY HANGERS

MRM FOR TIME HISTRY

MODEL : 1-B

SEISMIC : SSE

BOUNDARY : FIXED

DIRECTION : VERT.

COMPUTER RUN I.D

DYNRE 1. DRY=DXJ/DRYODTR

DYNRE 4. DRY=DF7

NODE ID.	a_{Ti} @ TRAY			Σa_{Ti}	w_i	$\Sigma a_{Ti} \cdot w_i$
	UP. (11) ~ (16)	MID. (41) ~ (46)	LOW (71) ~ (76)	(UP + MID + LOW)	@ EACH NODE	
11/41/71	.562	.575	.597		.039	
12/42/72	.438	.446	.457		.079	
13/43/73	.345	.345	.345		.074	
14/44/74	.692	.691	.682		.052	
15/45/75	.809	.807	.801		.034	
16/46/76	.754	.753	.759		.017	

NODE ID.	SUPPORT		
	a_T	w_T	$a_T w_T$
402	.343	.021	
403	.343	.021	
404	.344	.015	
405	.345	.013	
406	.345	.013	
407	.345	.013	
409	.343	.014	
410	.344	.014	
411	.344	.009	
		.133	.046

Σ	.295 x 3 = .885	.478

	TRAY	SUPT	Σ
$a_T w_T$	.478	.046	.524
w_T	.885	.133	1.018
$avg = \frac{\Sigma a_T w_T}{\Sigma w_T}$		.515	
A (2-D MODEL ACCL. LEVEL)		1.372	
$MRM = \frac{avg}{A}$		.375	

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CLIENT TEXAS UTILITIES GENERATING CO.
PROJECT COMANCHE PEAK UNIT 2
SUBJECT CABLE TRAY HANGERS

MRM FOR TIME HISTORY

MODEL : 1-B
SEISMIC : SSE
BOUNDARY : FIXED
DIRECTION : TRANS

COMPUTER RUN ID
DYNRE 1: DRYZDXJ / DRYODTR
DYNRE 4. DRYZDF7

NODE ID.	a_{Ti} @ TRAY UP. (11) ~ (16)	a_{Ti} @ TRAY MID. (41) ~ (45)	a_{Ti} @ TRAY LOW (71) ~ (76)	Σa_{Ti} (UP+MID+LOW)	w_t @ EACH NODE	$\Sigma a_{Ti} \cdot w_t$
11/41/71	.350	.384	.452		.039	
12/42/72	.352	.370	.428		.079	
13/43/73	.337	.444	.486		.074	
14/44/74	.621	.793	.956		.052	
15/45/75	.732	.956	1.171		.034	
16/46/76	.802	1.061	1.308		.017	

NODE ID.	SUPPORT a_T	SUPPORT w_T	
402	.384	.021	
403	.440	.021	
404	.481	.015	
405	.385	.013	
406	.442	.013	
407	.482	.013	
409	.384	.014	
410	.441	.014	
411	.481	.009	
		.133	.057

Σ	.295x3 = .885	.509

	TRAY	SUPT	Σ.
$a_T w_T$	.509	.057	.566
w_T	.885	.133	1.018
$avg = \frac{\Sigma a_T w_T}{\Sigma w_T}$			.556
A (2-D MODEL ACCL. LEVEL)			1.083
$MRM = \frac{avg}{A}$			.514

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BY C.W.H DATE 2-5-86 SHEET 100 OF 102

CHKD. BY YEH DATE 2-5-86 OFS NO. 3306.221 DEPT. NO. 550

CLIENT TEXAS UTILITIES GENERATING CO.

PROJECT COMANCHE PEAK UNIT 2
CABLE TRAY HANGERS

SUBJECT Multiple Response Multiplier for C.T.H System W/90° Beat (Time History)

MODEL	APPROACH	RANGE OF AMPLIFICATION FACTOR							
		OBE (4%)				SSE (7%)			
		VERT.	TRANS.	LONG.	RUN ID	VERT.	TRANS.	LONG.	RUN ID
1-A	RESPONSE SPECTRA (DYNRE4, RSS=1)	0.38	1.13	1.00	DRYZCL3	0.44	0.75	0.85	DRYZA4B
	TIME HISTORY (DYNRE 1)	0.31	0.95	0.80	DRYZDMN	0.36	0.76	0.80	DRYZDGJ DRYODA3
1-B	RESPONSE SPECTRA (DYNRE4, RSS=1)	0.38	0.57	1.07	DRYZC67	0.44	0.47	0.92	DRYZDF7
	TIME HISTORY (DYNRE 1)	.31	.58	.86	DRYZDXF DRYODUJ	.38	.51	.85	DRYZDXJ DRYODTR

7. Conclusion

The study of a Multi-Mode Reponse Multiplier (MRM) was extended to investigate a cable-tray-hanger system with bend. Two models (1A and 1-B) were constructed for this purpose. One with symmetrical settings. The other with cable tray terminated at one end. Hangers as well as cable tray used the identical configuration as those of ~~Fifty~~ Mode 1 in previous straight run MRM study.

A residual load method was used to account for the ~~missing~~ contribution due to the higher mode beyond the cut-off frequency in the modal response analysis. Both nodal accelerations and support reactions were investigated in this study. The results of MRMs were summarized on Tables 1 and 2

The results of this study further support and substantiate the amplification factor of 1.25 is adequate and conservative to use in the equivalent static analysis (ESA) method, regarding the nodal acceleration as well as support reaction.