CYGNA
ENERGY SERVICES
101 California Street, Suite 1000, San Francisco, CA 94111-5894
415 397-5600

March 13, 1984
84042.05

50-445/446

Mrs. Juanita Ellis, President
Citizens Association for Sound Energy
1426 South Polk
Dallas, Texas 75224

Subject: Comanche Peak Steam Electric Station Independent Assessment Program - Response to CASE Questions

Reference: (1) Brief Summary of Generic Problems from CASE Witness Jack Doyle, 2/22/84.

(2) Brief Summary of Cross-examination Questions from CASE Witness Mark Walsh, 2/22/84.

Dear Mrs. Ellis:

Enclosed please find our responses to reference (2) items 6, 8, 9, and 12.

Further responses will be forthcoming.

Very truly yours,

N. H. Williams

Nancy H. Williams
Project Manager

NHW:eam
Enclosures: Attachment A, Partial Responses to CASE Questions

cc: See attachment

A001
1/1

CYGNA
ENERGY SERVICES

Mrs. J. Ellis
Response to CASE Questions

March 13, 1984
Attachment

Nicholas S. Reynolds, Esq.
Bishop, Liberman, Cook, Purcell & Reynolds
1200 Seventeenth Street, N.W.
Washington, D.C. 20036

Robert Wooldridge, Esq.
Worsham, Forsythe & Sampels
2001 Bryan Tower
Dallas, Texas 75201

Mr. Homer C. Schmidt
Manager - Nuclear Services
Texas Utilities Generating Company
2001 Bryan Tower
Dallas, Texas 75201

Mr. H. R. Rock
Gibbs & Hill, Inc.
393 Seventh Avenue
New York, New York 10001

Mr. A. T. Parker
Westinghouse Electric Corporation
P.O. Box 355
Pittsburgh, Pennsylvania 15230

Renea Hicks
Assistant Attorney General
Environmental Protection Division
P.O. Box 12548, Capitol Station
Austin, Texas 78711

Mr. James E. Cummins
Resident Inspector/Comanche Peak Nuclear
Power Station
c/o U.S. Nuclear Regulatory Commission
P.O. Box 38
Glen Rose, Texas 76043

Mrs. S. Burwell
Licensing Project Manager
U.S. Nuclear Regulatory Commission
7920 Norfolk Avenue
Bethesda, Maryland 20014

Mr. H. Schmidt
c/o Westinghouse
4901 Fairmont Avenue
Bethesda, Maryland 20814

Mr. John T. Collins
U.S. NRC, Region IV
611 Ryan Plaza Drive
Suite 1000
Arlington, Texas 76011

Mr. Lanny Alan Sinkin
114 W. 7th, Suite 220
Austin, Texas 78701

B. R. Clements
Vice President Nuclear
Texas Utilities Generating Company
Skyway Tower
400 North Olive Street
L.B. 81
Dallas, Texas 75201

Peter B. Bloch, Esq.
Chairman, Atomic Safety and Licensing Board
U.S. Nuclear Regulatory Commission
4350 East/West Highway, 4th Floor
Washington, D.C. 20814

Dr. Walter H. Jordan
881 W. Outer Drive
Oak Ridge, Tennessee 37830

Dr. Kenneth A. McCollom
Dean, Division of Engineering Architecture and
Technology
Oklahoma State University
Stillwater, Oklahoma 74074

Stuart A. Treby, Esq.
Office of the Executive Legal Director
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Mr. J. B. George
Texas Utilities Generating Company
Comanche Peak Steam Electric Station
Highway FM 201
Glen Rose, Texas 76043

Mr. David H. Wade
Texas Utilities Generating Company
2001 Bryan Tower
Dallas, Texas 75201

Mr. David R. Pigott
Orrick, Herrington, & Sutcliffe
600 Montgomery Street
San Francisco, California 94111

Comanche Peak ASLB Hearings
Response to CASE Questions
Question No.: Walsh #6
Exhibit No.: 907

1.0 CASE Question

CTS-00-05. In the description, it discusses a channel bent about its weak axis. The resolution does not consider this problem nor does the document CASE requested on discovery; see CASE Exhibit 907. On CMC 88306, are the originator and approver the same person?

2.0 Cygna Interpretation

Please discuss the following:

a. How did the resolution to Observation CTS-00-05 address the channel bent about its weak axis?

b. Are the signatures on CMC 88306 satisfactory?

3.0 Response

a. The purpose of Observation CTS-00-05 was to investigate the baseplate. This is illustrated by the following reprint from the Observation:

> **"1.0 Description**
>
> The anchor bolts, base plate/angle and channel of cantilever support Detail "E" were originally designed as two-way restraints to resist axial loads on the channel and moments about its major axis. In order to use Detail "E" on a cable tray riser, where it must act as a three-way restraint, the channel section was modified to resist moments about its weak axis. The ability of this configuraiton to function as intended, i.e., to also resist moments about the weak axis, could not be guaranteed since the anchor bolts and the base plate/angle were not evaluated for such a load."

The channel was correctly analyzed by Gibbs & Hill in Calculations SCS-146C, sets 4 and 8.

b. CMC-88306, Rev. 4, was originated and approved by the same person. This is acceptable for the following reasons:

- There is a controlled list of people authorized to approve CMC's for construction prior to design review. In the case of CMC 88306, the approver was on that authorized list.
- Project procedures do not prohibit someone on the authorized approval list from also being an originator.
- The subject CMC is an interim release for construction purposes. Each CMC receives a subsequent design review by the original design organization in accordance with Gibbs & Hill Procedure DC-7.

Comanche Peak ASLB Hearings
Response to CASE Questions
Question No.: Walsh #8
Exhibit No.: None

1.0 CASE Question

CTS-00-07. The analysis that included the beam element did not consider prying action and the flexibility of the base plate to determine the center of compression.

2.0 Cygna Interpretation

N/A.

3.0 Response

Gibbs & Hill performed a refined analysis of the frame and baseplate to resolve Observation CTS-00-07. Cygna reviewed the results of this analysis and judged the frame, baseplate and anchor bolt design to be adequate.

In order to quantify the adequacy of that engineering judgement, relative to the anchor bolt design, Cygna performed an analysis of the frame/baseplate system using fixed boundaries at the hanger-to-baseplate connections. The fixed-end loads developed at these boundary points were then applied to a baseplate model. Cygna's program PSDS (Pipe Support Design System) was utilized for the analysis and design check. PSDS includes a standard baseplate/anchor bolt routine that considers mechanisms, such as prying action and baseplate flexibility.

The results of this analysis show the following design margins:

Bolt No.	Tensile Load (lbs)	Shear Load (lbs)	Design Interaction Ratio*
1	500	1540	.10
2	4340	1830	.75
3	3040	1890	.45
4	2970	1820	.45
5	4210	1530	.65

*Design Interaction Ratio = $(\text{tensile load/allow.})^{5/3} + (\text{shear load/allow.})^{5/3} \leq 1.0$

It is important to note that these results contain the same conservatisms as the original Gibbs & Hill analyses, i.e., lumped tray masses, enveloped response spectra, higher than actual tray weights (35 psf vs. 28 psf).

Based on the above, the engineering judgement of the Cygna review team was correct.

Comanche Peak ASLB Hearings
Response to CASE Questions
Question No.: Walsh #9
Exhibit No.: None

1.0 CASE Question

WD-03-01. What documentation was there that "accept as is" was valid? Were there calculations to support this?

2.0 Cygna Interpretation

The resolution to Observation WD-03-01 states the following:

> "Further discussions with Texas Utilities revecled that this problem had been identified during the as-built inspection on 2/1/83. The details were documented on As-Built Re-Verification Report Form 1267 and subsequently transmitted to the design review group on 3/3/83. Engineering approval to "accept as-is" was given on 4/20/83.
>
> "This documentation indicates that the Comanche Peak as-built verification is working effectively. Cygna, therefore, considers this Observation closed."

How was the adequacy of the "accept as is" approval verified?

3.0 Response

Cygna resolved this observation by reviewing the CPSES field inspection documentation. The key documents addressing Observation WD-03-01 are described below and attached for your information:

- As-Built Re-Verification Form 1267

  This document shows that the gaps were identified during an inspection and design review.

- Attachment to Form 1267

  This document shows the clearances measured by the as-built inspector.

AS-BUILT RE-VERIFICATION REPORT FORM EXHIBIT W9-1 NO. 1267

ITEM DESCRIPTION
SFX-033-007-F43R

STRESS PROBLEM
1-086A

	COMPL.	ADDITIONAL INFORMATION
SRP N/A REV.		
1. All dimensions and elevations verified	NA	
2. Valve orientations verified	1	
3. Orientation verified for line mounted equip.	NA	
BRHL/GHH N/A REV.		
1. Support mark numbers verified	NA	
2. Support locations verified	NA	
BRH SFX-033-007-F43R REV. 2		
1. Direction of support verified	✓	
2. Type of support verified	✓	
3. General configuration verified	✓	
4. Clearances (where applicable)	✓	Dwight E. Watts 1/3/83
5. Location verified and appropriate red marks entered on ~~BRHL~~/GHH SF-X-FB-028 REV. 1	✓	

COMMENTS

TRANSMITTED TO DESIGN REVIEW 3-3-83

ABRVF # 1267 Reviewed and Filed. No Engineering Action Required.
By [signature] Date 4-26-83

DISPOSITION
The above listed documents were reviewed, no change to location or function has occurred therefore inspection is not required

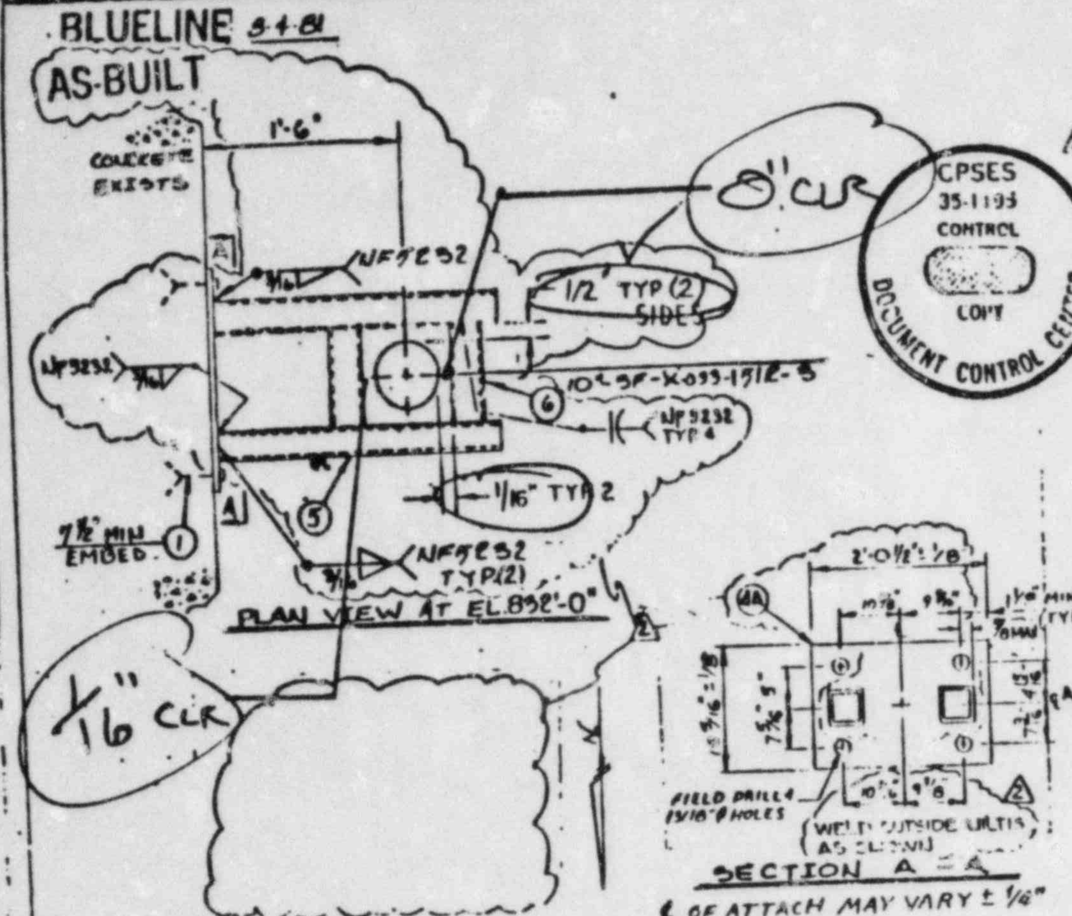
TSABC DATE

INSPECTION
Inspected by: Mike Osterman 2/1/83
(As-Built Inspector)

Ron Muckala 2/2/83

QAABC DATE

EXHIBIT W9-2



ITEM NO.	MATERIALS & OPERATIONS	QUAN	SHIP
	SEISMIC PIPE RESTRAINT CONSISTING OF:	ONE	
1	3/4"x10" Hilti Kwik Concrete Anchors (1144)	4	
2	W6x15 (SA-36)	2	
3	W6x15 (SA-36)	2	
4	(SA-515-GR-55 or SA-36)	1	
4A		1	
5		2	
6			
	SEISMIC ASSEMBLY SKETCH AND ENGINEERING	1	
	BUNDLE AND TAG	1	
	MARK # SF-X-033-007-143R		
	Apply Carbo Zinc 11 to above mat'l except th'ds which shall be treated with a rust preventative		
	No MAT'L BY G.R.W.I.		

USE FOR ANALYSIS REVIEW
PROBLEM I-086A
FOR ASBUILT VERIFICATION ONLY

Approved By: CFC
Date: 4-24-79

FOR MATERIALS AND OPERATIONS SEE SKETCH NO. SHEET OF

Brown & Root, Inc.

CONDITIONS	Fx	Fy	Fz	Mx
DESIGN	—	—	—	—
NORMAL & UPSET	—	—	1184	—
EMERGENCY	—	—	1840	—
FAULTED	—	—	—	—

REF. DRAWING NUMBERS
PIPE: M1-0006 REV.9 ELECT: REV.1
STEEL: REV.2 HV.A.C.:

REV	DATE	DWN	CHK	APP	DESCRIPTION
0	6-7-79	SW		M	ISSUE FOR CONST.
1	4/4/81				REV AS NOTED., REF. FMHS
2		FB		MW	REVD AS NTD REF CMC 56704 & DCA 7607 SEE NT 4 AS BUILT

CUSTOMER Texas Utilities
ORDER OR CONT. NO.
JOB NAME Comanche Peak
MARK NO. SF-X-033-007-143R
SKETCH NO.
SHEET 1 OF 1

C.R.I. Iso. 2BCS-MI-3835-07 REV.C
I.P.D. Iso. SF-X-FB-2B REV.C
Data Point 86 / PROB. 1-86A
Pipe Mat'l. SA312-TP304
Insul. — Bldg. F

TO# 4701

LOCATION PLAN

THIRD PARTY INSPECTION YES NO
CODE CLASS: ASME-III-3

NOTE:
4) LOCKING DEVICES FOR HIGH STRENGTH BOLTS ARE NOT REQUIRED PER DCA 7607

Comanche Peak ASLB Hearings
Response to CASE Questions
Question No.: Walsh #12
Exhibit No.: None

1.0 CASE Question

Cable Tray Checklist: CTS-11, Item 6, problem 4. This was not discussed in CTS-00-07.

2.0 Cygna Interpretation

Item 6 on Checklist CTS-11 addresses baseplates and anchor bolts. Part 4 of the commentary to Item 6 states the following:

> "The interaction equation is employed using the tensile bolt forces from the horizontal tray loads. All other tensile components are ignored. The tensile and shear ratio is also reduced by a ratio of vertical and horizontal spectral values. No reason is given for this reduction. Without the reduction, the anchor bolts would fail. See Observation No. CTS-00-07."

How was this question on anchor bolt loads addressed in Observation CTS-00-07?

3.0 Response

As shown in the following reprint from Observation CTS-00-07, the anchor bolt loads were addressed:

> "Details A, B, C and D on Gibbs & Hill drawing 2323-E1-0601-01-S utilize base plates with concrete expansion anchor bolts to attach the beam members to vertical concrete surfaces. In the initial base plate analysis, the plate was evaluated as a pinned-pinned beam. The resulting plate stresses exceeded allowables. A second check of plate stresses was made, assuming that the plate acted as a fixed-fixed beam. The calculated stresses were then found to be acceptable.
>
> "The use of a fixed-fixed assumption is not necessarily representative of the actual situation."

As noted in the resolution to Observation CTS-00-07, Gibbs & Hill performed a refined analysis to evaluate this baseplate system. Cygna reviewed the results and confirmed the adequacy of the baseplate system, including the anchor bolt loading and design.

CYGNA

PRELIMINARY

Calculation Sheet

Project: TEXAS UTILITIES - CPSES
Prepared By: [signature] Date: 28 Feb 84
Subject: BASE PLATE FLEXIBILITY / ANCHOR BOLTS
Checked By: T. Wittig Date: 3/13/84
System: DETAILS A, B, C, D, DRWG 2323-E1-601-S
Job No: 84042 File No:
Analysis No: NA Rev No: 0 Sheet No: 1/

QUESTION 8 BY MR. MARK WALSH IS CONCERNING WITH THE REANALYSIS OF THE BASEPLATE FOR DETAILS A, B, C, D OF DRWG. 2323-E1-601-S AS DISCUSSED IN OBSERVATION CTS-00-07.

THE ANALYSIS IN QUESTION IS LISTED IN TECH FILE 11.2.1.50 PAGES 50-55. THE ANALYSIS IS CONSERVATIVE FOR THE PLATE STRESS

TO CHECK THE BOLTS, CYGNA RAN AN ANALYSIS FOR THE MODEL SHOWN ON P. 50 OF THE TECH FILE WITH JOINTS AT THE BASE PLATE AND THE HANGER JOINT FIXED. THE FIXED END LOADS WERE APPLIED TO A BASE PLATE MODEL. THE PROGRAM PSDS WAS USED IN THE ANALYSIS.

STATIC LOADS EQUAL TO THE TRAY WEIGHT X THE PEAK ACCELERATION FACTOR (= 2.67 g) WERE APPLIED AT THE TRAY LOAD POINTS

VERTICAL LOADS = HORIZONTAL LOADS = 200 X 2.67 = 750 LBS.

BOLTS WERE 1" Φ HILTIS AT 4½" EMBEDMENT. CONCRETE STRENGTH = 4 KSI

BOLT 6 WAS ADDED AS A DUMMY TO PREVENT MODEL INSTABILITY.

CYGNA

PRELIMINARY

Calculation Sheet

Project: TEXAS UTILITIES – CPSES	Prepared By: John [signature] Date: 29 FEB 84
Subject: BASE PLATE FLEXIBILITY / ANCHOR BOLTS	Checked By: T. Vetting Date: 3/13/84
System: DET A, B, C, D DRWG 2323-E1-0601-S	Job No: 84042 File No:
Analysis No: NA Rev No: 0	Sheet No: 21

OUTPUT FILE: JOHN. BP1. EPLO

BOLT RESULTANTS ARE GIVEN IN STRESS.
FOR SHEAR, AREA = 1 in^2
FOR TENSION, AREA = $(\frac{1}{4})(\pi)(D^2) = (\frac{1}{4})(\pi) = .785 \ in^2$

BOLT	TENSILE LOAD	SHEAR LOAD
1	500 LB	1592 LB
2	4340 LB	1828 LB
3	3039 LB	1890 LB
4	2970 LB	1521 LB
5	4212 LB	1531 LB

TENSILE ALLOWABLE = 5.86 K
SHEAR ALLOWABLE = 6.8 K

BY CYGNA DESIGN CRITERIA FOR CABLE TRAYS

$$\left(\frac{T}{T_A}\right)^{5/3} + \left(\frac{V}{V_A}\right)^{5/3} \le 1$$

BOLT	INTERACTION RATIO
1	.115
2	.736
3	.452
4	.451
5	.659

} OK

Gibbs & Hill, Inc. Job No. 2323 Client TUSI

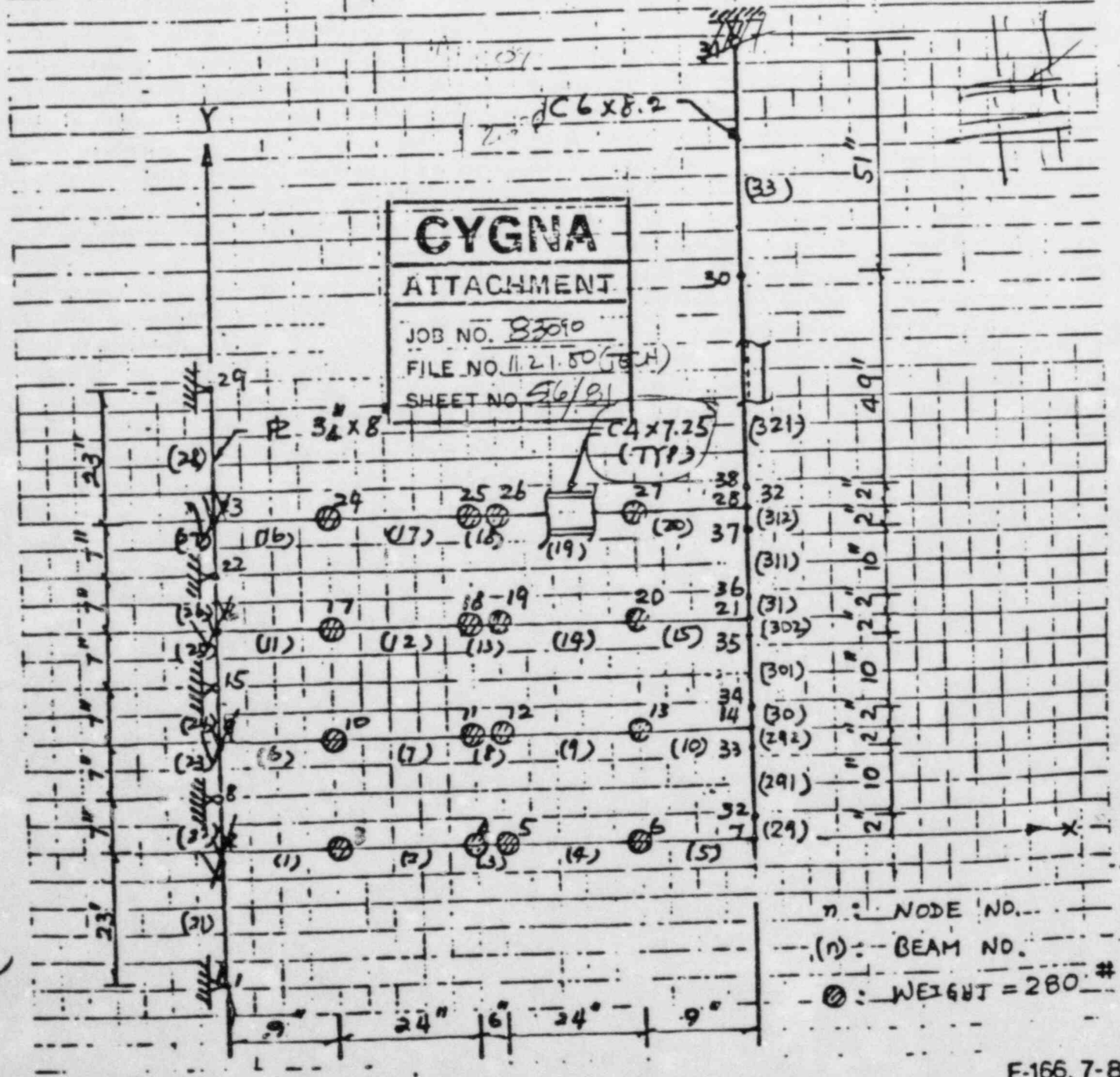
Subject CABLE TRAY SUPPORT ANALYSIS

Calculation Number Sheet No.

Revision	Originator	Date	Rev.	Date	Rev.	Date	Rev.	Date	Rev.	Date	
Drawing Number	1										
Preparer	JJT	10/12/83									
Checker	WT	10/12/83									

DETAIL "D" (E1-0601-01-S) - PLATE CHECK (CASE DP22)

2 TRAYS 6' SPAN



Checking Method # Hand Calculation

F-166, 7-82

Gibbs & Hill, Inc. Job No. 2323 Client TUSI

Subject CABLE TRAY SUPPORTS, DET 'D' (E1-0601-01-S)

Calculation Number SCS-104C, SET #1 Sheet No.

	Originator	Date	Rev.	Date	Rev.	Date	Rev.	Date	Rev.	Date	
Revision											
Checking Method #											
Preparer	Sccb	10/13/83									
Checker											

REF. COMPUTER'S PROGRAM, L = 6'-0"

i) FOR D.L., J216A, DATED OCT. 13, 1983

ii) FOR SEISMIC, J225A, DATED OCT. 13, 1983

1) BEAM C4X7.25

i) FOR D.L.; $f_a^{D.L.} = 0.247^{ksi}$ (ELEM 1); $f_{bx}^{D.L.} = 3.34^{ksi}$ (ELEM 18)

ii) FOR SEISMIC; $f_a^{EQ} = 0.341^{ksi}$ (ELEM 11), $f_{bx}^{EQ} = 4.61^{ksi}$ (ELEM 7)

LOW STRESSES, BEAMS ARE O.K.

2) HANGER C6X8.2

a) HANGER BETWEEN TRAY BEAMS

i) FOR D.L.; ELEM. 312: $f_a^{D.L.} = 0.764^{ksi}$, $f_{bx}^{D.L.} = 8.47^{ksi}$

ii) FOR SEISMIC; ELEM. 30: $f_a^{EQ} = 0.37^{ksi}$, $f_{bx}^{EQ} = 8.8^{ksi}$

$\left(\frac{Kl}{r}\right)_y = \frac{1.0 \times 14}{0.537} = 26.1 \Rightarrow F_a = 20.2^{ksi}$

$f_a^{DL}/F_a = 0.764/20.2 = 0.038 \ll 0.15$

6-2 (AISC)

$$\left(0.038 + \frac{8.47}{22}\right)_{DL} + \left(\frac{0.37}{20.2} + \frac{8.8}{22}\right)_{EQ} = 0.841 < 1.0 \text{ O.K.}$$

HANGER IS O.K.

CYGNA ATTACHMENT
JOB NO. 83090
FILE NO. 11.2.1.SD/FSAR
SHEET NO. 57/81

F-166, 7-82

Checking Method #

Gibbs & Hill, Inc. Job No. 2323 Client TUS1

Subject CABLE TRAY SUPPORTS, DET 'D' (E1-0601-01-S)

Calculation Number SCS-104C, SET # 1 Sheet No.

Revision	Original Issue	Date	Rev.	Date	Rev.	Date	Rev.	Date	Rev.	Date	
Design Verified											
Preparer	[illegible]	10/12/8[illegible]									
Checker											

3) CHECK PL $\frac{3}{4}$ x 8"

i) FOR D.L.; ELEM. 22:

$f_a^{D.L.} = 0.078$ ksi, $f_{bx}^{DL} = 4.81$ ksi

ii) FOR SEISMIC, ELEM 24:

$f_a^{EQ} = 0.051$ ksi, $f_{bx}^{EQ} = 5.11$ ksi

LOW STRESSES, BASE PLATE $\frac{3}{4}$"x8" O.K.

CYGNA
ATTACHMENT
JOB NO. B2090
FILE NO. 11.2.1.5D(3.4)
SHEET NO. 54/54

Checking Method #

F-166, 7-82