CP&L

Carolina Power & Light Company

February 4, 1983 SERIAL: LAP-83-01

Director of Nuclear Reactor Regulation
Attention: Mr. Steven A. Varga, Chief
Operating Reactors Branch No. 1
Division of Licensing
United States Nuclear Regulatory Commission
Washington, DC 20555

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-261
LICENSE NO. DPR-23
IE BULLETIN 80-11,
MASONRY WALL DESIGN

Dear Mr. Varga:

As requested by your letter dated October 4, 1982, Carolina Power & Light Company (CP&L) has completed the response to your request for additional information regarding IE Bulletin 80-11, Masonry Wall Design, for the H. B. Robinson Steam Electric Plant Unit No. 2 (HBR2).

In Section II of the enclosed report our consultant has listed each request as identified in your Technical Evaluation Report (TER) followed by their response to the request. With regard to request No. 11, all proposed masonry wall modifications are complete.

As discussed with your staff in a telecon on Friday, February 4, 1983, our consultant is continuing their analysis of a missile shield wall. Carolina Power & Light Company will submit the results of this analysis on or before March 1, 1983. In the event the report is affected by the analysis results, CP&L will forward the revised pages with the analysis results.

If you have any further questions regarding this matter, please contact a member of the Nuclear Licensing Staff.

Yours very truly,

S. R. Zimmerman
Manager
Licensing & Permits

DCW/cfr (6132DCW)

cc: Mr. J. P. O'Reilly (NRC-RII)
Mr. G. Requa (NRC)
Mr. Steve Weise (NRC-HBR)

IE11

CAROLINA POWER AND LIGHT COMPANY
H. B. ROBINSON STEAM ELECTRIC PLANT
700,000 KW EXTENSION UNIT NO. 2

CONCRETE MASONRY WALLS
RESOLUTION OF NRC QUESTIONS
ON IE BULLETIN 80-11

EBASCO SERVICES INCORPORATED
145 TECHNOLOGY PARK/ATLANTA
NORCROSS, GEORGIA 30092
JANUARY 1983

CONCRETE MASONRY WALLS
RESOLUTION OF NRC QUESTIONS
ON IE BULLETIN 80-11

CONTENTS

INTRODUCTION

This report provides additional information requested by the United States Nuclear Regulatory Commission, Docket No. 50-261, dated October 4, 1982, regarding the previous responses by CP&L to IE Bulletin 80-11, Concrete Masonry Walls, located in the Reactor Building, Reactor-Auxiliary Building, and the Fuel Handling Building at H. B. Robinson Unit No. 2.

I - SUMMARY

In accordance with the requirements of the United States Nuclear Regulatory Commission's IE Bulletin 80-11, and subsequent request for additional information required to complete their review of Concrete Masonry Walls in the Reactor Building, Reactor-Auxiliary Building, and the Fuel Handling Building before issuing a final technical evaluation report, responses to their comments are provided in this report.

II - DISCUSSION - NRC COMMENTS AND EBASCO RESPONSES

NRC Comment 1: The Structural Engineering Branch (SEB) criteria indicate that, for operating plants, the load combinations provided in the plant FSAR should be used in the re-evaluation of masonry walls. Explain and justify the difference (if any) between the load combinations provided in the plant FSAR and the load combinations given in Reference 3[1]. Also, indicate whether any wall is subjected to wind, tornado, or pipe rupture reaction loads.

Ebasco Response: The load combinations in the updated FSAR, Section 3.8.1.3.2., relevant to seismic accelerations of the masonry walls are:

(b) C = 1.0D ± 0.05D + 1.25E

(c) C = 1.0D ± 0.05D + 1.0E'

E = OBE Earthquake

E' = DBE Earthquake (hypothetical earthquake)

The load combinations given in Reference 3[1] are:

(1) For concrete masonry
 (D) + (E)

(2) For structural steel
 (D) + (E)

(E) = Hypothetical Earthquake

In reanalyses per Bulletin 80-11, the value of E' was used as a worst case. A five percent variation in vertical loading (the only dead load acting is the wall self weight) will not significantly affect the stresses in the structural elements since these stresses are primarily due to horizontal seismic forces. However, a review of calculations including a five percent increase in loads indicate no overstress in any structural element. Therefore, we can see that the load combination specified in Reference 3[1], i.e. (D) + (E), is essentially the same as that specified in the updated FSAR, C = 1.0D ± 0.05D + 1.0E'.

No Category I masonry wall is subjected to loads due to pipe rupture, wind, or tornado wind loads.

See the response to NRC Comment 10 for additional data regarding the seismic analysis.

[1] CP&L Letter to NRC, dated November 5, 1980, File: NG-3513(R), Serial: NO-80-1633

II - DISCUSSION - NRC COMMENTS AND EBASCO RESPONSES

NRC Comment 2: Provide and justify the boundary conditions and modeling techniques used for the re-evaluation of masonry walls at H. B. Robinson Unit 2.

Ebasco Response: The masonry walls are modeled as vertical beams, either cantilevered off the floor or spanning between horizontal supports. Each wythe is assumed to span independently with no interaction between the adjoining wythes.

The boundary conditions used in the analyses conservatively assumes that there is no bond or friction between wythes or between the top and side edges of a masonry wall panel and its adjoining reinforced concrete element. The masonry wall is vertically supported by a reinforced concrete floor. The floor connection is assumed to be a simple support with induced overturning load transmitted to the adjoining reinforced concrete elements by means of steel members and concrete anchors. Shear loads are transmitted to the floor by friction between the wall and the floor and/or by steel members attached with concrete anchors. Loads are transmitted across the vertical and overhead reinforced concrete element/block wall interface by means of steel members and concrete anchors. The steel members are either cantilevered off or framed between the adjacent reinforced concrete elements.

NRC Comment 3: Indicate how earthquake forces in three directions and equipment loads were considered in the analysis of the masonry walls.

Ebasco Response: The worst case (out-of-plane) loads due to horizontal seismic acceleration and loads due to vertical seismic acceleration are combined linearly per updated FSAR 3.7.1.

Where stability of the wall due to in-plane horizontal loads was in question, numerical analyses were performed. Based on previous analyses, stresses in the wall elements due to horizontal in-plane loads are of low magnitude and are, therefore, not considered in the analyses.

Since design criteria that simultaneously combine stresses due to three orthogonal seismic components (two in-plane loads and one out-of-plane load) normally use the square root of the sum of the squares method for combination, the linear combination envelope utilized here can be considered conservative for the directions considered.

No safety-related equipment is known to be attached to the masonry walls under investigation.

II - DISCUSSION - NRC COMMENTS AND EBASCO RESPONSES

NRC Comment 4: Specify the number of modes of vibrations considered in the seismic analysis and indicate how the effects of higher modes of vibration were accounted for in the masonry wall analysis.

Ebasco Response: An equivalent static analysis was performed, instead of a dynamic analysis. In the updated FSAR, Section 3.7.2., Modal Analysis and Response Spectrum Techniques were used to develop the acceleration factors selected for the static analysis. The building dynamic analysis was based on the theory of modal superposition. Since it was known that the modal maxima do not occur at the same instant in time, it was the accepted practice to combine the various mode contributions on the square root of the sum of the squares basis.

NRC Comment 5: Justify 5% damping factor used for all cases, while Regulatory Guide 1.61 allows only 4% damping for the operating basis earthquake (OBE).

Ebasco Response: As discussed in response to NRC Comment 1, the most conservative load combination used in these analyses involves the design basis earthquake (DBE), also called the hypothetical earthquake. Regulatory Guide 1.61 allows a 7% damping for DBE. Consequently, the 5% damping used in these analyses can be shown to be conservative. For additional discussion regarding justification of the use of DBE vs. the use of OBE, see the response to NRC Comment 10.

NRC Comment 6: Provide any increase factors that may have been used for allowable stresses under abnormal conditions. If they are higher than those factors listed in the SEB criteria, provide justification. The SEB factors are listed below by type of stress:

Axial or flexural compression	2.5
Bearing	2.5
Reinforcement stress except shear	2.0 but not to exceed 0.9 fy
Shear reinforcement and/or bolts	1.5
Masonry tension parallel to bed joint	1.5
Shear carried by masonry	1.3
Masonry tension perpendicular to bed joint	
Reinforced masonry	0
Unreinforced masonry	1.3

NRC Comment 6 (continued):

Ebasco Response: No increase in allowable stresses beyond those allowed by the applicable design codes were used. These design codes are listed in Section 2.b. of Reference 3[1]. The maximum stress increase allowed by these codes is 1/3 when combined with seismic stresses. This increase is essentially equivalent to the minimum of the applicable SEB criteria factors listed with NRC Comment 6.

NRC Comment 7: Provide information on construction practices and the availability of relevant quality assurance/quality control records to justify the use of allowable stresses of ACI 531-79 (6) applicable only to the special inspection category.

Ebasco Response: Ebasco design drawing G-190420 requires construction per the latest ACI specifications. The specification is assumed to have been ACI 67-23, per updated FSAR 3.8.4.1.5.1(b)(1). However, since there is no confirmation of the use of this code, including inspection of construction, a review of the analyses, using reduced allowable stresses per ACI 531-79, Section 10.1.5, has been performed. For the purpose of the review, allowable masonry stresses, as shown in ACI 531-79, Table 10.1, were modified by the factors shown below:

Compression: $1 \times 2/3 \times 1.33 = 0.89$

Tension and Shear: $1 \times 1/2 \times 1.33 = 0.67$

All calculated masonry stresses were found to be less than or equal to these modified stresses after installation of the additional supports as shown in Reference 3[1].

Since QA/QC records should be in the possession of CP&L, and were not made available to Ebasco, higher stresses permitted by ACI 531-79 were not used in the analyses.

NRC Comment 8: Provide sample calculations for:

(a) block pullout analysis for attachments
(b) missile impact (if applicable)
(c) a typical multi-wythe wall.

Ebasco Response: (a) No safety-related piping or equipment is known to be attached to the masonry walls included in these analyses. Therefore, no block pullout analysis was required. It should be noted, however, that wedge anchors were used at wall 3b to secure several reinforcing members to the block. No block pullout calculations were performed, but by inspection, we can see that adequate edge distance was provided to permit 100% load capacity of the wedge anchor installation.

[1] - See footnote, page 3.

II - DISCUSSION - NRC COMMENTS AND EBASCO RESPONSES

NRC Comment 8 (continued):

Ebasco Response: (b) Postulated missile impact loads are not applied to the Category I masonry walls considered in this report, since all the block walls are considered protected from this type of loading.

(c) Even though multi-wythe walls are provided, no additional strength due to that fact is considered. Consequently, all masonry wall analyses used for final design are based on the assumption that the walls are single wythe. (Note that the steel support framing is designed to resist loads induced by all wythes of multi-wythe walls). However, as noted in Reference 3[1], calculations to account for the multiple wythes were performed and a sample is attached in Appendix A.

NRC Comment 9: Indicate whether any nonlinear technique was used in the analysis. Provide justification for its use. If any existing test data are used to justify the technique, the applicability of the tests should be discussed for the following area:

(a) Nature of loads
(b) Boundary conditions
(c) Materials used
(d) Wall sizes
(e) Amount and distribution of reinforcement.

Ebasco Response: No nonlinear techniques were used in the analyses.

NRC Comment 10: Explain how seismic analysis was performed. Clarify whether acceleration values were selected from appropriate floor response spectrum. If not, provide justification and indicate whether the method used is consistent with the FSAR requirements.

Ebasco Response: An equivalent static analysis was performed for each wall. The analyses used a horizontal seismic acceleration factor of 0.2g, combined linearly with a vertical seismic acceleration of 2/3 x Horizontal = 0.134g.

From the seismic data in Appendix B of this report, we see that the accelerations from the appropriate floor response spectrum are (by using the NRC suggested damping factors specified in Regulatory Guide 1.61) lower than the assumed accelerations used in the analyses for the Fuel Handling Building and the Reactor Auxiliary Building.

From Appendix B the following data is obtained:

A. Reactor Auxiliary Building
   1. Operating Basis Earthquake-OBE (10% G) at NRC suggested 4% damping, g = 0.13
   2. Design Basis Earthquake-DBE (20% G) at NRC suggested 7% damping, g = 0.18

1 - See footnote, page 3.

II - DISCUSSION - NRC COMMENTS AND EBASCO RESPONSES

NRC Comment 10 (continued):

Ebasco Response: From the load combinations in NRC Comment 1 response, the horizontal acceleration with the applied load combination factor is:

OBE $0.13 \times 1.25 = 0.16 < 0.20$

DBE $0.18 \times 1.00 = 0.18 < 0.20$

B. Fuel Handling Building
  1. Operating Basis Earthquake-OBE (10% G) at NRC suggested 4% damping, g = 0.12
  2. Design Basis Earthquake-DBE (20% G) at NRC suggested 7% damping, g = 0.18

From the load combinations in NRC Comment 1 response, the horizontal acceleration with the applied load combination factor is:

OBE $0.12 \times 1.25 = 0.15 < 0.20$

DBE $0.18 \times 1.00 = 0.18 < 0.20$

C. Reactor Building
  1. Operating Basis Earthquake-OBE (10% G) at NRC suggested 4% damping, g = 0.17
  2. Design Basis Earthquake-DBE (20% G) at NRC suggested 7% damping, g = 0.25

From the load combinations in NRC Comment 1 response, the horizontal acceleration with applied load combination factor is:

OBE $0.17 \times 1.25 = 0.21 > 0.20$

DBE $0.25 \times 1.00 = 0.25 > 0.20$

These horizontal accelerations (and associated vertical accelerations) are greater than the values used in the analysis of Wall 6. A review of the analysis of Wall 6 (included as a sample calculation in Appendix A) reveals that the designed modifications are capable of withstanding these higher acceleration values.

NRC Comment 11: Provide the final status of the proposed wall modifications.

Ebasco Response: Information required to respond to this NRC comment should be in the possession of CP&L. Therefore, the final status of the modifications should be addressed by CP&L.

APPENDIX A

SAMPLE CALCULATIONS FOR A TYPICAL MULTI-WYTHE WALL

EBASCO SERVICES INCORPORATED

NEW YORK

BY W. FARAJ DATE OCT 3. 80

CHKD. BY A Wong DATE 10-17-80

SHEET 36 OF

OFS NO. 2762.017 DEPT. NO. 403

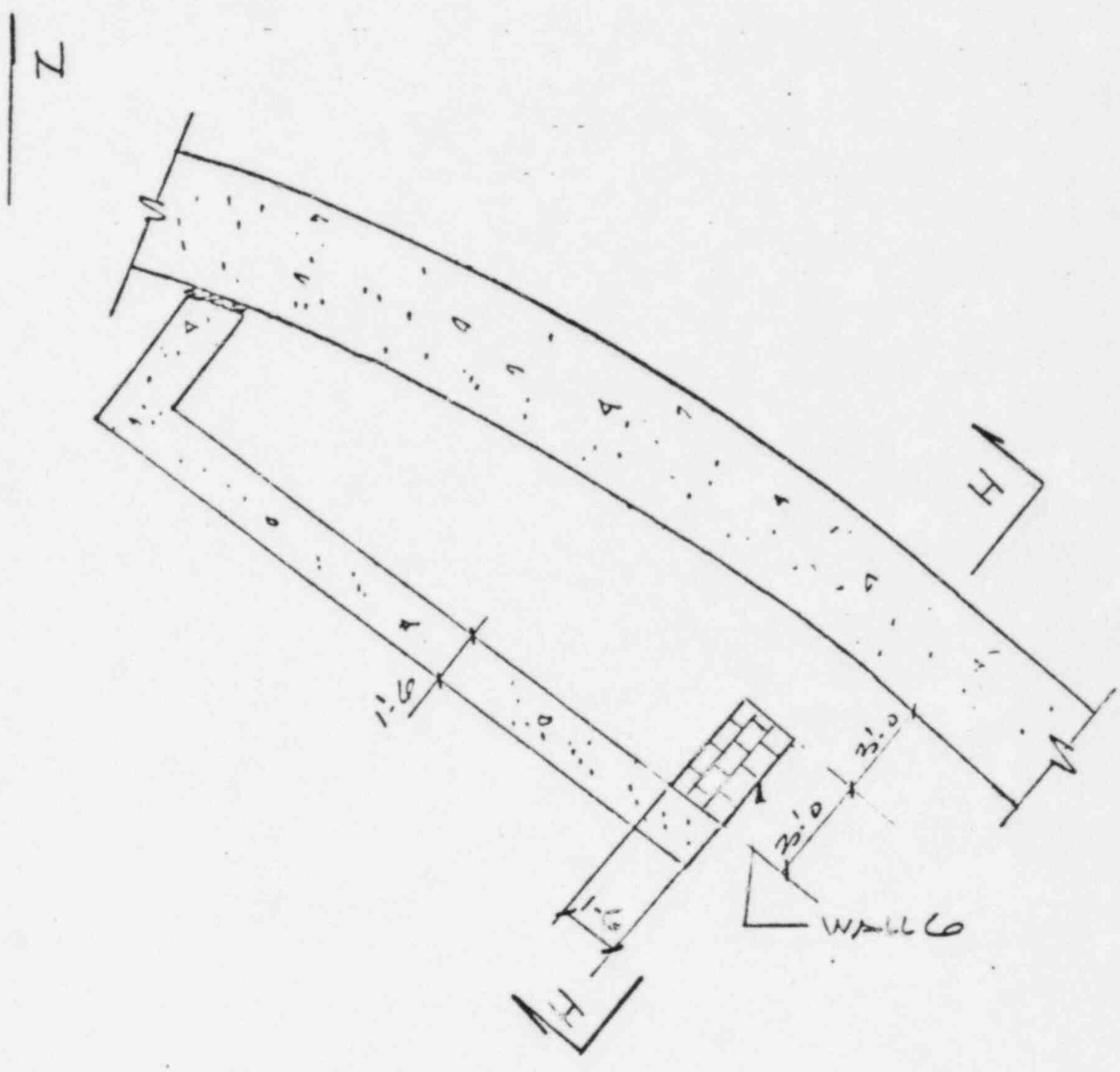
CLIENT CP&L

PROJECT H.B. ROBINSON UNIT 2

SUBJECT NRC BULLETIN 80-11 · BLOCK WALLS ·

WALL 6 · REACTOR BLDG

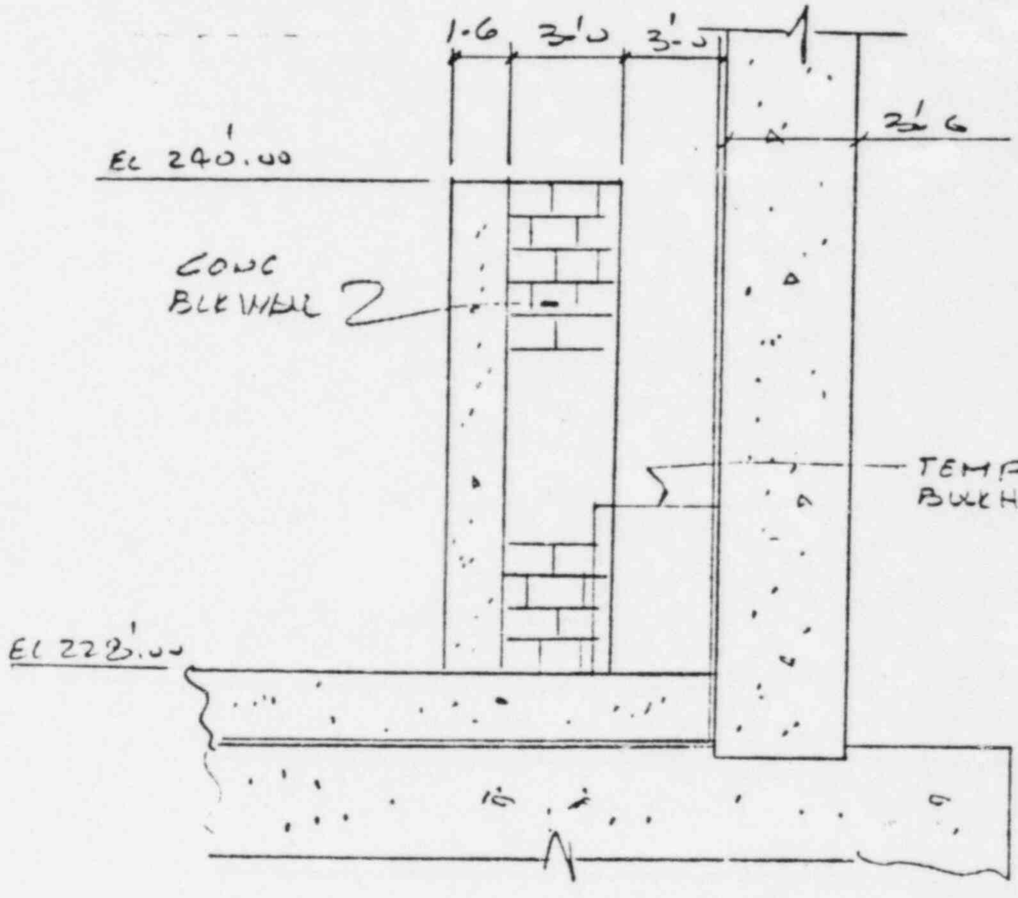
REF DWG: G-190367
G-190371



PART PLAN

3/16 = 1'-0

WALL 6



SECT H-H (G.190371)

G 190371

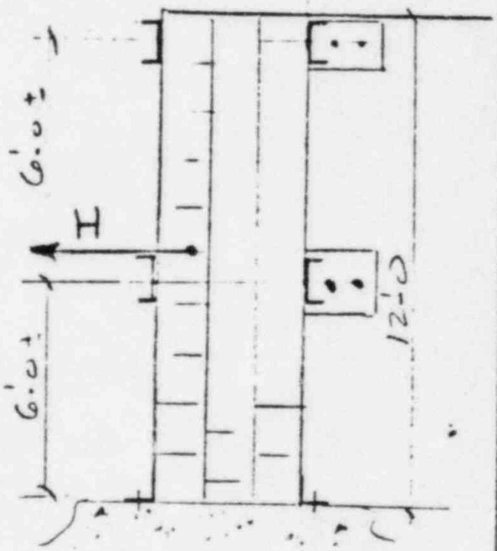
WALL 6 - MULTIPLE WYTHE SOLID CONC BLK WALL

3 - 6" WYTHES, 12'-0 HIGH.

WT OF 6" BLK. 12'-0 HIGH / FT WIDTH:

$= 143 \times \frac{6}{12} \times 12 = 858$ #/FT

$H_{SEIS} = .2 \times 858 = 172$ #



CHECK OVERTURNING:

$M_{OVERT} = 172 \times 6 = 1032$ #-FT

$M_{RESIST} = 0.86 \times 858 \times .25 = 180$ #-FT $< M_{OVER}$

PROVIDE SUPP FOR WALL:

PROVIDE CHANNELS @ TOP & MID-HEIGHT & L @ BOT.

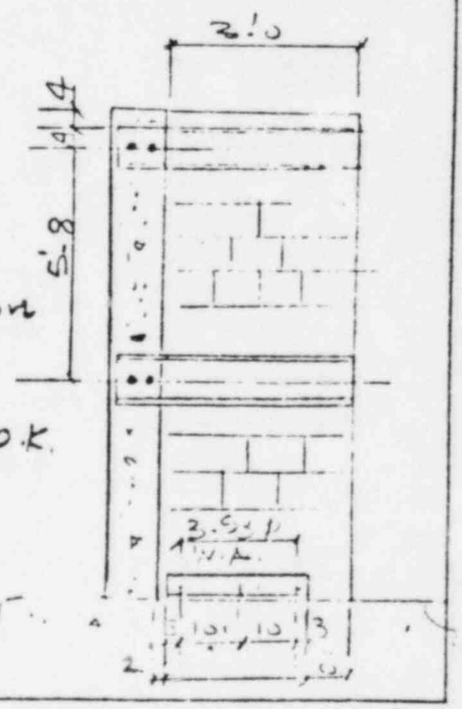
WALL SPANS VERTICALLY BTWS CHANNELS.

CHECK WALL TO SPAN VERT (6'-0):

6" SOLID CONC BLK. $A = 67.5$ in² $S = 63$ in³

$M_{MAX} = (143 \times .5 \times .2) \times \frac{6^2}{8} = 64.4$ #-FT $= 773$ #-in

$\frac{M}{S} = 773/62 = 12.3$ psi < 39 psi. O.K.



WALL 6 CONT

CHECK CHANNEL SUPPORT (MIDDLE SUPPORT)

LOAD ON CHANNEL = $\frac{858}{2} \times 3 \times .2 = 257^{\#/'}$

SPAN = 3'-0

$M_{MAX} = \frac{257}{2}(3)^2 = 1157^{\#FT} = 13878^{\#-in}$

TRY C8x13.75 $S_y = .853''^3$

$f = \frac{13878}{.853} = 16270$ psi $< .6 \times 36$ O.K

USE C8x13.75

CHECK WEDGE ANCHORS

TRY 2 - 3/4 φ W.A.

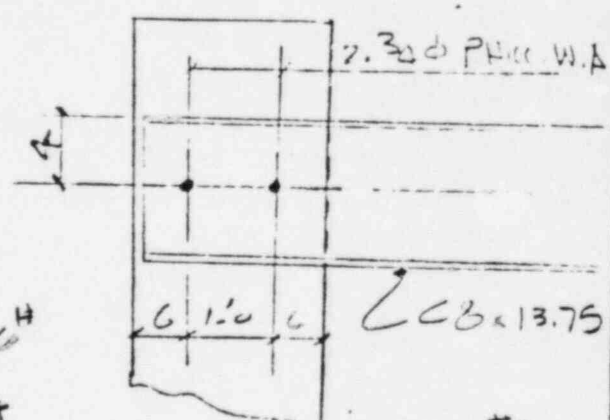
$M_{MAX} = 13878^{\#-in}$

TENSION DUE TO MAX = 13878/12" = $1156^{\#}$

TENSION DUE TO AXIAL = $\frac{257 \times 3}{2} = 386^{\#}$

TOT TENSION = 1156 + 386 = $1542^{\#} \times 1.5 = 2312 < 3010^{\#}$

T(ALLOW) = $3010^{\#}$



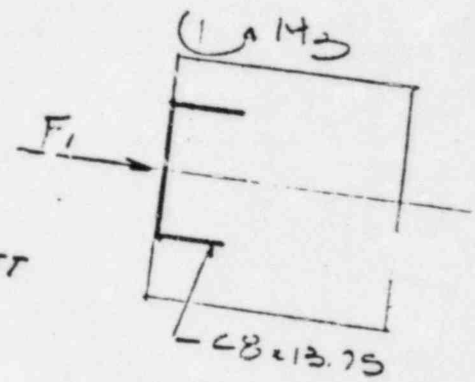
SUBJECT: H.B. ROBINSON - UNIT 2 — CP&L
NRC BULLETIN - 80-11 BLOCK WALLS.

WALL 6

CHECK WELD SIZE REQ'D:

C8x13.75

$M_3 = 13878$ #in
$F_1 = 771$ #

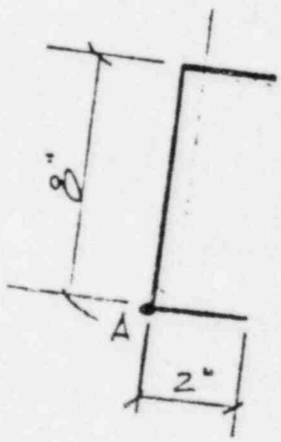


S @ EDGE OF CHANNEL $= \dfrac{2bd + d^2}{3}$ (REF: BLODGETT PAGE 7.4-7)

b = 8"   d = 2"

$S = \dfrac{2 \times 8 \times 2 + (2)^2}{3} = 12$

CHECK STRESS @ POINT A:



A = 12.69

$$f = \sqrt{\left(\frac{13878}{12}\right)^2 + \left(\frac{771}{12.69}\right)^2} = 1158 \text{ \#/in}$$

WELD SIZE REQ'D (USING E-70 ELECT):

$$= \frac{1158}{.707 \times 15800} = .104"$$ USE 5/16 WELD

FORM 881 REV 7-71

WALL 6

CHECK W. ANCHORS & BASE PL

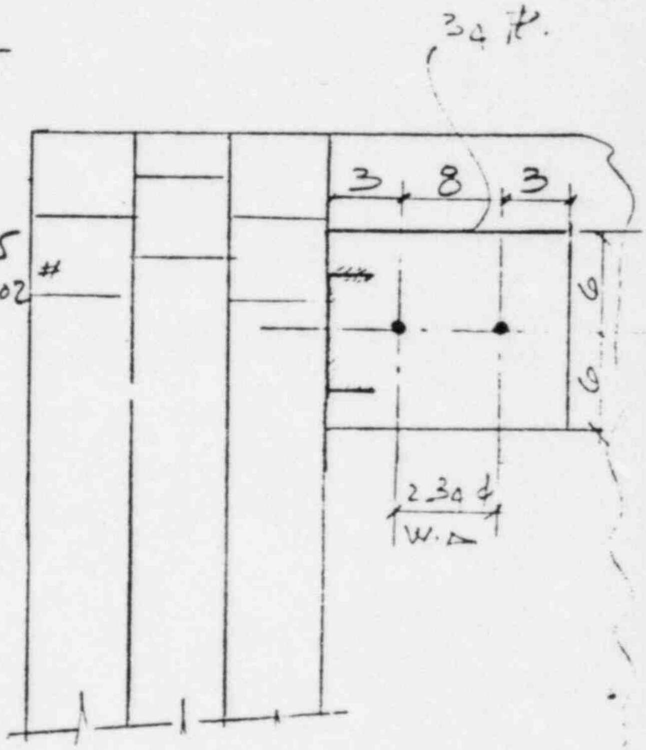
$M_{MAX} = 13878^{\#\text{-in}}$

MAX TENSION IN BOLT = $\frac{13878}{8} = 1735 \times 1.5 = 2602^{\#}$

MAX SHEAR = $257 \times \frac{3}{2} = 386^{\#}$

USE 3/4 ϕ PHILLIPS W. ANCHOR

$T_{ALLOW} = 3019^{\#}$



CHECK PL:

$S_{REQ} = \frac{13878}{27000} = .52^{in^3} = \frac{12}{6}(t)^2$

t = .51" USE 3/4" PL.

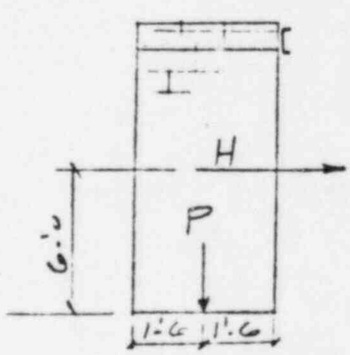
PROVIDE L4x4x1/4 W/ 5/8 ϕ W.A @ 18" o/c

CHECK OVERTURNING IN OTHER DIRECTION

$M_{OVERT.} = .2 \times 143 \times .5 \times 12' \times 6' = 1032^{\#\text{-FT}}$

$M_{RESIST} = (1-.14) \times 858 \times 1.5 = 1081^{\#\text{-FT}}$

F.S = 1081/1032 = 1.05



PROVIDE SUPPORT @ TOP OF WALL.

EBASCO SERVICES INCORPORATED

NEW YORK

BY W. FARAJ DATE OCT 3. 80 SHEET 23 OF 26

CHKD. BY A Wong DATE 10-17-80 OFS NO. 2762.017 DEPT. NO. 402

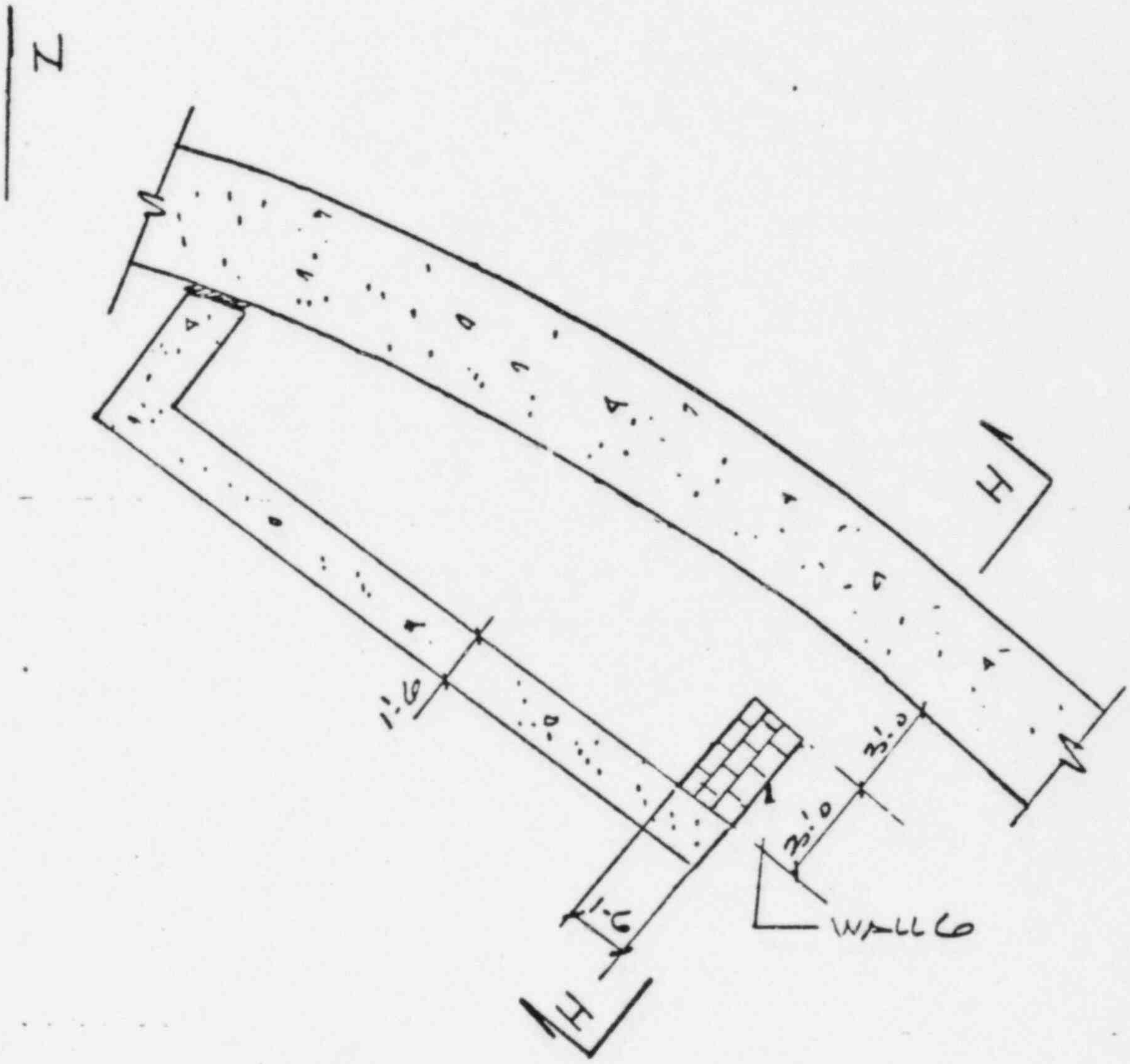
CLIENT CP&L

PROJECT H.B. ROBINSON UNIT 2

SUBJECT NRC BULLETIN 80-11 . BLOCK WALLS .

WALL 6 . REACTOR BLDG

REF DWG: G.190367
G.190371



PART PLAN

3/16" = 1'-0

FORM 881 REV 7-71

EBASCO SERVICES INCORPORATED

NEW YORK

BY W. FARZAJ DATE OCT 3. 80

CHKD. BY AWong DATE 10-17-80

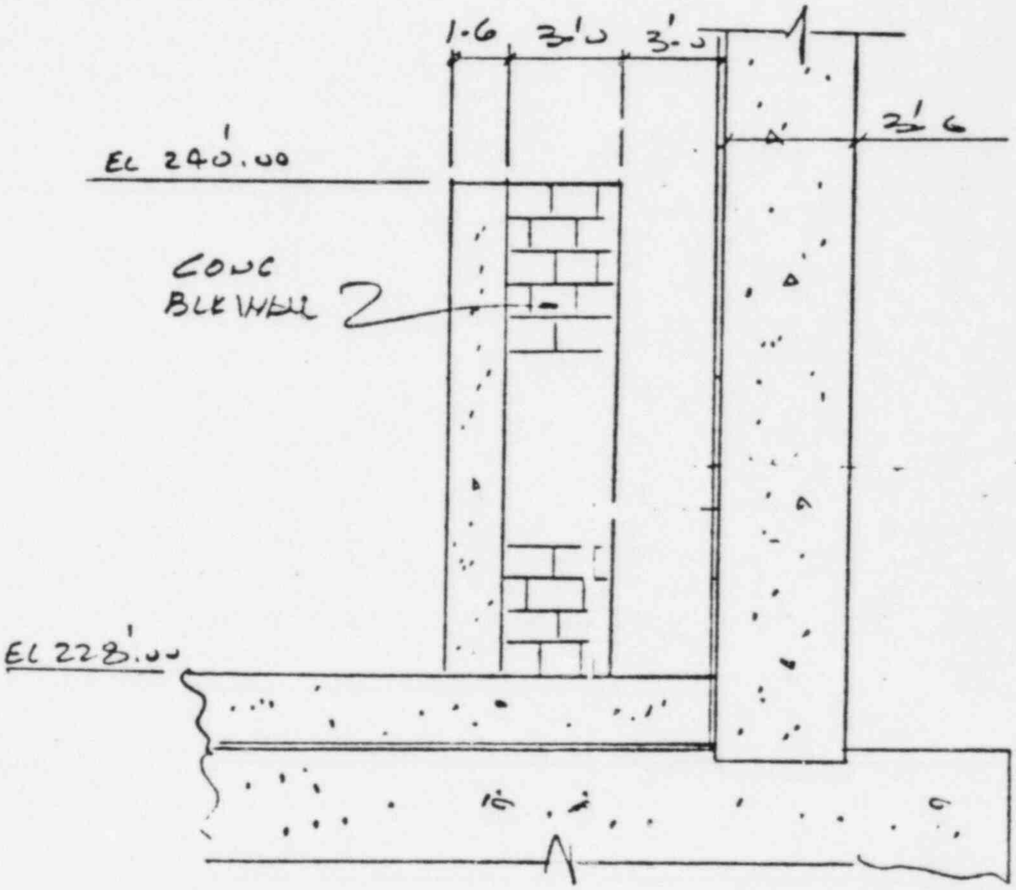
OFS NO. 2762.017 DEPT. NO. 4.3

CLIENT CP&L

PROJECT H.B. ROBINSON. UNIT 2

SUBJECT NRC BULLETIN. 80-11 BLOCK WALLS.

WALL 6



SECT H-H (G.190371)

G 190371

WALL 6

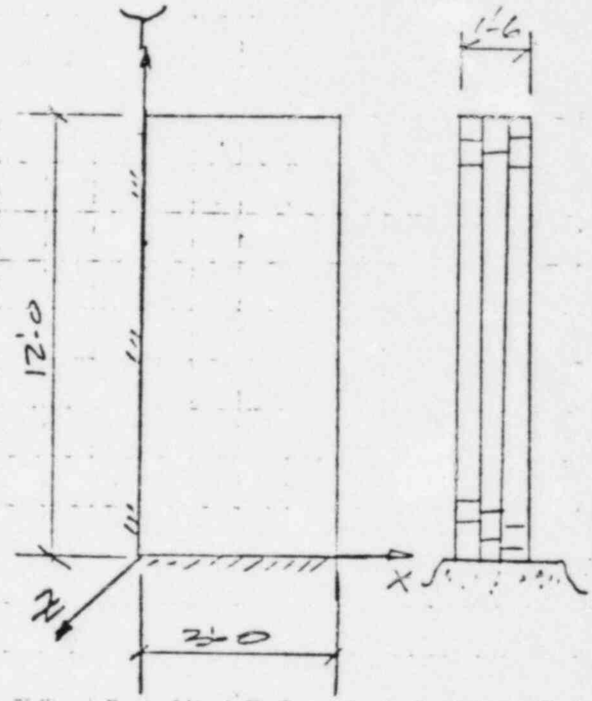
3 - 6" WYTHES.

18" SOLID BLK WALL.

WT OF BLK WALL :

$= 143^{PSF} \times 1.5' \times 12' \times 3' = 7722^{\#}$

$H_{SEIS} = 7722^{\#} \times .2 = 1544.4^{\#}$



$W_{UNIFORM} = \frac{1544.4^{\#}}{12 \times 3} = 43\ PSF$

$a/b = 12/3 = 4 >> 1$ ∴ ONE-WAY ACTION. HORIZ.

$M_{MAX} = \frac{43}{2}(3)^2 = 194^{\#-FT/FT}$

CHECK BENDING

$S = \frac{bd^2}{6} = \frac{(12)(18)^2}{6} = 648^{IN^3}$

$f_{MAX} = \frac{194 \times 12}{648} = 3.6\ psi < 40^{PSI}$

CHECK SHEAR

$V_{MAX} = 43 \times 3 = 129^{\#}$

CHKD. BY A. Wong DATE 11-1-80 OFS NO. 2762-017 DEPT. NO. 402

CLIENT CP & L

PROJECT H B ROBINSON UNIT NO 2

SUBJECT N.R.C BULLETIN 80-11 BLOCK WALLS

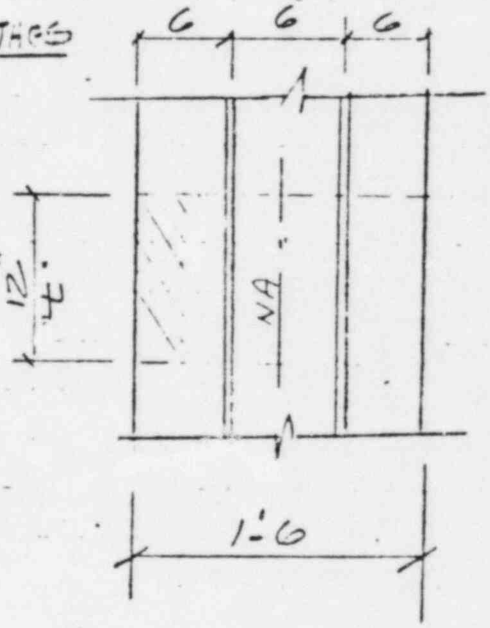
WALL 6

$$\text{SHEAR STRESS} = \frac{129^{\#}}{12 \times 18} = 0.6 \text{ psi} < 34 \text{ psi} \quad \text{ok.}$$

CHECK VERT JOINT TENSION DUE TO F_x LOAD:

$$F_x = 1544.4^{\#} \qquad f_t = \frac{1544.4}{12' \times 12 \times 18} = .59 \text{ psi} < 40 \text{ psi o.k.}$$

CHECK - COLLAR JOINT - SHEAR 5TW WYTHES



$$v_{\text{max}} = \frac{VQ}{It}$$

$$V = 129^{\#}$$

$$Q = 12 \times 6 \times 6 = 432 \text{ in}^3$$

$$I = \frac{12}{12}(18)^3 = 5832 \text{ in}^4$$

$$t = 12''$$

$$v = \frac{129 \times 432}{5832 \times 12} = 0.8 \text{ psi} < 8 \text{ psi} \quad \text{O.K.}$$

$$v_{\text{allow}} = 8 \text{ psi}$$

FORM 881 REV 7-71

APPENDIX B

JUSTIFICATION OF RESPONSE ACCELERATIONS USED
IN THE DESIGN CALCULATIONS

APPENDIX B

Method of analysis for determining the appropriate response acceleration using the Housner Charts:

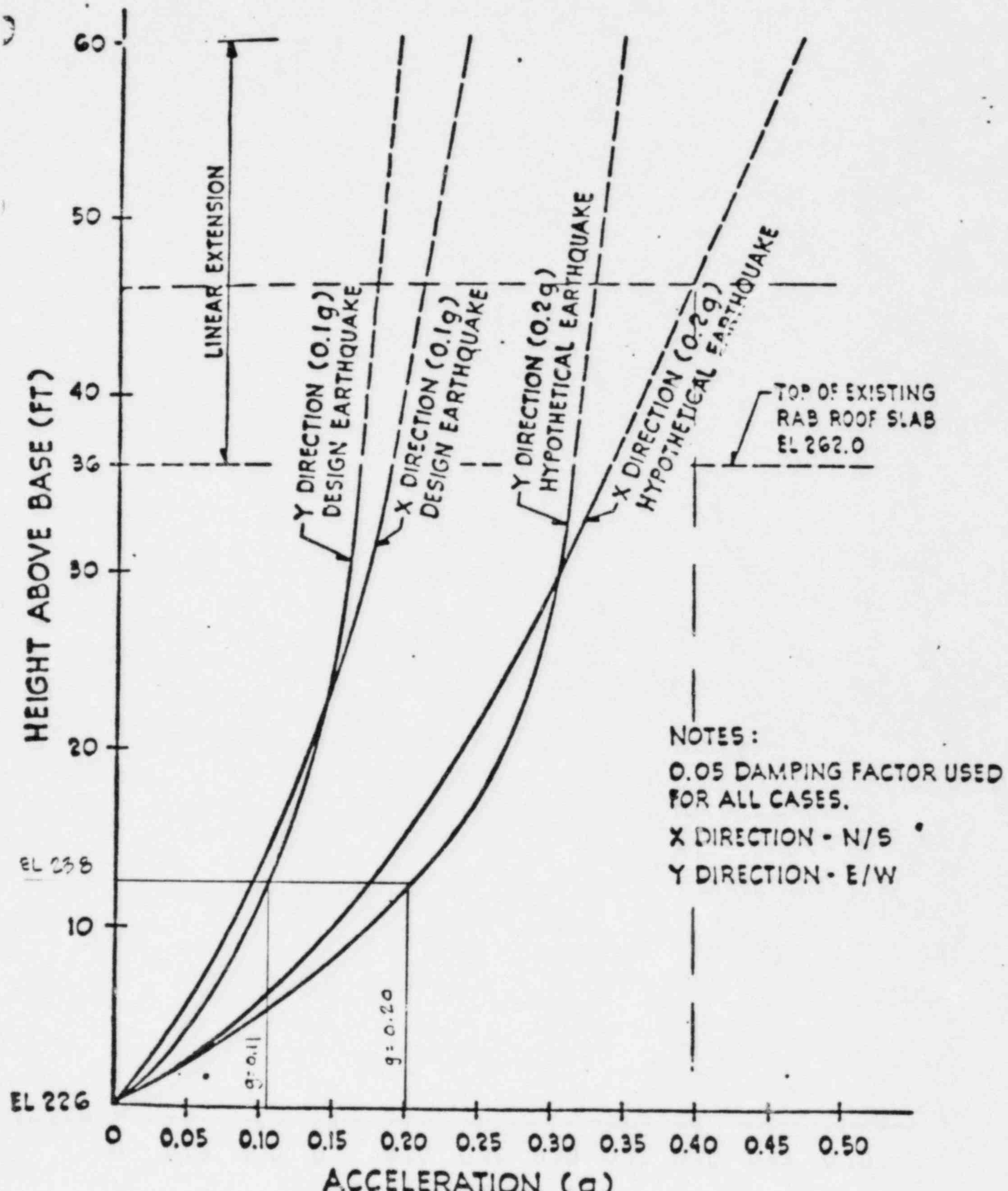
1. The peak response acceleration with damping factor was obtained from available sources.

2. The appropriate period was selected from the Housner Chart using the peak acceleration and damping factor.

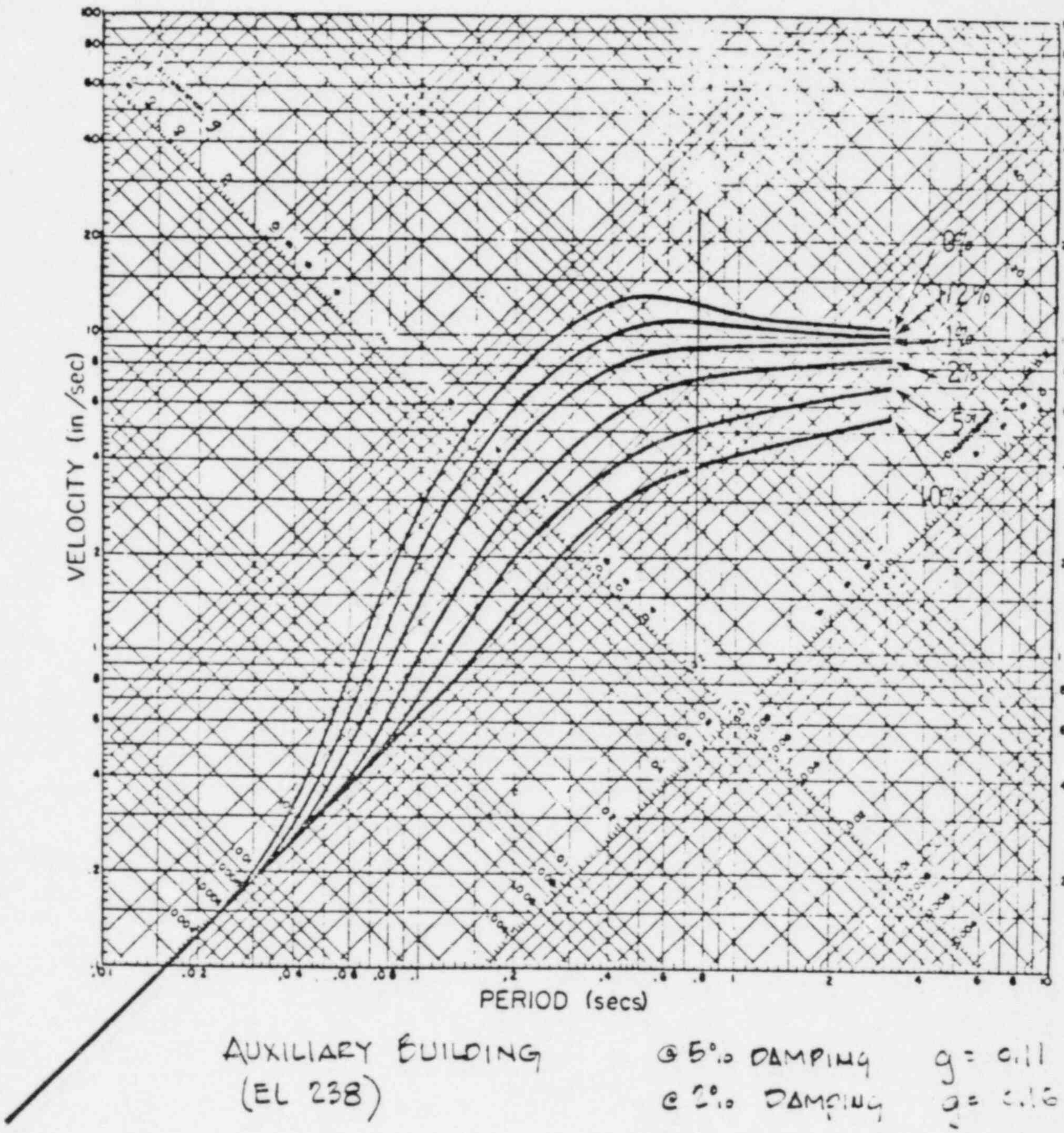
3. Using the period from Step 2, the response acceleration for an array of damping factors was read off the Housner Chart.

4. Interpolate the response acceleration for the assigned damping factor from the array of data generated by Step 3.

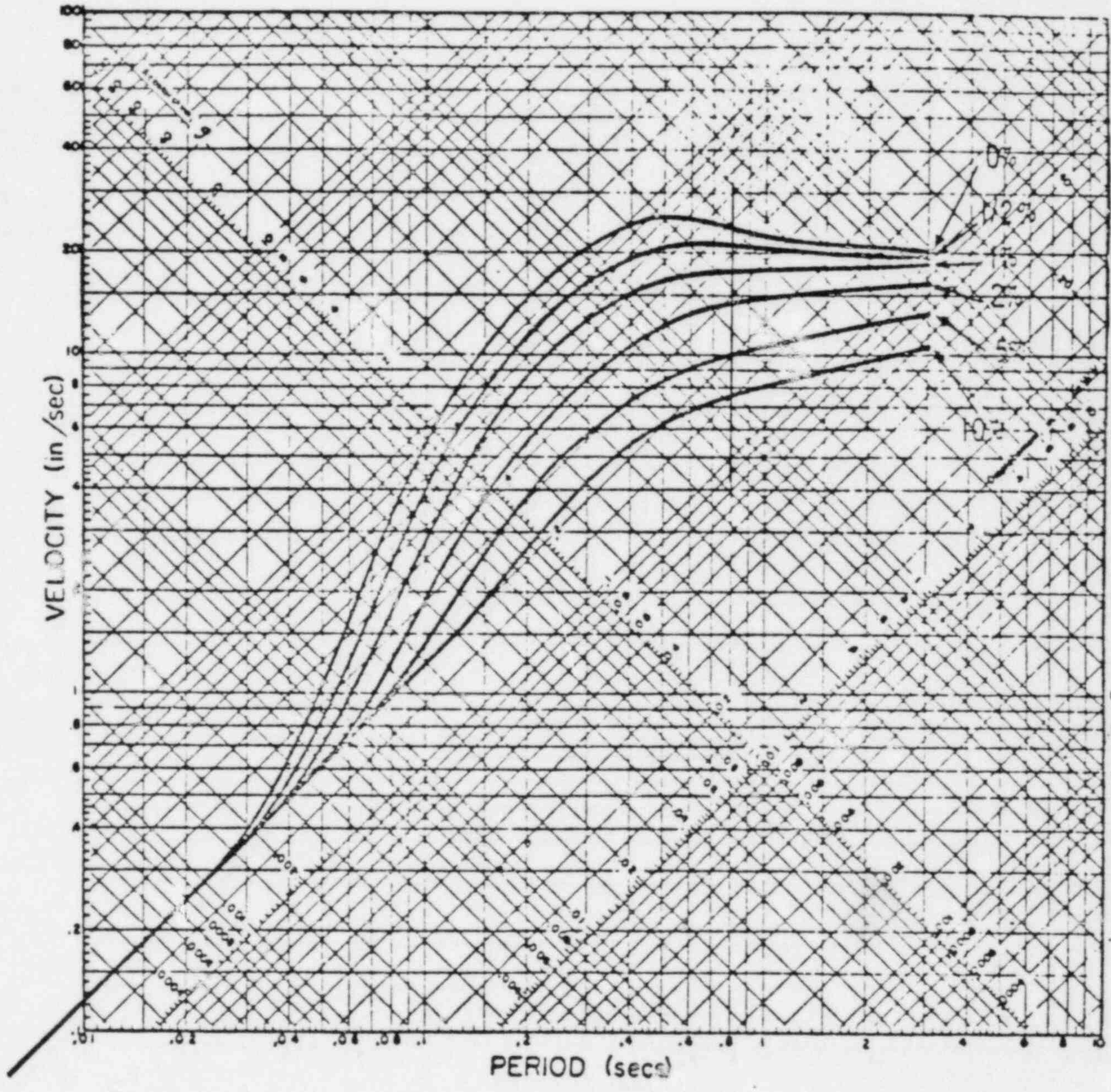
DATE: 6-25-80



ACCELERATION CURVE FOR REACTOR AUXILIARY BUILDING

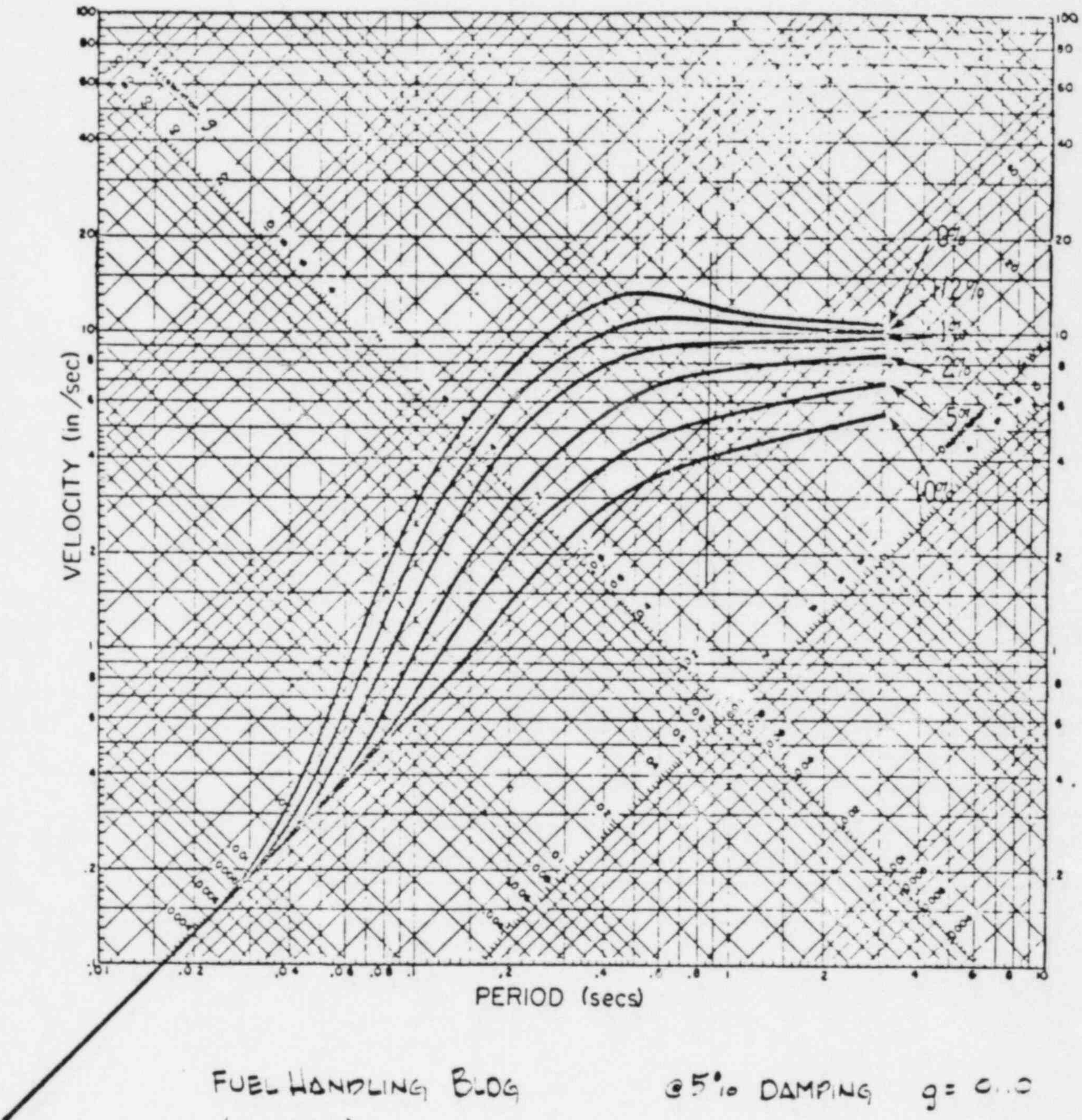


H. B. ROBINSON UNIT 2 Carolina Power & Light Company UPDATED FINAL SAFETY ANALYSIS REPORT	0.1 G-RESPONSE SPECTRUM	FIGURE 2.5.2 - 2



AUXILIARY BUILDING @ 5% DAMPING g = 0.20
(EL 238) @ 10% DAMPING g = 0.15

H. B. ROBINSON UNIT 2 Carolina Power & Light Company UPDATED FINAL SAFETY ANALYSIS REPORT	0.2 G-RESPONSE SPECTRUM	FIGURE 2.5.2 - 3

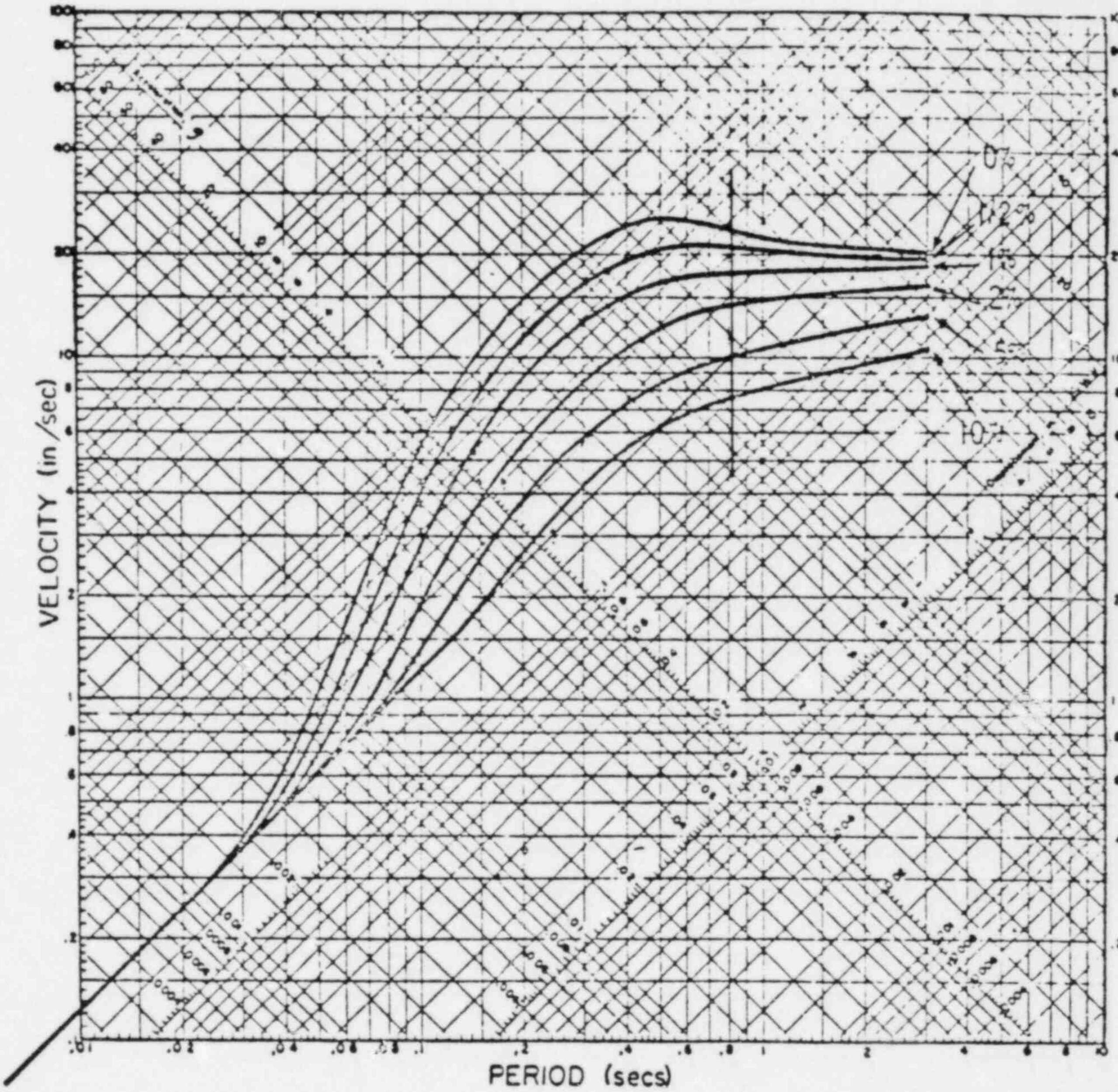


FUEL HANDLING BLDG
(EL 226)

@5% DAMPING g= 0.[illegible]
@2% DAMPING g= 0.[illegible]

H. B. ROBINSON UNIT 2 Carolina Power & Light Company UPDATED FINAL SAFETY ANALYSIS REPORT	0.1 G-RESPONSE SPECTRUM	FIGURE 2.5.2 - 2

B. 6



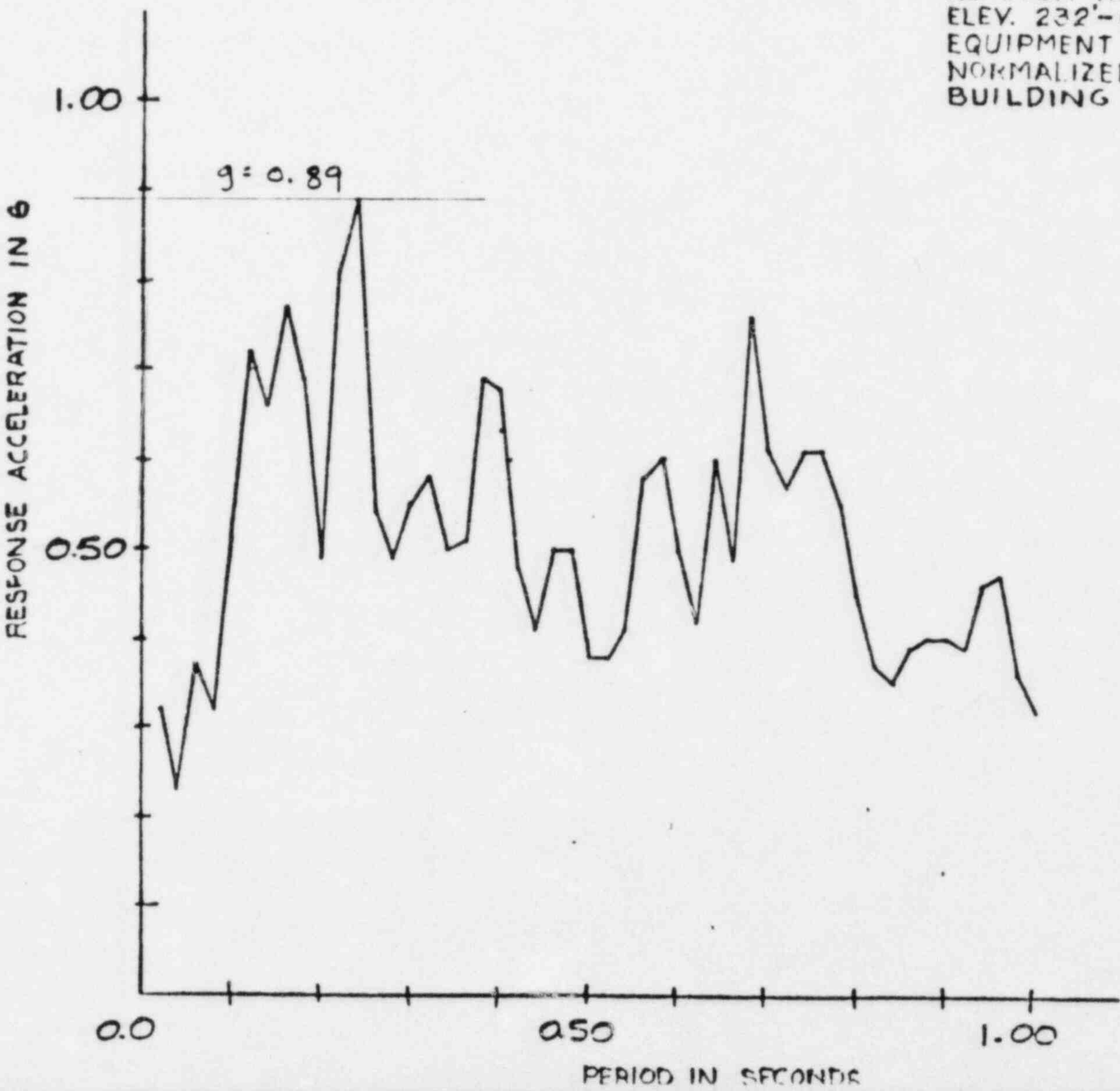
FUEL HANDLING BLDG
(EL 226)

@ 5% DAMPING g = 0.20
@ 10% DAMPING g = 0.15

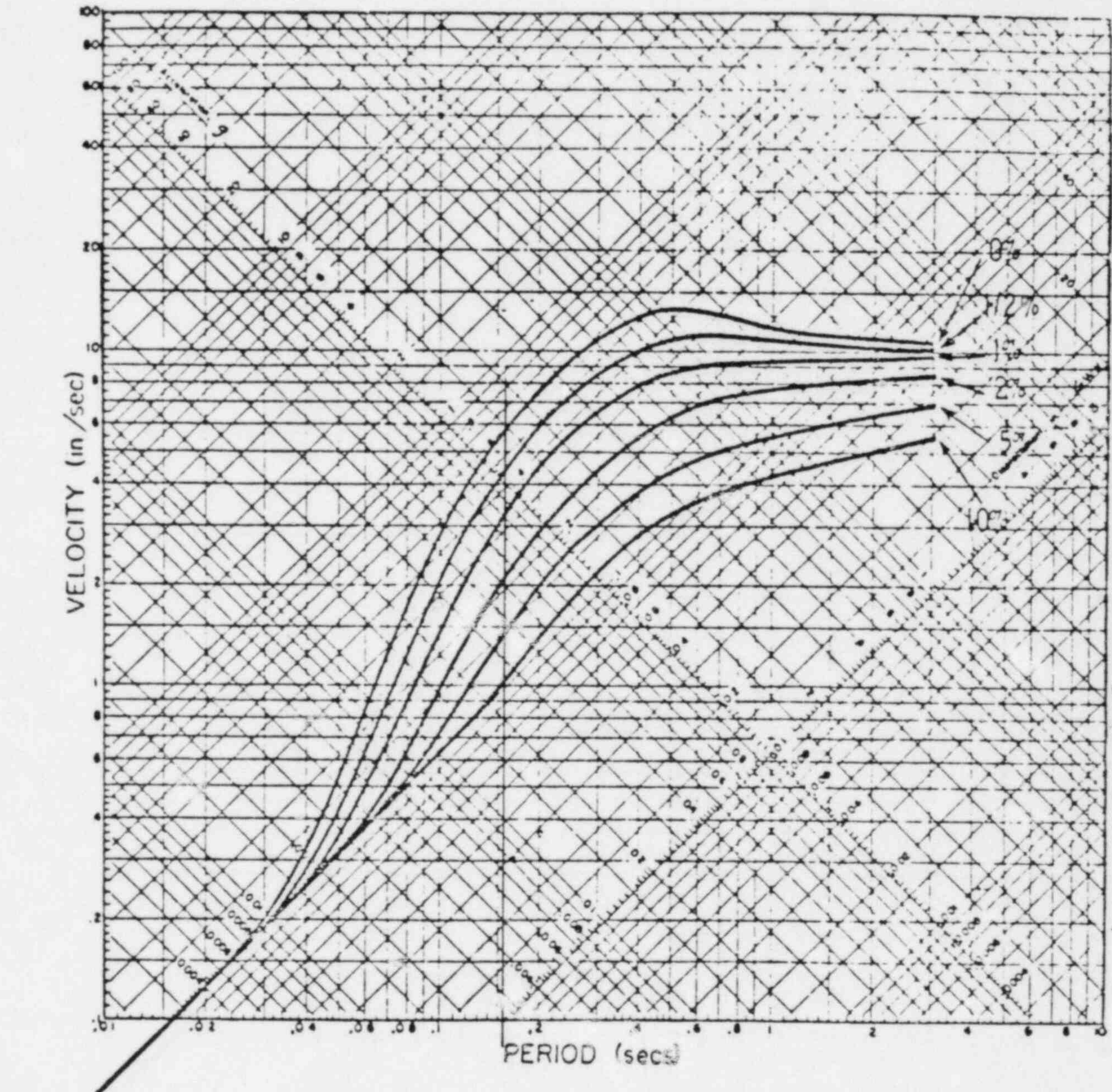
H. B. ROBINSON UNIT 2 Carolina Power & Light Company UPDATED FINAL SAFETY ANALYSIS REPORT	0.2 G-RESPONSE SPECTRUM	FIGURE 2.5.2 - 3

B.7

HORIZONTAL RESPONSE ACCELERATION SPECTRUM
H.B. ROBINSON STEAM ELECTRIC PLANT - UNIT NO. 2
REACTOR INNER STRUCTURE
ELEV. 232'-6"
EQUIPMENT DAMPING RATIO = 0.0[illegible]5
NORMALIZED EARTHQUAKE OF 0.2[illegible] G
BUILDING DAMPING RATIO = 0.05



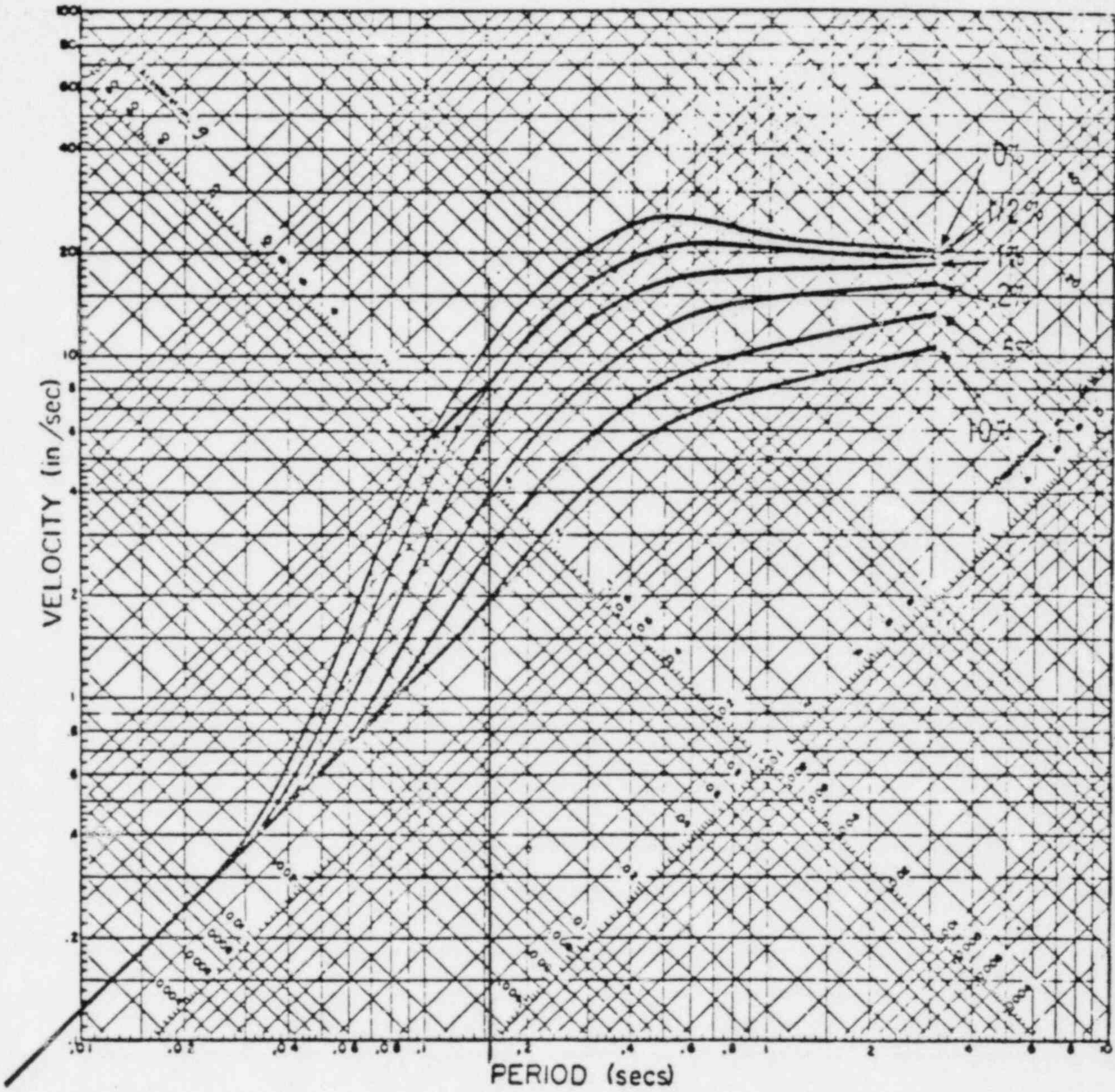
8.8



REACTOR BUILDING
(EL 232'-6)

@ 1/2% DAMPING g = 0.45
@ 2% DAMPING g = 0.22
@ 5% DAMPING g· 0.15
@ 10% DAMPING g: 0.11

H. B. ROBINSON UNIT 2 Carolina Power & Light Company UPDATED FINAL SAFETY ANALYSIS REPORT	0.1 G-RESPONSE SPECTRUM	FIGURE 2.5.2 - 2



REACTOR BUILDING
(EL 232'-6)

@ ½ % DAMPING g= 0.39
@ 2 % DAMPING g= 0.42
@ 5 % DAMPING g: 0.28
@ 10 % DAMPING g: 0.20

H. B. ROBINSON UNIT 2 Carolina Power & Light Company UPDATED FINAL SAFETY ANALYSIS REPORT	0.2 G-RESPONSE SPECTRUM	FIGURE 2.5.2 - 3

APPENDIX B - SUMMARY OF RESPONSE ACCELERATIONS

AUXILIARY BUILDING

OBE	
2% damping factor	g = 0.16
5% damping factor	g = 0.11
4% damping factor	g = 0.13
DBE	
5% damping factor	g = 0.20
10% damping factor	g = 0.15
7% damping factor	g = 0.18

FUEL HANDLING BUILDING

OBE	
2% damping factor	g = 0.14
5% damping factor	g = 0.10
4% damping factor	g = 0.12
DBE	
5% damping factor	g = 0.20
10% damping factor	g = 0.15
7% damping factor	g = 0.18

REACTOR BUILDING

OBE	
2% damping factor	g = 0.22
5% damping factor	g = 0.15
4% damping factor	g = 0.17
DBE	
5% damping factor	g = 0.28
10% damping factor	g = 0.20
7% damping factor	g = 0.25