AS

GENERAL ELECTRIC

NUCLEAR ENERGY
PROGRAMS DIVISION

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CONFORMED COPY

November 29, 1977

Mr. Edson G. Case, Acting Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D. C., 20555

Reference: 1) License R-33, Docket 50-73
2) Order to Show Cause, October 24, 1977
3) Letter, E. G. Case to R. W. Darmitzel, November 7, 1977

Dear Mr. Case:

General Electric hereby submits one signed and twenty (20) conformed copies of the seismic analysis and the confirmatory information on the General Electric Nuclear Test Reactor (NTR). Submittal of the confirmatory information is in accordance with your request of November 7, 1977 (Reference 3). The seismic analysis is included as Attachment A and the confirmatory information is included as Attachment B to this letter.

General Electric believes that the seismic analysis (Attachment A) provides assurance that the NTR can be operated safely without endangering the health and safety of site personnel or the general public under the existing technical specifications which limit the reactivity held in control rods and experiments. While completing the modifications as described in Attachment A and prior to approval of the seismic analysis by the NRC staff, General Electric requests to be allowed to continue to operate the NTR under existing procedures and commitments which limit the excess reactivity available for insertion as described in Items 1 and 2 of Attachment B. Upon approval of the seismic analysis and completion of the necessary structural modifications, these procedures and commitments would be discontinued and operation would be in accordance with the technical specifications. This approach assures safe operation of the NTR and will reduce the effort involving both General Electric and U.S. Nuclear Regulatory Commission personnel which would result from multiple temporary technical specification changes.

General Electric will be glad to meet with N.R.C. staff personnel at their convenience to discuss the seismic analysis and/or other information in the attachments.

GENERAL ELECTRIC

Mr. Edson G. Case
Washington, D. C.

In regards to Items 4 and 5 in Attachment B, General Electric requests modification of the technical specifications for the NTR as shown in Item 5.

Sincerely,

/s/ R. W. Darmitzel

R. W. Darmitzel, Manager
Irradiation Processing Operation

vcc

Encl.

GENERAL ELECTRIC

AFFIRMATION

General Electric hereby submits the seismic analysis and confirmatory information on the General Electric Nuclear Test Reactor (NTR) requested by the Nuclear Regulatory Commission in their letter of November 7, 1977.

To the best of my knowledge and belief, the information contained herein is accurate.

BY: /s/ R. W. Darmitzel

R. W. Darmitzel, Manager
Irradiation Processing Operation

Submitted and sworn before me this ____________day of_____________, 1977. ______________________________, Notary Public in and for the County of Alameda, State of California.

ATTACHMENT A

SEISMIC ANALYSIS
OF THE
GENERAL ELECTRIC
NUCLEAR TEST REACTOR
AND
SURROUNDING STRUCTURES

ATTACHMENT A

During the oral presentation GE made to the NRC on October 28, 1977 it was postulated that a seismic event resulting in peak ground accelerations greater than 0.75 g could produce movement of certain structures with resultant reactivity insertions. A structural analysis* has been completed which addressed those structures in question. This analysis addresses the following:

1. The reactor cell structure.
2. The roof on the reactor cell.
3. The lead shield wall at the north face of the main graphite pack.
4. Control rod support structures.
5. The reactor cell bridge crane.
6. The fuel loading tank.
7. The 'T' slab structure on top of the reactor.

The structural analysis was performed assuming a peak ground acceleration of 0.8 g and "Criterion Earthquake Ground Response Spectra" as supplied by EDAC. Conclusions of the report are summarized as follows:

1. The reactor cell will survive the postulated seismic event without modification.
2. The roof on the reactor cell will survive the postulated seismic event without modification.
3. The lead shield wall will remain intact and in position during the postulated seismic event.
4. The control rod support structures will survive the postulated seismic event with minor modifications.

* Attached report "Seismic Analysis of Nuclear Test Reactor Cell/Room and Major Shielding Components" by K. Dovydaitis dated November 19, 1977.

5. The reactor cell bridge crane will remain in place during the postulated seismic event.
6. The fuel loading tank will survive the postulated seismic event with the addition of a cover plate and specified braces.
7. The 'T' slab will survive the postulated seismic event with the addition of specified support braces.

Visual inspection of the reactor cell and equipment and inspection of drawings indicated that there are no other items which could credibly damage the reactor in a manner which could result in the postulated reactivity insertions.

Based on the structural analysis, modifications will be performed which will satisfy the recommendation presented in the report. Upon completion of these modifications there will be no credible mechanism resulting from the postulated seismic event which could result in reactivity insertions.

KESTUTIS DOVYDAITIS STRUCTURAL ENGINEER

TELEPHONE 408/297-5620
1180 COLEMAN AVENUE
SAN JOSE, CALIFORNIA, 95110

Novem - 19, 1977

General Electric Company
Vallecitos Nuclear Center
Pleasanton, California 94566

SUBJECT: SEISMIC ANALYSIS OF NUCLEAR TEST REACTOR CELL/ROOM AND MAJOR SHIELDING COMPONENTS.

Gentlemen:

In accordance with your request, I have performed the subject analysis. The accompanying report presents the results of the analysis and specific recommendations for reifo-cement of some of the components.

If you have any questions, please call me at your conveniece.

Very truly yours

Kestutis Dovydaitis

Kestutis Dovydaitis

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INTRODUCTION

In this report we present the analysis of the response of the NTR Cell/Room and major shielding components to an earthquake represented by the Response Spectra shown on sht. 26.

The Cell/Room containing the NTR is shown and analyzed in sheets 1 thru 6. This room will survive an earthquake represented by the spectra on sht. 26. Although this spectra is not of sufficient magnitude to force the bridge crane inside the NTR room to jump off its tracks, a fix to prevent this possibility is shown on sketch NO.1, sht. 7.

There is a water tank adjacent to the NTR which would overturn @ 0.8g unless the bracing shown on sht. 9 is added and the existing top plate is bolted to the tank.

The existing lead shielding in front of the tank is adequately supported, see sht's 10 thru 13.

The existing concrete shielding on top of the NTR is adequately supported, see sht's 14 thru 16, but one of the connectons of the support to the Cell/Room walls has to be reinforced see sht. 17.

The secondary support plate for the NTR control rods has to be braced to the main plate to prevent it from moving relative to the rest of the adjacent structure, see sht. 18 for additional braces.

KESTUTIS DOVYDAITIS
CIVIL AND STRUCTURAL ENGINEER

BY K.D. DATE 11/12/77 SUBJECT NTR @ V.N.C. SHEET NO. 1 OF
CHKD. BY DATE ROOM STRUCTURE JOB NO. 7782

THE NUCLEAR TEST REACTOR (NTR) IS LOCATED IN A 21' x 23' ROOM IN BUILDING 105 @ Vallecitos N.C. THE ROOM WALLS ARE 4' to 5' THICK & WERE DESIGNED BY BECHTEL CORP. IN 1956. A 3' THICK ROOF STRUCT. WAS ADDED IN 1963 (Kirk McFarland Job № 6234)

FOR DETAILS OF THE STRUCTURE SEE BECHTEL DRAWING 2462-2C-103A & 104A & McF. Job 6234

FOR THE GENERAL LAYOUT & DIMENSIONS SEE ATTACHED SKETCHES

WALL STRUCTURE

Max. Wall Span = 23 (horiz) Clr. Wall Wt. ≈ 4' x 25 $^{\#}/_{ft^3}$ = 1.0 $^{k}/_{ft^2}$ = 83 $^{\#}/_{in}$

Assuming wall fixed between corners calculate natural period

$\omega = \frac{3.25\pi^2}{\ell^2}\sqrt{\frac{EIg}{w}}$; $I = \frac{bd^3}{12} = \frac{12 \times 48^3}{12} = 110{,}592\ in^4$ $EI = 3.32 \times 10^{11}\ \#\text{-}in^2$

$\omega = \frac{3.25\pi^2}{(12 \times 23)^2}\sqrt{\frac{3.32 \times 10^{11} \times 384}{83}} = 360\ ^{rad}/_{sec} \div 2\pi = 57.3\ cps = f$ $T = 0.017\ sec.$

∴ BUILDING WILL ACCELERATE WITH THE GROUND @ 0.8g

lateral $v = .80w = .80\ ^{k}/_{'}$ $M \approx \frac{w\ell^2}{10} = .80 \times \frac{23^2}{10} = 42^{\,\prime\text{-}k}$

Req'd $A_s = \frac{42}{1.76 \times 45''} = 0.53\ in < 0.66\ in^2$ #6 @ 8" EA. WAY OK

The above analysis assumes the wall acts as a one way strip beam. The actual wall will span two ways and be stronger than the above analysis indicates

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CIVIL AND STRUCTURAL ENGINEER

ROOF STRUCTURE:

WT. OF ROOF ≈ AVE THK'NESS ≈ 3.2' × .15 K/ft³ = .48 KSF × 26.5 × 27.5 = 350 K

LATERAL LOAD ON ROOF FROM 0.8g = 350K × .8 = 280K

CONTACT AREA (ROOF TO TOP OF WALLS) = (26.5 × 5.5) + (22' × 2.5')
AREA = 200.75 ft² × 144 = 28,908 in²

SHEAR @ JNT (ROOF TO TOP OF WALLS) = $\frac{280,000}{28,908}$ = 9.7 psi

USUAL ALLOW. SHEAR (GROUT & CONC. BLK.) ≈ 17 psi × 4/3

CALC. PERIOD OF ROOF BM: $\omega_1 = \frac{\pi^2}{\ell^2}\sqrt{\frac{EI \cdot g}{w}}$ = circ. freq.

ROOF Δ, BM., ROOF UNIFORM

$W_{AVE} = \left(.48^{KSF} \times \frac{13.7'}{3} \times \frac{1}{2}\right) + \left(2.5' \times 3.5' \times .15^{KCF}\right) + \left(\frac{6.8}{2} \times .48^{KSF}\right) = 4.59$ K/'
= 382 #/in

$I \approx \frac{42 \times 42^3}{12} = 2.6 \times 10^5$ in⁴ EI = 3×10⁶ × 2.6 × 10⁵ = 7.78 × 10¹¹ in²-#

$\omega_1 = \frac{\pi^2}{(12 \times 22)^2}\sqrt{\frac{7.78 \times 10^{11} \times 384}{382}}$ = 125 rad/sec = 19.9 cps = f

T = 1/f = 0.05 sec. LATERAL ACC. ≈ 0.9 g
VERTICAL ACC = 0.9 × 2/3 = .6 g + WT.

∴ W_Δ = .48 × 1.6 × $\frac{13.7}{4}$ × 22' = 57.9K W_{UNIF} = 2.95 K/' × 1.6 × 22 = 103.7K
M = (57.9 × 22' ÷ 6) + (103.7 × 22 ÷ 8) = 497 '-K
$A_{s\ REQ}$ = 497 ÷ 1.76 (40") = 7.1 in² < 10.16 in²
@ 60% YIELD 8-#10's OK FOR 1.6 g ↓

CHECK 1962 McFARLAND DESIGN FOR 1.6 g ↓:

ROOF SLAB MAX. SPAN = 13.7', W_g = .48 × 1.6 = .77 K/ft² $M = \frac{.77(13.7)^2}{8}$ = 18.0 '-K

MIN REQ A_s = 18.0 ÷ 1.76(33) = 0.31 in² ≈ .30 f_s = 60% YIELD ✓
#4 @ 8 OK ✓ EXIST'G SLAB OK @ 1.6 g ↓

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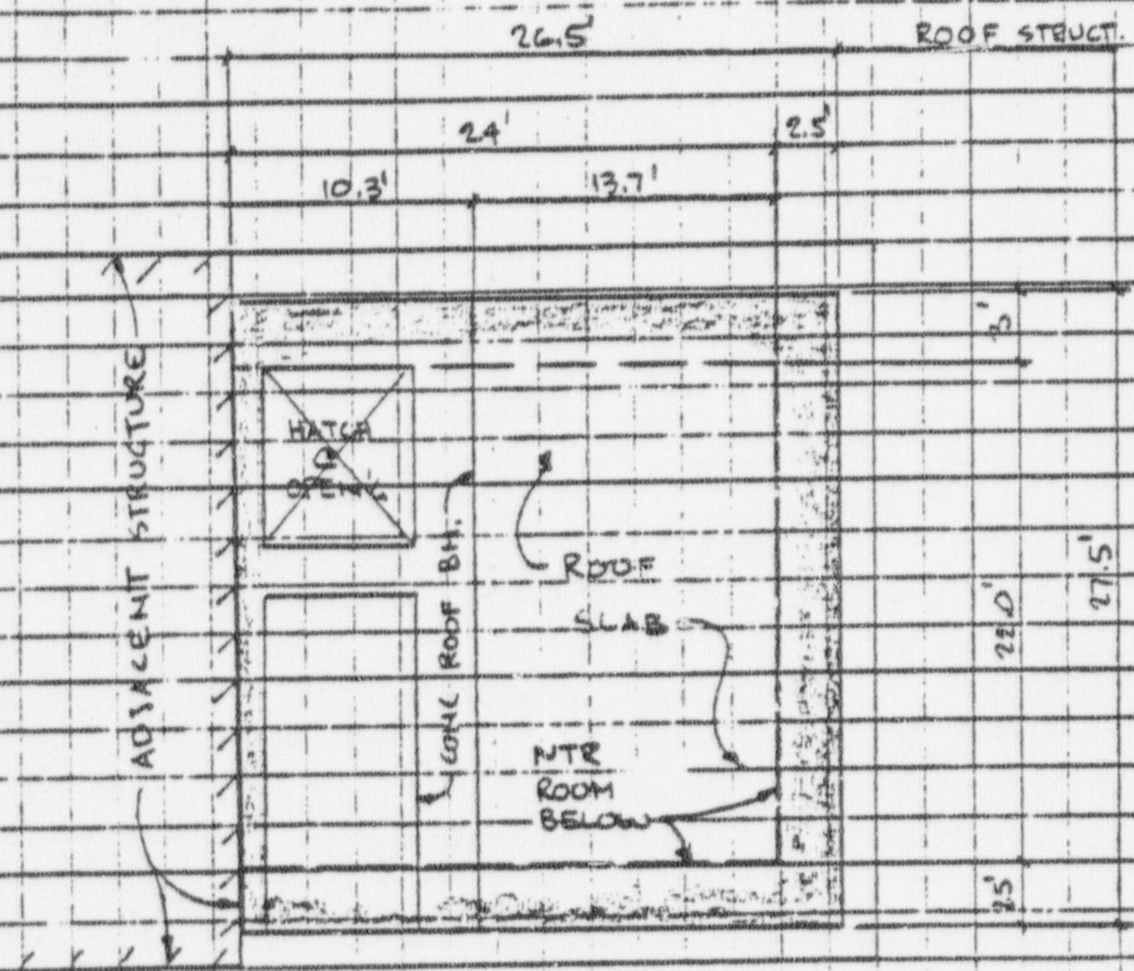
BY KD DATE 11/12/77 SUBJECT NTR CVNC SHEET NO. 3 OF
CHKD. BY DATE JOB NO. 7782
ROOM STRUCTURE



ROOF PLAN

N. T. R. ROOM

SCALE 1/8" = 1'-0"

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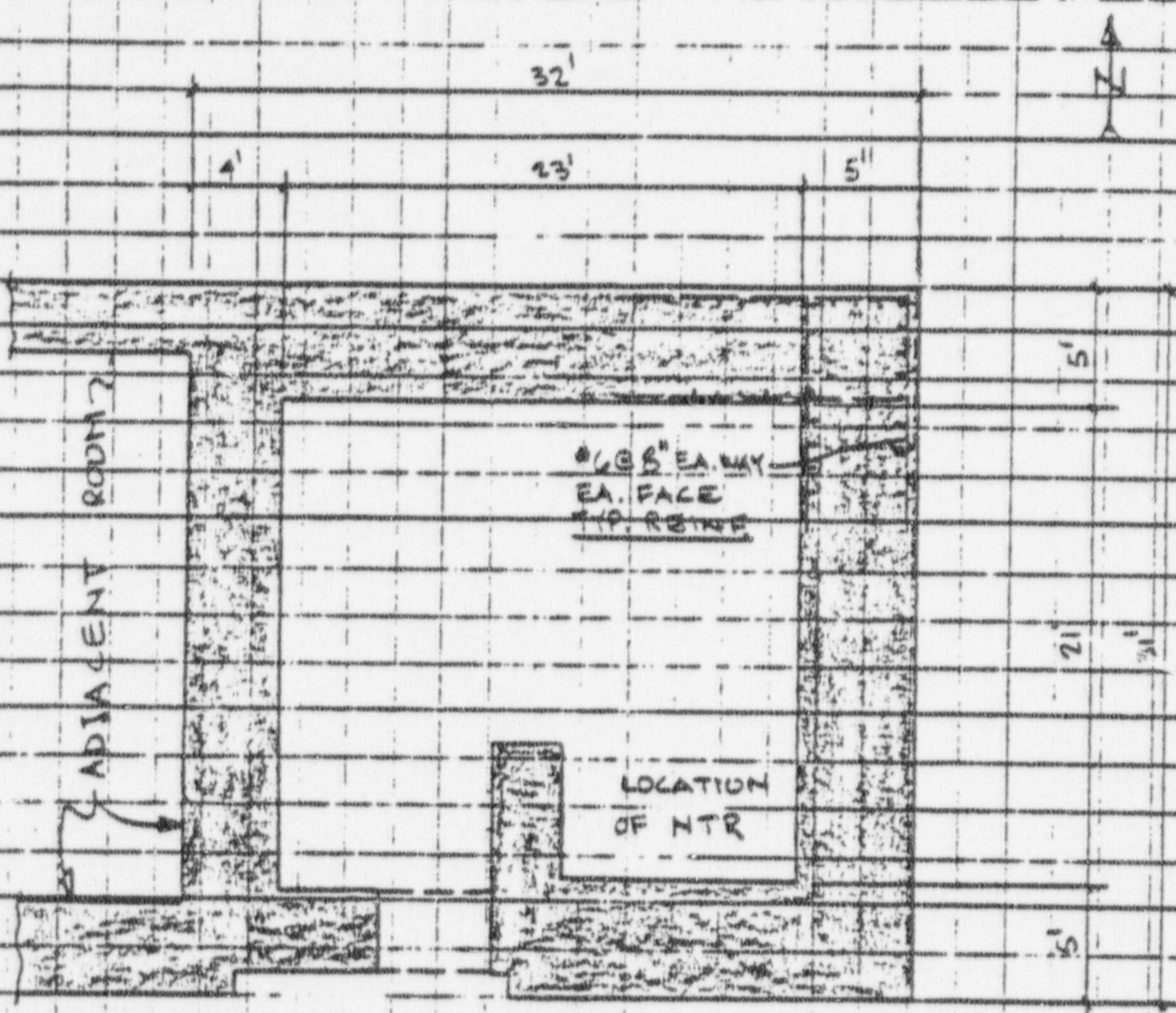
BY KD DATE 11/12/77 SUBJECT NTR @ VNC SHEET NO. 4 OF
CHKD. BY DATE JOB NO. 7782
ROOM STRUCTURE



PLAN SECTION

N.T.R. ROOM

SCALE 8' = 1'-0"

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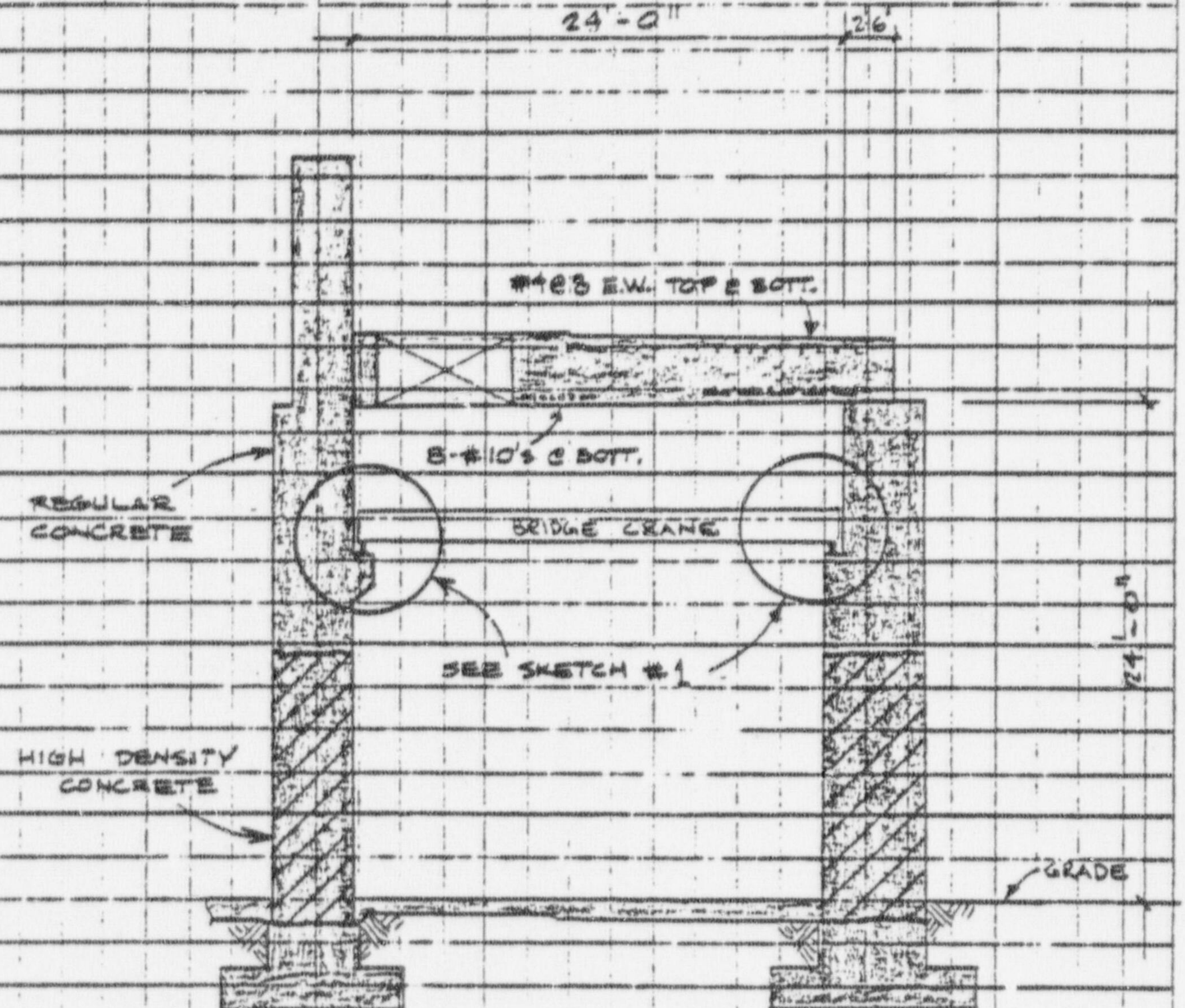
BY KD DATE 11/12/77 SUBJECT NTR @ VNC SHEET NO. 5 OF
CHKD. BY DATE JOB NO. 7732
ROOM STRUCTURE



EAST-WEST SECTION

N.T.R. ROOM

SCALE 1/8"=1'-0"

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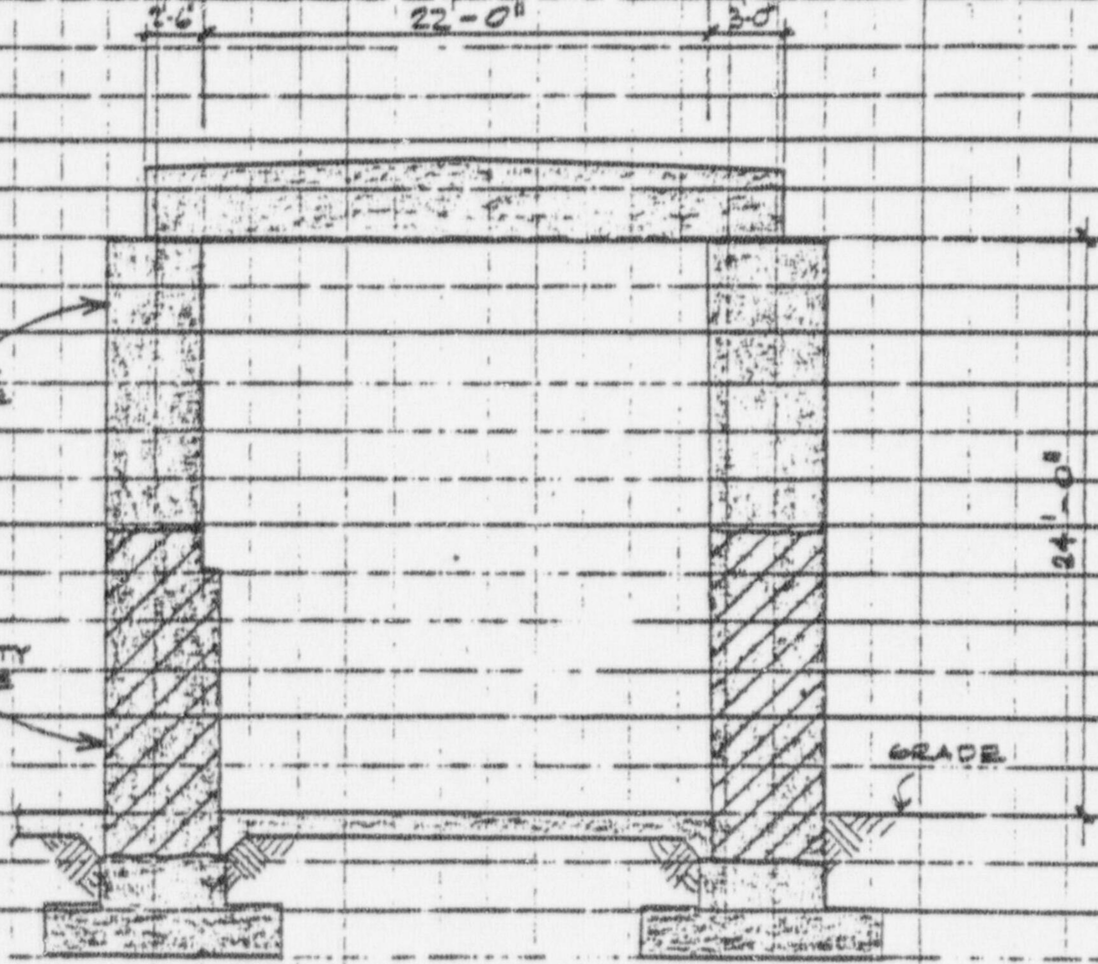
BY K.D. DATE 11/12/77 SUBJECT NTR @ VNC SHEET NO. 6 OF
CHKD. BY DATE JOB NO. 7782
ROOM STRUCTURE



NORTH - SOUTH SECTION

N.T.R. ROOM

SCALE 1/8" = 1'-0"

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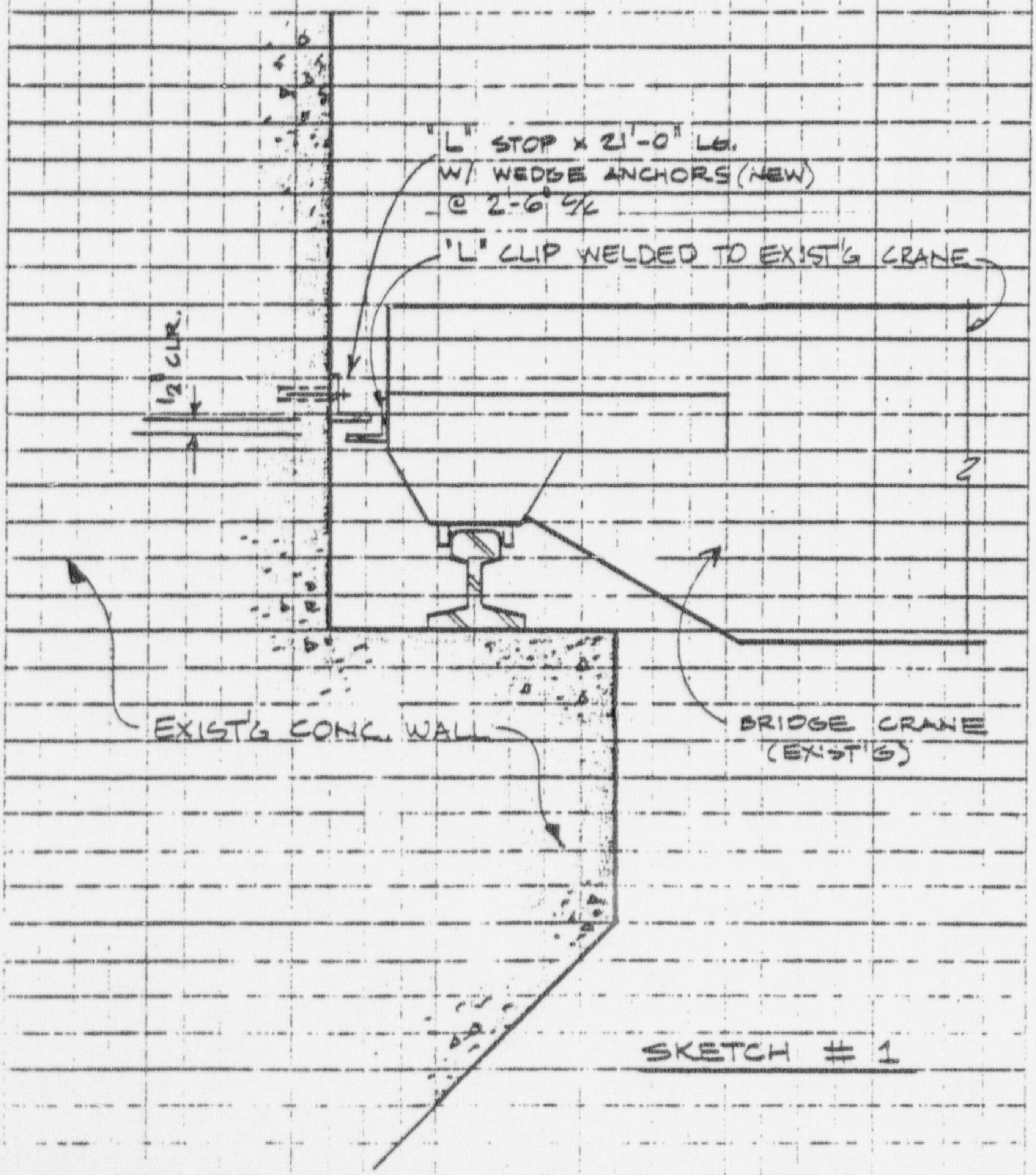
BY GR DATE 11/16/77 SUBJECT NTR @ VNC SHEET NO. 7 OF
CHKD. BY K.D. DATE 11/17/77 JOB NO. 7782
BRIDGE CRANE FIX



SKETCH # 1

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BY GR DATE 11/15/77 SUBJECT NTR @ VNC SHEET NO. 8 OF
CHKD. BY K.D. DATE 11/17/77 JOB NO. 7782
STORAGE TANK

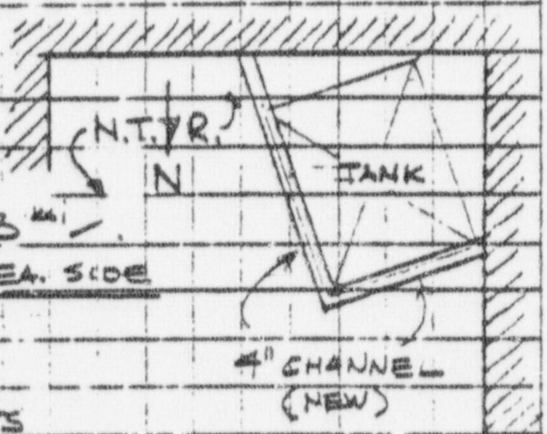
ANALYSIS BASED ON G.E. DWG # 338 D 636

WEIGHTS: TANK – 3.35' × 4.24' × 11.33'

WATER:	@ 62.4 #/ft³ × 161 ft³	=	10,050#
Al. TANK:	(3/16 WALL) @ 2.6 psf × 11.33 [6.7' + 8.5']	=	450
TOP:	(3/8 TH'K) @ 5.2 psf × 4.67' × 3.07'	=	75
L's 2×2×1/4 @	1.4 #/1 × [6.7' + 8.5'] × 16	=	350
		≈	11,000#

TOTAL $V_{seismic} = .8\,(11.0^k) = 8.8^k$

TOP CONN. TO WALLS:



$V_{TOP} = 8.8^k \div 2 = 4.4^k$

CONNECT FREE TOP PL. TO TANK:

PL. SHEAR = $4.4^k \div 5$ bolts = .88 k/bolt

3/8"φ MB's $V_{bolt} = .88^k \div .078\,in^2 = 11.3$ ksi ✓

BOLT TOP PL. TO TANK W/ 5-3/8"φ MB's/EA. SIDE AROUND ENTIRE PERIMETER

CONN. TO WALL: 2-5/8"φ DYNABOLTS

$T_{bolt} = 4.4^k \div 2 = 2.2^k$/bolt

$T_{FAILURE} = 5.1^k$ MARGIN OF SAFETY = $\frac{5.1}{2.2} - 1 = 1.3$ OK ✓

END PL'S:

$M = \frac{4.4^k}{2} \times (3.75" - 2") = 3.85$ "-k

FOR $f_b = 20$ ksi $t^2 = \frac{M \times 6}{f_b\,(b)} = \frac{3.85 \times 6}{20\,(2.5)} = 0.462$ $t_{REQ} = 0.68$ in

USE 3/4" END PL

BOTT. CONN. – BM's & FLR:

SHEAR/BOLT = $4.4^k \div 8 = 0.55$ k/bolt $f_v = \frac{.55}{.068} = 8.1$ ksi 3/8"φ MBs OK ✓

GROUT CONTACT AREA = (3" × 60" × 2) + (3" × 37" × 5) = 915 in²

GROUT SHEAR STRESS = 4,400# ÷ 915 = 4.8 psi < 17 psi × 4/3 ✓

BOTT. CONN. OK AS IS ✓

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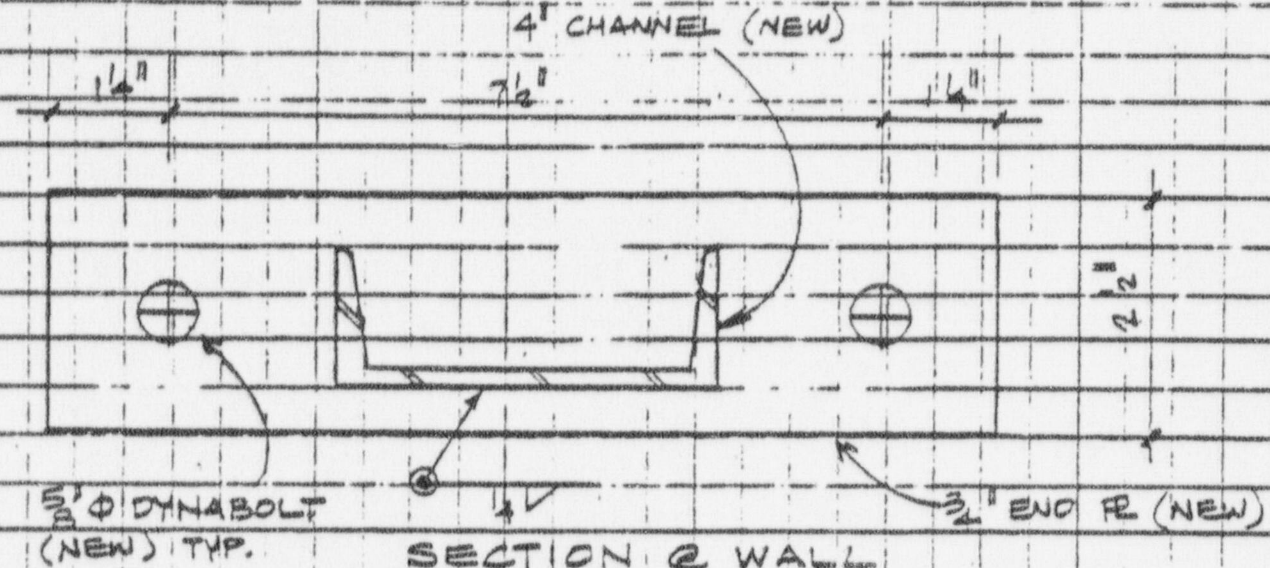
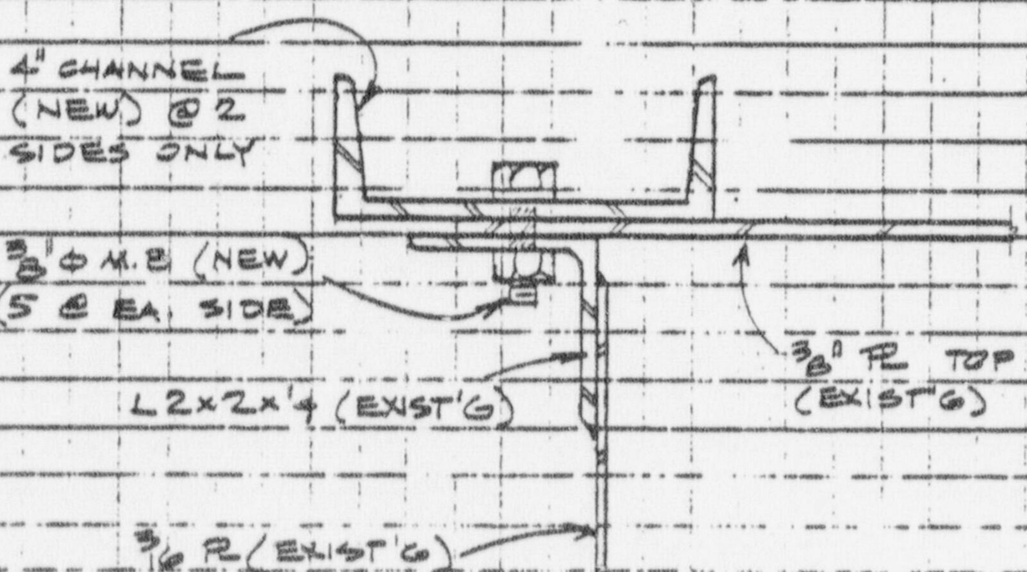
BY GR DATE 11/16/77 SUBJECT NTR @ VNC SHEET NO. 9 OF
CHKD. BY K.D. DATE 11/17/77 JOB NO. 7782
STORAGE TANK TOP BRC'G



SECTION @ WALL

HALF SCALE



SECTION @ TANK

HALF SCALE

SKETCH No 2

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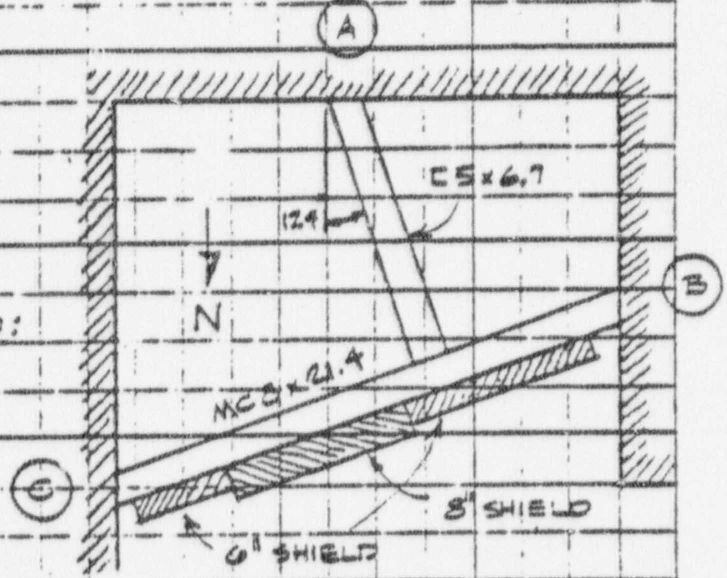
BY GR DATE 11/15/77 SUBJECT NTR @ YNC SHEET NO. 10 OF
CHKD. BY K.D. DATE 11/17/77 JOB NO. 7782
LEAD SHIELD'G SUPPORT FRM

ANALYSIS BASED ON G.E. DW'G NO. SK-RML-C1444



PROPERTIES OF LEAD:

YIELD 1200 psi

ULTIMATE 2400 psi

E = 2.5 × 10^6 psi

CALC. PERIOD OF 6" SHIELD:

$w \approx .35^k/ft = 30^{\#}/in$; SPAN = 5.2'

$I = 12'' \times 6^3 \div 12 = 216\ in^4$

$S = 72\ in^3$

$$\omega_n = \frac{\pi^2}{\ell^2}\sqrt{\frac{EI}{m}}$$

$$\omega_1 = \frac{\pi^2}{63^2}\sqrt{\frac{2.5\times10^6\ \#/in^2 \times 216\ in^4 \times 384\ in/sec^2}{30\ \#}} = 210\ rad/sec$$

$f = 210 / 2(\pi) = 33.5$ cps $T = 1/f = 0.030$ sec

∴ ACC. = 0.8 g

CHECK BEND'G IN LEAD SHIELD: (6" THICK @ .8g)

$M = w\ell^2 \div 8 = .35 \times 5.2^2 \times 12 \div 8 = 14.2''$-k

$f_b = 14.2 \div 72 = 197$ psi ÷ 1200 psi = 16% YIELD ✓

WEIGHT OF 8" LEAD SHIELD (4.0' × 5.5')

MC 8 × 18.7 × 2 (4.0 + 5.5) = 355#

½" PL @ 20.4 psf × 2 (4.0 × 5.5) = 900#

LEAD @ 710 pcf × .67 × 4.0 × 5.5 = 10,465#

11,720# ÷ 4.0' = 2930 #/ft

WEIGHT OF 6" LEAD SHIELD (2.0' × 5.5')

MC6 × 15.1 × 2 (2.0 + 5.5) = 230#

½" PL @ 20.4 × 2 (5.5) = 225

LEAD @ 710 pcf × .5 × 2.0 × 5.5 = 3905

4,360# ÷ 2.0' = 2180 #/ft

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CIVIL AND STRUCTURAL ENGINEER

BY GR DATE 11/15/77 SUBJECT NTR @ VNC SHEET NO. 11 OF
CHKD. BY K.D. DATE 11/17/77 JOB NO. 7782
LEAD SHIELD'G SUPPORT FR'M

CHECK BOLT'D CONN @ TOP OF SHIELDS:

8" SHIELD → $V = .8(11.7^k \div 2) = 4.68^k$

$P_{bolt} = 4.68 \div 5 = .94^k/bolt$

$T_{bolt} = .94 \div .078 in^2 = 12^{ksi}$ ✓

6" SHIELD → $V = .8(4.4^k \div 2) = 1.76^k$

$P_{bolt} = 1.76^k \div 3 = .59^k/bolt$ 3/8" ⌀ M.B's OK

$T_{bolt} = .59 \div .078 in^2 = 7.6^{ksi}$ ✓

(SAME NO. OF BOLTS @ BOTT. CONN. ∴ OK AS IS) ✓

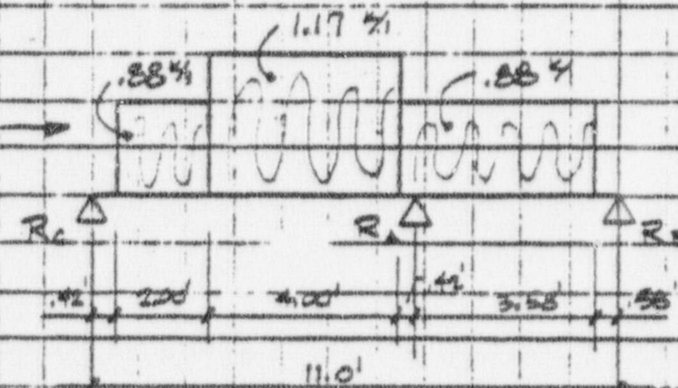
CHECK MC 8×21.4 BM:

8" SHIELD $\omega = 4.68^k \div 4.0' = 1.17^k/ft$

6" SHIELD $\omega = 1.76^k \div 2.0' = .88^k/ft$

BM. SPAN = 11.0'

LATERAL LOADS @ 0.8g →



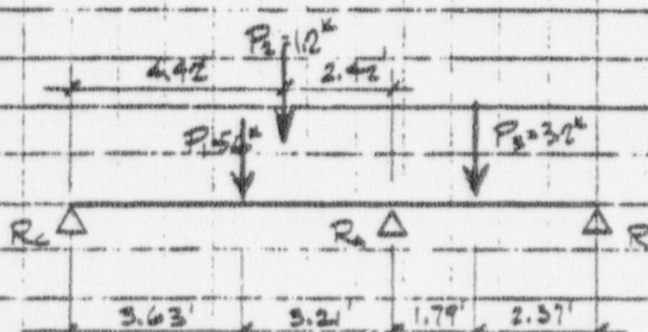
EQUIV. PT. LOADS:

$P_1 = .88 \times 6.42 = 5.6^k$

$P_2 = (1.17 - .88) \times 4.0 = 1.2^k$

$P_3 = .88 \times 3.58 = 3.2^k$

10^k



FIXED END MOMENTS:

P_1 $FEM_c = 5.6^k(3.63)(3.21)^2 \div (6.84)^2 = 4.48'^{-k}$

$FEM_A = 5.6^k(3.63)^2(3.21) \div (6.84)^2 = 5.06$

P_2 $FEM_c = 1.2^k(4.42)(2.42)^2 \div (6.84)^2 = .66$

$FEM_A = 1.2^k(4.42)^2(2.42) \div (6.84)^2 = 1.21$

P_3 $FEM_A = 3.2^k(1.79)(2.37)^2 \div (4.16)^2 = 1.86$

$FEM_B = 3.2^k(1.79)^2(2.37) \div (4.16)^2 = 1.40$

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CIVIL AND STRUCTURAL ENGINEER

BY GR DATE 11/15/77 SUBJECT NTR @ YNC SHEET NO. 12 OF
CHKD. BY K.D. DATE 11/17/77 JOB NO. 7782
LEAD SHIELD'G SUPPORT FR'M

CHECK MC8×21.4 BM. (CONT.)

$STIFF_{CA} = 1/? = .146$ $STIFF_{AB} = 1/4.16 = .240$

$DISTRIB_{CA} = .146 \div .386 = .38$ $DISTRIB_{AB} = .62$

MOMENT DISTRIBUTION

(C)	6.84	(A)		4.16	(B)
		.38	.62		
4.48 1-k		-5.06 1-k			
.66		-1.26			
5.14		-6.27	1.86		-1.40
-5.14		-2.57	.70		+1.40
0		-8.84	2.56		0
		2.39	3.89		
		-6.45 1-k	6.45 1-k		

$R_C = \frac{1}{6.84}\left[(5.6^k \times 3.21) + (1.2^k \times 2.42) - 6.45\right] = 2.11^k$

$R_B = \frac{1}{4.16}\left[(3.2^k \times 1.79) - 6.45\right] = -0.17^k$ $\Sigma R = 10^k$ ✓

$R_A = (5.6 + 1.2 + 3.2 + .17) - 2.11 = 8.06^k$

MAX M_{CA} (@ V=0) $= 2.11^k \times 3.63' = 7.66^{1-k} \times 12 = 92^{''-k}$

$f_b = 92 \div 15.4\ in^3 = 6.0^{ksi}$ ✓

CHECK 2-5/8"Φ INSERTS @ (A):

$T_{INSERT} = 8.06^k \times \cos 17.4° \div 2 = 3.85^k/_{INSERT}$

$T_{FAILURE} \approx 6.2^k$ MARGIN OF SAFETY $= \frac{6.2}{3.85} - 1 = 0.61$ ✓

MARGINAL ?

IF INSERTS @ (A) FAILED:

$R_C = 1/11\left[(5.6 \times 7.37) + (1.2 \times 6.58) + (3.2 \times 2.37)\right] = 5.16^k$

$R_A = 10.0 - 5.16 = 4.84^k$

$M_{MAX} = 5.16^k \times 3.63' = 18.7^{1-k} \times 12 = 225^{''-k}$

$f_b = 225 \div 15.4\ in^3 = 14.6^{ksi}$ ✓ $F_b = \frac{12,000}{37 \times 4.42} = 47.6^{ksi}$

$V/_{INSERT}$ @ (C) $= 5.16^k \div 2 = 2.58^k$

$V_{FAILURE} = 10.5^k$ MARGIN OF SAFETY $= \frac{10.5}{2.58} - 1 = 3.0$ OK ✓

ALTHOUGH ADDITIONAL INSERTS ADDED, SEE SKETCH #1

KESTUTIS DOVYDAITIS
CIVIL AND STRUCTURAL ENGINEER

BY GR DATE 11/16/77 SUBJECT NTR @ VNC SHEET NO. 13 OF

CHKD. BY K.D. DATE 11/17/77 JOB NO. 7782

REACTOR & SHIELD SUPPORT

ANALYSIS BASED ON G.E. DRW'GS NO. 541 C 480 & SK·RML·D1455

LOADS ON SUPPORT:

BOTT. ½ OF LEAD SHIELDS: $.5\left[(3 \times 4.36^k) + 11.72^k\right] = 12.4^k$

REACTOR (CORE & GRAPHITE) $= 13.3^k$

MISC. $= 2.3^k$

28.0^k

$V_{seismic} = 0.8(28.0^k) = 22.4^k$

SEISMIC SHEAR TRANSFERRED TO FL'R SLAB THRU GROUT UNDER SUPPORT BM'S.

GROUT CONTACT AREA: (A_{MIN} @ BOTT. FL'G OF BM'S)

$144'' \times 3'' \times 2 = 864 \text{ in}^2$

$55'' \times 3'' \times 6 = 990$

$106'' \times 3'' \times 2 = 636$

2490 in^2

GROUT SHEAR STRESS = $22{,}400^\# \div 2490 \text{ in}^2 = 9.0$ psi

ALLOW SHEAR STRESS = $17 \text{ psi} \times 4/3 > 9.0$ ✓

EXIST'G SUPPORT OK ✓

KESTUTIS DOVYDAITIS
CIVIL AND STRUCTURAL ENGINEER

BY K.D. DATE 11/11/77 SUBJECT N.T.R. @ V.N.C. SHEET NO. 14 OF
CHKD. BY GR DATE 11/17/77 TOP SHIELD SLAB JOB NO. 7782
AND SUPPORT STRUCTURE General Electric

See attached McFarland calc's for reactions of Shielding Slab @ D.L. + 0.3g Lateral acceleration
See McFarland Job No 6503 drawings for design details

Check the McFarland design for D.L. + .5g Vert. + 0.8g Lateral by proportioning original design loads

Reactions @ (A) = Vertical $10.75^k \times 1.5g = 16^k$
Horiz. SHR $5.65^k \times \frac{.8}{.3} = 15^k$
Horiz. Pull $6.42 \times '' = 17^k$

Since the support brackets are loaded @ the bottom bearing plate only the bottom two inserts will resist the pull out force $= 17^k \div 2 = 8.5^k$/ea.
For the inserts specified the predicted minimum values at 99.5% probability are 8426# Tension & 12,445# Shear ("Dynaset" inserts by Ramset)

∴ FOLLOWING ANALYSIS ASSUMES THAT THE INSERTS @ (A) FAIL IN TENSION BUT STILL PROVIDE VERT. & LAT. RESTRAINT

Reactions @ (B) = Vertical $6.06^k \times 1.5g = 9^k$
Horiz. Shear $17^k \times 7/10.5 = 11.3^k$ from pull-out @ (A)

Reactions @ (C) = Vertical $7.67^k \times 1.5g = 11.5^k$
Horiz Shear $3.26^k \times .8/.3 = 8.7^k$ } 14.4^k Σ Horiz. Shear
" " $17^k \times 3.5/10.5 = 5.7$ } from pull-out @ (A)
Pull-out $4.05 \times .8^x/.3 = 10.8^k$

Calculate Period of Edge Bm for Lat. load from R_A $\Delta = \frac{Pa^2b^2}{3EIl}$

$\Delta = \frac{1^k 3.5^2 \times 7^2 \times 1728}{3 \times 1.43 \times 10^4 \times 105} = 2 \times 10^{-3}$ in/k $= 500^k$/in $= k$ $T = 2\pi\sqrt{\frac{W}{kg}} = 2\pi\sqrt{\frac{15^{k\,in\,sec^2}}{500^k \times 384\,in}}$
secht = 16

T = 0.07 sec ∴ lat load ≡ 1g on Edge Bm

REFER TO SHT. #26

KESTUTIS DOVYDAITIS
CIVIL AND STRUCTURAL ENGINEER

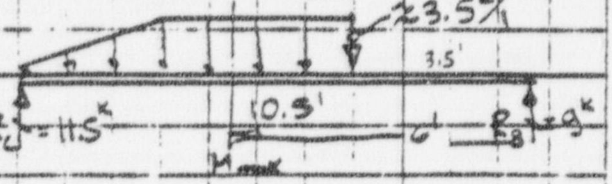
BY K.D. DATE 11/11/77 SUBJECT NTR @ VNC SHEET NO. 15 OF

CHKD. BY GR DATE 11/17/77 TOP SHIELD SLAB JOB NO. 7782

SUPPORT BEAM G.E.

EDGE SUPPORT BEAM (B) to (C) See Sht 16 for Sect. Properties

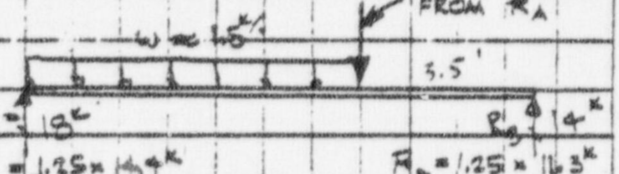
VERT. BENDING from D.L. + 0.5g



Max. $M_x = (9^k \times 6') - (3.5^{k/'} \times \frac{2.5^2}{2}) = 43^{'k}$

$f_b = \frac{43 \times 12}{48} = 10.8^{ksi} = f_x$ from 1.5 g Vert. Accel.

HORIZ. BENDING from 1.0g



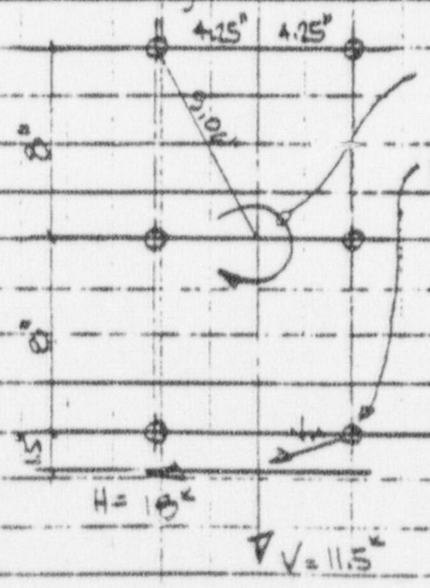
Max $M_y = 14^k \times 3.5' = 49^{'k}$

@ ↗ $M_x = 9^k \times 3.5' = 32^{'k}$

Max. COMBINED BENDING = $\frac{49 \times 12}{59.4} \pm \frac{32 \times 12}{48} = 18^{ksi}$ from 1.5g + 1g Lateral ✓

CHECK BM. SUPPORT @ (C) Pull-out = $\frac{10.8}{2} = 5.4^k < 8.4^k$ T_{ult}

ΣAr^2 for 6-Insert group = $(4 \times 9.06^2) + (2 \times 4.25)^2 = 364.5$ in²/in²



$M = 18^k \times 9.5" = 171^{"k}$ $V_H = \frac{171 \times 9.06}{364.5} = 4.25^k$

Max. Insert Shr. = $H = \frac{18}{6} + 4.25 \times \frac{8}{9.06} = 6.75^k$

$V = \frac{11.5}{6} + 4.25 \times \frac{4.25}{9.06} = 3.91^k$

Max. Shear = $\sqrt{6.75^2 + 3.91^2} = 7.8^k$

Combined Tension & Shr. = $\frac{5.4}{8.4} + \frac{7.8}{12.44} = 1.27$

Combined as √sum of sq. $\sqrt{(.64)^2 + (.627)^2} = 0.9$

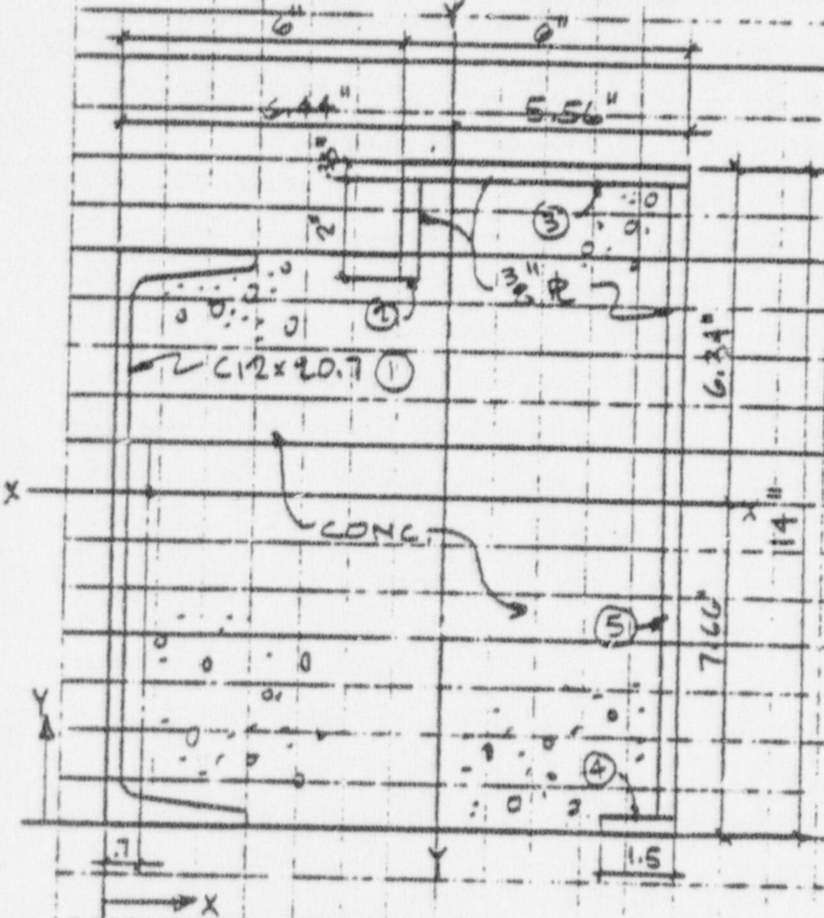
INSERTS @ (C) CLOSE TO FAILING

∴ REINFORCE CONN. @ (C) PER SKETCH No 3

KESTUTIS DOVYDAITIS
CIVIL AND STRUCTURAL ENGINEER

BY K.D. DATE 11/11/77 SUBJECT NTR @ VNC SHEET NO. 16 OF
CHKD. BY GR DATE 11/17/77 TOP SHIELD SLAB JOB NO. 7782
SUPPORT BEAM

SECTION PROPERTIES OF COMPOSITE BM.



CONSIDER ONLY STEEL FOR STRENGTH CALC'S
CONSIDER BOTH STEEL & CONC. FOR STIFFNESS

SEE McFARLAND JOB 6503 DET. 3/2 FOR MORE INFO. & DETAILS

$\bar{X} = \frac{94.2}{14.62} = 6.44"$

$\bar{Y} = \frac{112}{14.62} = 7.66"$

$I_{conc.} \approx \frac{bd^3}{12} \approx \frac{12^3}{12} = 1728 \text{ in}^4$

Conc. $EI_y = 3\times10^6 \times 1728 = 5.18\times10^9$

steel $EI_y = 29\times10^6 \times 382.5 = 11.09\times10^9$

16.3×10^9 #-in²

1.63×10^7 k-in²

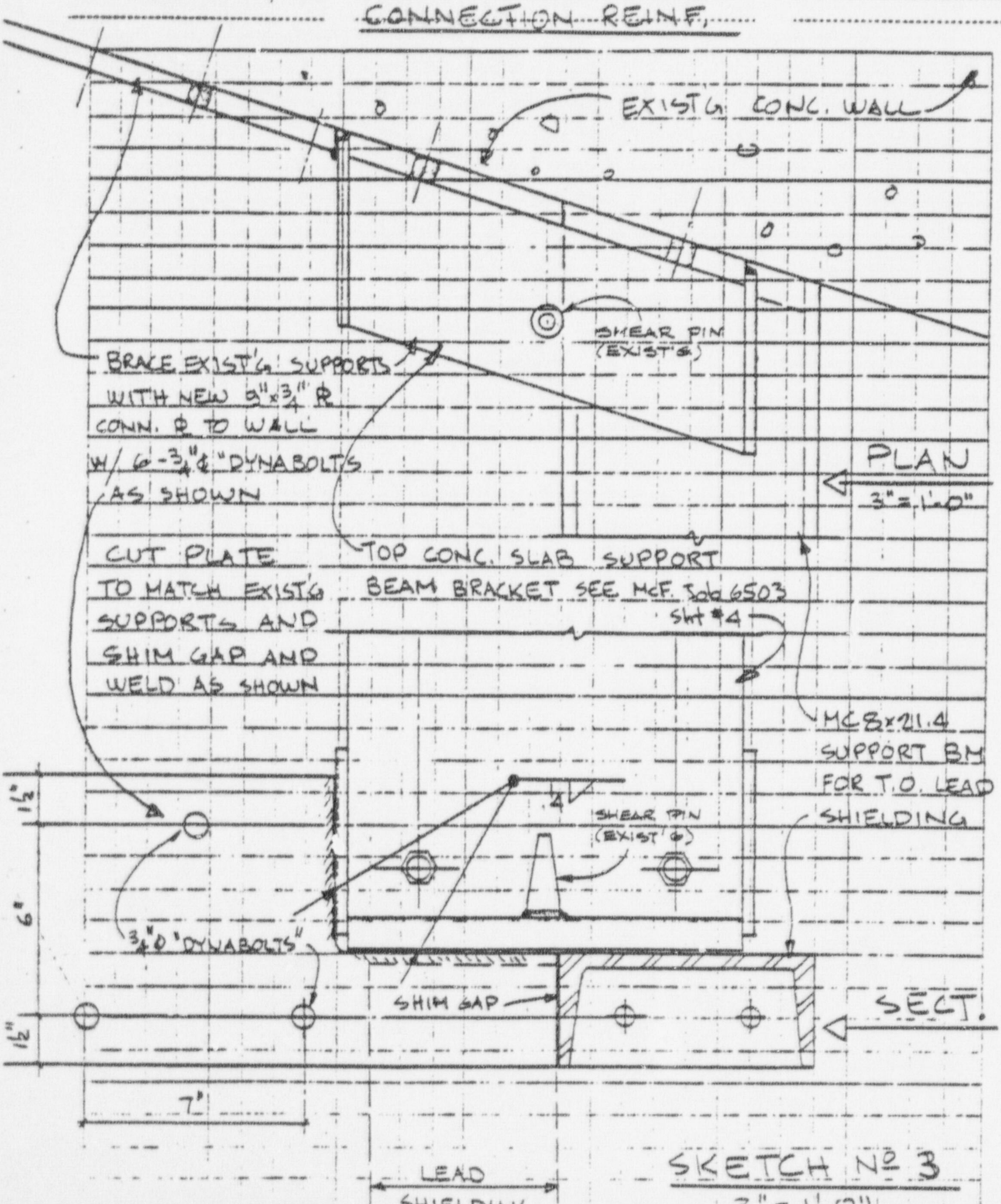
Elem. NO	Area	x	y	Ax	Ay	Ax^2	I_{yo}	Ay^2	I_{xo}
①	6.09	0.7	6.0	4.3	36.5	3.0	3.9	219.2	129
②	0.75	6.19	12.62	4.6	9.5	28.7	—	119.5	—
③	2.25	9.0	13.81	20.3	31.1	182.3	6.8	429.1	—
④	0.56	11.25	0.19	6.3	0.1	70.9	—	—	—
⑤	4.97	11.81	7.0	58.7	34.8	693.2	—	243.5	86
	14.62 in²			94.2	112.0	978.1	10.7	1011.3	215

$I_y = \Sigma Ax^2 + \Sigma I_{yo} - \Sigma A\bar{x}^2 = 382.5 \text{ in}^4 \quad S_{min} = \frac{382.5}{6.44} = 59.4 \text{ in}^3$

$I_x = \Sigma Ay^2 + \Sigma I_{xo} - \Sigma A\bar{y}^2 = 368.3 \text{ in}^4 \quad S_{min} = 368.3/7.66 = 48 \text{ in}^3$

KESTUTIS DOVYDAITIS
CIVIL AND STRUCTURAL ENGINEER

BY K.D. DATE 11/12/77 SUBJECT NTR @ VNC SHEET NO. 17 OF
CHKD. BY GR DATE 11/17/77 TOP SHIELD SUPPORT BM. JOB NO. 7782
CONNECTION REINF.

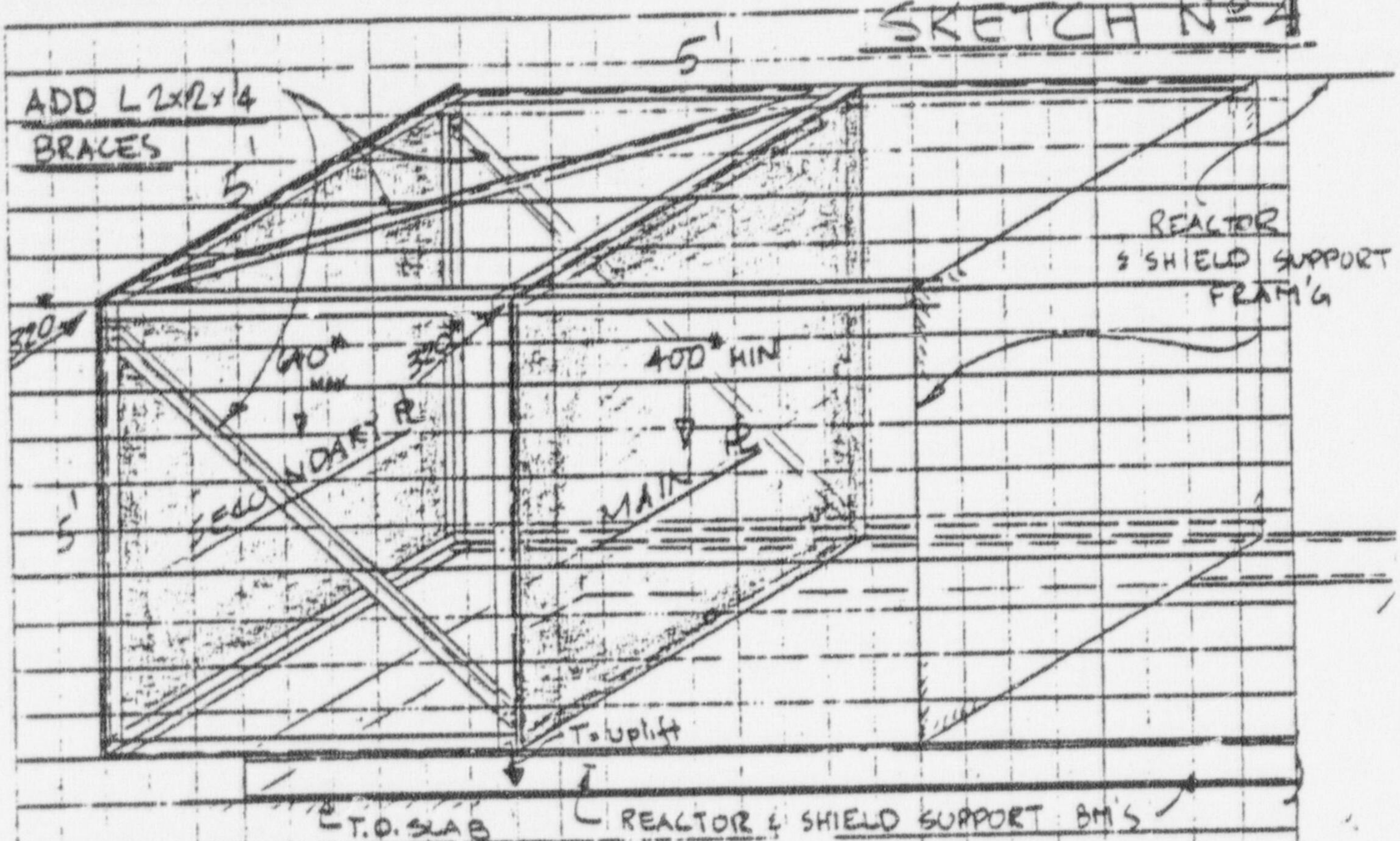


SKETCH № 3
3" = 1'-0"

KESTUTIS DOVYDAITIS
CIVIL AND STRUCTURAL ENGINEER

BY K.D. DATE 11/16/77 SUBJECT NTR @ VNC SHEET NO. 18 OF
CHKD. BY GR DATE 11/17/77 CONTROL ROD SUPPORT ℞'s JOB NO. 7782

SKETCH Nº 4



WT. OF ½" Alum. ℞ + fitting ≈ 11 psf × 5.5'² = 330# + 70# Misc = 400# Design Wt

Max. Vert. Load = wt + 0.6g t = 1.6g × 400# = 640#

Compression in new L2×2×¼ = $\frac{640}{2}$ ÷ cos45° = 453#

L buckling stress = $\frac{\pi^2 E}{(l/r)^2} = \frac{\pi^2 \times 10.5\times10^3}{(212)^2}$ = 2.35 ksi P_{allow} = 2.35 × .94 in² = 2210#

for new L2×2×¼ BRACES Margin of Safety = $\frac{2210}{453}$ − 1 = 3.88 ✓

Check Main ℞ for Overturning T = $\frac{2(320\times5) - (400\times2.5)}{5}$ = 440# uplift

for ⅜" φ M. BOLT $f_t = \frac{440\#}{.078 in^2}$ = 5.64 ksi $f_s = \frac{453\#}{.068 in^2}$ = 6.66 ksi SHEAR

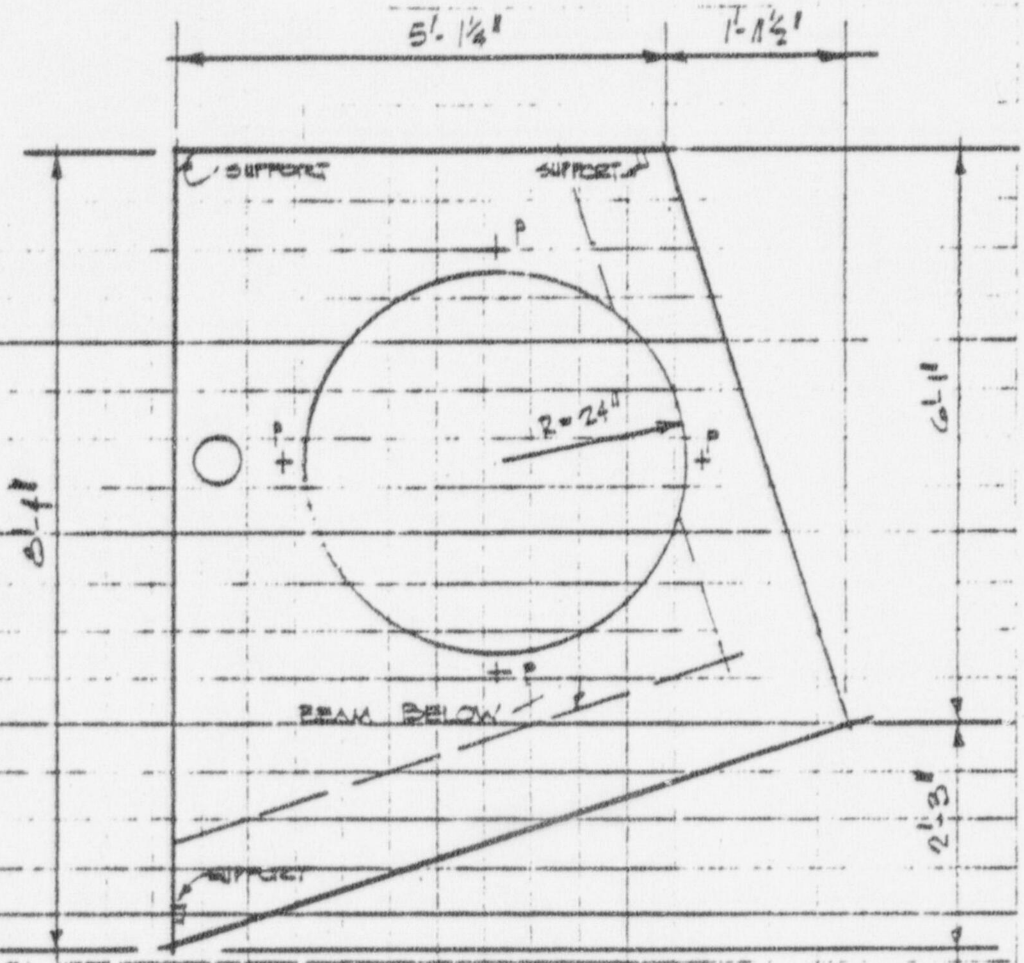
BRACE SECONDARY SUPPORT PLATE TO MAIN SUPPORT ℞ AS SHOWN; USE ⅜" φ M. BOLTS @ CONNECTIONS

FOR REF ONLY

SHT. # 19

KIRK C. McFARLAND, JR.
CIVIL AND STRUCTURAL ENGINEER

BY WK DATE 5-6-65 SUBJECT NTR SHIELDING SLAB SHEET NO. 6 OF 8
CHKD. BY KCM DATE JOB NO. 6503
G.E.



LOADING

275 lb/ft³ conc. P = 5000 lb.

$M = \frac{1.33 \times 275 \times 7^2}{8} + \frac{5000 \times 7}{4} = 2.25 + 8.75 \cong 11.00$ ft-kips

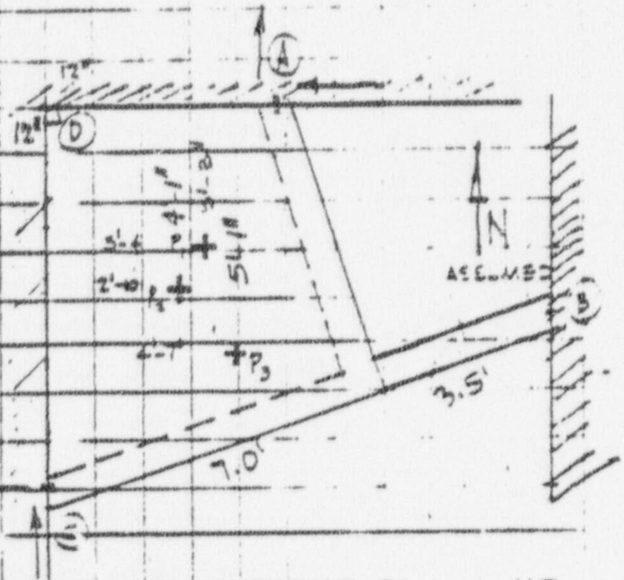
$S = \frac{M}{f} = \frac{11 \times 12}{22} = 6.0 \text{ in}^3$ USE 12 [20.7 @ ALL EDGES OF SLAB

ACT. $S = 21.4 \text{ in}^3$

FOR REF. ONLY

KIRK C. McFARLAND, JR.
CIVIL AND STRUCTURAL ENGINEER

BY WK DATE 5-5-65 SUBJECT NTR SHIELDING [illegible] SHEET NO. 7 OF 8
CHKD. BY KCM DATE .... JOB NO. 6502 GE



DESIGN CONNECTIONS TO WALL

$P_1 = 20000 lb.$

$P_2 = 8967 lb$

$P_3 = 3300 lb$

LATERAL EAST-WEST

$M_{A} = 20 \times 3.25 + 8.97 \times 4.07 + 3.3 \times 5.07 - 8 \times C$

$C = \frac{108.2}{8} = 13.5$ KIPS (PULL OUT)

$20 + 8.97 + 3.3 - 13.5 = A = 18.8$ KIPS (SHEAR)

LATERAL NORTH-SOUTH

$M_C = 20 \times 3.33 + 8.97 \times 2.83 + 3.3 \times 4.57 - 5 \times A$

$A = \frac{66.6 + 25.4 + 15}{5} = 21.4$ KIPS (PULL OUT) $C = 10.8$ (SHEAR)

A SHEAR = 18.8 × .3 = 5.65 KIPS A PULLOUT = 21.4 × .3 = 6.42 KIPS

C SHEAR = 10.8 × .3 = 3.26 KIPS C PULLOUT = 13.5 × .3 = 4.05 KIPS

VERTICAL

DISTANCE FROM LOADS TO SUPPORTS

LOAD	SUPPORT	DISTANCE	
P_1	A	3'-5"	20'-10"
P_1	B	7'-1"	
P_1	C	5'-8"	
P_1	D	4'-8"	
P_2	A	4'-5"	21'-6"
P_2	B	7'-7"	
P_2	C	4'-8"	
P_2	D	4'-10"	

FOR REF. ONLY

SHT. #2

KIRK C. McFARLAND, JR.
CIVIL AND STRUCTURAL ENGINEER

BY WK DATE 5-5-65 SUBJECT N.T.R. SHIELDING SLAB SHEET NO. 3 OF 8
CHKD. BY KCM DATE JOB NO. 6503
G.E.

REACTION TO (A) DUE TO $P_1 = \frac{.192}{.827}$ × 20 KIPS = 7.05 KIPS
" " (B) " " $= \frac{.143}{.827}$ × 20 KIPS = 3.46 KIPS
" " (C) " " " $= \frac{.176}{.827}$ × 20 KIPS = 4.25 KIPS
" " (D) " " " $= \frac{.216}{.827}$ × 20 KIPS = 5.24 KIPS
20.00 ✓

REACTION TO (A) DUE TO $P_2 = \frac{.226}{.779}$ × 8.967 KIPS = 2.61 KIPS
" " (B) " " " $= \frac{.132}{.779}$ × 8.967 KIPS = 1.53 KIPS
" " (C) " " " $= \frac{.214}{.779}$ × 8.967 KIPS = 2.46 KIPS
" " (D) " " " $= \frac{.207}{.779}$ × 8.967 KIPS = 2.38 KIPS
8.98 ✓

REACTION DUE TO BEAM WT. @ (A) $= \frac{.194}{.555}$ × 3.12 = 1.09 KIPS
" " " " " @ (B) $= \frac{.190}{.555}$ × 3.12 = 1.07 KIPS
" " " " " @ (C) $= \frac{.171}{.555}$ × 3.12 = .96 KIPS
3.12 ✓

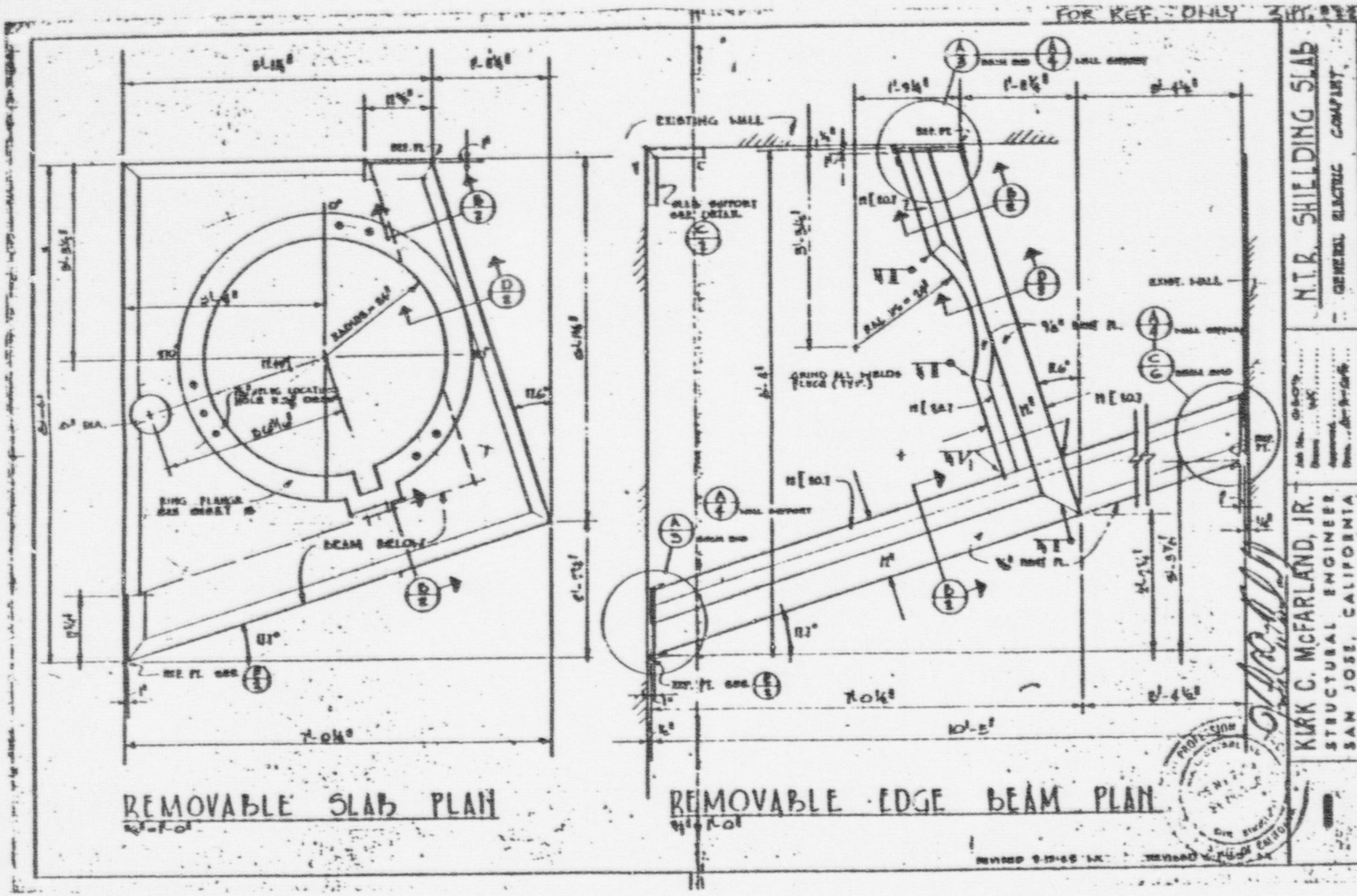
TOTAL LOADS ON SUPPORTS:

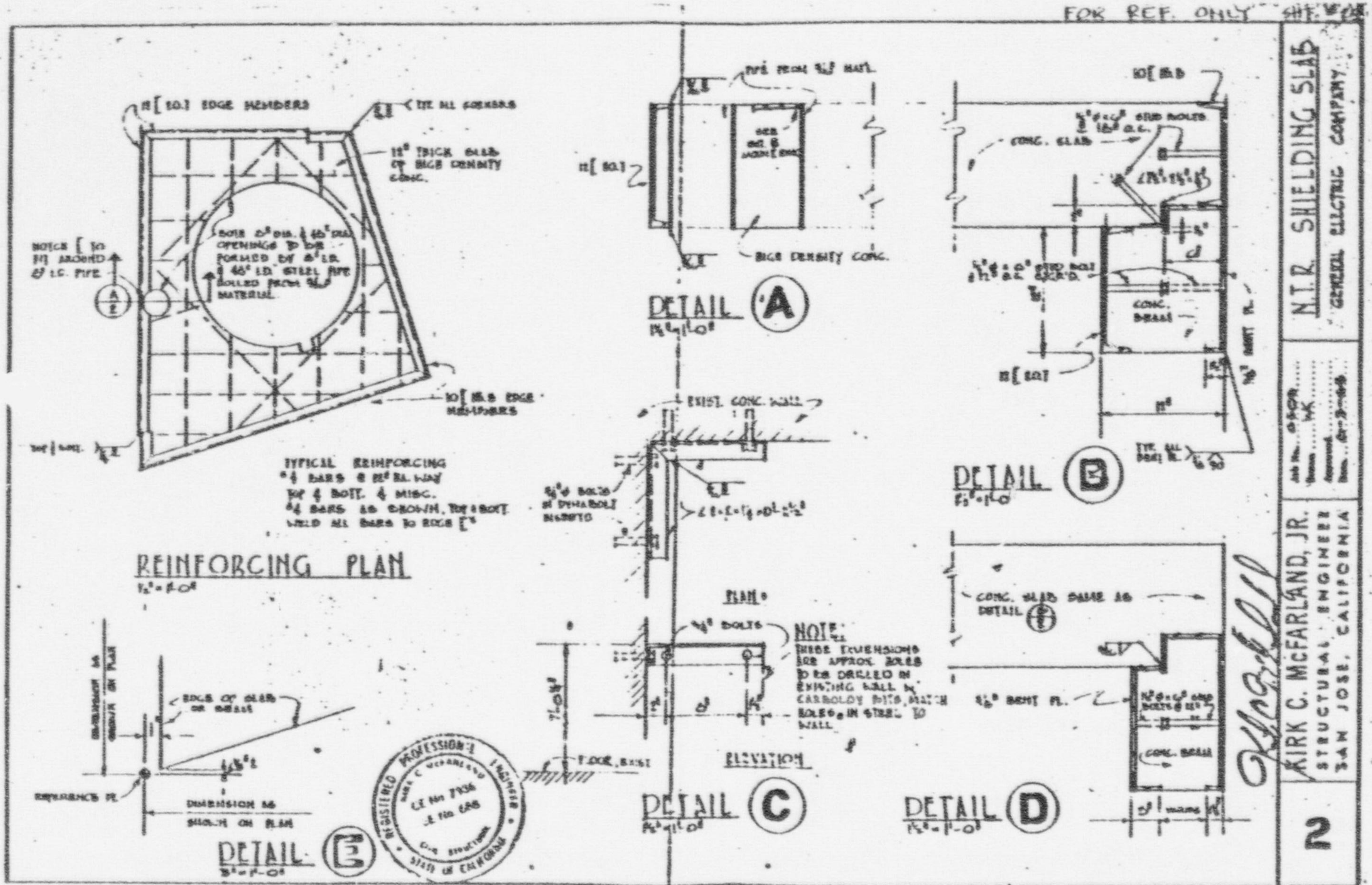
A = 7.05 + 2.61 + 1.09 = 10.75 KIPS
B = 3.46 + 1.53 + 1.07 = 6.06 KIPS
C = 4.25 + 2.46 + .96 = 7.67 KIPS
D = 5.24 + 2.38 = 7.62 KIPS

CONNECTION @ (A) PULL OUT = 6.42 KIPS SHEAR = 12.20 KIPS (VERT.+LAT.)
CONNECTION @ (B) VERTICAL = 6.06 KIPS
CONNECTION @ (C) PULL OUT = 4.05 KIPS SHEAR = 8.70 (VERT.+LAT.)
CONNECTION @ (D) SHEAR = 7.62 KIPS (VERT.)

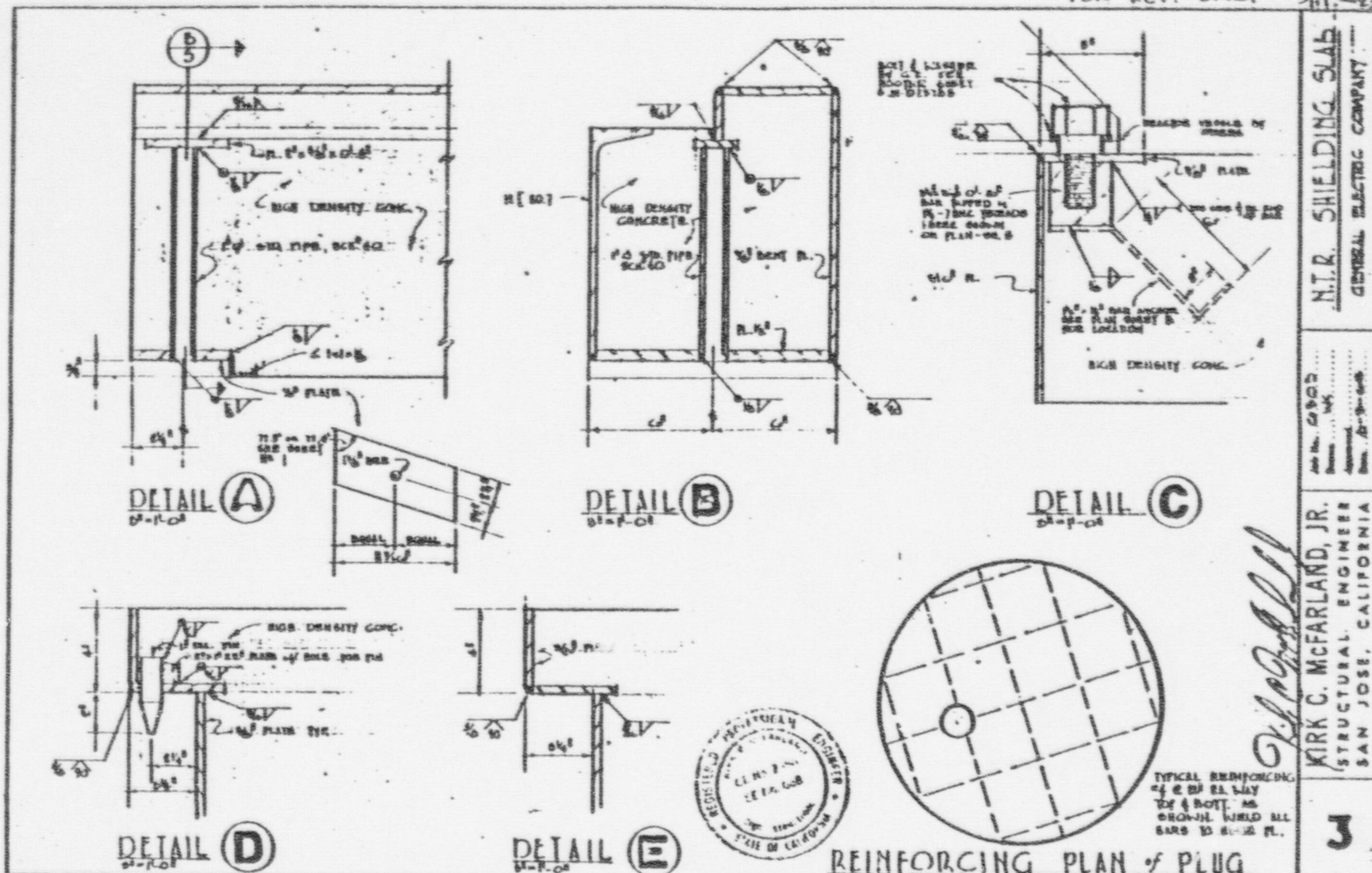
@A USE 7-5/8"Ø REDHEADS OR 5-3/4"Ø REDHEADS MIN.
@B USE 4-5/8" " OR 3 " " "
@C USE 6-5/8"Ø OR 5-3/4"Ø REDHEADS MIN.
@D USE 5-5/8"Ø OR 4-3/4"Ø REDHEADS MIN.

FOR REF. ONLY SHT. #2



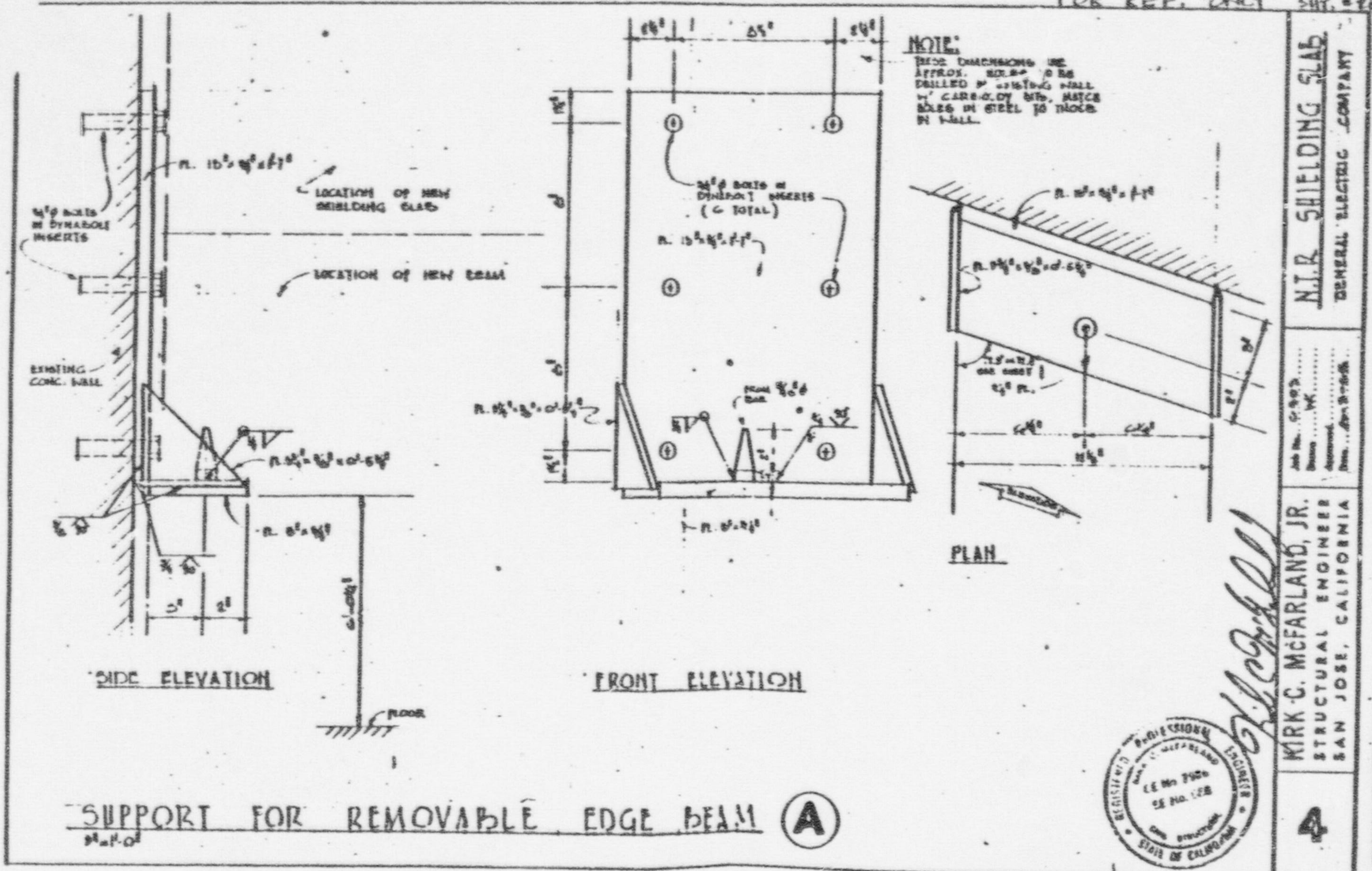


FOR REF. ONLY SHT. #2



FOR REF. ONLY SHT. "2"

FOR REF. ONLY SHT. #6



FOR REF. ONLY SHT. #2

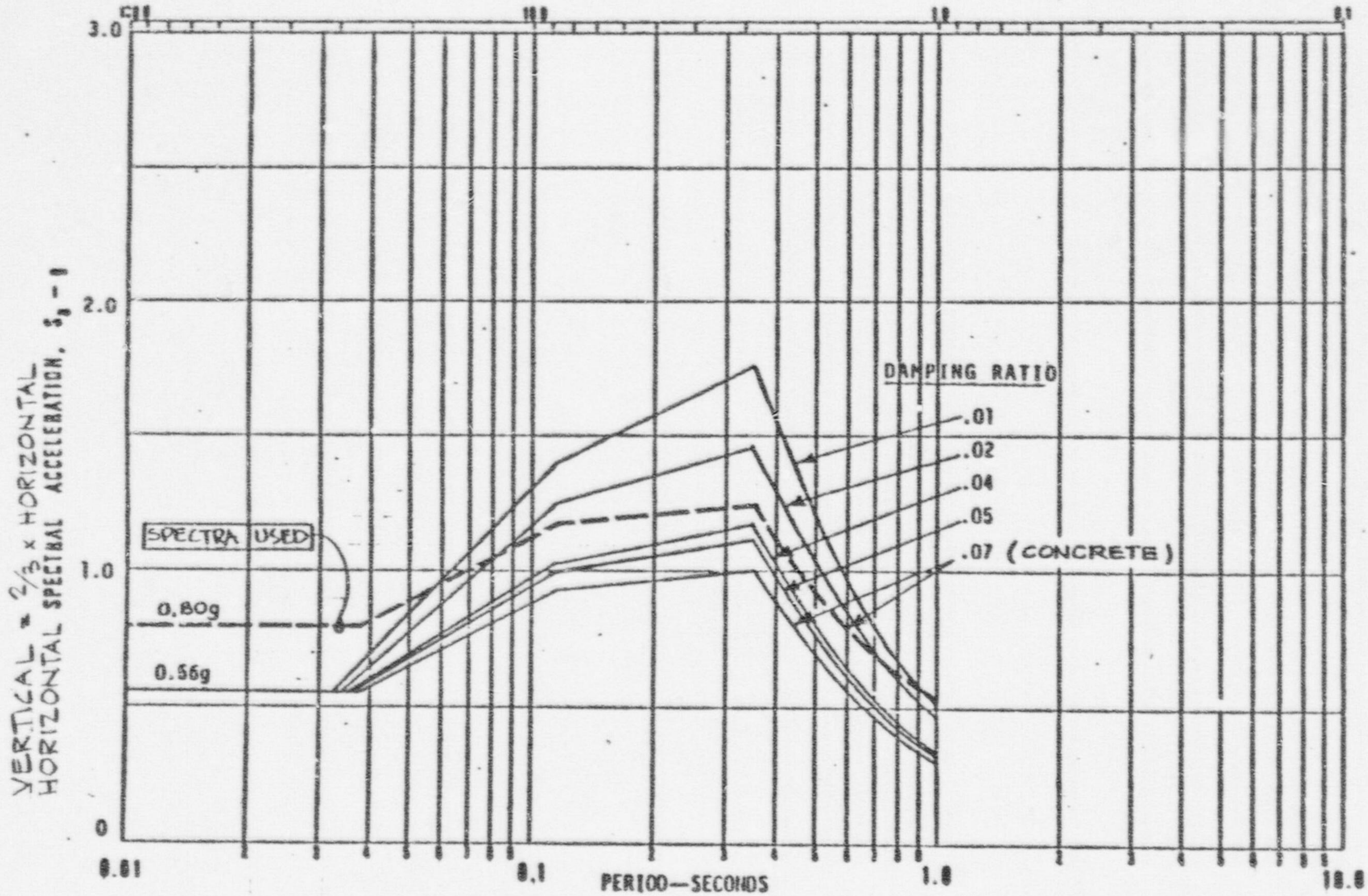


FIGURE 2.10 CRITERION EARTHQUAKE GROUND RESPONSE SPECTRA

EDAC

FOR REF. ONLY SHT. #26

ATTACHMENT B

CONFIRMATORY INFORMATION

ON THE

GENERAL ELECTRIC

NUCLEAR TEST REACTOR

Item 1. Provide an analysis that shows the fuel temperature will not exceed about $600^{O}F$ when excess reactivity equal to \$.80 is inserted into the core. The analysis should document the discussions of October 28, 1977, with regard to earthquake damage mechanisms and decay heat removal and present the scenarios which might lead to reactivity insertions.

Response:

A seismic analysis of the NTR cell and major components has been completed and submitted for NRC review and approval. Assessments indicate that failure of the reactor cell will not occur and only minor alterations or additions would be required to insure that no damage would occur to safety systems associated with the NTR. Nevertheless, even if catastrophic non-mechanistic failure of the NTR facilities is assumed, there are no potential consequences more severe than those associated with accidents previously analyzed in APED 4444A and the Amendments. Compaction of the fuel, while essentially impossible mechanistically, would not cause the reactor to go critical since water loss, increased self shielding in the fuel and the geometry change due to flattening of the cylindical core are all negative reactivity effects. Loss of water shuts the reactor down and no fuel melting occurs as previously discussed in the LOCA analysis. Also deformation of the core causing fuel to contact the core can structure would improve heat transfer and result in lower LOCA temperatures.

The only mechanism then, which might cause fuel damage and release of fission products from the NTR fuel, are those accidents resulting from large reactivity insertions. The non-mechanistic Design Basis Accident (DBA) for the NTR assumed that in spite of mechanical devices and procedural control there could be combinations of independent failures which hypothetically could introduce large enough amounts of reactivity which would lead to power excursions and fuel melting. Rather than debate the amount of fuel melting which might occur, the DBA conservatively assumed 100% of the fuel melted and that the reactor cell was breached. The consequences of the DBA were shown to be within the guidelines set forth in Commission regulations and the details of the conservative evaluation are shown in APED 4444A.

If a large seismic event were to occur and the several minor modificiations described in Attachment A have not been made, it may be hypothesized that certain

structures used to support the control and safety rod mechanisms as well as experiments might fail or move in such a manner as to withdraw the control rods and experiments from the core region and prevent operation of the safety rods. The cadmium poison sheets are manually positioned entirely within the graphite reflector, have no drive mechanisms, and will not move relative to the core during a seismic event. If the reactivity addition caused by control rod and experiment movement is sufficiently large, a power excursion not terminated by a scram could occur and result in fuel melting. While the consequences are no different than those already found acceptable in the DBA analysis, a mechanism for adding this reactivity has now been postulated.

Based on the seismic analysis as presented in Attachment A and with minor alterations or additions to the NTR and surrounding structures, it is assured that a large seismic event will cause neither failure to scram nor addition of sufficient excess reactivity to cause any fuel damage. Until approval by the NRC of the analysis and the recommended modifications, the NTR will be operated in such a manner as to limit the available excess reactivity to less than that required to cause fuel damage assuming failure to scram. At full power (100 kW), this value is 0.80$ based on the analysis in APED 4444A Section 11.5.3.

To determine the effects of positive reactivity additions from less than full power, reactor dynamics were simulated with the same model as described in APED 4444A Section 11.3. All transients were run with an initial power level of 1×10^{-7} kW. Inlet water temperatures ranged from $55^{o}F$ to $90^{o}F$ and initial positive reactivity steps were varied from 0.60$ to 0.80$. Results of the transient analyses led to two conclusions. First, the transients are relatively long, on the order of 40 or more seconds which leads to the conclusion that the positive reactivity can be introduced in either a step or relatively long ramp without affecting the outcome. Second, the positive reactivity feedback from the temperature coefficient while not important for the full power cases since the feedback is very small, is important for the zero power cases.

Limiting values for the positive reactivity insertions were determined based on the acceptance criteria that the resulting transient was terminated by bulk boiling before any steam blanketing occurred in the core. The limiting values based on this criterion are shown as the reactivity insertion limit values in Table 1 for various inlet water temperatures. Also in Table 1 are the maximum values of additional

reactivity available from the temperature coefficient which is positive at temperatures less or equal to 124°F. As can be seen from the total reactivity values, limiting the total excess reactivity available from the temperature coefficient, control rods and experiments to 0.76$ or less insures that there are no mechanisms available which will cause fuel damage.

Figure 1 is a plot of reactor power and peak fuel temperature vs time for a 0.66$ step insertion from 1×10^{-7} kW and 65°F inlet water temperature. While the time scale is different for other limiting reactivity insertions, the peak fuel temperature is virtually identical remaining in the 240°F to 250°F range during bulk boiling.

It should be stressed that these transient calculations are extremely conservative since no credit is taken for the negative reactivity feedback from subcooled voids during nucleate boiling. With the large negative void coefficient of the NTR it is felt that all of the transients presented here would terminate prior to bulk boiling and realistic limits for reactivity insertions would be 0.90$ to 1.00$.

TABLE 1

LIMITING REACTIVITY INSERTION VALUES

BASIS: Transient terminated by bulk boiling prior to any steam blanketing in core.
Initial Power 1×10^{-7} kW
No Scram

Reactivity Insertion Limit ($)	Inlet Water Temperature (^oF)	Reactivity* Addition From Temperature ($)	Total Reactivity ($)
0.62	55	0.14	0.76
0.66	65	0.10	0.76
0.76	90	0.03	0.79

*Using the temperature coefficient of $d\rho/_{dt} = -5.7 \times 10^{-3}$ (T-124) ¢/of where T is the water temperature in ^oF, the reactivity added by increasing the water temperature from T to 124^oF is equal to:

$$\text{Reactivity Addition} = 2.85 \times 10^{-3} (T-124)^2 \text{ ¢}$$

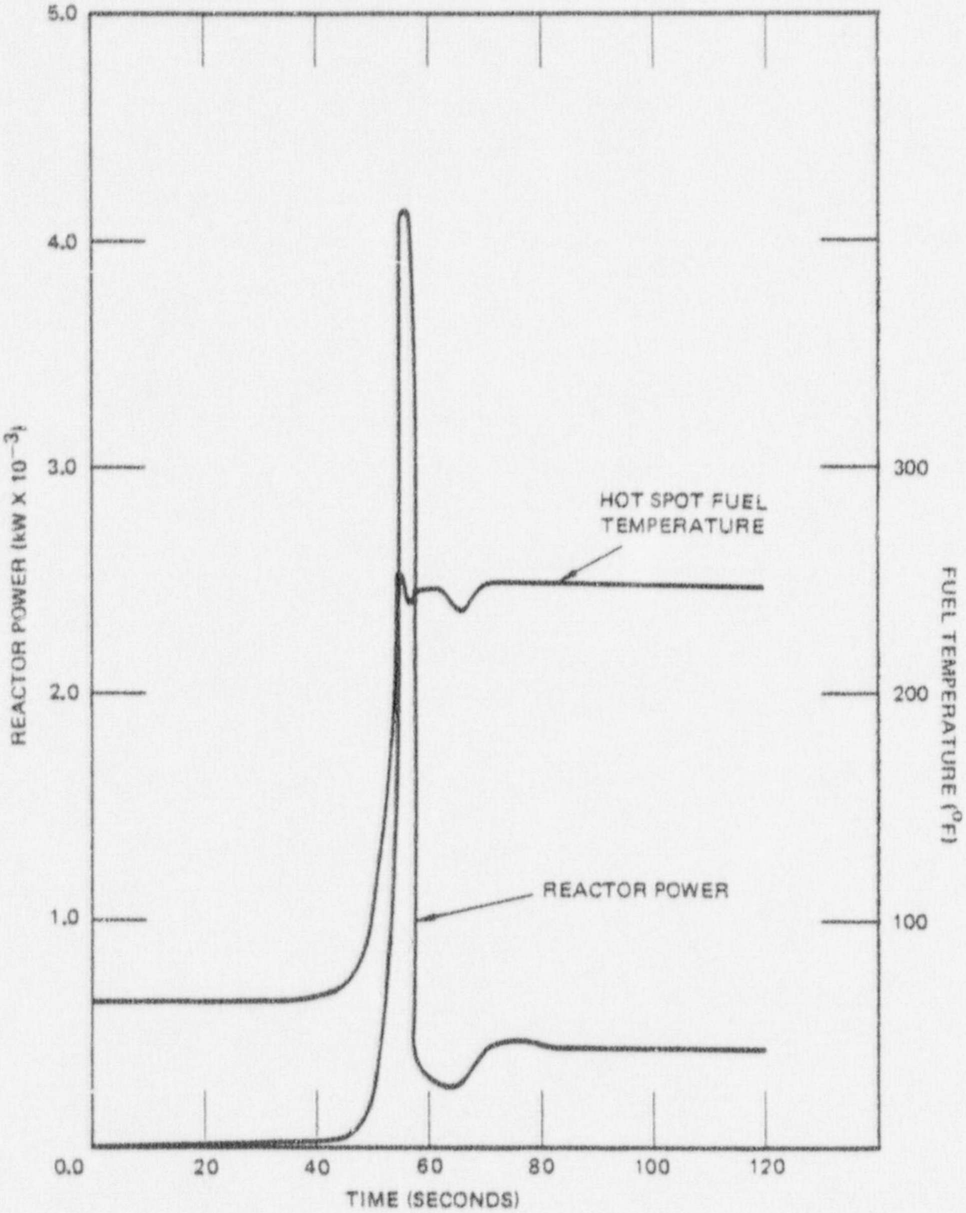


FIGURE 1. REACTOR POWER AND HOT SPOT FUEL TEMPERATURE VERSUS TIME, 0.66 $ STEP FROM SOURCE LEVEL, 65°F COOLANT INLET TEMPERATURE

Item 2. Propose technical specifications limiting the excess reactivity available for insertion during reactor operation. Such a limitation should apply to the combined worth of the control rods and any experiment.

<u>Response</u>:

The only mechanisms which might cause fuel damage and release of fission products from the NTR fuel are those transients resulting from large reactivity insertions. While the consequences of these transients are no different from those already found acceptable in the Design Basis Accident (DBA) analysis, it has now been postulated that a large seismic event could cause transients of this magnitude to occur. In order to preclude any mechanism which could lead to fuel melting prior to NRC review of a detailed seismic analysis and modifcations, as required, for the NTR and surrounding structures, operation of the NTR is being conducted in such a manner as to limit the excess reactivity available for insertion during reactor operation. Procedures are in place which limit the total excess reactivity from the temperature coefficient, control rods and experiments to less or equal to 0.76$.

Item 3. Provide a description and analysis of the proposed attachment of experiments with the potential to introduce positive reactivity by removal or insertion into the core which precludes their moving independently of the core in the event of earthquake damage and propose any associated technical specifications.

Response:

During the oral presentation to the NRC on October 28, 1977, the possibility was mentioned of NTR operation with one or more experiments attached in such a manner as to preclude their movement relative to the core during a large seismic event. The purpose of this type of operation was to be able to exclude one or more experiments from the limit on excess reactivity available for insertion during a large seismic event. Because of the inaccessability of the main graphite pack, restraints are, of necessity, tied to the existing shield wall. Since the structural analysis of the shield wall has not been approved, current practice precludes operation when the excess reactivity available from the termperature coefficient and from movement of the control rods and experiments could exceed the value specified in Item 2. Under this restriction, no restraints are required since movement of experiments relative to the core is assumed.

In Section 11.4.2 of APED 4444 A, three sections of the reflector having significant reactivity effects are discussed. It should be noted that the vertical facility and the fuel loading chute graphite fillers add reactivity only upon insertion. Current operations are conducted with these graphite fillers in place and any movement would be a negative reactivity effect. If experiments are positioned in either the vertical facility and/or the fuel loading chute, the graphite reflector sections are removed and stored within the reactor cell. There are no credible mechanisms other than direct operator action which could cause these reflector sections to be inserted since they require precise manual handling to position them for insertion. The horizontal facility is used for experiments whose reactivity worth on insertion can be positive or negative. The reactivity worth of these experiments in addition to the worth from other experiments in and around the NTR core are considered in determining the excess reactivity available in the event of a large seismic event.

ITEM 4. Provide a description and analysis of the mechanism whereby the poison shims cannot be removed as a result of earthquake damage.

RESPONSE

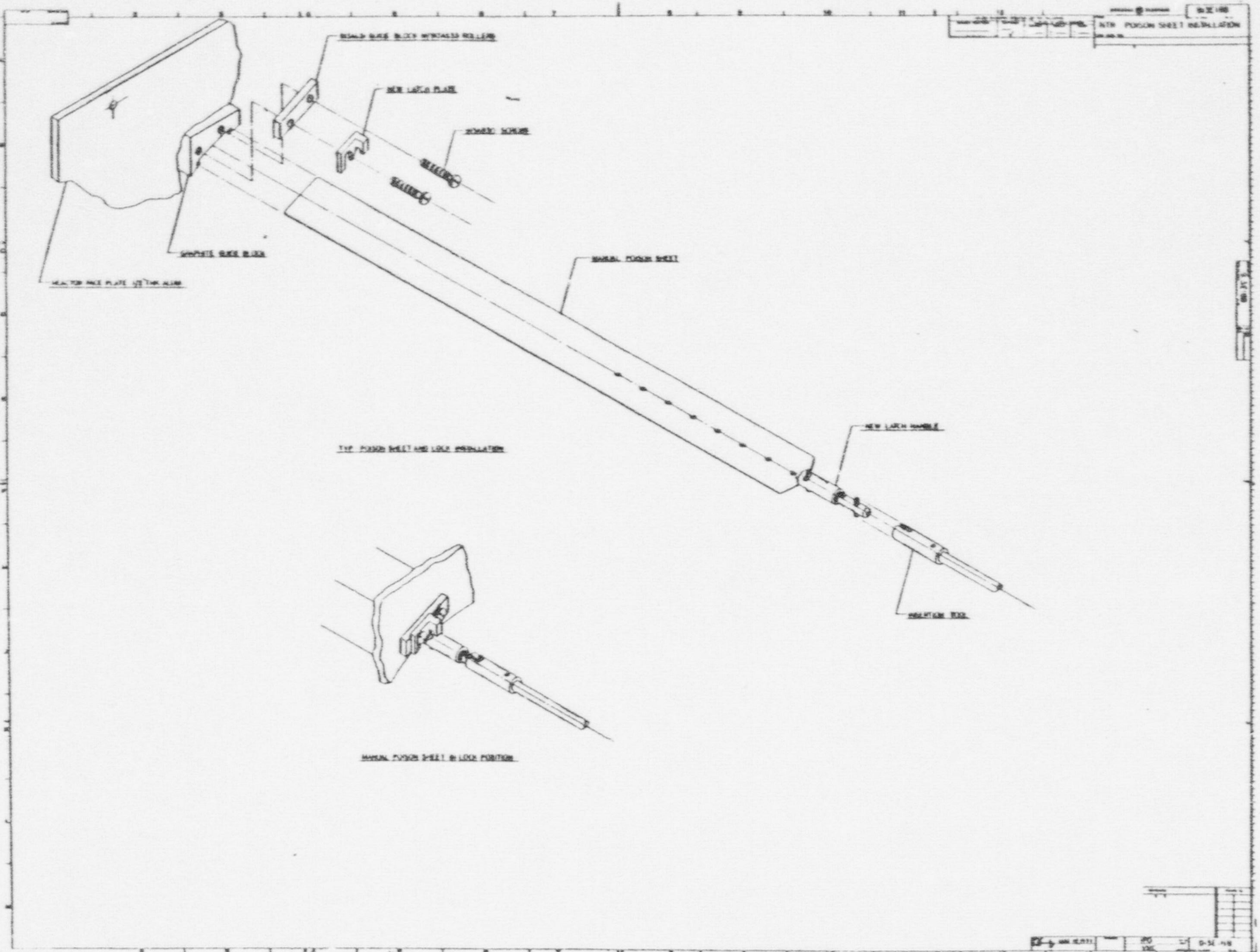
The NTR Poison Sheets are restrained during reactor operation by the mechanism shown in Drawing #913 E 188.

In lieu of structural analysis of the restraining device, testing was performed on one of the latch mechanisms utilizing a hydraulic press. The entire latch assembly was mocked up and tested to 500 pounds without failure of the mechanism. This value is approximately 100 times higher than is needed to restrain the Manual Poison Sheets during a one g acceleration.

Movement of the Poison Sheets are restricted by the latching device to less than 1/8 inch.

Removal and insertion of the Poison Sheets can only be accomplished by use of the special tool designed to rotate a spring loaded latch pin.

It is concluded that no force induced by vibration, shock, or movement would cause the Poison Sheets to be moved relative to the core. The NTR Standard Operating Procedure 3.5 defines the requirements for Poison Sheet changes and insures that each Poison Sheet installed in the core during reactor operation is latched in place.



POISON SHEET INSTALLATION
REACTOR FACE PLATE 1/2" THK ALUM
GRAPHITE GUIDE BLOCK
NEW LATCH PLATE
MANUAL POISON SHEET
NEW LATCH HANDLE
INSERTION TOOL
TYP. POISON SHEET AND LOCK INSTALLATION
MANUAL POISON SHEET IN LOCK POSITION

ITEM 5. Propose technical specifications which require that the poison shims be properly attached prior to startup.

RESPONSE

As indicated in the response to Item 4, movement of the NTR manual poison sheets is restrained with a latching device and detailed procedures which require verification that the poison sheets are latched in place following any changes are used. These devices and procedures insure compliance with the following proposed technical specification.

5.4.3 Each manual poison sheet used shall be restrained in its respective graphite reflector slot in a manner which will prevent movement relative to the reactor core during reactor operation.

Item 6. Provide on-site meterological data in the form of joint frequency distribution of wind speed, wind direction, and atmospheric stability.

Response:

Since no mechanisms exist for fuel damage and fission product release from the NTR, on-site meteorological data is not required for the NTR safety evaluation.

Item 7. Verify that your emergency procedures for VBWR include provisions for sampling water supplies in the area, if a release of radioactive liquid should occur.

Response:

Personnel assigned to the Reactor Irradiations organization are responsible for routine surveillance of the VBWR containment building. The Reactor Irradiations organization is also responsible for operation and maintenance of the GETR.

Procedures for inspection, access control, and facility use and modification for the VBWR are included in the GETR procedures. The GETR Emergency Plan contains instructions for actions to be taken in the event of various types of emergencies. The section discussing post-earthquake actions has been modified to require measurement of VBWR water level and if the measurement indicates loss of water, samples will be taken of off-site potable water supplies.