UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

JUN 17 1980

Docket Nos.: 50-329/330

APPLICANT: Consumers Power Company

FACILITY: Midland Plant, Units 1 and 2

SUBJECT: SUMMARY OF THE MAY 23, 1980 MEETING ON PRESERVICE FAILURE OF THREE REACTOR VESSEL HOLD-DOWN STUDS

On May 23, 1980 the NRC staff and its consultants met in Bethesda, Maryland with representatives from Consumers Power Company (the applicant), Bechtel, Babcock & Wilcox (B&W) and Teledyne to review three reactor vessel holddown studs which have failed during preservice at the Midland Plant, Unit 1. This meeting follows an earlier meeting on May 2, 1980 with the NRC's Office of Inspection and Enforcement (I&E) in which I&E noted that any remedial actions whereby the studs would not be used in their original intended design would have to be reviewed by NRR. Meeting attendees are listed in Enclosure 1. Enclosure 2 is the meeting agenda.

Background

The holddown design for the Midland reactor vessels is shown on Slides 1, 2 and 3 of Enclosure 3. Further detail is shown on FSAR Figure 3.8-30. The design utilizes 96 anchor studs, each 7 feet 4 inches long and 2 1/2 inches in diameter, embedded vertically in the reinforced concrete reactor vessel pedestal and arranged in two concentric rows of 48 studs each. All studs were purchased by Bechtel to a modified version of ASTM-A354-66, Grade BD standards under Bechtel Specification 7220-C-223(Q), Rev. 3. The modification was a waiver of the maximum diameter allowed in the 1966 version for Grade BD bolts. The studs for Midland Unit 1 are nominally AISI 4140 and 4145, while the studs for Unit 2 are all nominally AISI 4340. Stud failure has occurred in Unit 1 only. The Unit 1 failed studs were purchased from Mississippi Valley Structural Steel of St. Louis, Missouri and fabricated by Southern Bolt and Fastener of Shreveport, Louisiana. The stud material originated from Bethlehem Steel and the studs were heat treated by J. W. Rex of Lansdale, Pennsylvania.

The studs were received on site by Bechtel in early 1976, embedded in Unit 1 concrete by Bechtel in April 1977, and tensioned by B&W on July 26, 1979 with a Biac anchor bolt tensioner. Each stud was preloaded to an initial nominal stress of 75 ksi in the unthreaded region (A=4.9 square inches) before relaxation losses are taken into account. It was intended to obtain

a final pretension of 55 ksi. The initial prestress force should have been calculated on the basis of the effective tensile area (A=4.0 square inches) of the threaded region. This error resulted in a higher than planned preload, 92 ksi. The allowable design stress of the material, 105 ksi, was not exceeded.

As shown on Slide 2, the vessel skirt design also includes shear pins, 2 inches in diameter and 6 1/16 inches in length, to transmit lateral loads to the 5 1/2 inch thick annular sole plate segments beneath the skirt. Shear lugs are welded beneath the sole plate. Lateral and torsional loads therefore, are resisted by friction, bearing, shear pins, and shear lugs, and transmitted to an inner ledge of the primary shield wall. The studs are intended to resist overturning moments and uplift forces acting on the reactor vessel, such as would result from a loss of coolant accident located so as to pressurize the reactor vessel subcompartment.

Failure History

The identification of individual studs relative to position on the reactor vessel skirt are indicated in Slide 4 of Enclosure 3. The points of failure along the length of the three failed studs are shown by Slide 5.

On September 14, 1979 as B&W personnel were installing jam nuts on the anchor bolts, it was discovered that the stud and nut of stud 3 (inside row) were missing. A search by Bechtel personnel recovered the stud fragment on September 18th. Several minute dimples on the surface of the reactor vessel were caused by the ejection of the stud at the time of the spontaneous failure. A second failed stud (number 36, outside) was discovered on December 19, 1979.

On February 5, 1980, an I&E Regional Inspector visiting the site to observe the first two broken studs noticed that stud 35 (outside row and adjacent to failed stud 36) was off its seat about an inch. The stud was removed during the week of March 31, 1980 and was observed to be broken about 1/2 inch below the top of the bottom heavy hex nut. (Note: to prevent the studs from bonding to the concrete, a bond breaker was used from the top of the bottom anchor plate to the upper threads - the breaker consisted of Pennzoil lubricant No. 952 and Visqueen.)

Investigations

Shortly after the initial failure, the applicant enlisted the services of Teledyne Engineering Services of Waltham, Massachusetts for testing to determine the cause of the failures. Results of the Teledyne efforts to date were summarized by Dr. William Cooper. Tests and inspections for the first failed stud were:

1. Visual and non-destructive examinations, including dye penetrant, magnetic particle and ultrasonic techniques.

2. Tensile tests for ultimate and yield strength, reduction in area, elongation, modulus of elasticity.

3. Charpy V notch impact energy and lateral expansion.

4. Plane strain fracture toughness (K_{IC}).

5. Hardness.

6. Chemical composition.

7. Microstructure analysis.

8. Fractography.

The second stud failure occurred during the course of the above investigation and the failed end was forwarded to Teledyne for investigation. Tests 1, 5, 7 and 8 above were performed for the second failed stud. A hardness survey on all remaining vessel anchor studs was performed in both Unit 1 and Unit 2.

Results of the tests for the first two failed studs are reported in Teledyne technical report TR-3887-1, Rev. 1, "Investigation of Preservice Failure of Midland RPV Anchor Studs", May 15, 1980 which was submitted by the applicants letter of May 16, 1980. The metallurgical study test results for the third failed stud will be reported before the end of June 1980 by Addendum 1 to TR-3887-1, Rev. 1.

The Rockwell hardness tests (HRC) performed by Teledyne behind the fracture surface and on the ends of the failed studs indicated a significant hardness gradient across the diameter of studs 35 and 36. It is also believed that a gradient exists along the axis of the studs. However, stud 3 had no hardness gradient across its diameter nor along its length. Teledyne concludes that the maximum permissible surface hardness for the Unit 1 or Unit 2 material should be 41 HRC for the specified maximum center hardness of 38 HRC. Results of the hardness traverse across the diameter of the three failed studs are shown on Slide 6 of Enclosure 3. Field hardness testing of the remaining studs of Unit 1 and Unit 2 show that some of the Unit 1 studs also have a hardness gradient, but none of the Unit 2 studs exhibited a gradient. The Unit 2 studs had a nominal hardness of 38 HRC, for which 14 were at this nominal value, 42 were softer, and 40 were harder.

The Teledyne reports indicate that the failures resulted from stress corrosion cracking which propagated to the point that the studs failed by cleavage fracture. The decreased resistance to stress corrosion resulted

from excessive surface hardness. The crack originated as a very small surface discontinuity such as that typical of surface oxide film cracking or corrosion pitting. The corrosive environment may have been humid air. The root cause of failure, i.e., the cause of the excessive hardness, has not yet been established.

Special inspections have been conducted by I&E to review the applicant's records for the Units 1 and 2 vessel anchor studs. I&E has also attended meetings with the applicant and Southern Bolt and Fastener Corporation and Mississippi Valley Structural Steel. Inspector C. M. Erb summarized findings regarding contents of the Bechtel purchase specification, noted that Charpy V notch results were provided for information purposes only and were below the foot pound and lateral deformation requirements, expressed concern that 19 of the Unit 2 bolts were above the 38 HRC level, described the modification in minimum shank size allowed by Bechtel, and explained the stud quenching procedure used. These items are discussed in IE Inspection Report 50-329/80-05; 50-330/80-05, attached as an appendix to this meeting summary.

Applicant's Remedial Actions and Acceptance Criteria

The applicant noted that the stud deficiency for Unit 1, if not corrected, could adversely affect plant safety. Therefore, for Unit 1, the applicant proposes to detension the remaining studs and to modify the vessel support concept so that the studs are used, but are subjected to reduced service stress. The revised support concept would modify the existing A-36 shield plug support brackets which would be shimmed tight (a 1/32 inch hot gap) to the reactor vessel to achieve additional lateral support. The revised concept is shown in Slides 7, 8 and 9.

The applicant's position is that the following criteria are acceptable for the Unit 1 studs:

> The Unit 1 RPV support studs are being detensioned, with the existing preload determined during detensioning. Retensioning is permitted if the average tensile stress computed on the basis of the nominal net cross-sectional area does not exceed 6 ksi. Short-term service loadings are permitted if the stress does not exceed 43 ksi, subject to the restriction that:
>
> 1. When in detensioning a lower as-relaxed preload is measured, the short-term allowable stress value for all studs shall be reduced to one-half of the lowest measured detensioning load on any stud which is considered to contribute to load carrying capability in the new design concept.

2. The detensioning load may be increased above the prestress load required for nut rotation in order to determine the allowable short-term service stress.

For Unit 2, it is the applicant's position that these studs are acceptable for service in the manner originally planned. (Notwithstanding this position, the applicant also noted its intention to modify the lateral support brackets for Unit 2 as for Unit 1, although this modification for Unit 2 is for design enhancement purposes). Unit 2 will be detensioned to the original intended value appropriate to achieve the final value of 55 ksi.

The basis for the above positions by the applicant for Units 1 and 2 are developed in Teledyne report TR-3887-2, Rev. 1, "Acceptability for Service of Midland RPV Anchor Studs", May 20, 1980. The applicant requested that the NRC provide its position regarding the indicated criteria for Unit 1 and the applicant's position that Unit 2 is acceptable as-is. This initial information from the staff is needed so that the applicant can continue to develop the concept with reasonable assurance of the approach.

The applicant presented the preliminary results of forces and moments at the reactor vessel skirt support for various LOCA break types and locations. These results are shown in Slide 10. The analytical model and vessel foundation spring rate are shown in Slides 11, 12 and 13. The staff also noted that the upper lateral support design would require a finite element analysis of the interaction of the vessel and bracket support.

The applicant noted that detensioning of the anchor studs began in April 1980 and is presently underway. To date, 29 studs have been detensioned. The actual tension in these, as determined by the lift-off force, are:

ksi	Quantity of Studs
54	1
56	1
63	1
≥72	26

The maximum lift-off force measured was 94 ksi and the average value for the 29 is 81.85 ksi. Procedures for the detensioning process have included precautionary measures for personnel safety. Dr. Cooper predicted that additional failures for Unit 1 during detensioning may occur.

Future Activities

The applicant described plans for continued investigation of the failed Unit 1 studs. Anomalies are being identified and mechanisms to explain the anomalies will be developed and tested. Some of the anomalies identified at present are listed in Slide 14. The applicant is also checking for excessive hardness in bolts for other components and supports, including steam generators supports and pipe hangers.

The staff will comment within a few weeks on the applicant's criteria for Unit 1 and the applicant's finding of acceptability for Unit 2 studs.

By the end of June, the applicant will submit Addendum 1 to TR-3887-1, Rev. 1 providing test results of the third failed stud.

By the end of June, the applicant will submit a report describing the revised design to achieve additional lateral support of the vessel, including the design allowable stresses to be used.

The applicant will further describe analytical techniques in the autumn of 1980 and provide results of detailed analyses of the reactor vessel loads during the first quarter of 1981. Installation of the upper lateral supports is presently scheduled to begin about May 1, 1981.

Staff Conclusions

After a brief caucus, the staff acknowledged the applicants plans to pursue development of the lateral support concept and stated that it could see no reasons why such an approach cannot be successfully developed to fulfil the commitment in Section 1.5 of the PSAR. The staff expressed some concern for some of the Unit 2 studs which had hardness measurements in excess of 38 HRC and will consider this matter further. The staff also wishes to be advised of the results of the present detensioning effort, once completed.

DARL S HOOD

Darl S. Hood, Project Manager
Licensing Branch No. 3
Division of Licensing

Enclosures:
1. Attendees
2. Agenda
3. Viewgraph Slides
4. Appendix: Fiorelli 3/20/80

cc: See next page

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ENCLOSURE 1

ATTENDEES

MAY 23, 1980

NAME	ORGANIZATION	TITLE
Darl Hood	NRR/DOL/LB#3	Licensing Project Manager
Dennis M. Budzik	CPCO	Midland Project Manager
John Rutgers	Bechtel	Midland Project Manager
Jim Cook	CPCO	VP-Midland Project Manager
G. Fiorelli	Region III	Branch Chief
A. J. Cappucci	NRR/DE/MEB	Midland Reviewer
D. Yuan	Bechtel	Midland Civil Engineer
M. Elgaaly	Bechtel	Assistant Project Engineer
W. Belke	NRC/QA Branch	
C. D. Sellers	NRC/MTEB	
R. Bosnak	NRC/DE/MEB	
C. M. Erb	Region III	Reactor Inspector
R. E. Schewmaker	NRC/IE	Senior Structural Engineer
Pao C. Huang	NAVSWC	Consultant
Frank Rinaldi	NRR/DE/SEB	
Frank Schuer	NRR/DE/SEB	
Geoff Egan	Aptech. Engineer Services	Technical Director
Randy Howard	B&W	Task Engineer Loading Analysis
Roland Reed	B&W	Assoc. Project Manager
W. R. Bud	CPCO	QA Department Manager
T. R. Thiruvengadam	CPCO	Section Head. Civil Engineer
H. L. Brammer	NRC/DE/MEB	
H. W. Slager	CPCO	Section Head Materials Engr.
W. G. Dobson	Teledyne	Project Manager
P. C. Hearn	CSB, DSI, NRR	
W. E. Cooper	TES	Consultant Engineer
S. Hou	NRC/DE/MEB	
J. P. Matra, Jr.	NSWC/WO	Consultant
W. S. Hazelton	NRR/DE/MA	

ENCLOSURE 2

PROPOSED MEETING AGENDA
REACTOR ANCHOR STUDS
Friday, May 23, 1980
At 9AM
PHILLIPS BUILDING - ROOM P-114
BETHESDA, MD

I. Opening Remarks (JWCook/DHood) - (10 minutes)

II. Reactor Vessel Anchor Studs

A. Description of Hold-down Design and Criteria (TRT) - (20 minutes)

B. Background of Anchor Bolt Occurrences (HWS) - (10 minutes)

C. Results of Teledyne Investigations (HWS/WEC) - (90 minutes)

1. Investigations of first two failed studs
2. Investigations of the third failed stud
3. Conclusions as to cause of failure
4. Acceptability of the Unit 2 studs
5. Allowable stresses for the Unit 1 studs

D. Proposed Unit No 1 RV Support Design Revision (TRT/ME) - (30 minutes)

III. Investigations and Findings of Other Areas of Plant (HWS) - (20 minutes)

IV. Administrative Aspects of NRC Review (DMBudzik) - (30 minutes)

ANTICIPATED ATTENDEES

Consumers Power	Bechtel	B&W	Teledyne	APTECH
WRBird	BDhar	JGalford	WECooper	GEgan
DMBudzik	MElgaaly	CEMahaney	WGDobson	
JWCook	JARutgers			
HWSlager				
TRThiruvengadam				

CC: WRBird
DMBudzik (30)
JWCook
HWSlager
TRThiruvengadam

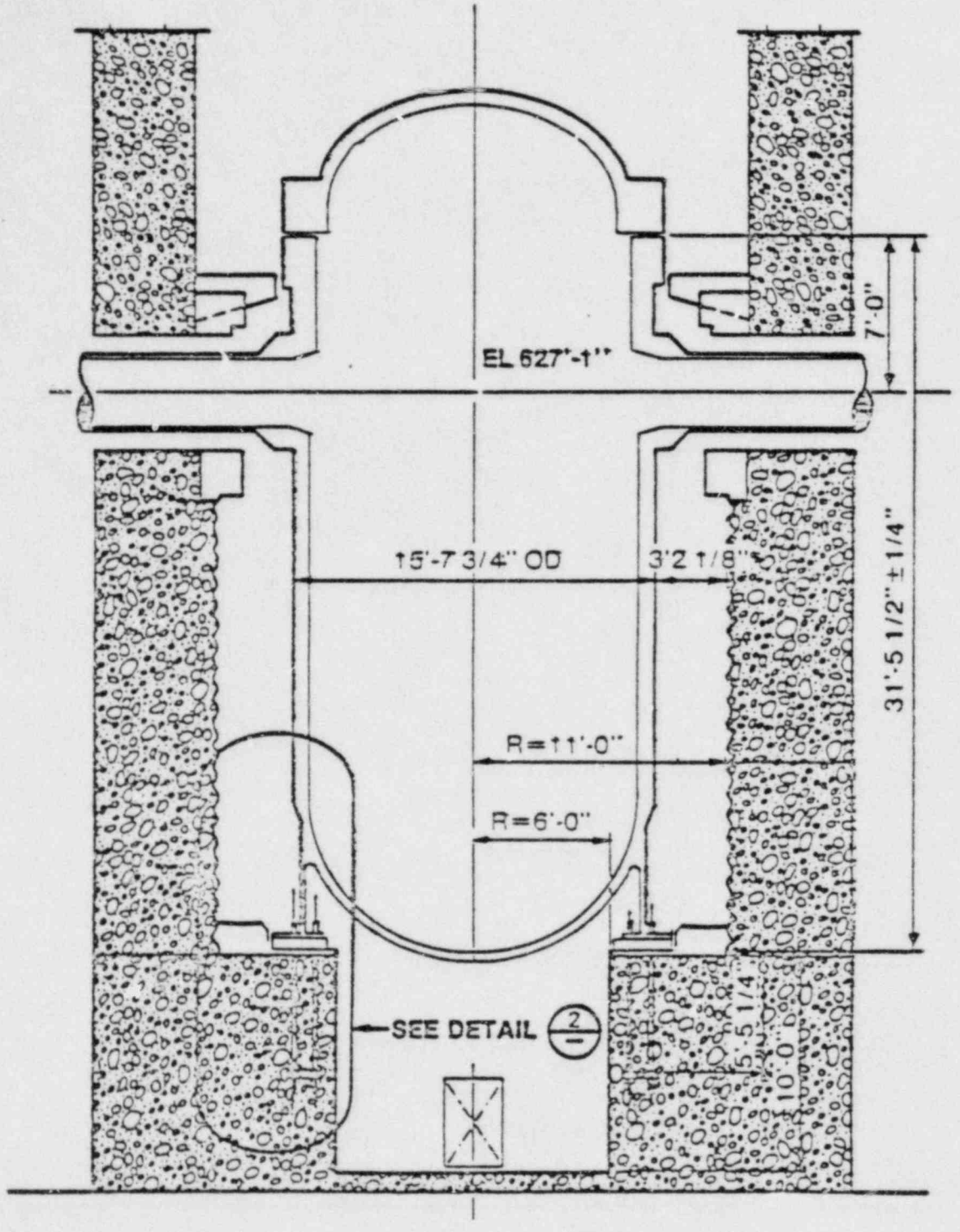
ENCLOSURE 3

VIEWGRAPH SLIDES

USED DURING

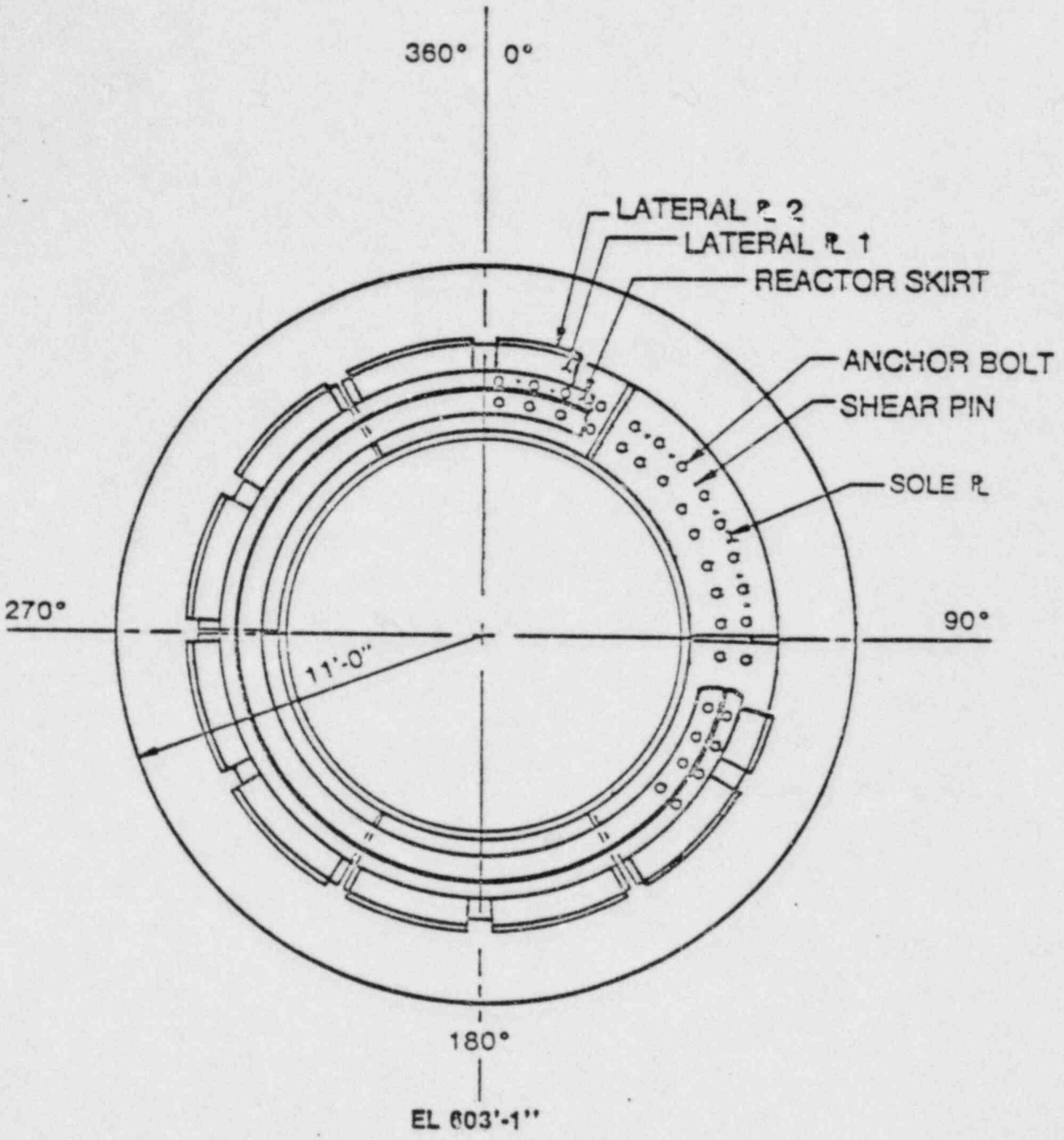
MAY 23, 1980

PRESENTATIONS



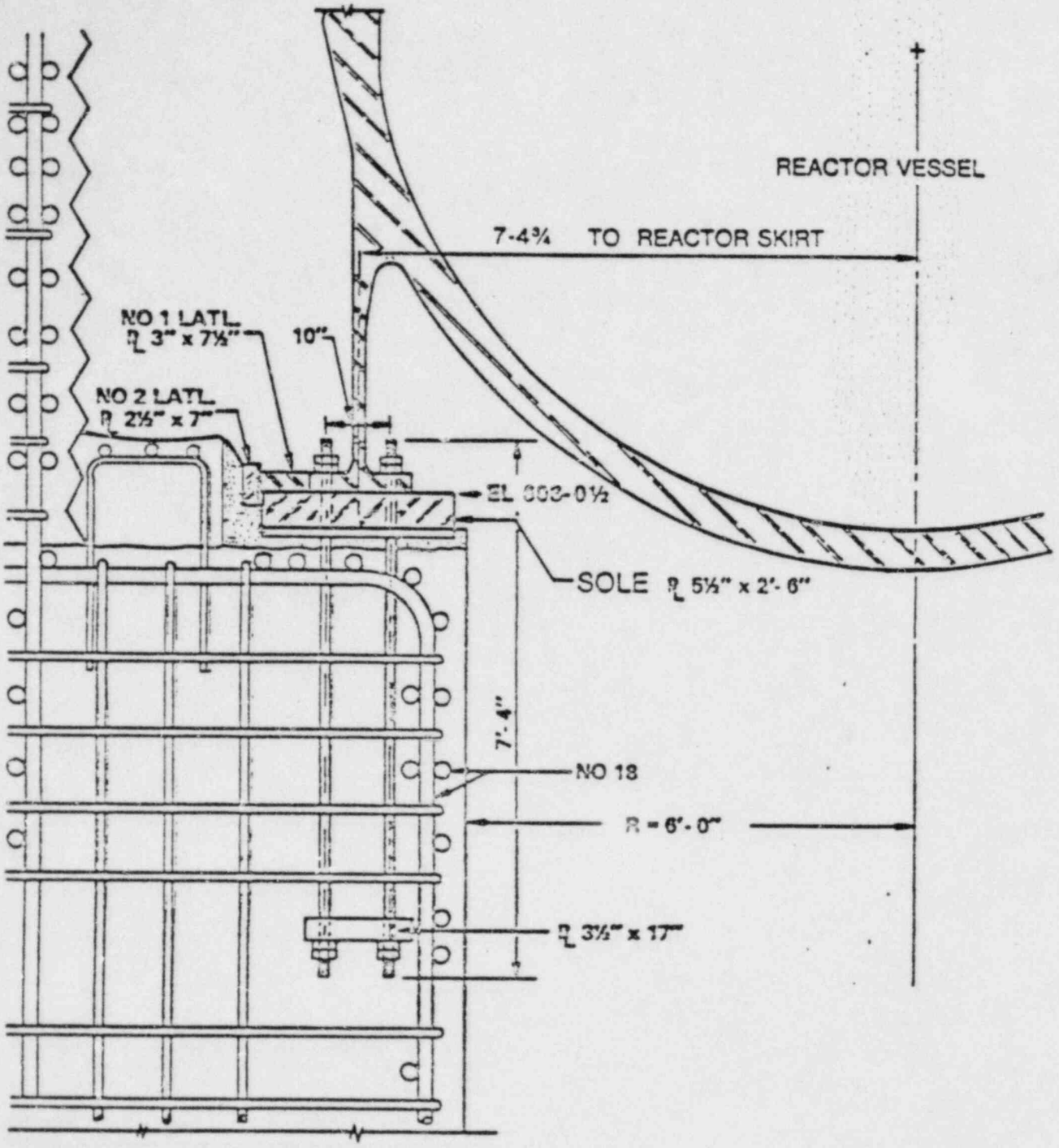
REACTOR VESSEL ELEVATION

Slide 1


360°
0°
LATERAL ℄ 2
LATERAL ℄ 1
REACTOR SKIRT
ANCHOR BOLT
SHEAR PIN
SOLE ℄
270°
90°
11'-0"
180°
EL 603'-1"

PLAN

Slide 2



DETAIL 2/—

Slide 3

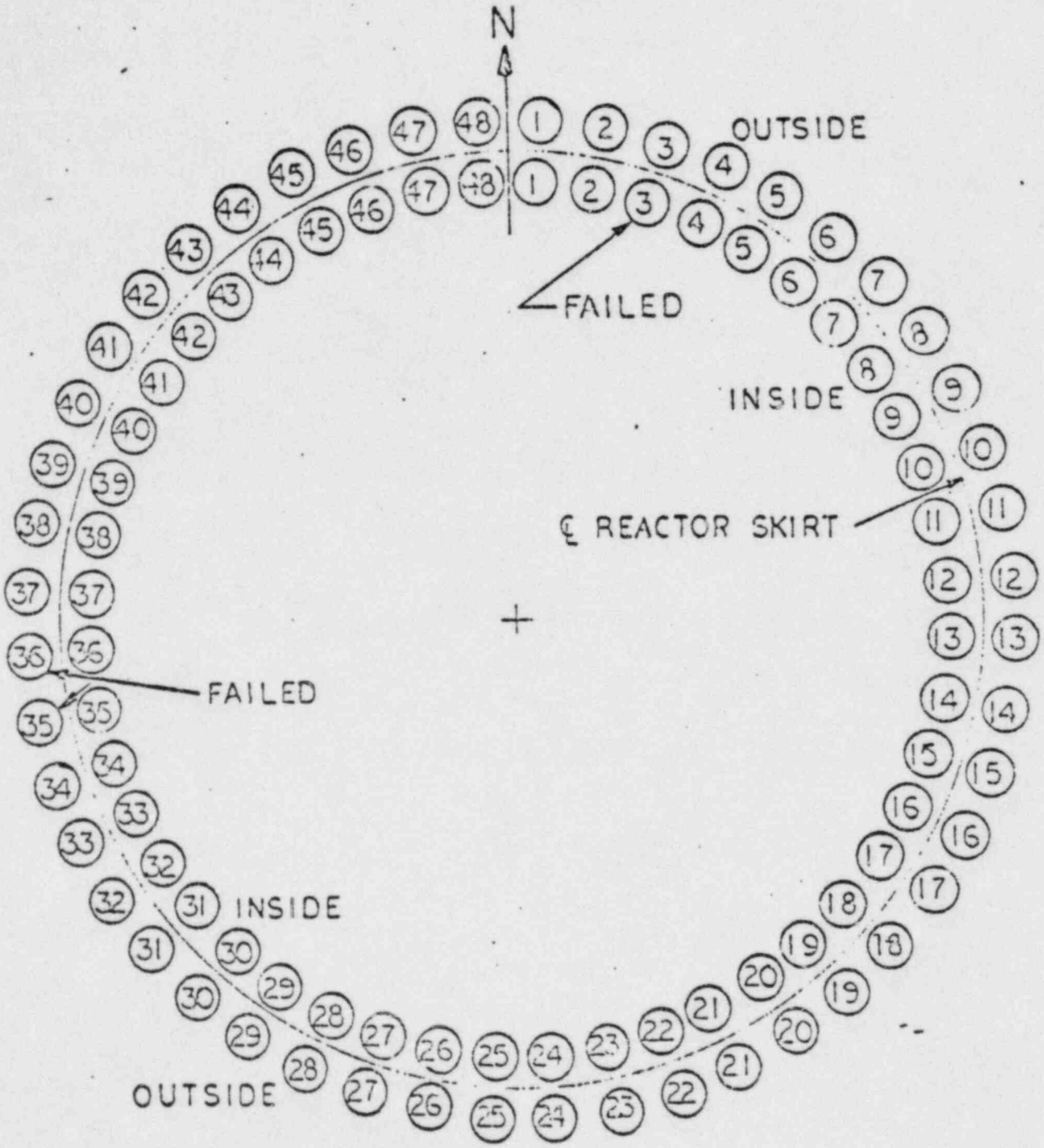


FIGURE 1.
POSITION AND NUMBERING OF STUDS IN UNITS 1 AND 2

slide 4

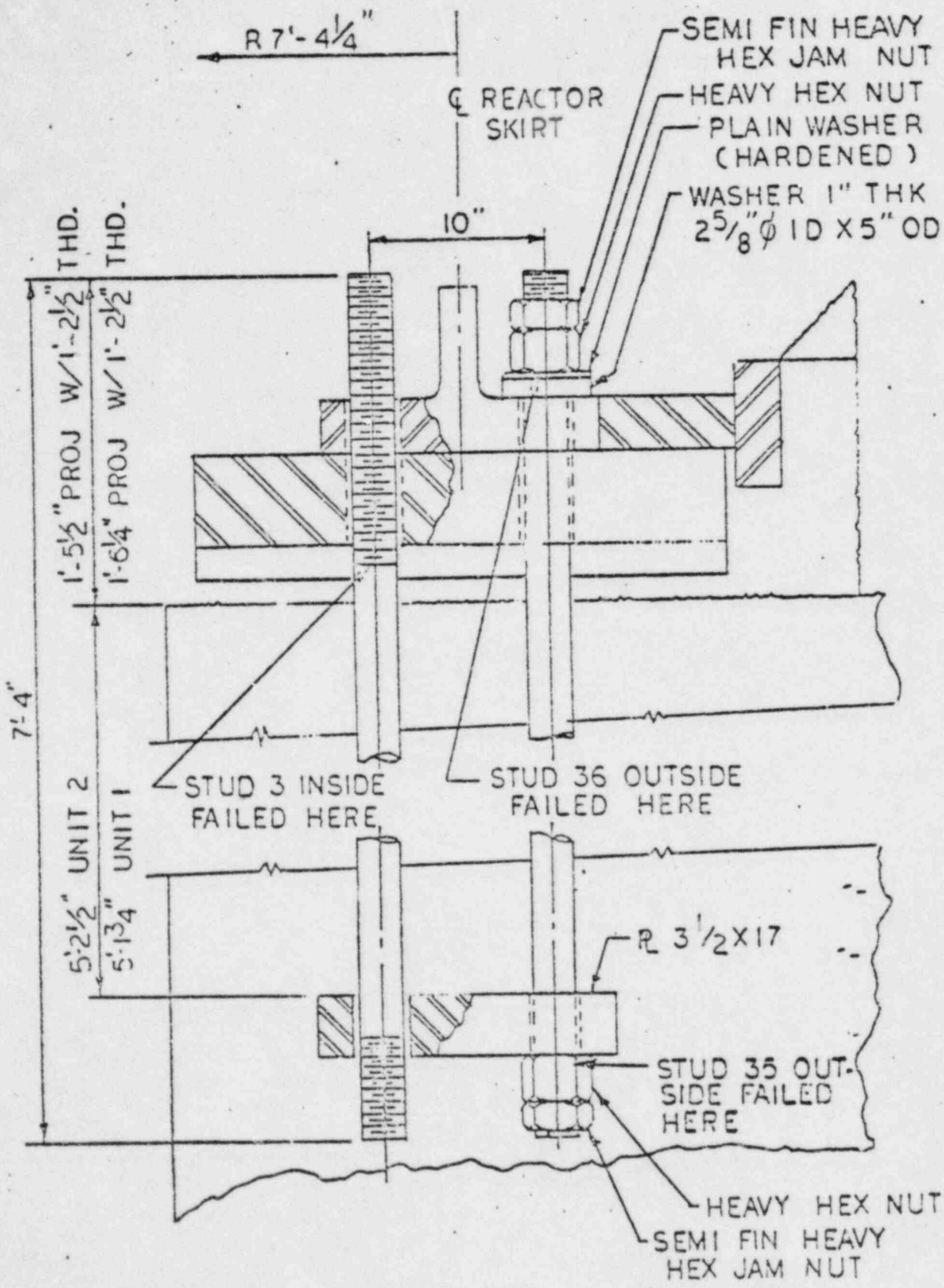
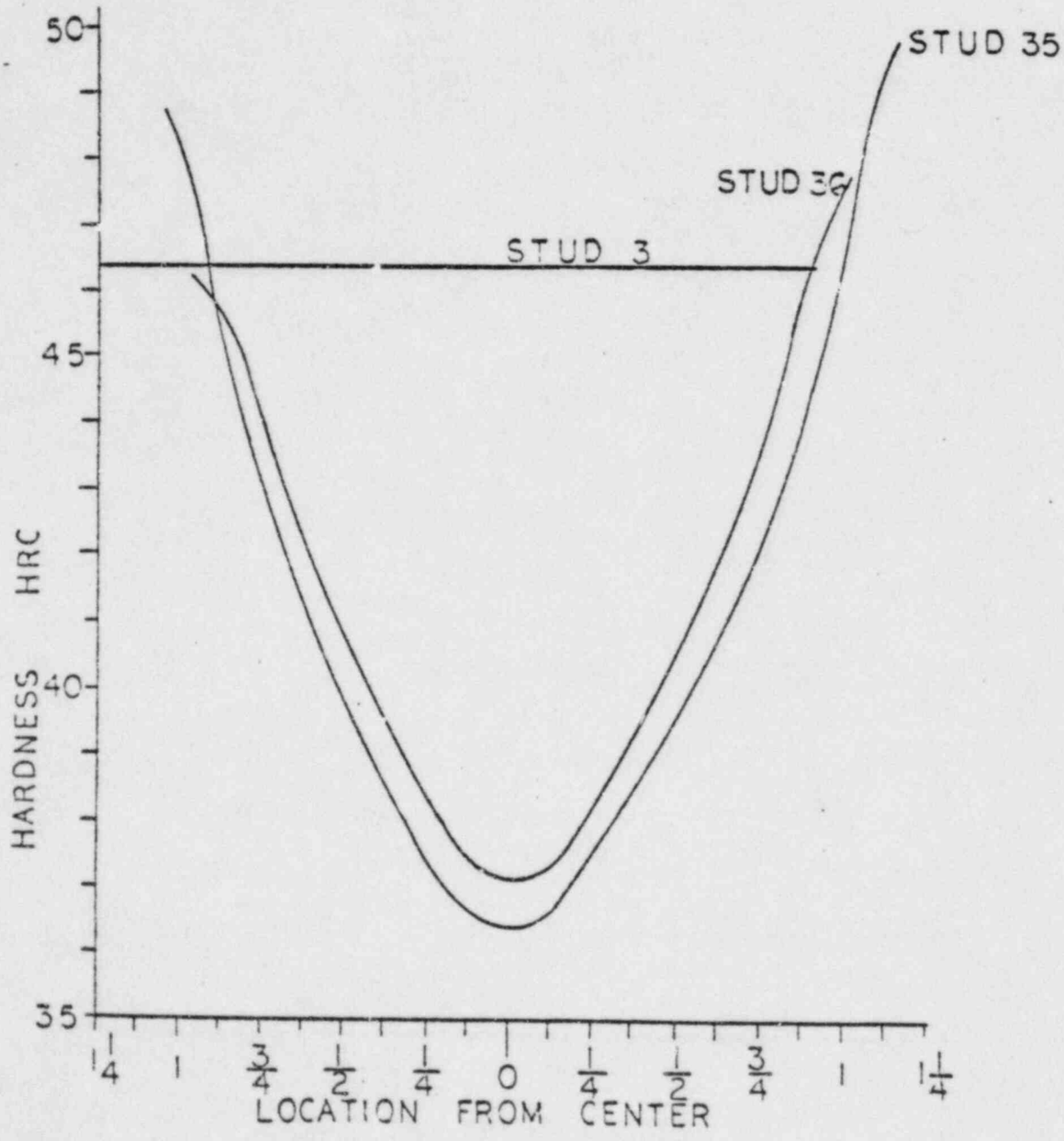


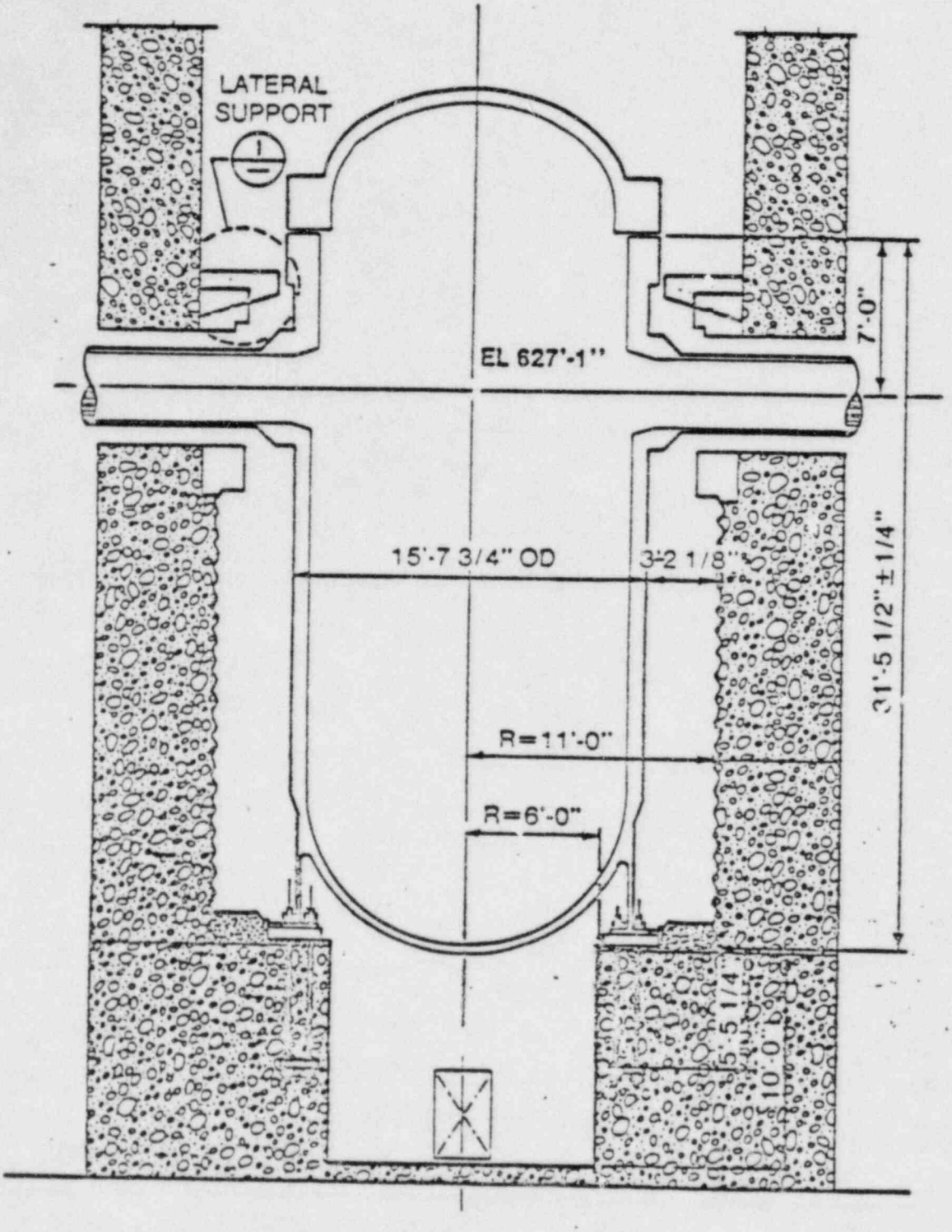
FIGURE 2. ANCHOR STUD INSTALLATION

slide 5



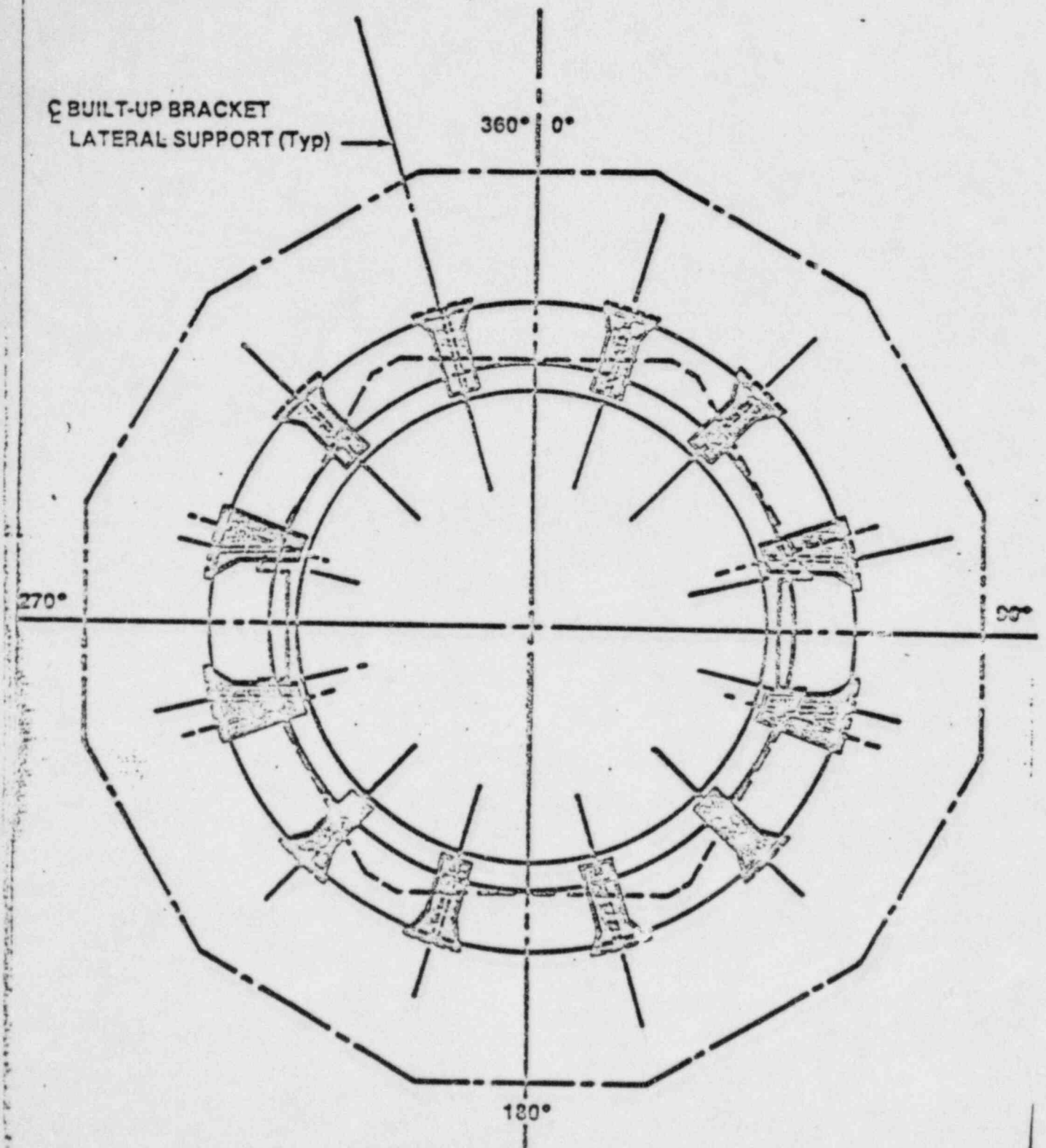
HARDNESS TRAVERSE FOR STUDS 3 35 36

slide 6



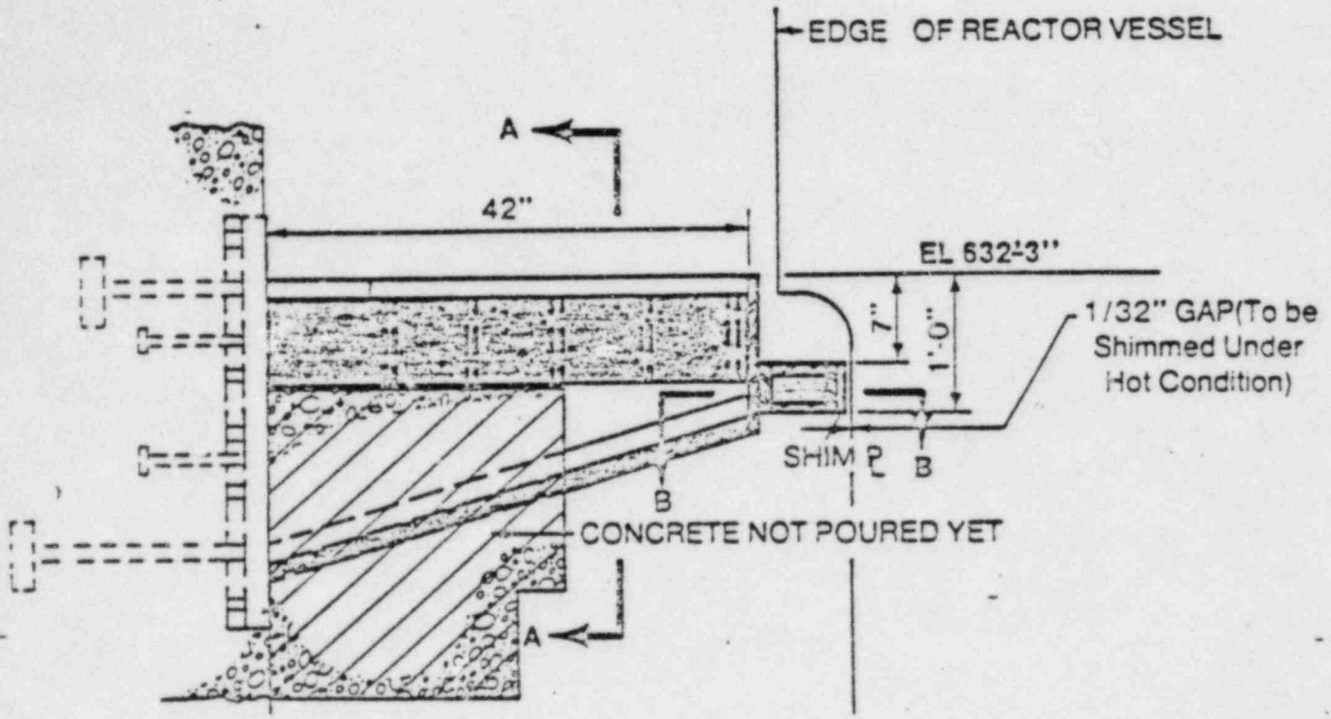
REACTOR VESSEL ELEVATION

slide 7

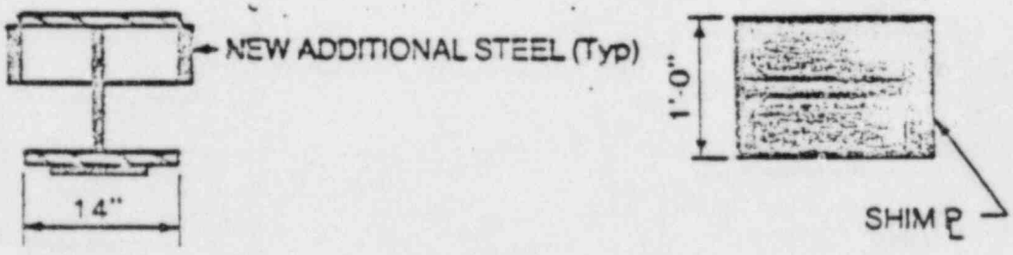


LATERAL SUPPORT PLAN

Sht 8



DETAIL "I"



A-A B-B

slide 9

G-1077-02

Slide 10 (page 1 of 2)

REACTOR VESSEL

SKIRT SUPPORT PT 213 FIG 7

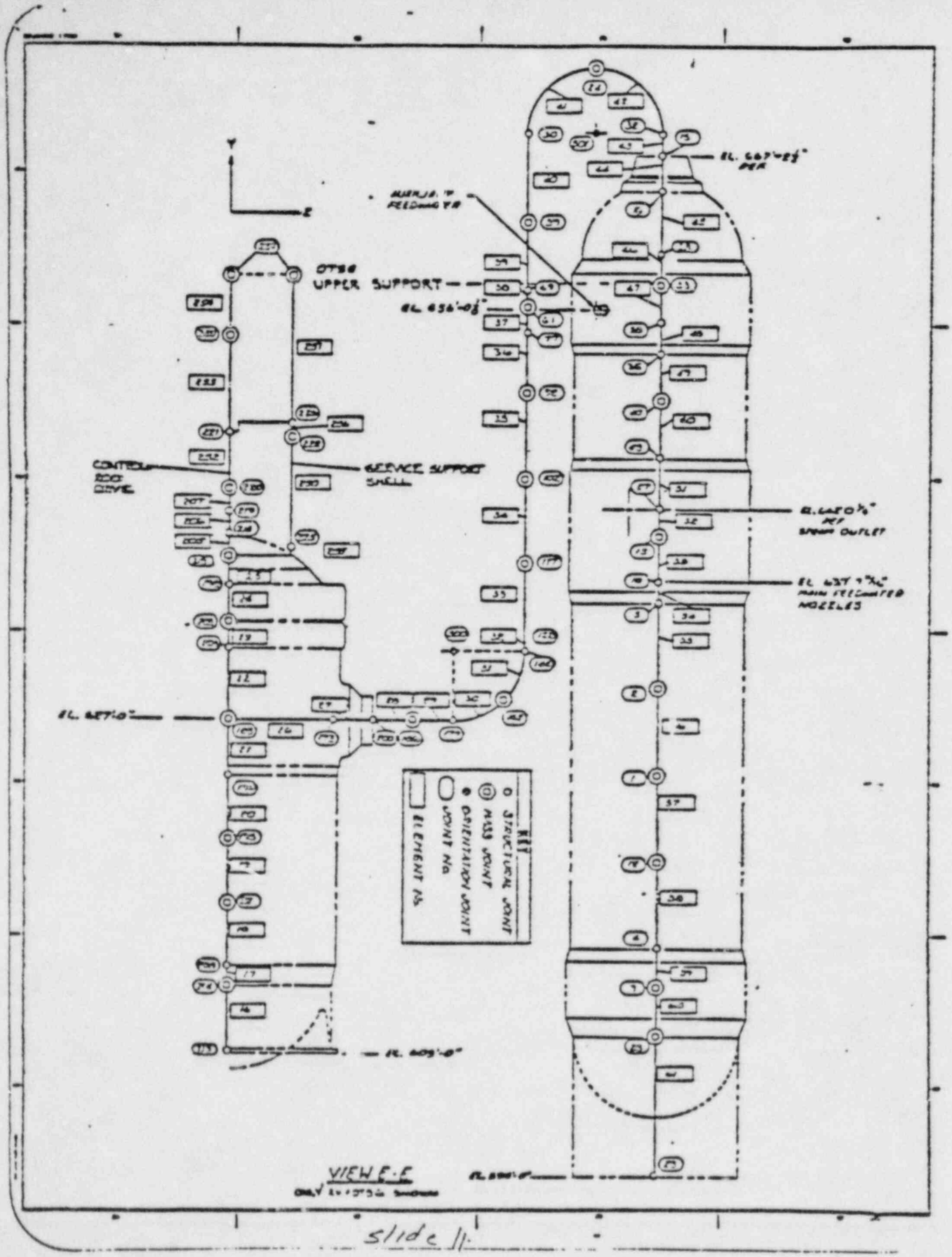
LOAD CASE	FORCES (KIPS) FX	FY	FZ	MOMENTS (FT-KIPS) MX	MY	MZ
THERMAL EXPANSION 8 PER CENT	32.8	209.6	0.0	0.0	0.0	-833.3
THERMAL EXPANSION 15 PER CENT	36.1	178.2	0.0	0.0	0.0	-925.6
THERMAL EXPANSION 100 PER CENT	34.6	165.2	0.0	0.0	0.0	-896.2
DEADWEIGHT	-1.0	-1017.5	0.0	0.0	0.0	65.5
OBE SEISMIC	717.0	116.6	294.8	9503.0	823.0	21187.4
OBE SEISMIC	1434.0	233.0	589.8	19006.0	1645.8	42374.8
HTL-1, HTL RV TRNNL END GUIL *	168.4	848.2	4305.4	57253.0	594.8	4441.4
HTL-2, HTL INTERMEDIATE GUIL *	139.8	848.2	4305.4	57253.0	459.1	3515.2
HTL-3, HTL DECAY HEAT NOZ GUIL	99.3	634.6	865.8	22037.0	1004.2	2601.0
HTL-4, HTL SURGE LINE NOZ GUIL	NOT A DESIGN CASE FOR THIS LOAD POINT					
HTL-5, HTL INTERMEDIATE GUIL	163.0	684.6	379.9	9144.8	1753.3	2795.4
HTL-6, HTL OTSG TRNNL END GUIL	150.6	1628.5	403.6	8405.3	1657.5	2655.3
UCL-1A, UCL RV TRNNL END GUIL	1707.5	1589.9	1263.8	30645.8	2415.1	44148.5
UCL-1B, UCL RV TRNNL END GUIL	1815.8	1508.8	1364.7	32169.5	2167.7	47240.7
UCL-2A, UCL INTERMEDIATE GUIL	SEE LOCA CASE - UCL-1A					
UCL-2B, UCL INTERMEDIATE GUIL	SEE LOCA CASE - UCL-1B					

slide 10 (page 2 of 2)

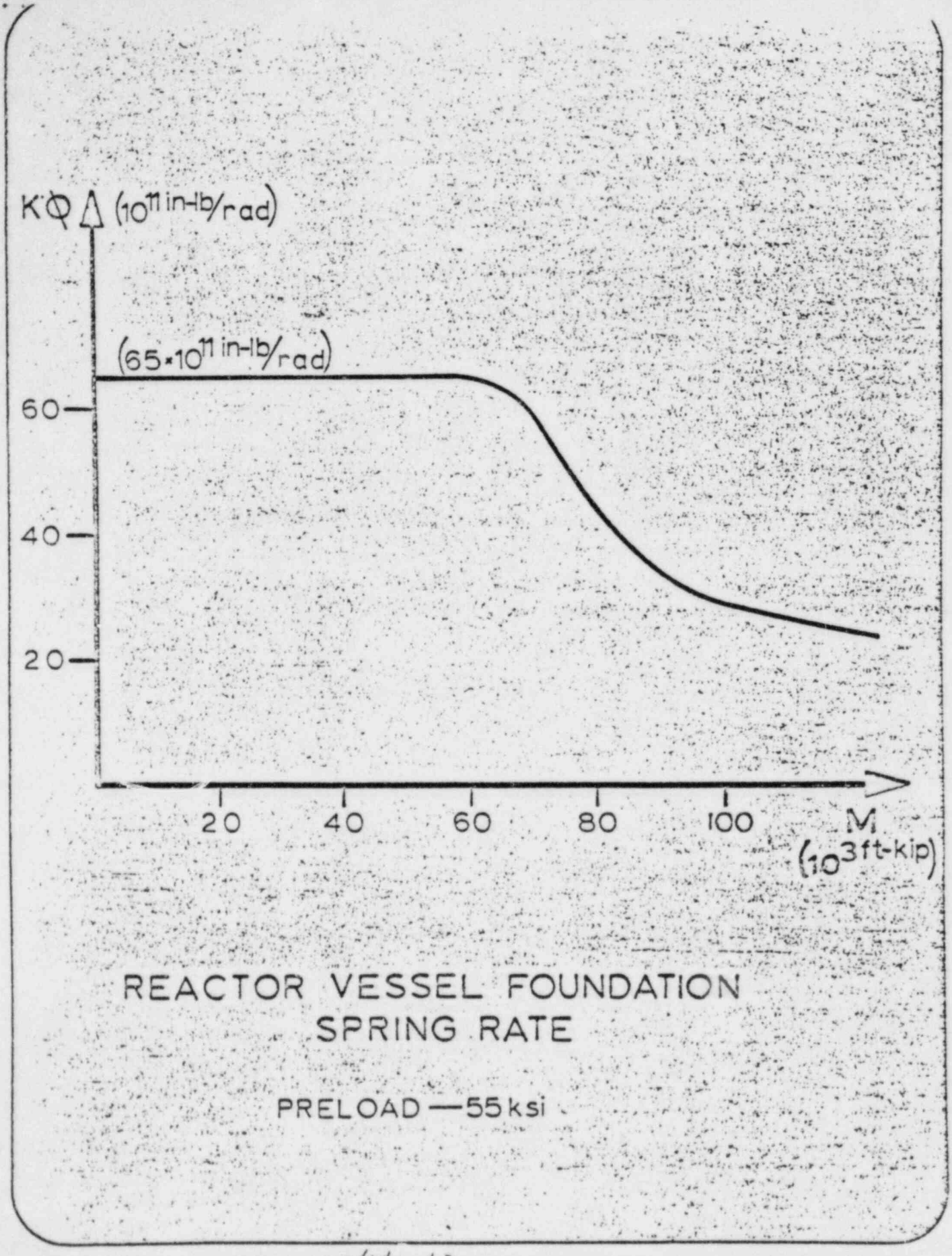
REACTOR VESSEL

SKIRT SUPPORT PT 213 FIG 7

LOAD CASE	FORCES (KIPS) FX	FY	FZ	MOMENTS (FT-KIPS) MX	MY	MZ
CL-3A, UCL NPI NOZZLE GUIL			NOT A DESIGN CASE FOR THIS LOAD POINT			
CL-3B, UCL NPI NOZZLE GUIL			NOT A DESIGN CASE FOR THIS LOAD POINT			
CL-4A, UCL ELBOW SPLIT	699.1	1037.4	1110.8	20667.7	4671.5	9918.0
CL-4B, UCL ELBOW SPLIT	273.2	1350.8	787.4	15181.2	9795.2	5562.3
CL-5 , UCL SPRY LINE NOZ GUIL			NOT A DESIGN CASE FOR THIS LOAD POINT			
CL-6A, UCL PNP TRNNL END GUIL	479.1	1031.0	816.2	17763.2	2453.8	11297.2
CL-6B, UCL PNP TRNNL END GUIL	364.5	1290.5	807.2	18029.9	2116.8	8277.1
CL-1A, LCL PNP TRNNL END GUIL	317.4	1131.8	852.6	22559.3	6210.4	6007.2
CL-1B, LCL PNP TRNNL END GUIL	528.7	1463.9	1065.7	25203.4	3466.2	11727.8
CL-2A, LCL SPLIT	529.9	1302.3	1282.8	29516.3	8868.7	8878.3
CL-2B, LCL SPLIT	557.7	1314.2	1327.2	29836.7	10071.4	10894.8
CL-3A, LCL DRAIN GUIL			NOT A DESIGN CASE FOR THIS LOAD POINT			
CL-3B, LCL DRAIN GUIL			NOT A DESIGN CASE FOR THIS LOAD POINT			
CL-4A, LCL INTERMEDIATE GUIL	172.2	1100.7	973.7	21268.8	2095.3	4528.5
CL-4B, LCL INTERMEDIATE GUIL	206.8	1096.5	976.7	20922.7	1113.1	4247.6
CL-5A, LCL OTSG TRNNL END GUL	124.7	1119.8	982.2	21032.5	1931.8	3806.9


OTSG UPPER SUPPORT
EL 636'-0"
SERVICE SUPPORT SKIRT
EL 627'-0"
EL 609'-0"
KEY
STRUCTURAL JOINT
MID JOINT
ORIENTATION JOINT
JOINT No.
ELEMENT No.
VIEW E-E

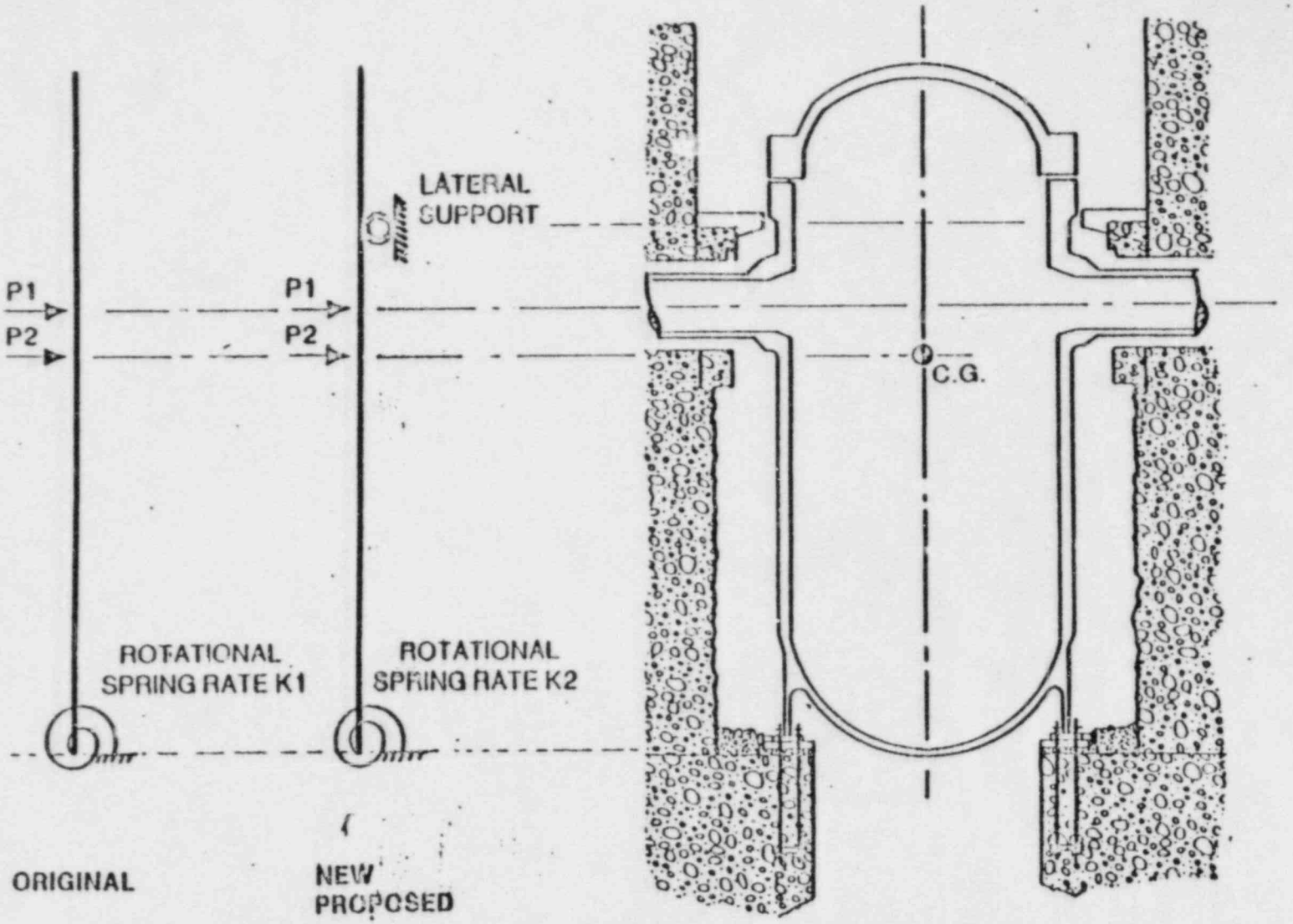
Slide 11



REACTOR VESSEL FOUNDATION
SPRING RATE

PRELOAD — 55 ksi

slide 12



K1 ≫ K2

slide 13

1077 04

slide 14

II ANOMALIES

A Preliminary ~~Preliminary~~ Listing of Anomalies Would Include the Following :

A. The Selection of an 850° Temper Temperature Appears Low For AISI 4140.

B. Material Hardness (Especially Surface Hardness) is High for an 850° Temper.

C. The First Stud to Fail did not Exhibit a Hardness Gradient.

D. About one Half of the Unit 1 Studs Exhibited Unanticipated Hardness on the Ends of the Studs.

E. The Strength and Hardness Apparently Varies Along the Length of the Stud.

APPENDIX

UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION III
799 ROOSEVELT ROAD
GLEN ELLYN, ILLINOIS 60137

MAR 20 1980

Docket No. 50-329
Docket No. 50-330

Consumers Power Company
ATTN: Mr. Stephen H. Howell
Vice President
1945 West Parnall Road
Jackson, MI 49201

Gentlemen:

This refers to the inspection conducted by Messrs. C. M. Erb and T. E. Vandel of this office on February 4-5 and 14, 1980, of activities at the Midland Nuclear Power Plant, Units 1 and 2 authorized by Construction Permits No. CPPR-81 and No. CPPR-82 and to the discussion of our findings with Messrs. J. Corley, H. Slager and others of your staff at the conclusion of the inspection.

The enclosed copy of our inspection report identifies areas examined during the inspection. Within these areas, the inspection consisted of a selective examination of procedures and representative records, observations, and interviews with personnel.

No items of noncompliance with NRC requirements were identified during the course of this inspection.

In accordance with Section 2.790 of the NRC's "Rules of Practice," Part 2, Title 10, Code of Federal Regulations, a copy of this letter and the enclosed inspection report will be placed in the NRC's Public Document Room, except as follows. If this report contains information that you or your contractors believe to be proprietary, you must apply in writing to this office, within twenty days of your receipt of this letter, to withhold such information from public disclosure. The application must include a full statement of the reasons for which the information is considered proprietary, and should be prepared so that proprietary information identified in the application is contained in an enclosure to the application.

~~8004080260~~

We will gladly discuss any questions you have concerning this inspection.

Sincerely,

G. Fiorelli, Chief
Reactor Construction and
Engineering Support Branch

Enclosure: IE Inspection
Report No. 50-329/80-05
and No. 50-330/80-05

cc w/encl:
Central Files
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Service Commission
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U.S. NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT

REGION III

Report No. 50-329/80-05; 50-330/80-05

Docket No. 50-329; 50-330 License No. CPPR-81; CPPR-82

Licensee: Consumers Power Company
1945 West Parnall Road
Jackson, MI 49201

Facility Name: Midland Nuclear Power Plant Units 1 and 2

Inspection At: Midland Site, Midland, MI and Southern Bolt Company, Shreveport, LA

Inspection Conducted: February 4-5 and 14, 1980

Inspectors: T. E. Vandel 3-11-80

C. M. Erb 3/11/80

Approved By: R. C. Knop, Chief 3-11-80
Project Section 1

Inspection Summary

Inspection on February 4-5 and 14, 1980 (Report No. 50-329/80-05; 50-330/80-05)

Areas Inspected: This inspection was a special inspection conducted to review the Units 1 and 2 reactor pressure vessel anchor bolts records and fabrication information gathered by the licensee, and observe a meeting conducted at Southern Bolt Company regarding the acceptability of the bolts supplied. The inspection involved a total of 43 inspector-hours by two NRC inspectors.

Results: No items of noncompliance were identified.

8004140267

DETAILS

Persons Contacted at Midland Site

Consumers Power Company

*J. L. Corley, Section Head IE & TV
B. H. Peck, Construction Supervisor
*D. R. Keating, QA Group Supervisor
*H. W. Slager, Staff Engineer, Project Engineering Services
*R. M. Wheeler, PMO - Civil Section
*J. L. Wood, QA Group Supervisor

Bechtel Power Corporation

*A. J. Boos, Project Field Engineer
*L. A. Dreisbach, Project QA Engineer
*P. Goguen, Field Engineer
*R. E. Sevo, QA Engineer
E. M. Hughes, Assistant Project Engineer

*Denotes those present at the exit meeting held on February 5, 1980.

Persons Contacted at the Southern Bolt and Fastener Corporation Meeting

Consumers Power Company

H. W. Slager, Engineer, Project Engineering Services
R. Wheeler, Field Civil Engineer
J. L. Wood, QA Group Supervisor

Bechtel Power Corporation (Bechtel)

C. Boyak, Project Engineer
P. Goguen, Field Engineer
E. Hughes, Assistant Project Engineer
M. Elgaaly, Project Engineer
W. Keyser, Materials

Southern Bolt and Fastener Corporation

E. Nelson, President
R. Alexander, Vice President
W. Gow, Metallurgist
D. Sibley, Quality Assurance
T. Goin, Sales
B. Mathias, Sales
J. Wisby, Sales

Mississippi Valley Structural Steel (MVSS)

J. Pantukhoff, Vice President
N. Cohn, Engineer

Review of 10 CFR 50.55(e) Reported Deficiency

The licensee reported to the NRC RIII office on September 14, 1979 the discovery of a broken reactor pressure vessel holddown stud. Following is the review of this reportable deficiency:

1. Inspection at Midland Plant 50.55(e) Item

a. Unit 1 Studs

The inspectors visited the site to review information regarding the two broken holddown studs. Failed stud No. 3 was located in the inner ring of studs and was of heat 00 while failed stud 36 was located in the outer ring and also was of heat 00. While inspecting the RPV holddown bolts of the outer ring, one of the NRC inspectors noticed that stud No. 35 (heat 00) in the outer ring and adjacent to stud 36 was off its seat about an inch. Examination revealed that it had also fractured sometime between December 14, 1979 and February 5, 1980. It had not been removed yet at the time of writing. Teledyne Engineering Services (TES) had been contracted in November 1979 to investigate the failure of first failed stud 3 and had also been given stud 36 for examination. In conjunction with the investigation of the two failed studs they had made hardness tests on the exposed ends of all 96 bolts in Unit 1.

Hardness checks were made by TES using a French portable hardness tester. Testing was done on the polished end of each stud from the edge to the center. Some bolts showed a decided drop-off in hardness at the center while others were quite uniform from edge to center. This reveals a non-uniformity in the heat treat, which could arise for reasons such as shielding of the stud top by the holding nut and fixture or lack of hardenability in the 4140 steel.

Edge hardness readings were taken and correlated by heat number in the TES study with the following results:

Heat No.	No Studs	L - Converted to Rockwell C.
0	51	above 38 RC
00	9	" " "
00	6	38 or under .
000	21	42 RC or above

Heat numbers for nine studs are missing, apparently because the heat number could not be ascertained from the exposed end. (Only one end was stamped). Bechtel specification 7220C-233(Q) was used to procure the studs, and it referenced ASTM-A 354 Grade BD for the material. A Rockwell "C" hardness of 32-38 was required by that standard. A minimum tensile of 150,000 psi and a minimum yield strength of 130,000 psi was required from specimens machined from approximate center of 2-1/2" test bars. A minimum elongation of 14% and minimum reduction of area of 35% was also required. Charpy V notch (CVN) tests were required at 40°F at the 1/2 radius of the bar and the values of lateral expansion for 3 specimens shall be a minimum of 25 mils. However, the results of the CVN test were requested for information only.

The Standard Pressed Steel (SPS) Company made 2 tensile test and 2 Charpy tests from each heat of material after heat treatment. The results were as follows:

Heat	No. Type	Tensile psi	Yield psi	Elong. %	Red. Area %	Lateral Deform. mils	Ft. Lbs. (CVN)
0	4140	166,000	135,000	16.0	55.8	5.5, 4.5 8.5	16.5,10.0,16.0
		171,800	133,800	16.0	56.2	7.5, 5.5 6.0	15.0,15.0,14.5
00	4145	163,000	138,800	17.0	56.8	5.5, 1.5 4.5	16.5, 9.5,13.5
		173,200	151,800	10.0	52.4	5.0, 5.5 8.5	12.0, 13.0, 17.0
000	4140	167,800	135,200	14.0	50.4	9.0, 5.5 3.4	16.0, 12.5, 11.0
		163,000	131,800	17.0	56.8	2.5, 1.5 6.0	8.5, 6.0, 6.0

The hardness results for the above tests were in 36-38 RC range and thus met the specification requirements. The tensiles and yield results were also satisfactory, but the CVNs were much below the foot pound and lateral deformation requirement. Since the CVNs were for information only, no action was taken except to provide the results. An explanation for the above satisfac-

tory tensile, yield, elongation and reduction of area results means that tensiles machined from the center of bars with a high hardness gradient would indicate much lower hardness, lower tensiles and higher elongation than material near the edge of the stud.

b. Unit 2 Studs

The Unit 2 studs were also checked for hardness by TES with the following results:

Ht.	Code and Type	No. Bolts	Hardness
X	4340	18	39 and above
X	"	14	38 and below
XX	4340	1	39 RC
XX	"	55	38 and below

From the above, it is plain that many more of the studs meet the 38 RC and below criteria than in Unit 1. However, 19 of the bolts in Unit 2 are above the 38 RC level.

These studs were made from 4340 steel which did respond with uniform hardness across the section and were tempered between 925°F and 975°F. However, the suitability for use of the hard studs in Unit 2 remains to be established.

2. Trip to Southern Bolt and Fastener

The inspectors went to Southern Bolt Plant and met, together with the personnel indicated under Persons Contacted, with Southern Bolt and Mississippi Valley structural steel management. Bechtel and Consumer Power Company had prepared questions for the meeting. The gist of certain answers are given below:

a. The round bars were received by Southern Bolt in 2-1/2" diameter because the preferred 2-3/4" stock was unavailable due to tightness of supply. Visual examination and magnetic test revealed longitudinal indications due to dirty steel and a seamy condition. Grinding was used by Southern Bolt to remove the MT indications and permission was asked from Bechtel to accept bolts if the shank size were 2.257" or above. Three heats (0,4140), (00,4145),(000,4140) and (0000,4140) of bars were received by Southern Bolt with all 0000 material finally scrapped. Of 200 bars that were started through the processing cycle, only 97 bolts were accepted after heat treatment and a final magnetic particle inspection.

The heat treatment was performed at the J. W. Rex Company in Philadelphia, Pa. MT was performed after heat treatment by Peabody Company and several bolts were rejected.

SPS Company in Philadelphia made 2 tensile test and 2 Charpy impact tests from each heat using test bars supplied by Southern Bolt and heat treated by J. W. Rex with production bolts. No record exists that the bolts were normalized prior to the austenitize and quench. The bolts were hung 10 at a time vertically from a fixture in a furnace using a nut on threaded end to hold each piece. The quench was made using the same fixture into an agitated oil bath tank. Hardness surveys by Teledyne of the installed bolts in Unit 1 indicated a wide hardness gradient from center to outside of the bolts. This indicates uneven quenching possibly affected to some degree by the nut and holding fixture holding each bolt at the top end. The tempering temperature was 850°F minimum by ASTM specification A354-66 which is referenced by Bechtel procurement specification 7220-C-233 Q Revision 12. Forty bolts were processed in each tempering batch. Bolts were distributed between 3 heats as follows:

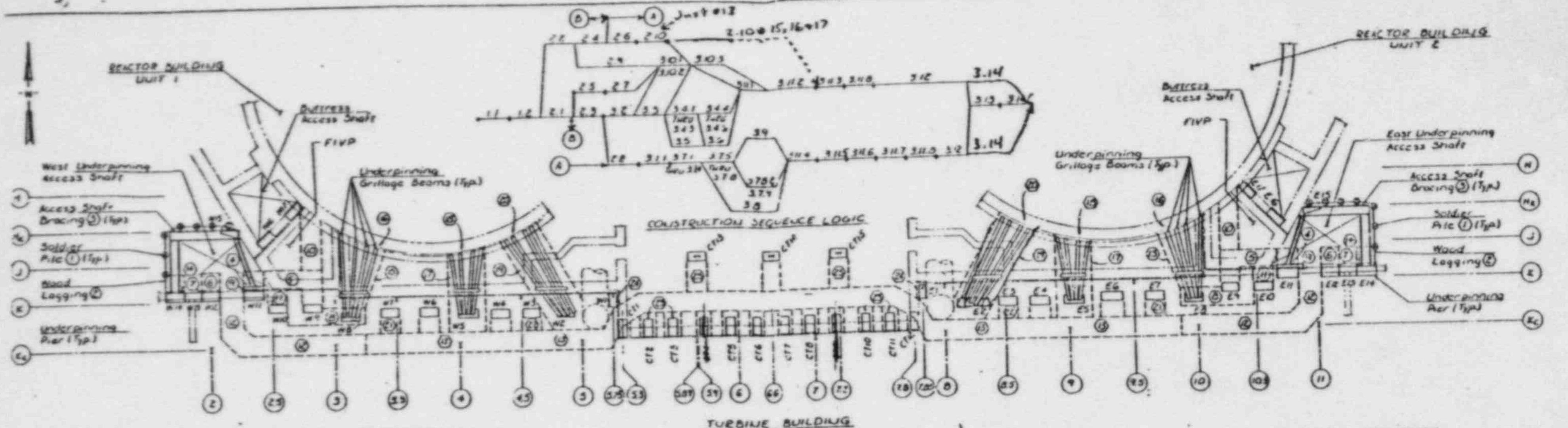
Code	Heat No.	Material	No. Studs
0	654N136	4140	58
00	54980	4145	18
000	655N051	4340	21

The 18 bolts from heat 00 were given an additional temper at 925°F, but the remaining 78 bolts from Heats 0, and 000 saw only the 850°F.

Exit Interview

An exit interview was conducted with the licensee representatives denoted in the Persons Contacted paragraph at the conclusion of the inspection at the Midland site on February 5, 1980. The inspectors expressed their appreciation for the efforts of the licensee to provide the inspectors with the information obtained to date regarding the adequacy of holddown studs for both Unit 1 and Unit 2 vessels.

Enclosure 1



CONSUMERS POWER COMPANY
MIDLAND PLANT UNITS 1 & 2

UNDERPINNING AUXILIARY BUILDING
CONSTRUCTION SEQUENCE LOGIC

1-20-82

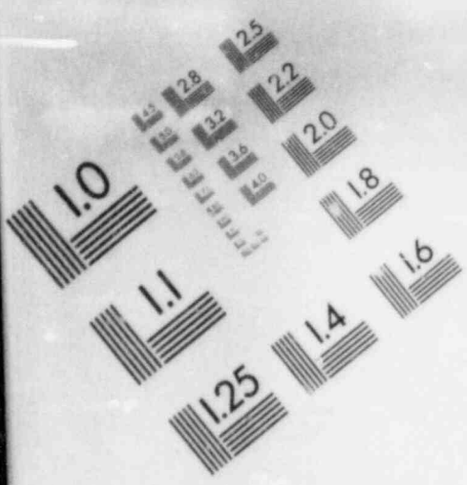
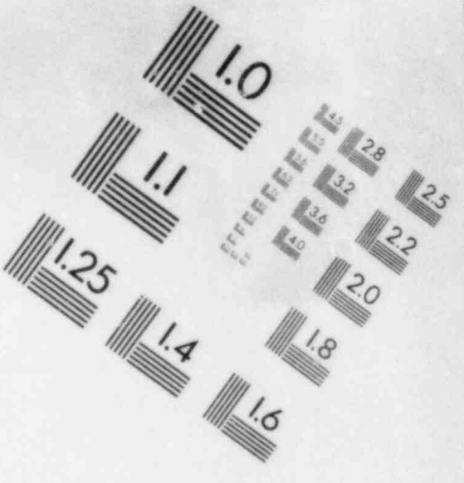
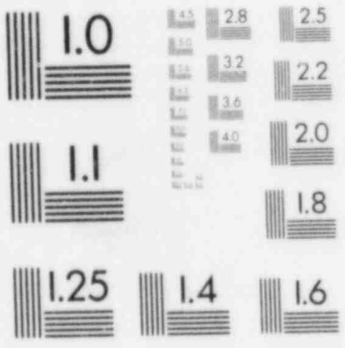
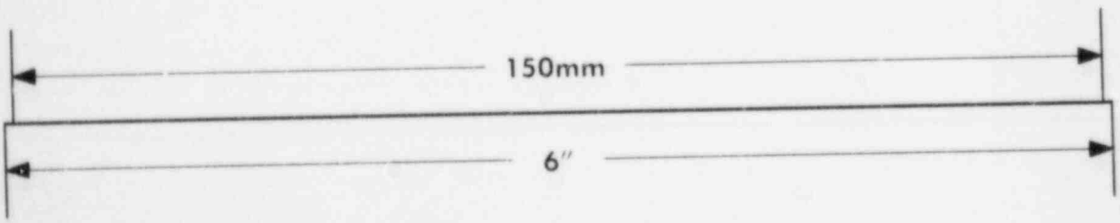
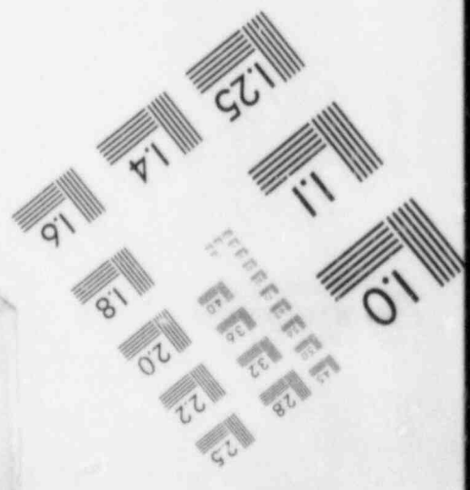


IMAGE EVALUATION TEST TARGET (MT-3)









Swanberg
1-18-82

Enclosure 2
(Page 1 of 2)

AUXILIARY BUILDING UNDERPINNING

AGENDA

1)	INTRODUCTION	N. Swanberg
2)	CONSTRUCTION SEQUENCE	D. Bartlett
3)	DESIGN DETAIL	
	A) FIVP Temporary	S. Lo
	B) Extention of Acess Shaft to elevation 597	N. Rawson
	C) Drift under FIVP, Turbine Building	N. Rawson
	D) Turbine Building Underpinning	N. Rawson
4)	Monitoring Details	R. Adler

PROPOSED CONSTRUCTION RELEASE (PHASE II)

1) EXTEND ACCESS SHAFTS TO ELEVATION 597

2) CONSTRUCT DRIFTS UNDER F ! V P AND TURBINE BUILDING UP TO PIER W8 AND E8

3) CONSTRUCT PIERS W8 THRU W14 AND E 8 THRU E14

Enclosure 3

Calculations

FIVP Temporary Support
Turbine Wall below el 609
Turbine Mat for Undermining
Piers adjacent to FIVP under Turbine Bldg.
Buttress access shaft for Wale loads from acess shaft
Containment wall for strut loads
Lagging Calculations
Turbine Building Permanent Condition
Bearing Pressure Calculations for Piers

Specifications

Access Shaft Installation
Underpinning (Information Draft)

Drawings

FIVP Support Steel
Tunnel Details
Pier Details
Pit Details (Sketch)
Strut Details
Construction Sequence
Deep Seated Bench Marks
Monitoring Instrumentation
Monitoring Data Forms

1-17-72

A DISCUSSION ON THE EFFECTS OF PHASE II CONSTRUCTION ON THE AUXILIARY BUILDING FOUNDATION

This discussion presents reasons why Phase II construction will not be detrimental to the foundation support of the auxiliary building. Phase II is primarily the construction of several 3 ft. by 6 ft. hand dug piers and 7 ft. high by 6 ft. wide access drifts necessary for access to the pier locations. Phase II does not include any undermining or removal of the supporting soil directly beneath the auxiliary building. Although there is lateral excavation adjacent to the materials supporting the auxiliary building, and there are excavations for hand dug piers, as explained below, these excavations and the construction of the piers will not be detrimental to the auxiliary building foundation.

The first consideration must be the strength and rigidity of the auxiliary building structure. The massive east-west shear wall is capable of redistributing the building loads to the underlying soil if necessary. A preliminary finite element analysis of the structure indicates that approximately 7 ksi maximum increase in rebar stress will occur if a 20 ft. width of soil were removed under both the east and west ends of the electrical penetration wings. This is a design case far more severe than any condition that could exist in Phase II construction. Therefore, this acceptable increase in stress provides assurance that the Phase II construction will not be detrimental to the auxiliary building foundation. In the actual case, there will not be any soil removed from under the auxiliary building; only a minor redistribution of the soil pressure bulb will take place, as a result of the construction.

Construction procedures are an important consideration. For the access drift, the procedure will be to advance the excavation approximately four feet without lagging. The unlagged excavation can be expected to stand at greater than 3 vertical to 1 horizontal during this stage of construction. After the excavation has been extended, a steel support frame will be installed four feet beyond the last in-place frame. Lagging will be placed along the sides of the drift between these two frames. Previously excavated soil will then be packed behind the lagging to restore lateral support to the unexcavated soil.

The pits will be constructed by the "excavate a foot - lag a foot" method in the fill material. Immediately after the lagging is in place, it will be backpacked to return lateral support to the surrounding soil.

These construction procedures for the access drifts and the pits are by controlled hand methods. They are also very localized construction activities. Additionally, no two adjacent pits will be worked on at the same time.

From field experience and the references listed at the end of this discussion, approximate limits of significantly disturbed soil adjacent to drift excavation can be expected to resemble the shape shown in Figures A1 and B1. The maximum horizontal projection of these zones of influence is approximately one half the height of the excavation. These figures, drawn to scale, indicate that the expected zones of influence do not extend to the soil supporting the auxiliary building.

The effect that the excavation will have on the "bulb of pressure" beneath the auxiliary building must also be evaluated. The vertical pressure in the supporting soil reduces with depth. The pressure lines on Figures A2 and B2 represent the bulb of pressure corresponding to one-tenth of the contact pressure beneath the foundation of the auxiliary building. Thus, it is seen from Figures A2 and B2 that this one-tenth ratio line does not intersect the access drifts.

However, there is an overlap of the zone of influence of significantly disturbed soil from Figures A1 and B1 with the 0.1 pressure bulb . This overlap will cause a redistribution of pressure, but because it occurs in a zone of low pressure the effect on the auxiliary building will be insignificant.

In a similar manner, excavation for the pits will cause disturbance of the low stress regions of the pressure bulb created by the auxiliary building. Again, this is a minor redistribution having an insignificant effect.

A contingency plan for ground stabilization will be implemented if the soil is found to be instable, or if the instrumentation indicates movement of the auxiliary building.

The above discussion clearly indicates that Phase II construction will not be detrimental to the auxiliary building.

REFERENCES

1. Foundation Design, Wayne C. Teng, page 125, 126.

2. NAVFAC DM-7, Department of Navy, Figure 13-8.

3. Rock Tunneling With Steel Supports, Proctor & White, page 62.

4. Cofferdams, White and Prentis, page 61.

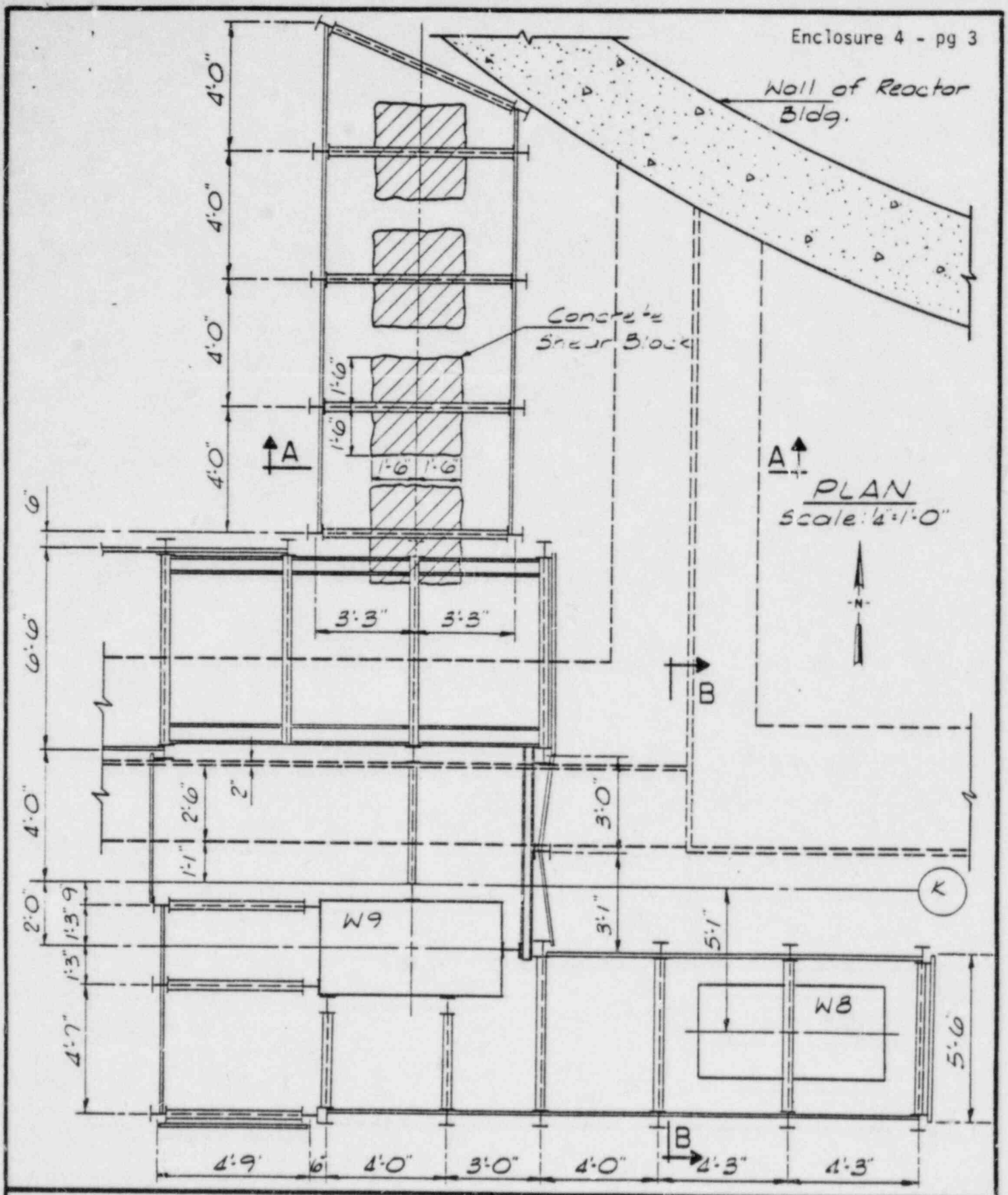


FIGURE A

1-20-82

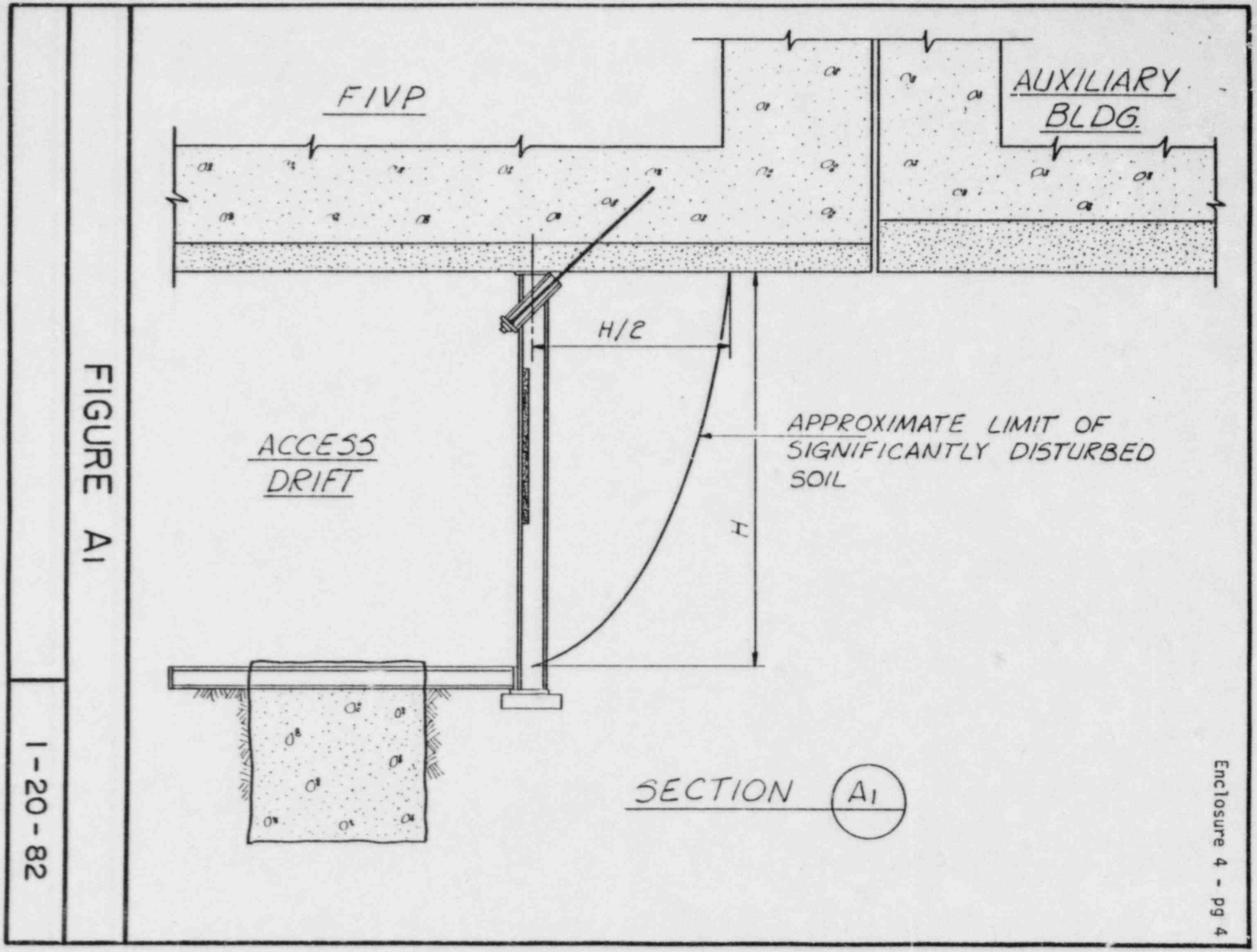


FIGURE A1

1-20-82

Enclosure 4 - pg 4

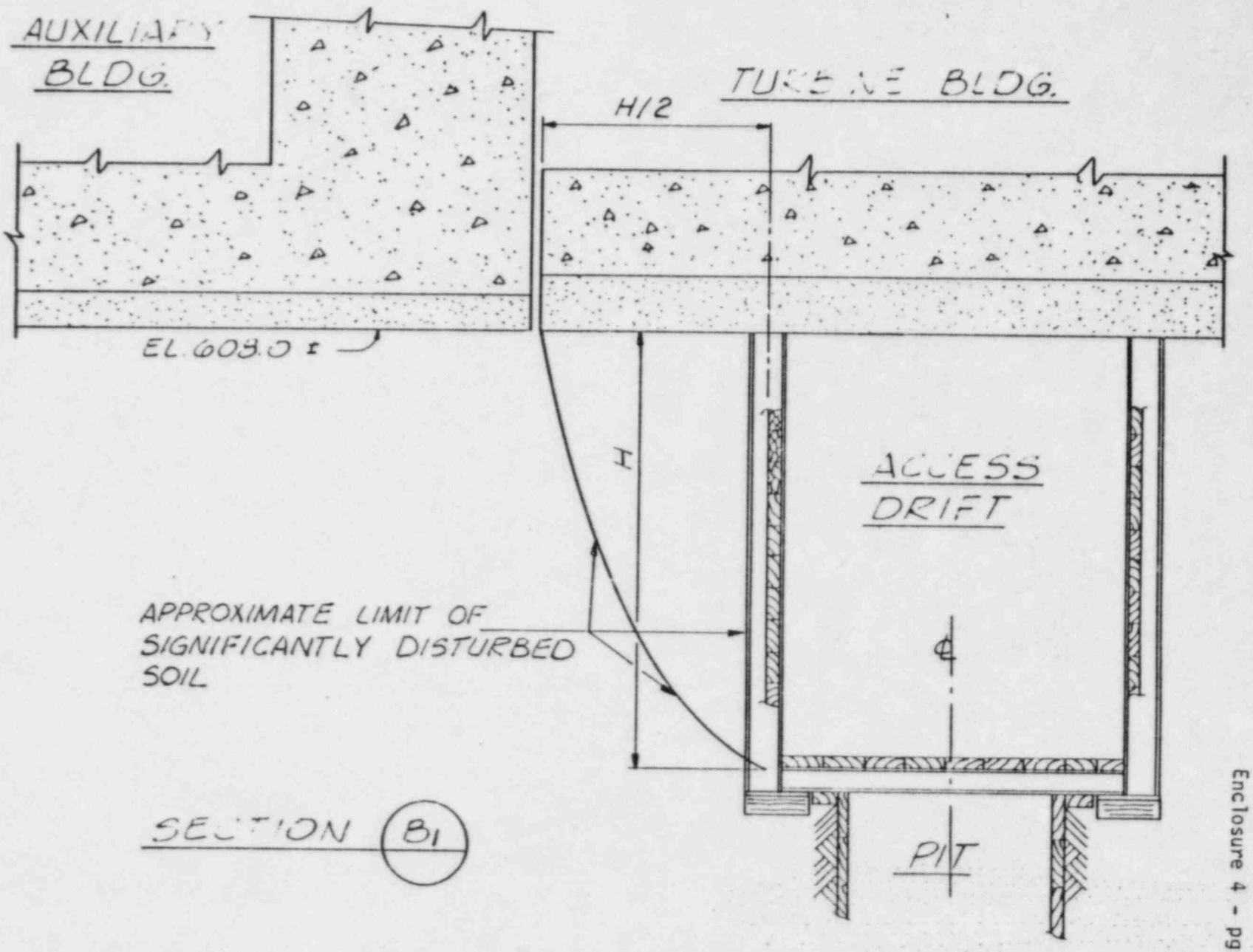


FIGURE B1

1-20-82

Enclosure 4 - pg 5

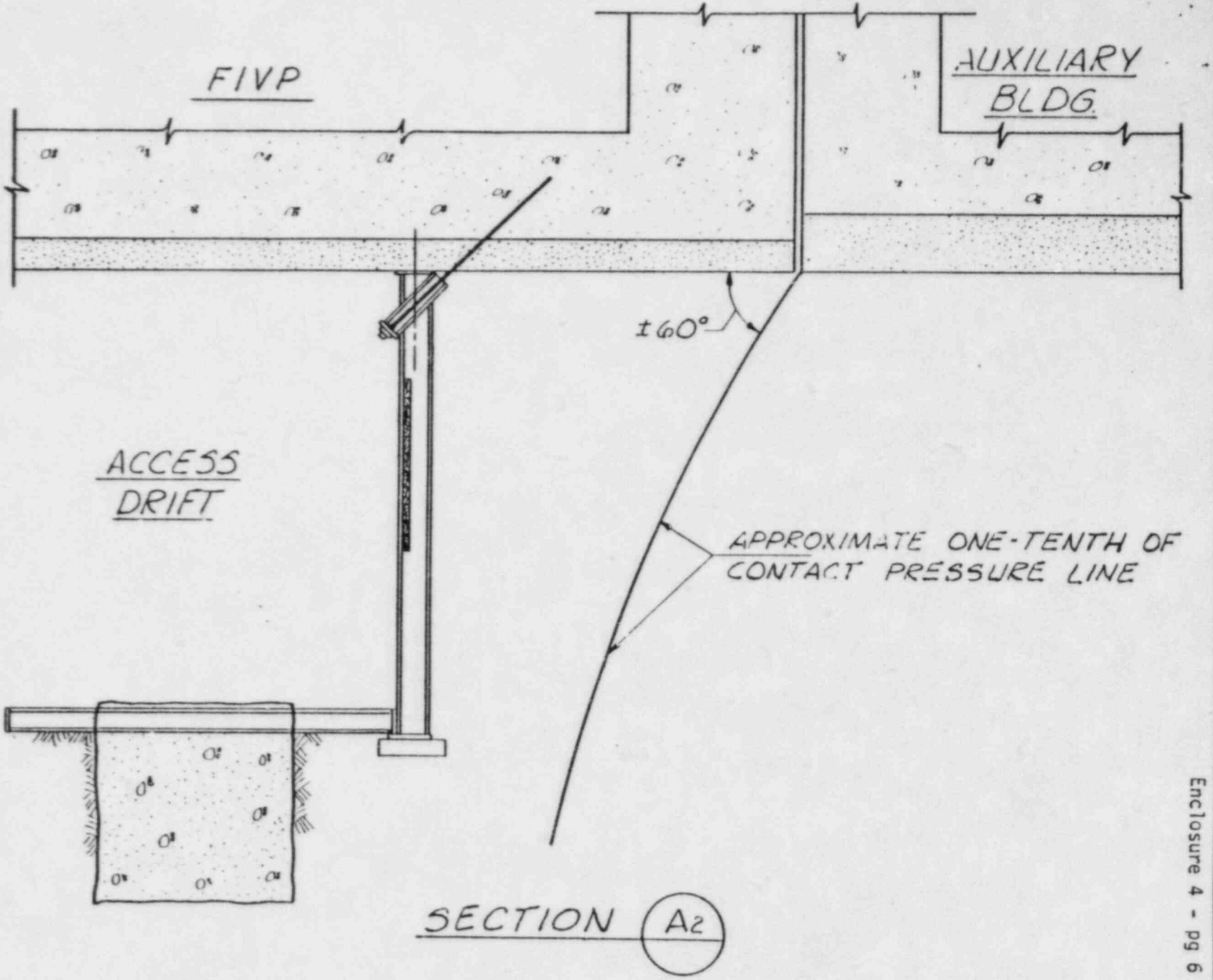


FIGURE A2

1-20-82

Enclosure 4 - pg 6

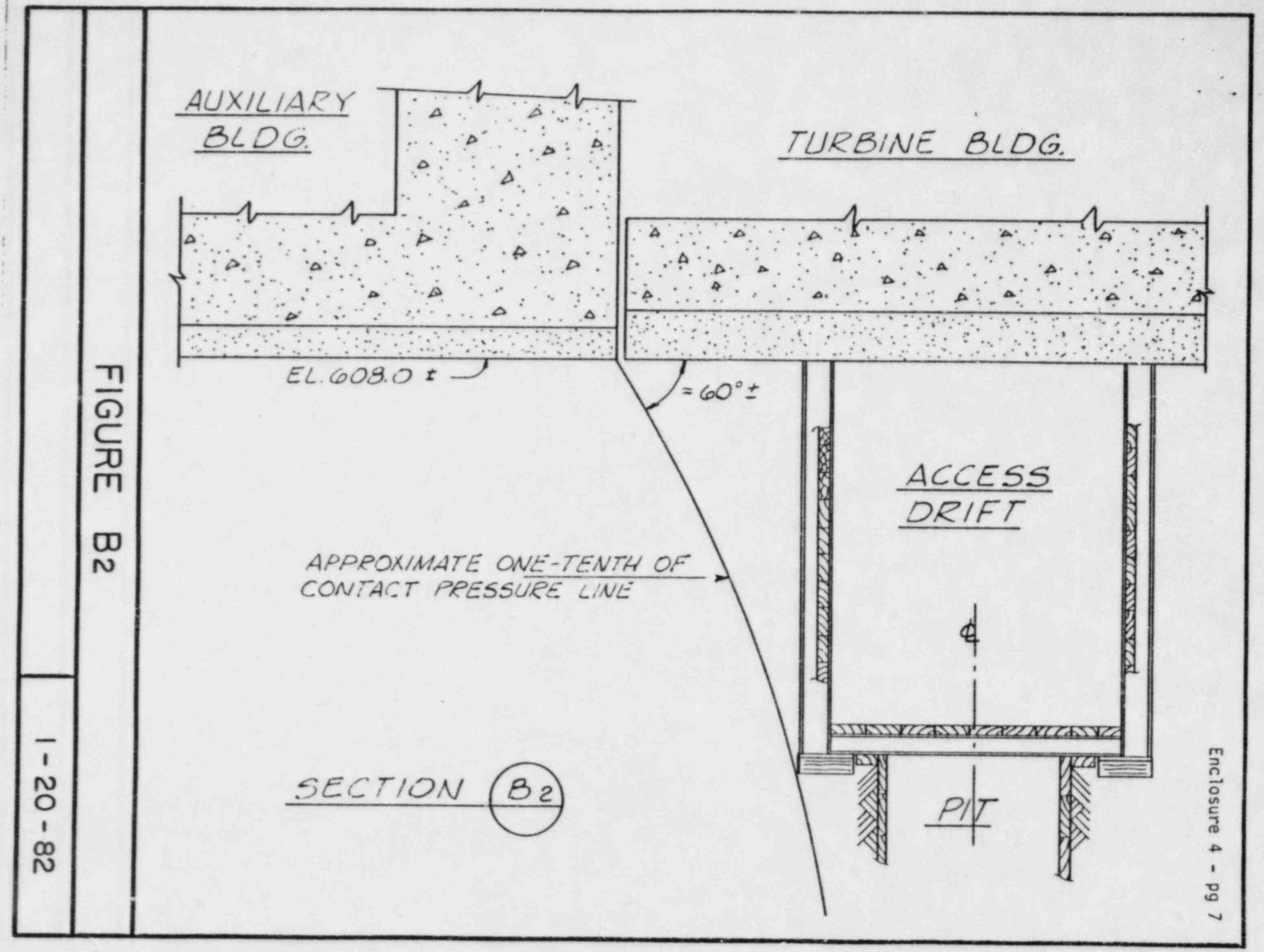


FIGURE B2

1-20-82

Enclosure 4 - pg 7

Let L_{l+d} = live load + dead load for the column which has the largest live load/dead load ratio;

L_s = service load for the same column;

= dead load + ½ live load for ordinary buildings;

q_a = allowable bearing pressure as determined by the principles discussed in Sec. 6-5;

q_d = design pressure for all footings except the one with largest live load/dead load ratio.

Then A = area of footing supporting the column with the largest live load/dead load ratio.

$= L_{l+d}/q_a$

$q_d = L_s/A$

$$\text{Area for other footings} = \frac{\text{Service load}}{q_d}$$

6-7 Stress on Lower Strata

1. For stability analysis of footings, the pressure under a footing may be assumed to spread out on a slope of 2 vertical to 1 horizontal. Thus, a load Q acting concentrically on a footing area of $B \times L$ is assumed to be distributed over an area of $(B + Z)(L + Z)$ at a depth Z below the footing, Fig. 6-8. If any stratum of soil is inadequate to sustain this spread-out pressure, the design bearing pressure should be reduced. However, for a two layer system of clays, the procedure described in Fig. 6-11 gives more reliable results.

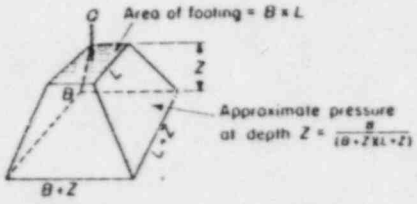


Fig. 6-8 Approximate distribution of vertical pressure under footing.

2. For settlement analysis, the approximation above may not be sufficient, and a more accurate approach based on elastic theory may be required. All elastic methods are developed from the Boussinesq's equation which deals with a single load acting on the surface of a half-space (infinitely large area and depth).

$$q = \frac{3Qz^3}{2\pi R^5} = \frac{3Q}{2\pi z^2}\cos^5\psi \qquad (6\text{-}5)$$

where q = vertical stress at any given point;

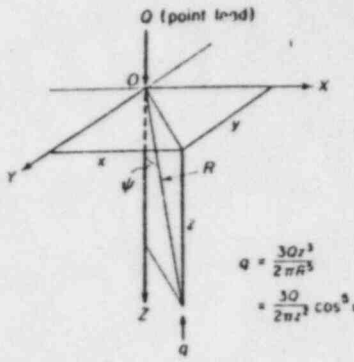


Fig. 6-9 Vertical stress due to a point load.

Q = surface load;

z = depth of the given point;

$r = \sqrt{x^2 + y^2 + z^2}$, see Fig. 6-9;

ψ = angle between line R and vertic

Based on Boussinesq's equation, vertical stresses under continuous, r angular and circular footings have b computed. The results are shown in 6-10. In these figures the magnitud vertical pressure at various points given in terms of the bearing pressu For example the vertical pressure at point along the line $0.2q$ is equal to

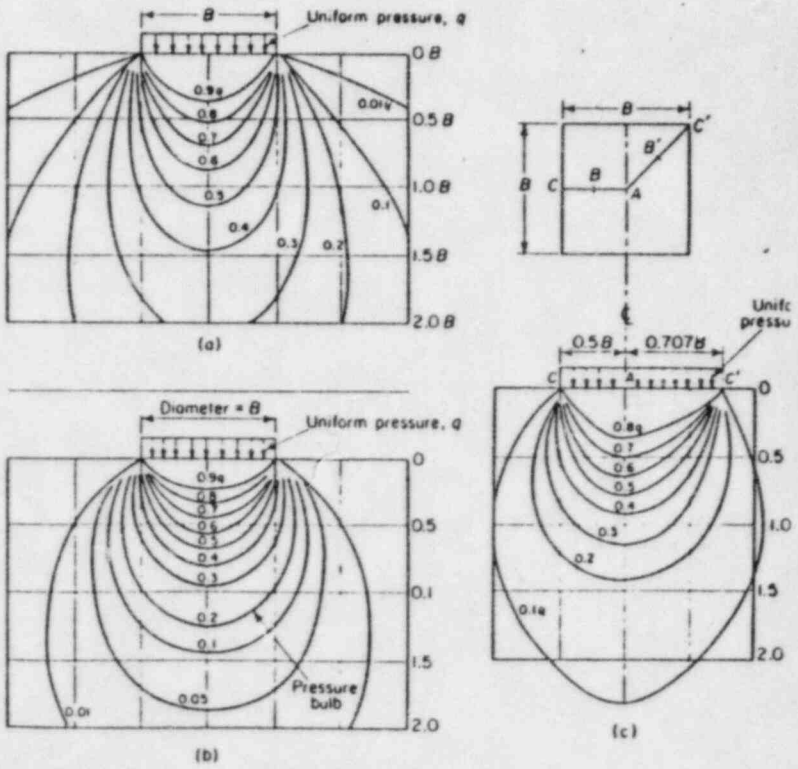
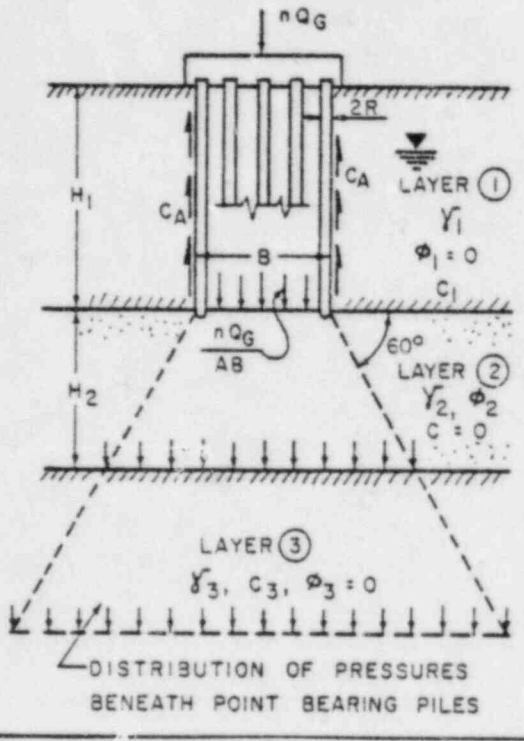
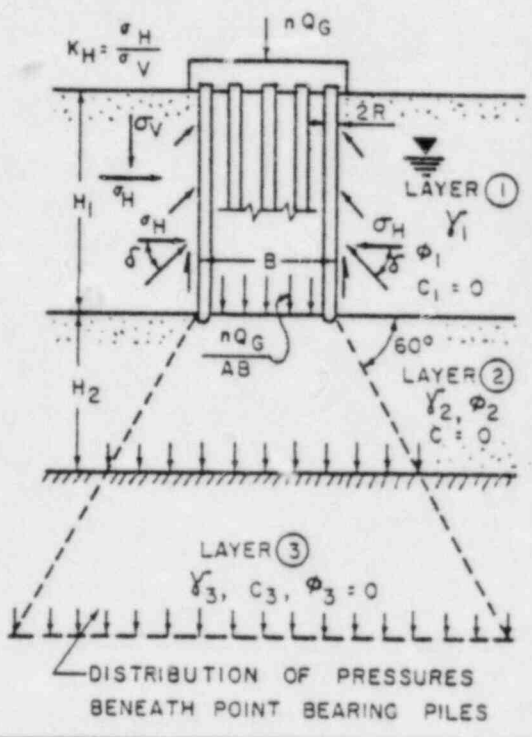


Fig. 6-10 Vertical stresses under footing: (a) under a continuous footing; (b) under a circular footing; (c) under a square footing.

OUTSIDE DIMENSIONS OF PILE GROUP IN PLAN = A x B, (B) IS SMALLER DIMENSION. PILES STOP IN TOP OF COARSE GRAINED LAYER (2). LAYER (2) IS UNDERLAIN BY COHESIVE STRATUM, LAYER (3). n = NUMBER OF PILES.





LAYER (1) IS COHESIVE ($\phi = 0$)

nQ_G = ULTIMATE LOAD CAPACITY OF GROUP

Q_{ult} = ULTIMATE CAPACITY OF SINGLE PILE (WEIGHT OF PILES NEED NOT BE INCLUDED IN APPLIED LOAD).

FAILURE IN LAYER (2) ($H_2 \geq B$)

PILE SPACING $\leq 6R$:

$$nQ_G = (\gamma_1 H_1 N_{q2} + 0.4\gamma_2 B N_{\gamma 2})\, A \times B + 2C_A (A+B) H_1 - AB\gamma_1 H_1$$

PILE SPACING $> 16R$: $nQ_G = n(Q_{ult})$

$$Q_{ult} = (\gamma_1 H_1 N_{q2} + 0.4\gamma_2 B N_{\gamma 2})\, \pi R^2 + 2C_A \pi R H_1 - \pi R^2 \gamma_1 H_1$$

LAYER (1) IS COHESIONLESS ($C = 0$)

FAILURE IN LAYER (2) ($H_2 \geq B$)

IF GROUND WATER IS AT DEPTH GREATER THAN (B) BELOW TOP OF LAYER (2):

IF LAYER (1) IS ESSENTIALLY SIMILAR TO TO LAYER (2), OBTAIN nQ_G FROM FIG. 13-2.

IF ϕ_1 DIFFERS GREATLY FROM ϕ_2:

PILE SPACING $< 6R$:

$$nQ_G = (\gamma_1 H_1 N_{q2} + 0.4\gamma_2 B N_{\gamma 2})\, A \times B + (A+B) K_H \gamma_1 \tan\delta_1 H_1^2 - AB\gamma_1 H_1$$

PILE SPACING $> 16R$: $nQ = n(Q_{ult})$

$$Q_{ult} = (\gamma_1 H_1 N_{q2} + 0.4\gamma_2 B N_{\gamma 2})\, \pi R^2 + \pi R \gamma_1 K_H \tan\delta_1 H_1^2 - \pi R^2 \gamma_1 H_1$$

FOR PILE SPACING BETWEEN 6R AND 16R, INTERPOLATE BETWEEN THE VALUES FOR 6R AND 16R.

FOR WATER NEAR TO THE GROUND SURFACE, SUBSTITUTE $\gamma_{1\,sub}$ FOR γ_1 AND $\gamma_{2\,sub}$ FOR γ_2 IN THE ABOVE FORMULAS. INTERPOLATE BETWEEN THESE LIMITS FOR INTERMEDIATE WATER LEVEL.

IN ANY CASE THE POSSIBILITY OF FAILURE IN CLAY LAYER (3) MUST BE INVESTIGATED. THIS IS PARTICULARLY IMPORTANT IF LAYER (2) IS THIN COMPARED TO DIMENSION (B). FAILURE OF LAYER (3) OCCURS IF LOAD DISTRIBUTED ON TOP OF LAYER (3) AS SHOWN EXCEEDS $1.3 c_3 N_c$.

FACTORS N_c N_γ & N_q OBTAINED FROM FIG. 11-1 FOR ALL CONDITIONS EXCEPT FOR COHESIONLESS SOILS WHEN LAYER (1) IS SIMILAR TO LAYER (2), IN THIS CASE USE N_c, N_γ AND N_q FROM FIG. 13-2.

FIGURE 13-8
Ultimate Load Capacity of Pile Groups in Layered Subsoils

7-13-17

The rock load H_p is represented in *Fig. 27* by the rectangle e f f_1 e_1. The balance of the weight of the overburden is carried by the ground arch. The weight of the middle part c d d_1 c_1 is transferred by the ribs of the tunnel support to the floor of the tunnel. The weight of the outer part acts as a surcharge on the top of the wedge-shaped bodies which tend to slide into the tunnel and increase the horizontal pressure exerted by these bodies.

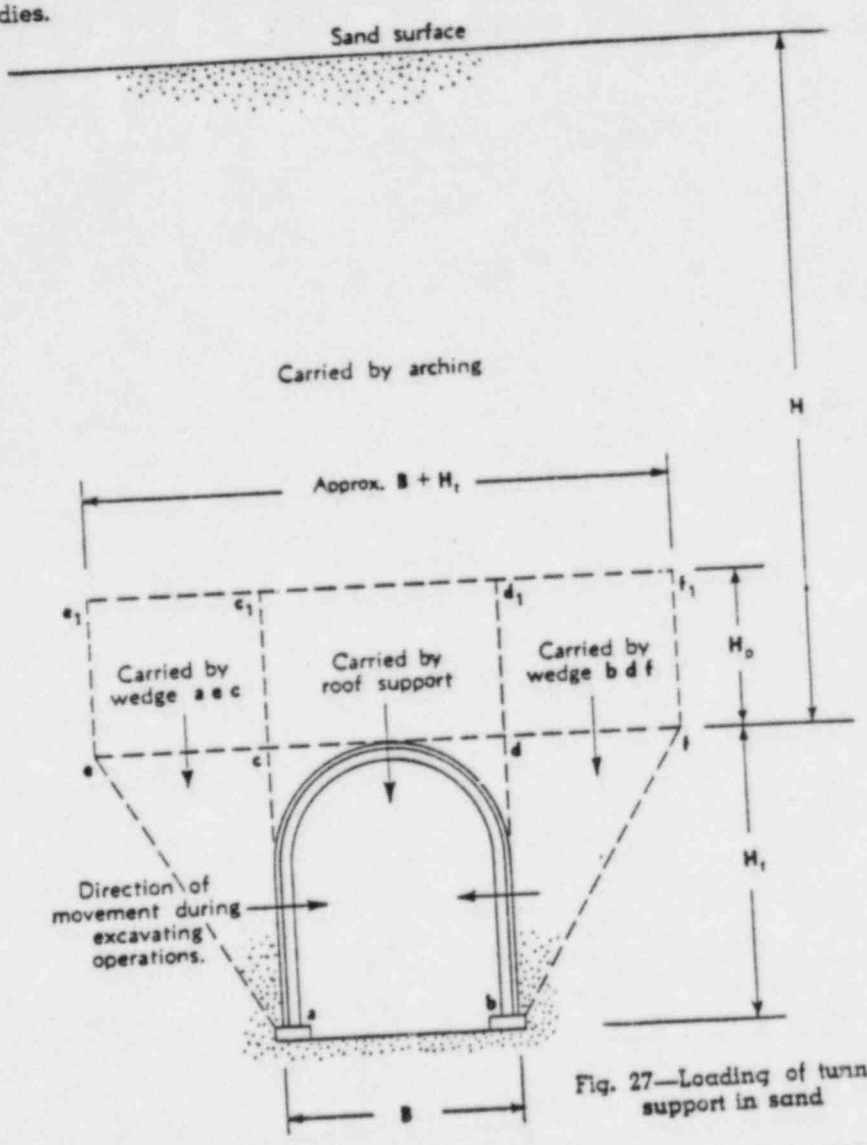


Fig. 27—Loading of tunnel support in sand

The rock load H_p is determined by eq. (2). According to the text accompanying this equation, the value of the constant C depends on the degree of compactness of the materials in which the tunnel is located and on the distance d through which the crown of the ground arch yielded before the support was installed. The distance d is not known and it can hardly be determined by practicable means. At a given width B of the tunnel it depends to a large extent on the skill of the miners and on the care with which the tunnel support is backpacked. The following numerical values are exclusively based on the results of the model tests with dry sand. Nevertheless it is

$$P = \frac{H \times \frac{1}{2}H}{2} \times \frac{w}{2} = \frac{1}{8}wH^2$$

Comparing the above to the liquid pressure of a material of the same unit weight, we get a ratio of 0.25, as liquid pressure would be $\frac{1}{2}wH^2$. This ratio is called the coefficient K and was introduced by Terzaghi.[1] It is an aid to rough computations of earth pressures, but in many respects is misleading, as the distribution of pressure along the face of a solid may be entirely different from that produced by a liquid. It will be noted from Figure 63 that

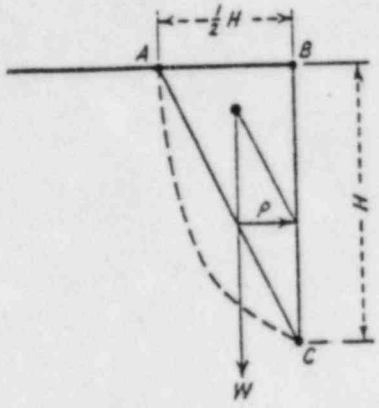


FIGURE 63. APPROXIMATE BREAK IN A BANK, SIMPLIFIED FOR COMPUTATION

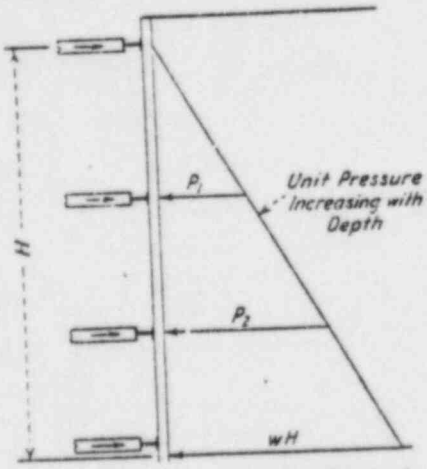


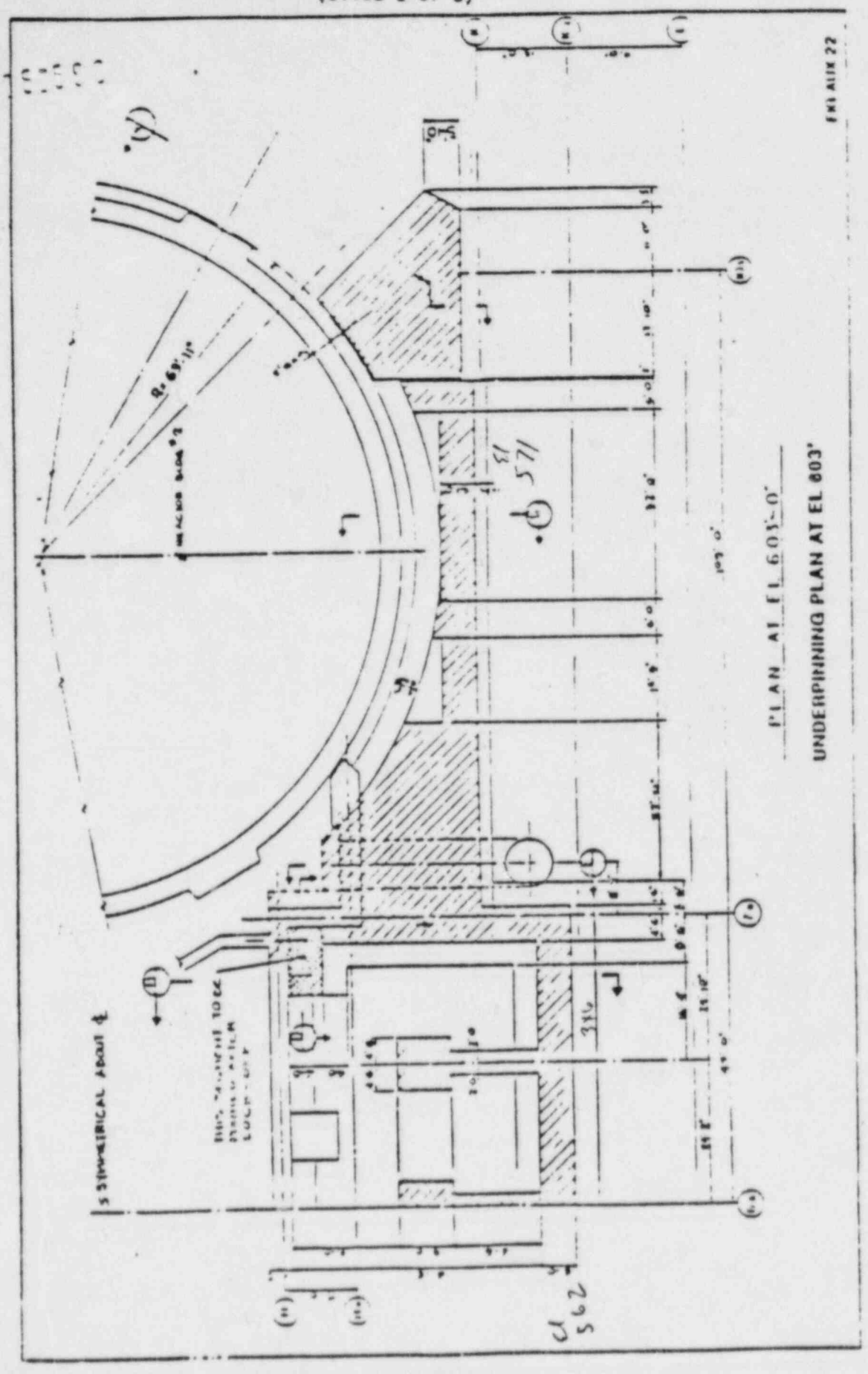
FIGURE 64. LIQUID PRESSURE ON A WALL

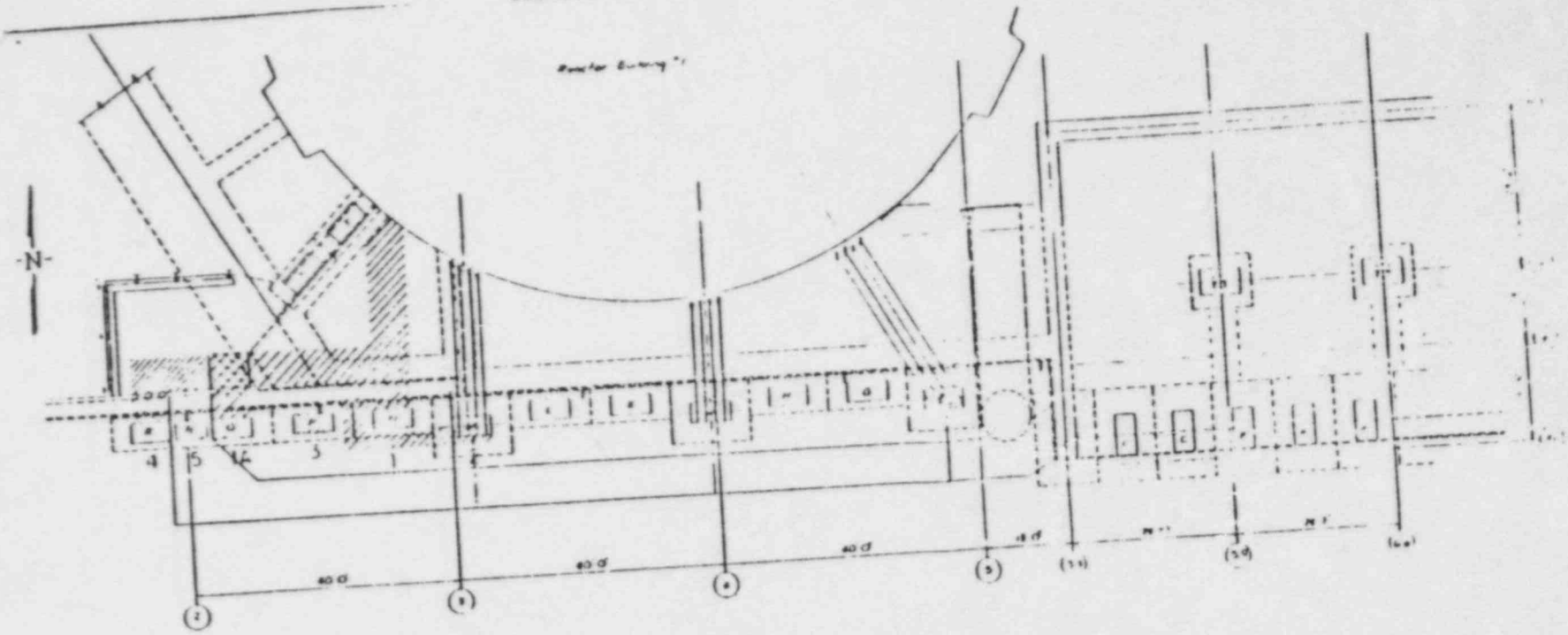
Total pressure (P) for unit width: $P = \frac{1}{2}wH^2$.

[1] *Soil Mechanics in Engineering Practice* by Karl Terzaghi and Ralph Peck, John Wiley & Sons, Inc., 1948, p. 353.

Enclosure 5
(slide 1 of 8)

Don Bartlett
1-18-82

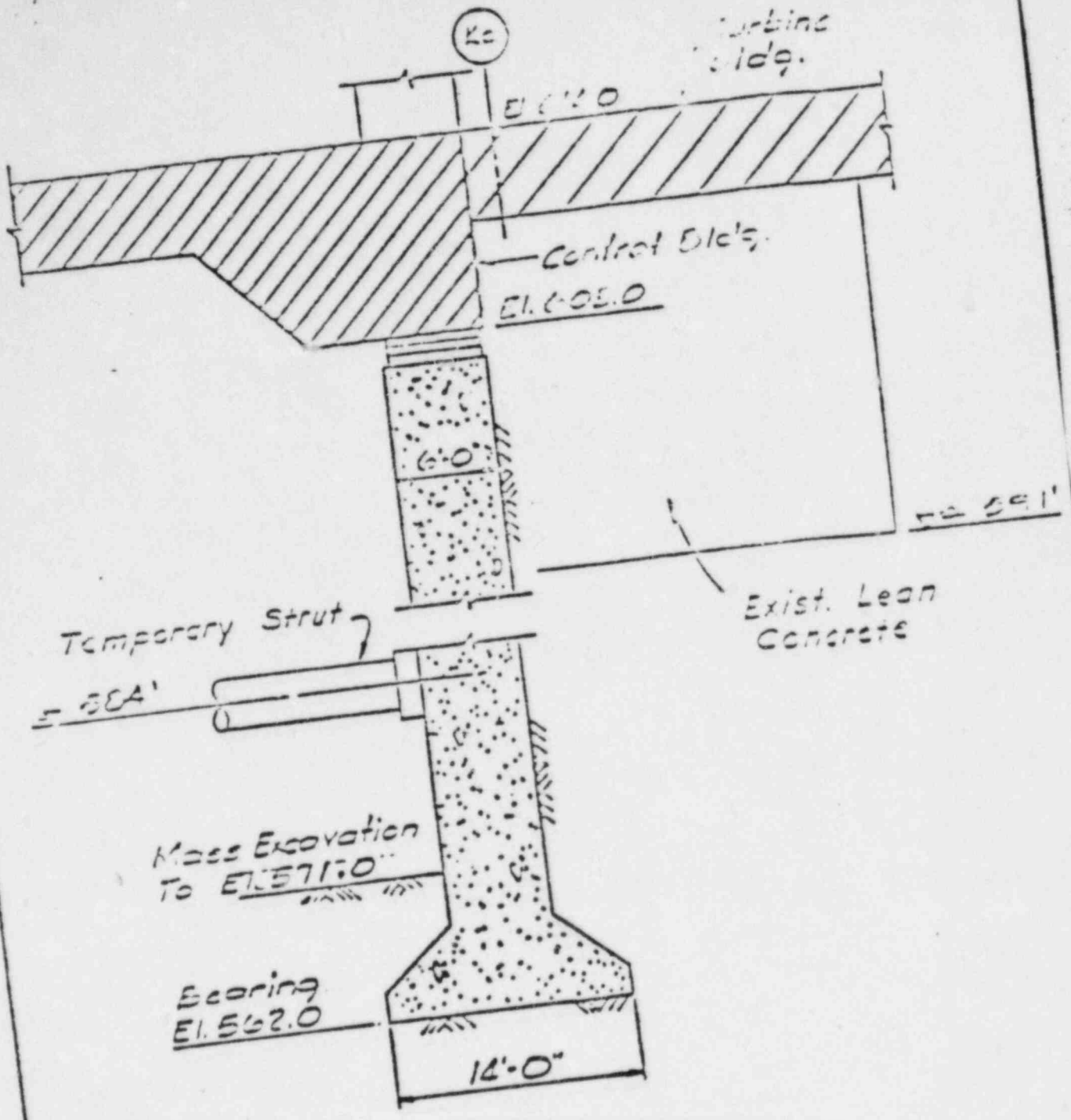




GENERAL PLAN
(WEST SIDE)

CONSUMERS POWER C
MIDLAND PLANT UNITS 1
CONCEPT DRAWING
UNDERPINNING AUXILIARY F
GENERAL PLAN

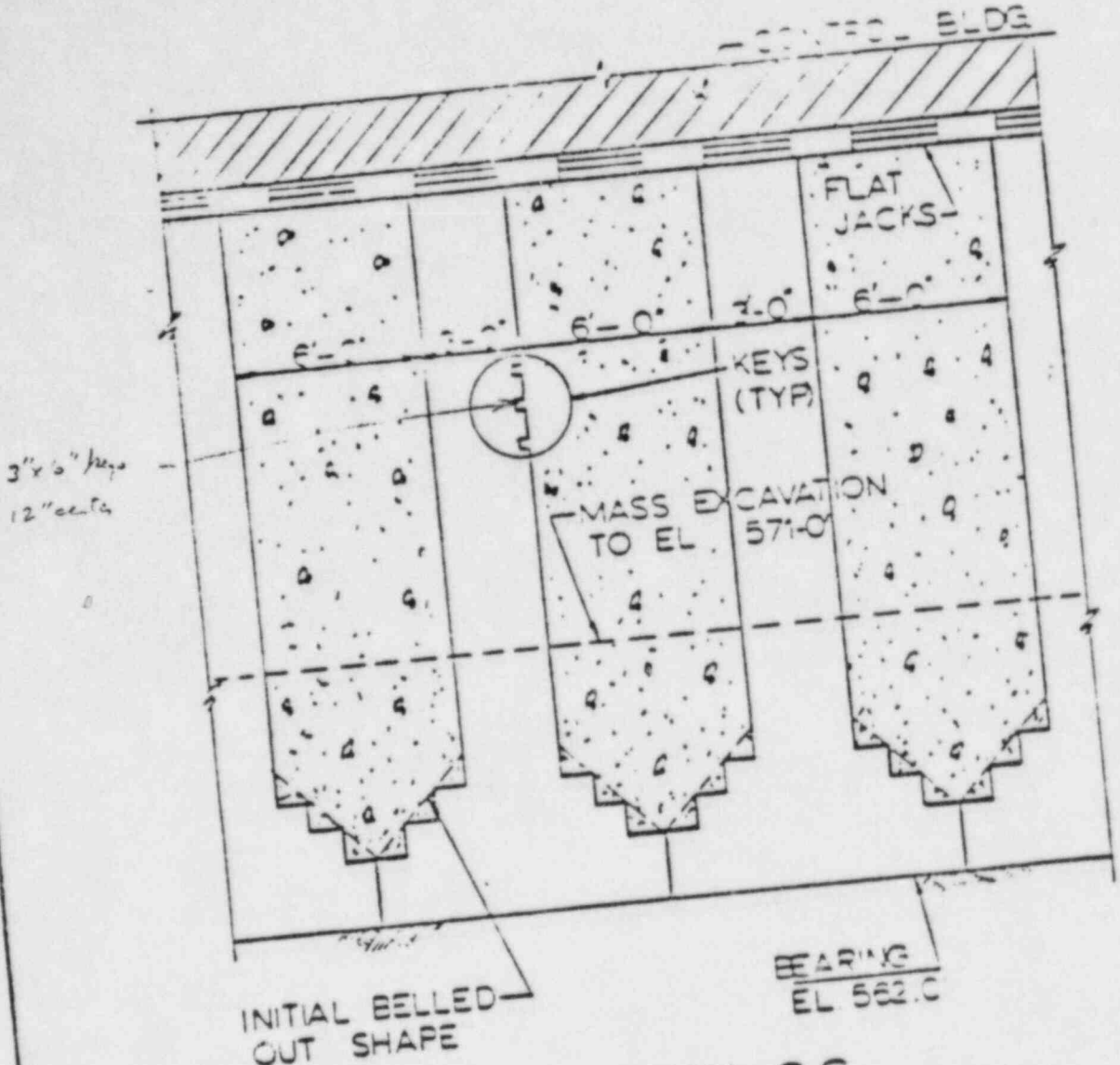
APPENDIX C FIGURE 1



SECTION B-B

SECTION AT CONTROL TOWER
UNDERPINNING WALL

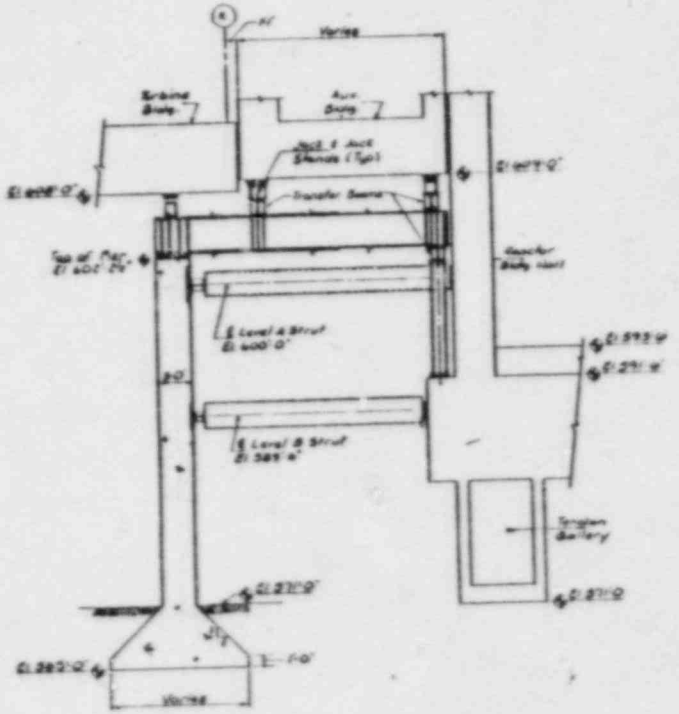
FIG AUX-3.4



SECTION C-C

ELEVATION AT CONTROL TOWER
UNDERPINNING WALL

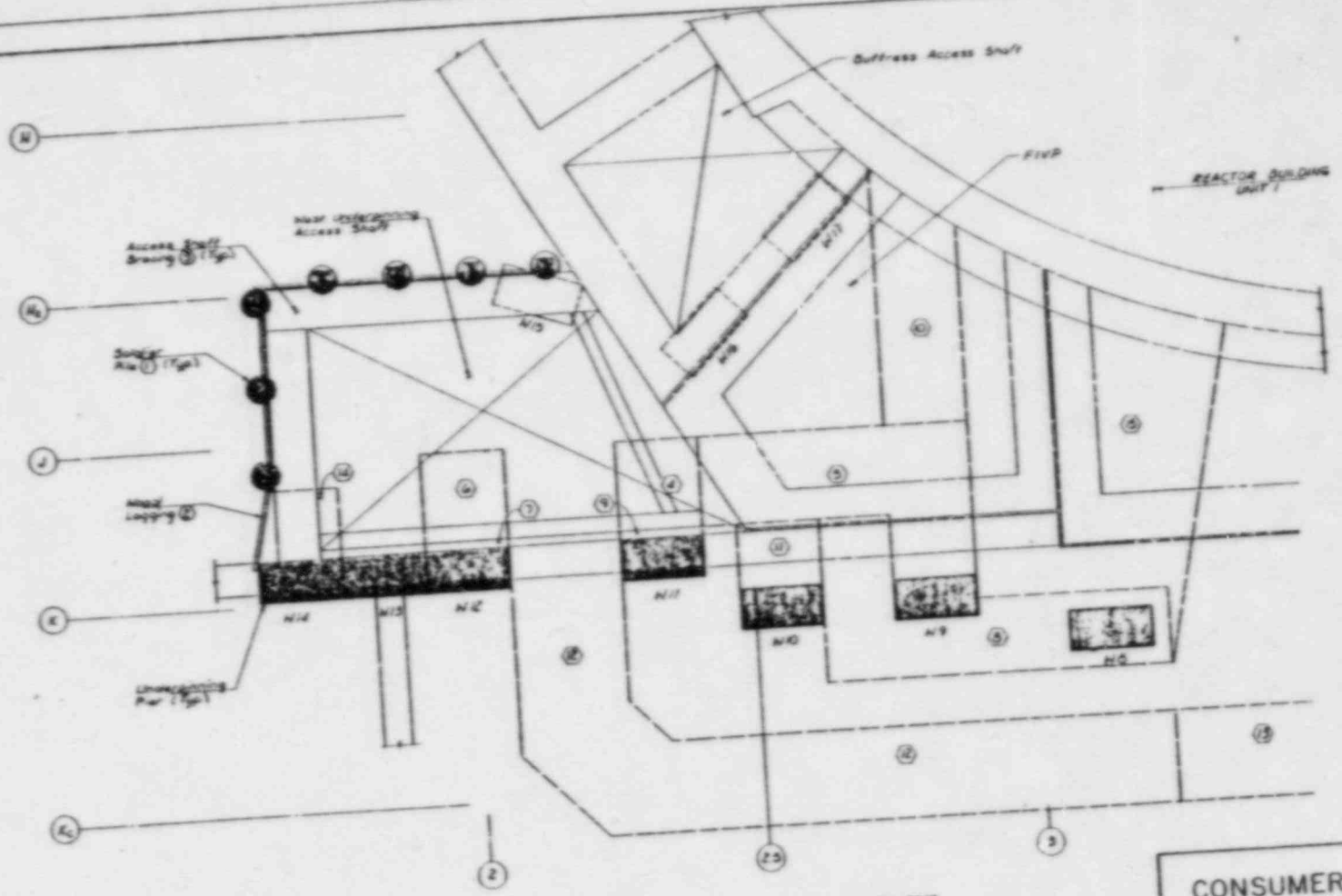
FIG AUX-35



CONSUMERS POWER COMPANY
MIDLAND PLANT UNITS 1 & 2

UNDERPINNING AUXILIARY BUILDING

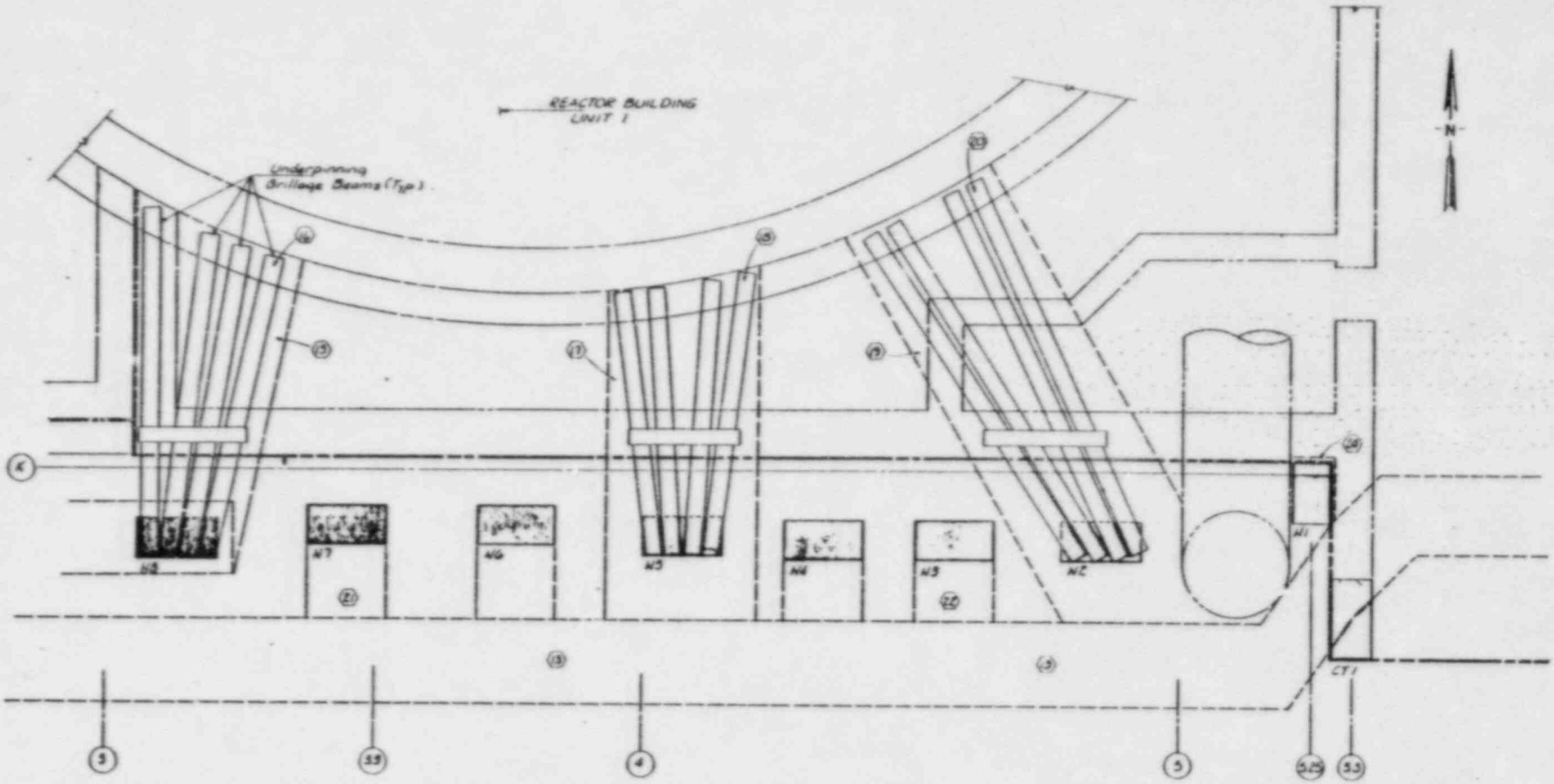
TYPICAL SECTION



CONSUMERS POWER COMPANY
MIDLAND PLANT UNITS 1 & 2

UNDERPINNING AUXILIARY BUILDING

CONSTRUCTION SCHEMATIC 1

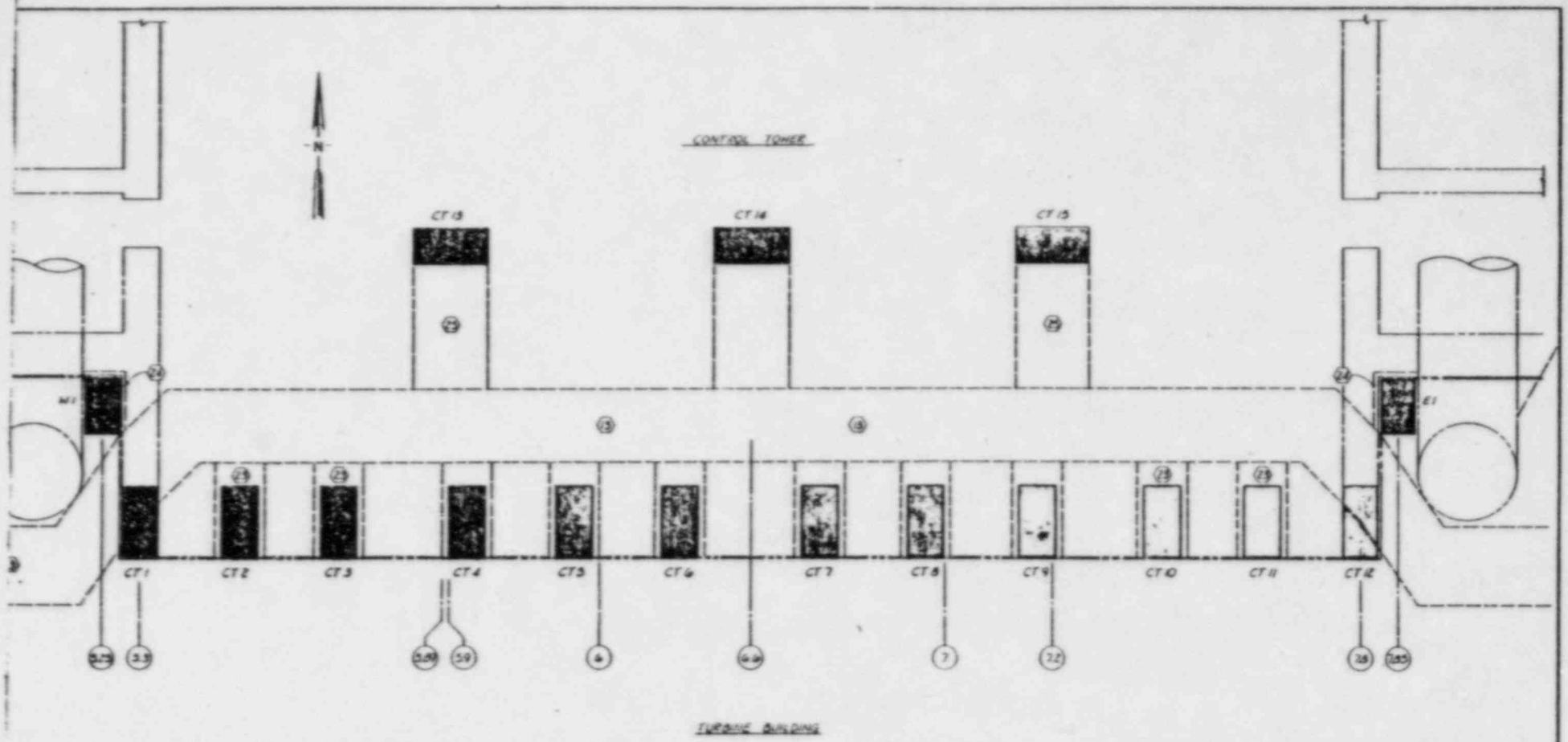


CONSUMERS POWER COMPANY
MIDLAND PLANT UNITS 1 & 2

UNDERPINNING AUXILIARY BUILDING

CONSTRUCTION SCHEMATIC 2

Slide 7 of 8



CONSUMERS POWER COMPANY
MIDLAND PLANT UNITS 1 & 2

UNDERPINNING AUXILIARY BUILDING

CONSTRUCTION SCHEMATIC 3

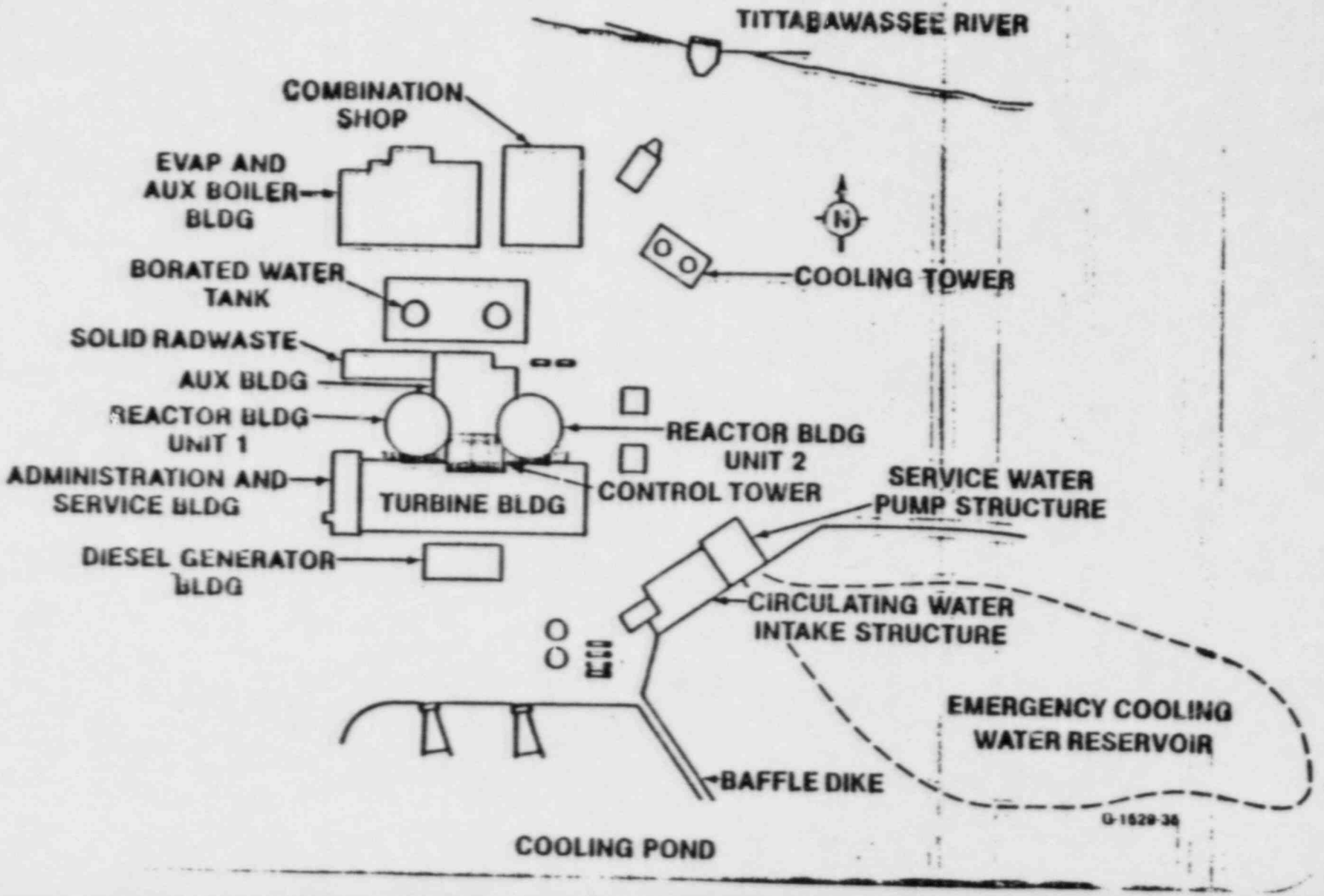
AUXILIARY BUILDING UNDERPINNING

FEEDWATER ISOLATION VALVE PIT TEMPORARY SUPPORT STRUCTURE

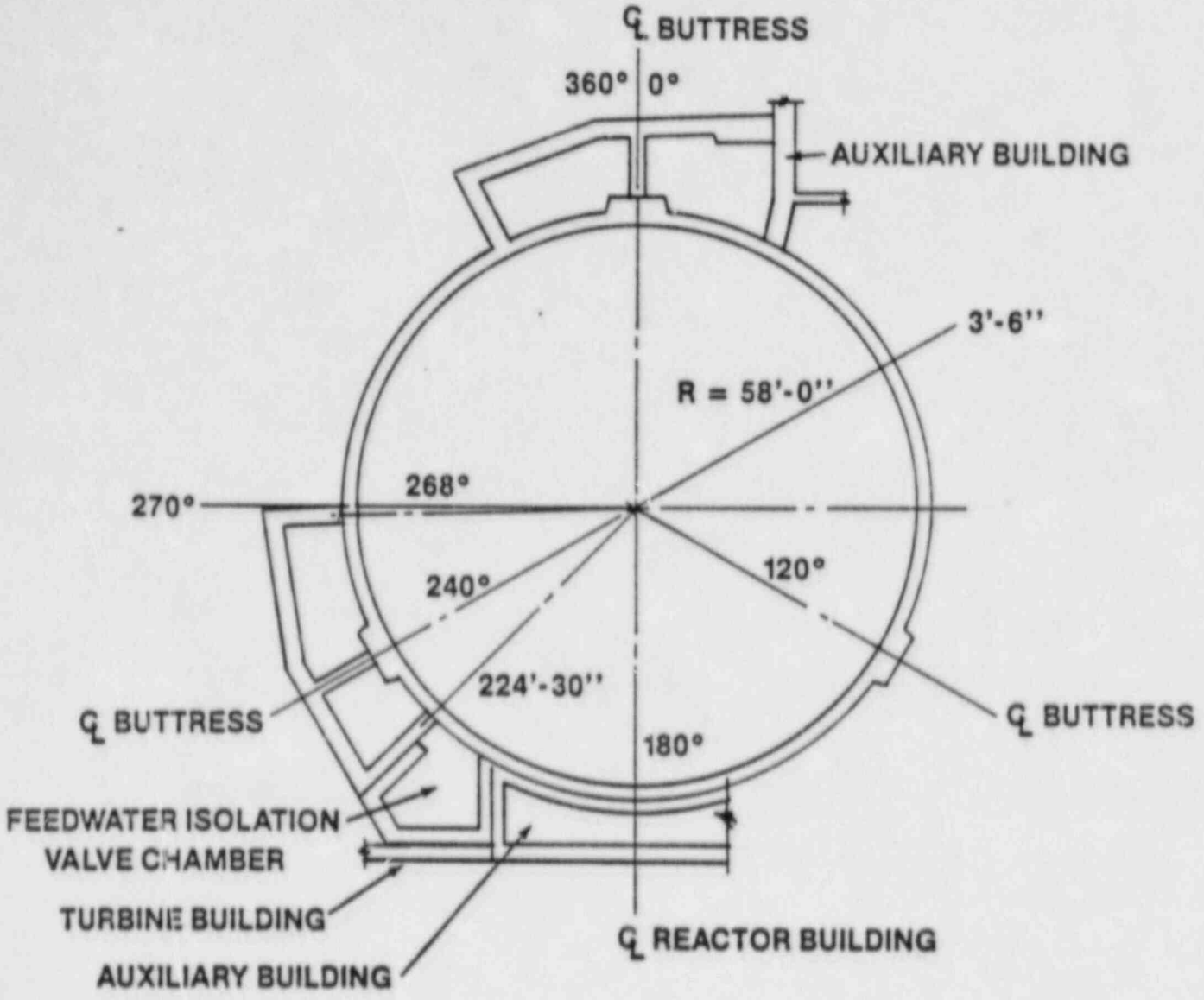
SUMMARY OF PRESENTATION

- DESCRIPTION OF FIVP
- DESCRIPTION OF TEMPORARY SUPPORT STRUCTURE
- METHOD OF ANALYSIS AND DESIGN
- LOAD TRANSFER PROCEDURE
- MONITORING PROGRAM

MIDLAND SITE PLAN



FEEDWATER ISOLATION VALVE CHAMBER LOCATION PLAN



UNIT 1 SHOWN - UNIT 2 OPPOSITE HAND

G-1932-05

AUXILIARY BUILDING UNDERPINNING
FUNCTIONS OF FEEDWATER ISOLATION VALVE PIT

- ENCLOSE SEISMIC CATEGORY I FEEDWATER PIPE AND ISOLATION VALVES

- PROVIDE MISSILE PROTECTION

G-1932-09

AUXILIARY BUILDING UNDERPINNING
DESCRIPTION OF FIVP

- APPROXIMATE DIMENSION - 28' (E-W) x 26' (N-S) x 26'-6'' (height)
- WALL - 2'-6'' TO 3'-6'' THICK
- ROOF - 2'-0'' THICK
- BASE SLAB - 4'-0'' THICK (nominal)
- WEIGHT - 1950 KIPS EACH

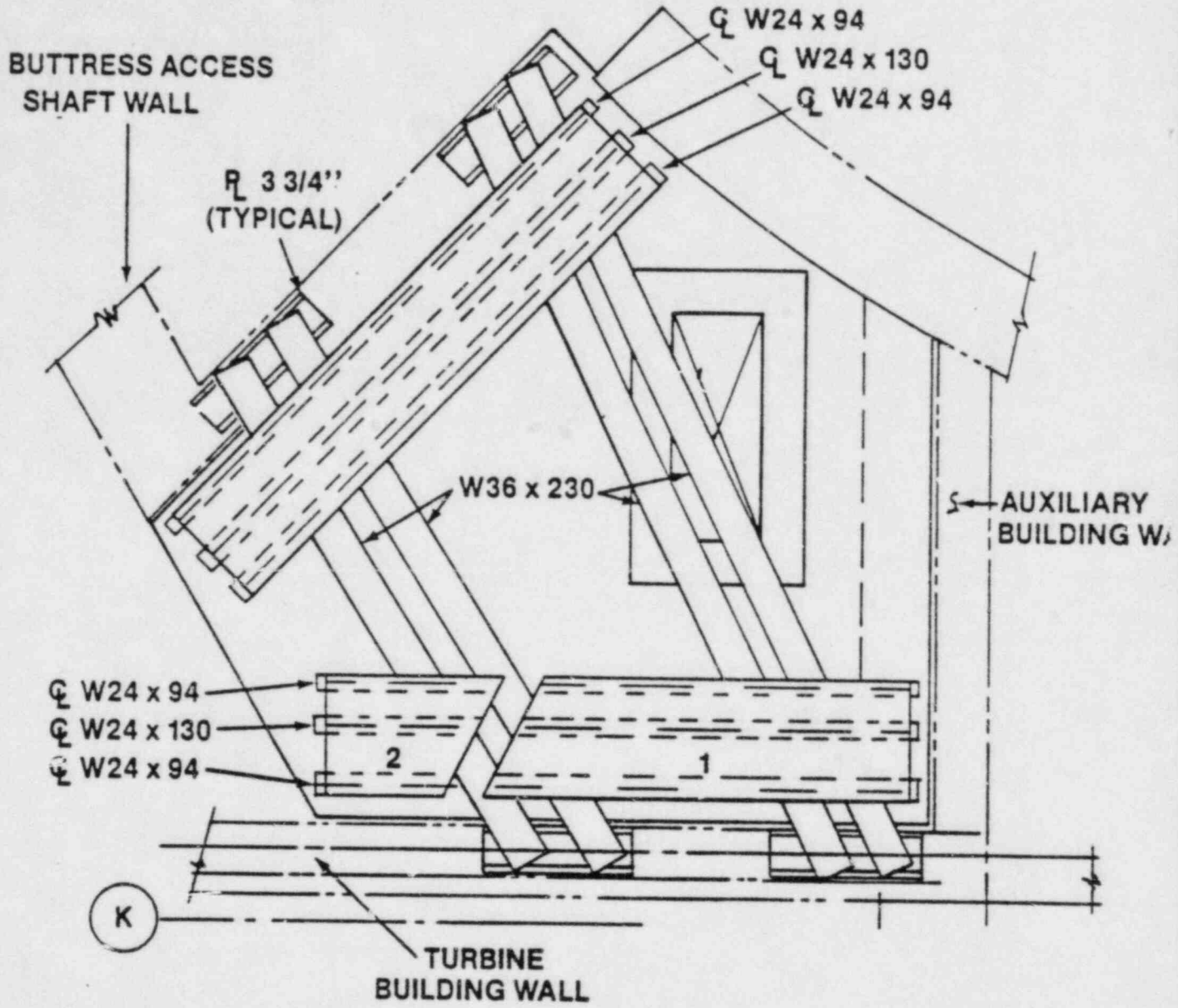
AUXILIARY BUILDING UNDERPINNING

MATERIALS USED FOR FIVP

- CONCRETE - 5,000 psi

- REBAR - 60 ksi MINIMUM YIELD

AUXILIARY BUILDING UNDERPINNING
FEEDWATER ISOLATION VALVE PIT PLAN VIEW OF SUPPORT

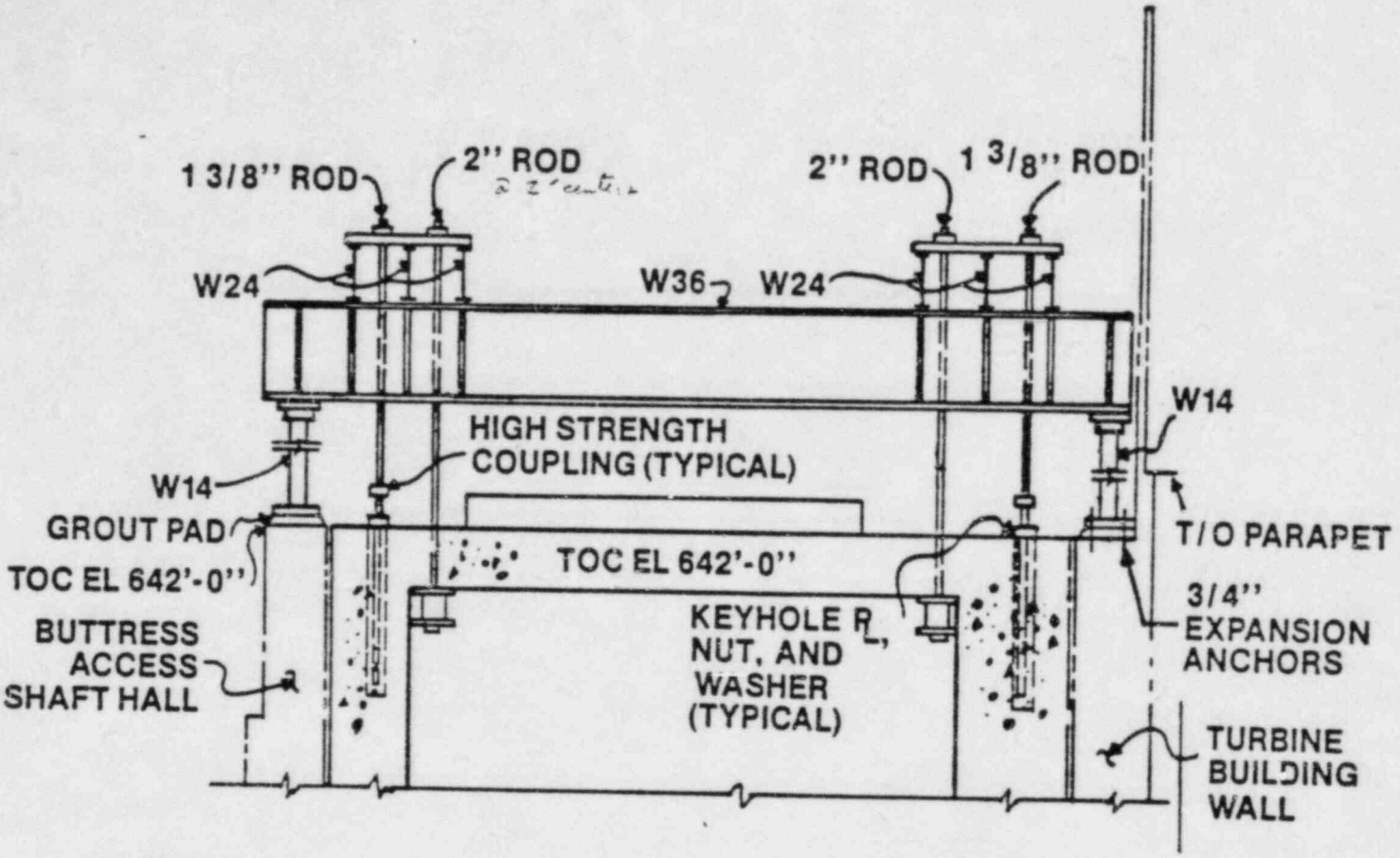


PLAN AT EL 651'-0"

MIDLAND UNITS 1 AND 2
AUXILIARY BUILDING UNDERPINNING 1/15/82

G-1932-03

AUXILIARY BUILDING UNDERPINNING
FEEDWATER ISOLATION VALVE
PIT SECTION VIEW OF SUPPORT



MIDLAND UNITS 1 AND 2
AUXILIARY BUILDING UNDERPINNING 1/15/82

G-1932-02

AUXILIARY BUILDING UNDERPINNING

FIVP TEMPORARY SUPPORT

METHOD OF ANALYSIS

- APPROXIMATE METHOD
- COMPUTER METHOD

AUXILIARY BUILDING UNDERPINNING
MATERIALS USED FOR FIVP TEMPORARY SUPPORT

- STRUCTURAL SHAPES - A36
- STRUCTURAL PLATES - A 36 AND A588
- RODS - 2''ϕ RODS OF A354 GRADE BD
- ROCK BOLTS - 1-3/8''ϕ SUPER HIGH STRENGTH WILLIAM ROCK ANCHOR

AUXILIARY BUILDING UNDERPINNING

FIVP TEMPORARY SUPPORT

APPROXIMATE METHOD OF ANALYSIS

- CONSIDER STIFFNESSES OF RODS, BEAMS
- LOCATE CENTER OF STIFFNESS AND CENTER OF MASS
- DISTRIBUTE FIVP WEIGHT TO RODS AND BEAMS

AUXILIARY BUILDING UNDERPINNING

FIVP TEMPORARY SUPPORT

COMPUTER ANALYSIS

- USE STRUDL PROGRAM
- MODEL RODS AND BEAMS
- APPLY JACKING FORCE TO BEAM SUPPORTS

AUXILIARY BUILDING UNDERPINNING

FIVP AND TEMPORARY SUPPORT DESIGN CRITERIA

- ACI FOR CHECKING FIVP
- AISC FOR DESIGN OF STRUCTURAL STEEL MEMBERS AND RODS
- MANUFACTURER RECOMMENDATION FOR ROCK BOLT DESIGN
- 1/3 STRESS INCREASE FOR STRUCTURAL STEEL DESIGN O FOR CONSTRUCTION CONDITION

AUXILIARY BUILDING UNDERPINNING

SUMMARY OF STRESSES FOR FIVP TEMPORARY SUPPORT

	ACTUAL	ALLOWABLE
• W36 BEAM	20.6 KSI	22.0 KSI
• W24 BEAM	13.3 KSI	24.0 KSI
• 2" ROD	141 KIPS	259 KIPS
• 1 3/8 ROCK BOLT	100 KIPS	98 KIPS (2% OVER FOR 2 BOLTS)

AUXILIARY BUILDING UNDERPINNING

SUMMARY OF STRESSES FOR FIVP

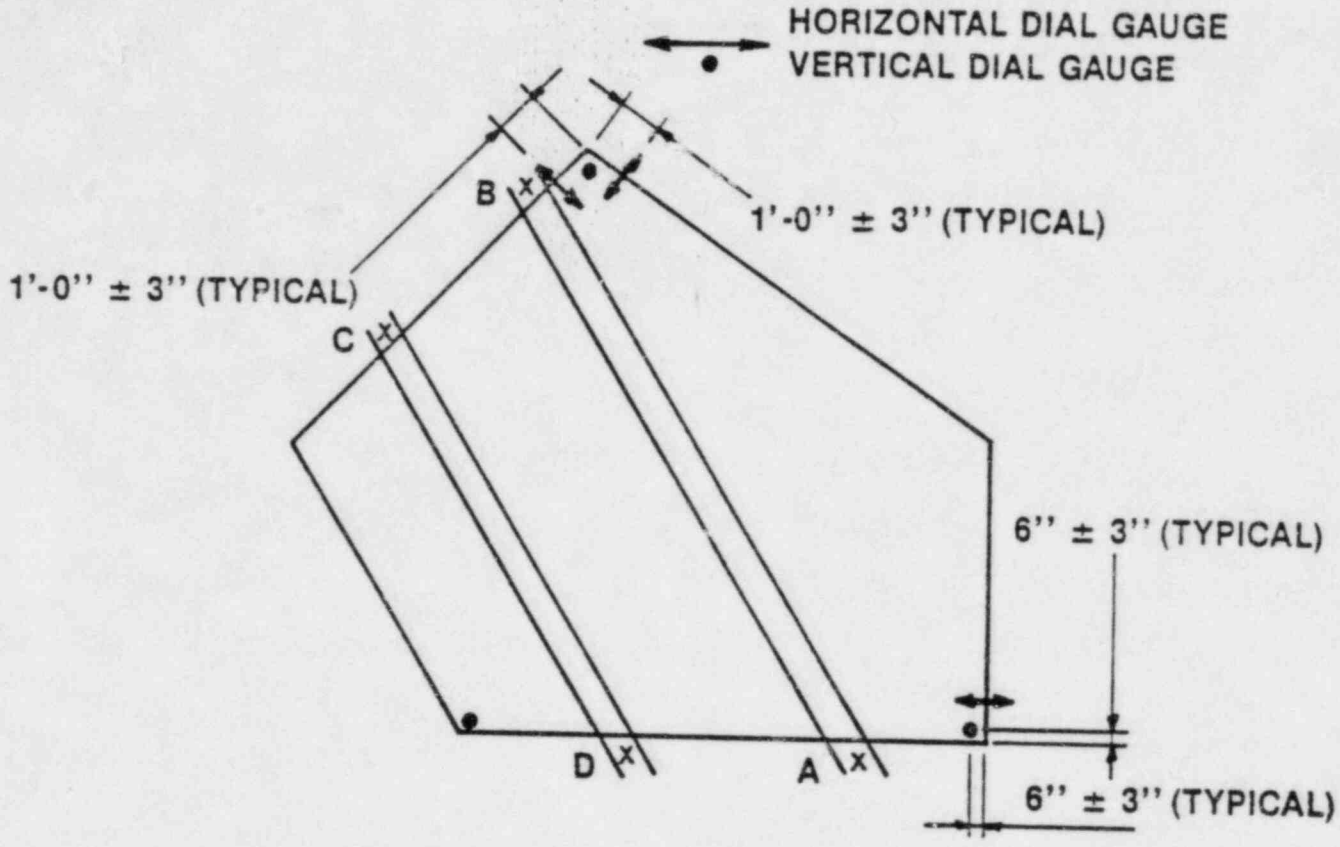
	ACTUAL	ALLOWABLE
SHEAR AT ROOF SLAB	43 K/FT	60 K/FT
MOMENT AT ROOF SLAB	41 K'/FT	49 K'/FT
TENSION ON WALLS	1950 KIPS	2065 KIPS (FOR 2 WALLS)

AUXILIARY BUILDING UNDERPINNING

SUMMARY OF STRESSES FOR TURBINE BLDG & BUTTRESS ACCESS SHAFT

	ACTUAL	ALLOWABLE
CONCRETE BEARING		
TURBINE BLDG WALL	0.6 KSI	0.89 KSI
BUTTRESS ACCESS SHAFT WALL	0.52 KSI	1.49 KSI
INCREASE IN LOCAL SOIL BEARING		
TURBINE BLDG	3.5 KSF	10 KSF
BUTTRESS ACCESS SHAFT	3.4 KSF	15 KSF

AUXILIARY BUILDING UNDERPINNING
FEEDWATER ISOLATION VALVE PIT LOAD AT SUPPORTS

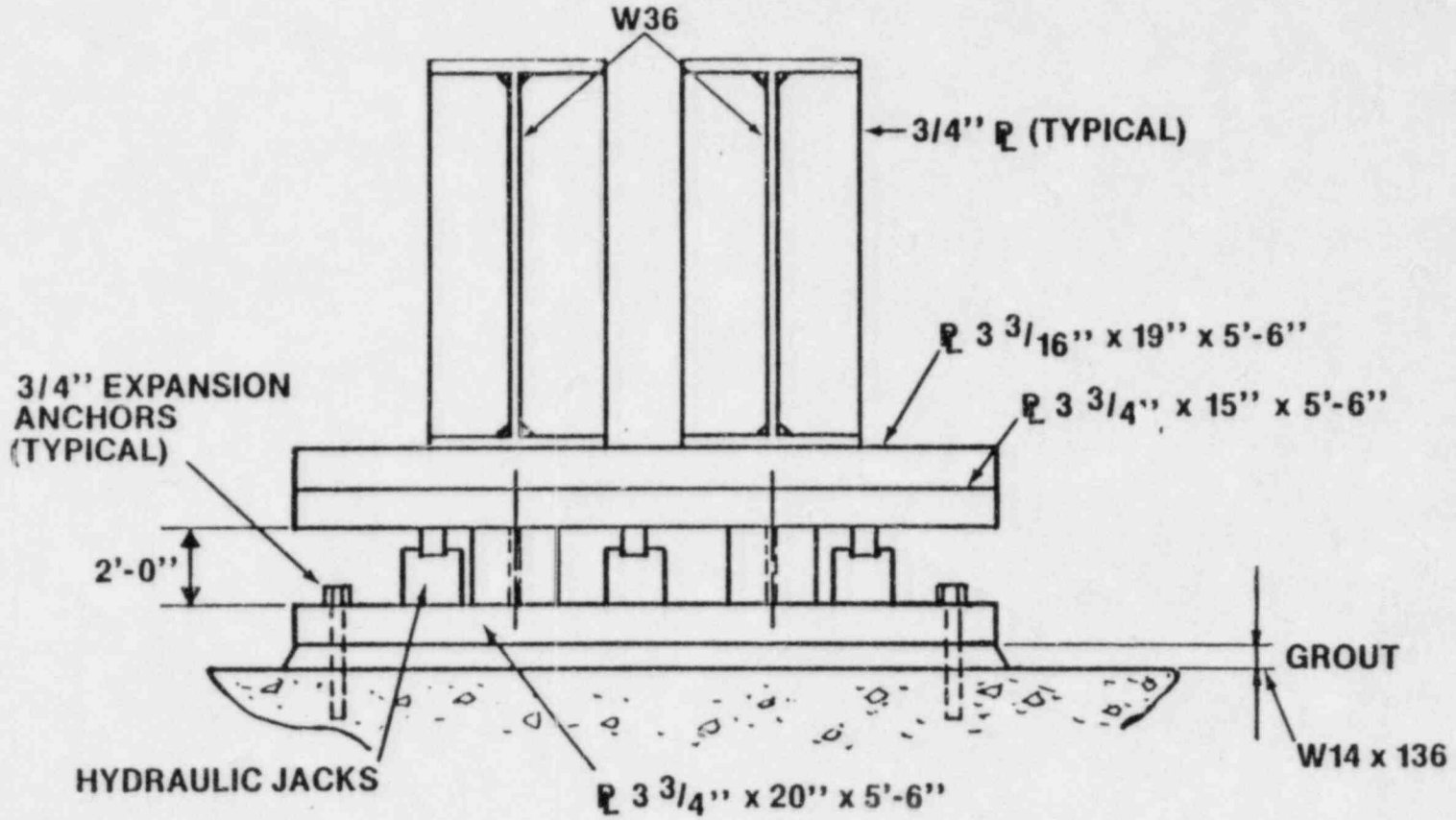


SUPPORT NO.	LOAD (K)
A	650
B	550
C	550
D	650

MIDLAND UNITS 1 AND 2
AUXILIARY BUILDING UNDERPINNING 1/15/82

G-1932-01

AUXILIARY BUILDING UNDERPINNING
FEEDWATER ISOLATION VALVE
PIT SECTION



MIDLAND UNITS 1 AND 2
AUXILIARY BUILDING UNDERPINNING 1/12/82

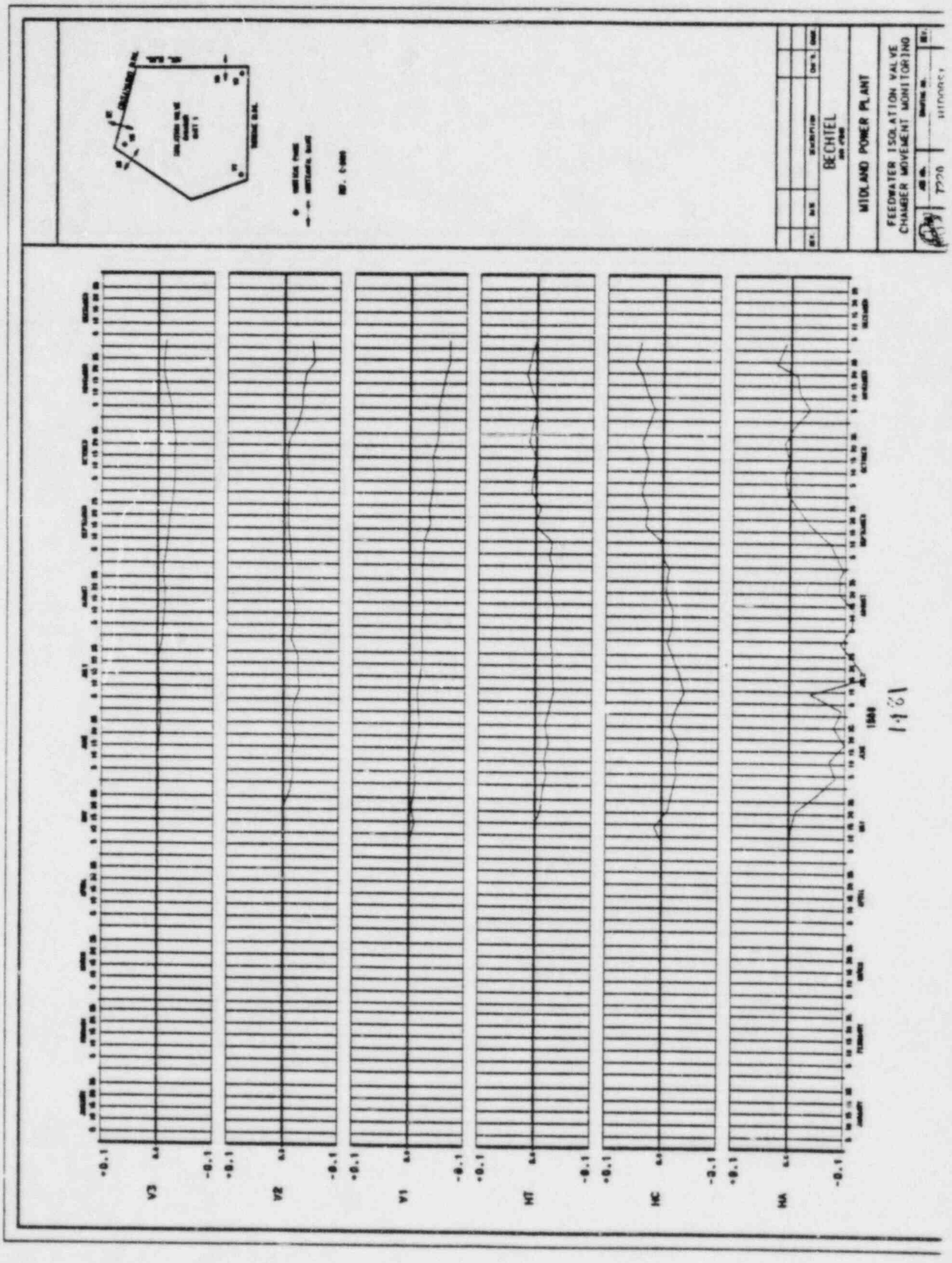
G-1932-04

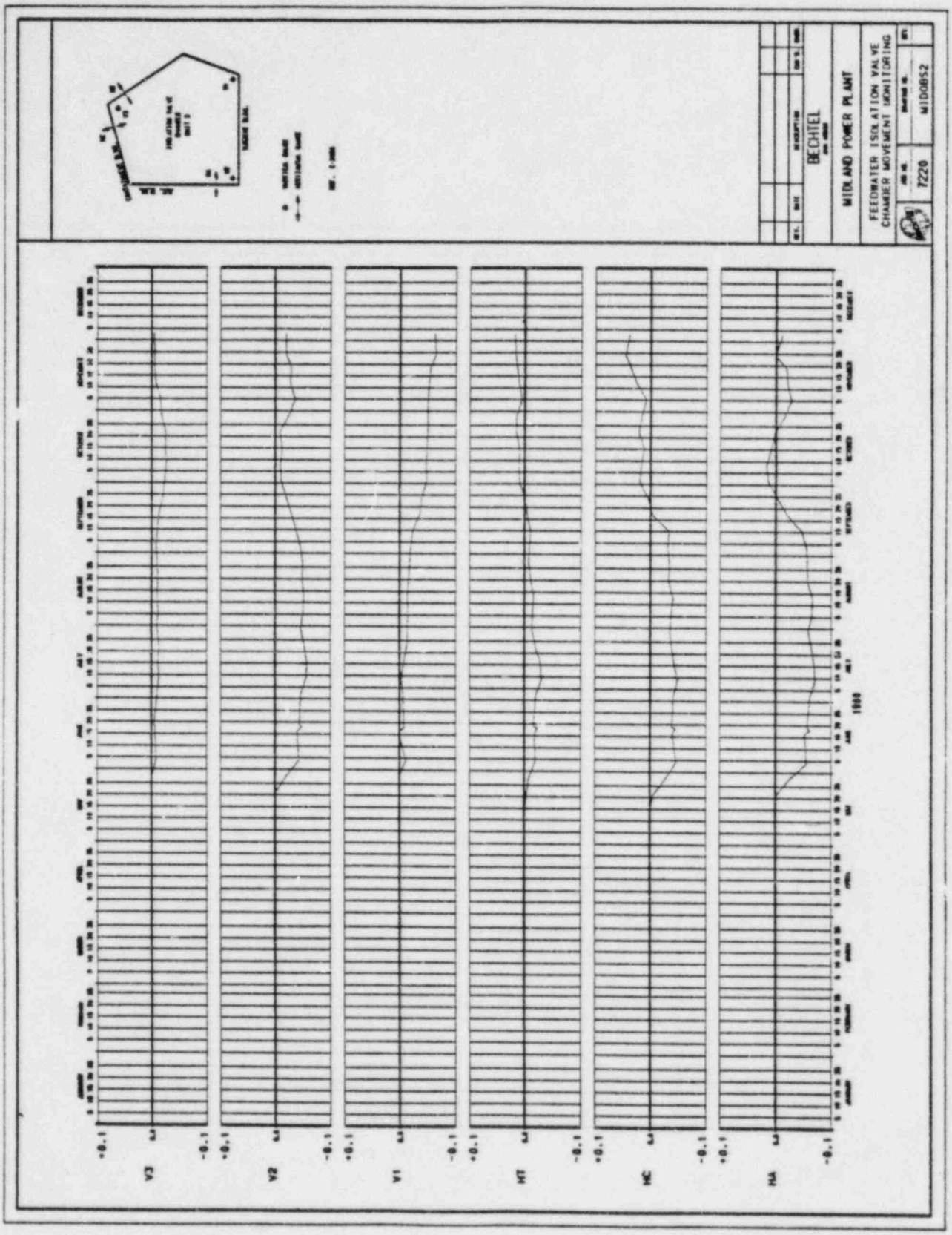
AUXILIARY BUILDING UNDERPINNING

FEEDWATER ISOLATION VALVE PIT

PRESENT MONITORING PROGRAM

- DIAL GAGES TO MEASURE HORIZONTAL AND VERTICAL MOVEMENTS
- ½ INCH MAXIMUM SETTLEMENT BASED ON FEEDWATER PIPING
- GAGES READ WEEKLY


BECHTEL
MIDLAND POWER PLANT
FEEDWATER ISOLATION VALVE
CHAMBER MOVEMENT MONITORING
VA
VB
VC
HA
HB
HC


BECHTEL
MIDLAND POWER PLANT
FEEDWATER ISOLATION VALVE
CHAMBER MOVEMENT MONITORING
7220
M1006852
V3
V2
V1
HT
HC
H3

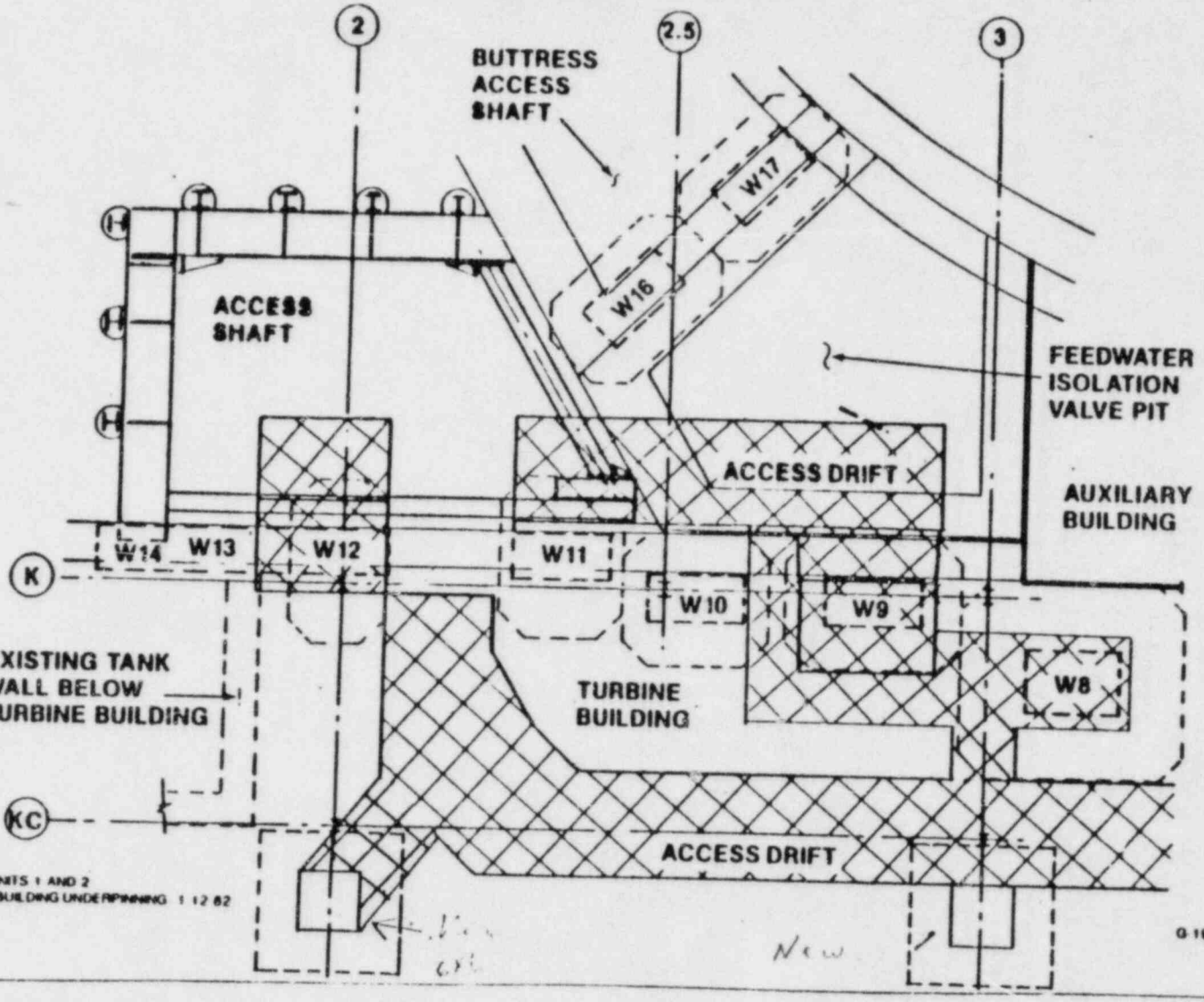
AUXILIARY BUILDING UNDERPINNING

FEEDWATER ISOLATION VALVE PIT

MONITORING DURING UNDERPINNING

- FIVP MONITORING PART OF OVERALL UNDERPINNING PROGRAM
- REJACK FIVP WHEN SETTLEMENT APPROACHES 3/8 INCH
- CRACK MAP FIVP BEFORE AND AFTER EACH MAJOR CONSTRUCTION ACTIVITY AFFECTING FIVP

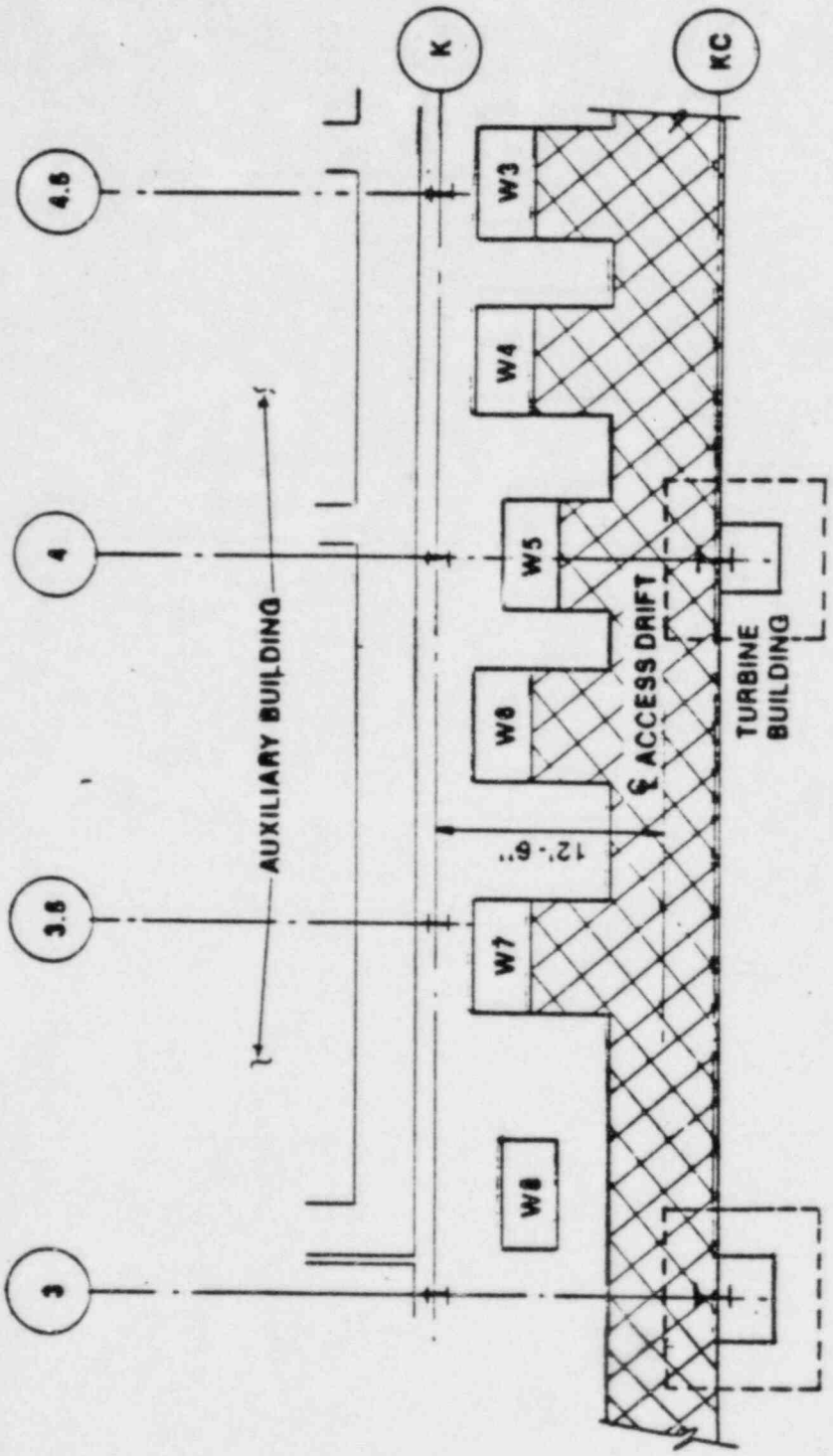
PLAN - ACCESS SHAFT AND ACCESS DRIFT



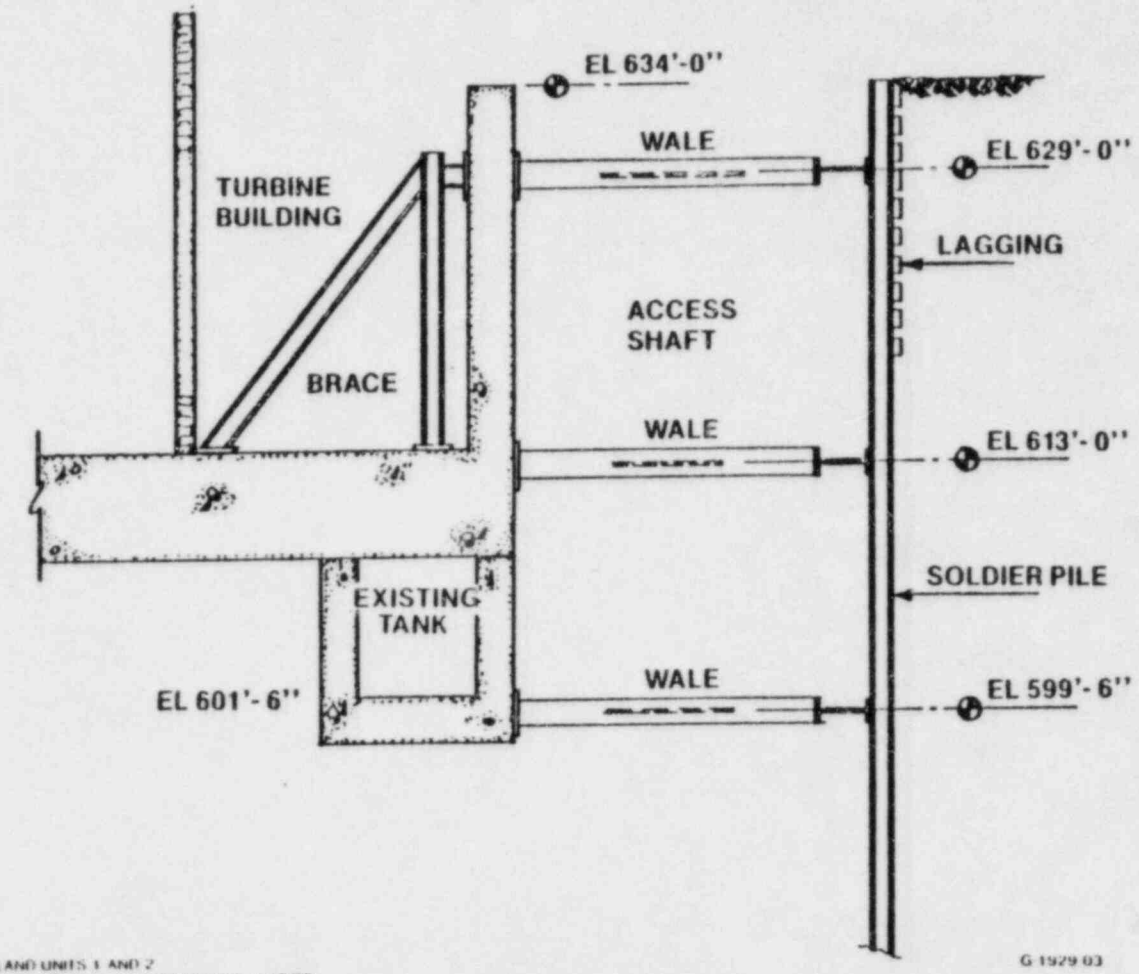
Enclosure 7
(Page 1 of 16)

Norm Rawson
1-18-82

PARTIAL PLAN OF ACCESS DRIFT



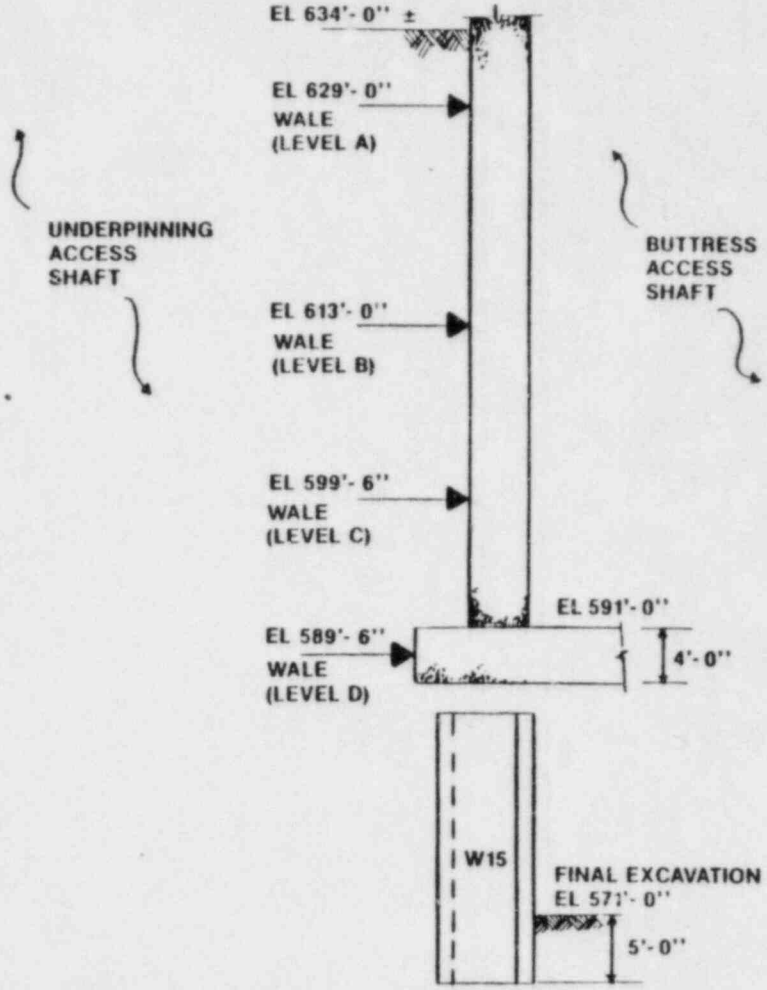
SECTION - ACCESS SHAFT/TURBINE BUILDING



MIDLAND UNITS 1 AND 2
AUXILIARY BUILDING UNDERPINNING 1 12 82

G 1929 03

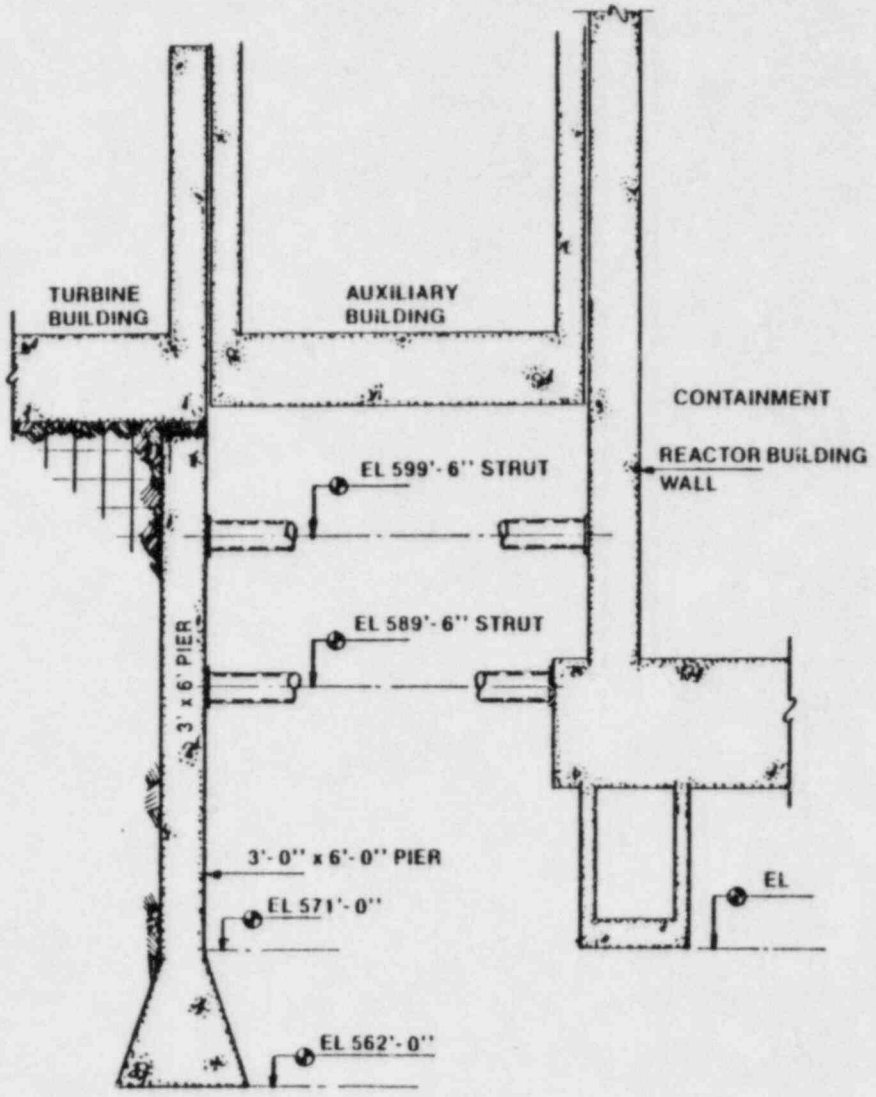
ACCESS SHAFT
WALES AT BUTTRESS ACCESS SHAFT



MIDLAND UNITS 1 AND 2
AUXILIARY BUILDING UNDERPINNING 1-15-82

G-1929-16

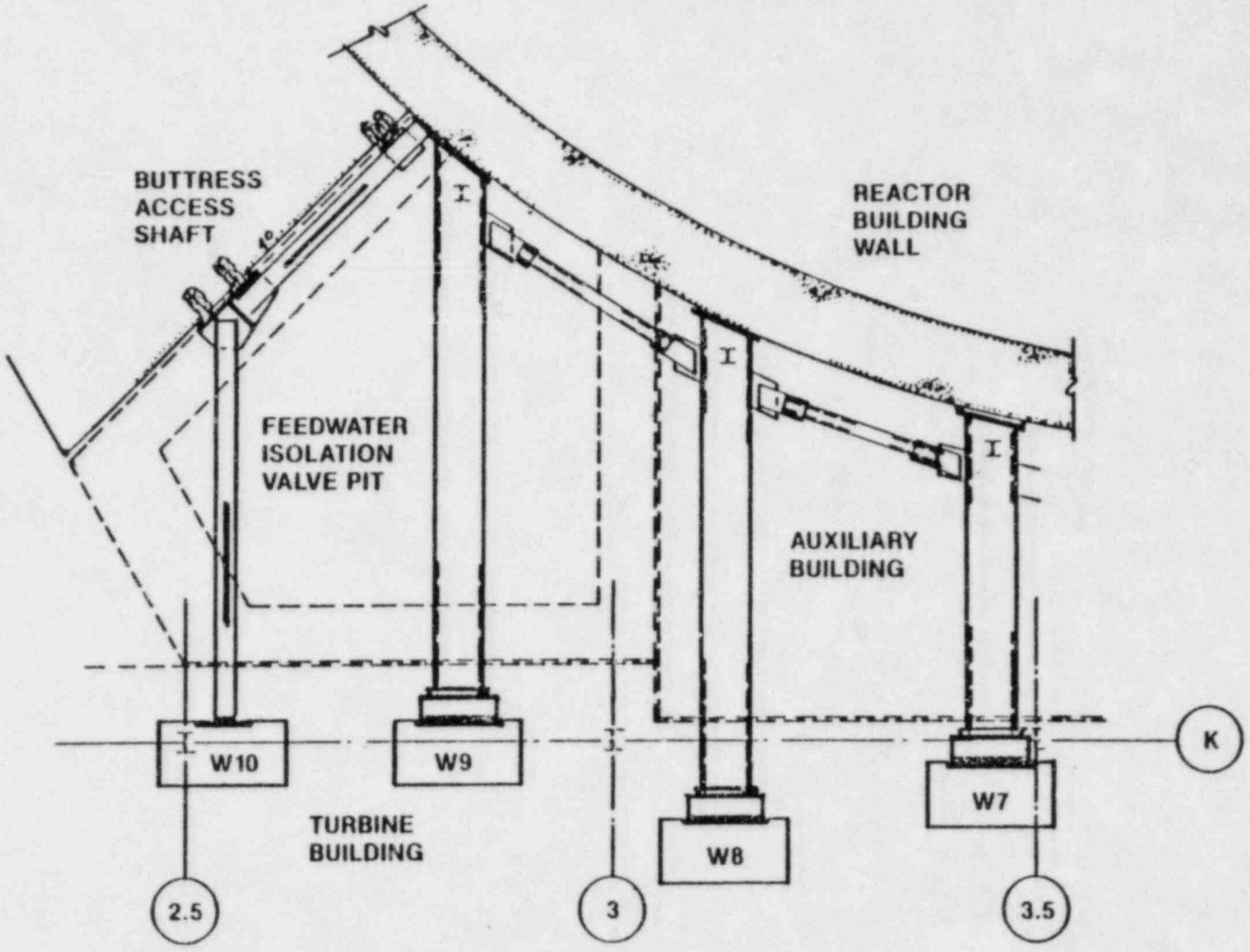
PIER BRACING



MELAND UNITS 1 AND 2
AUXILIARY BUILDING UNDERPINNING 1 12 82

G 19/9 04

STRUT BRACING

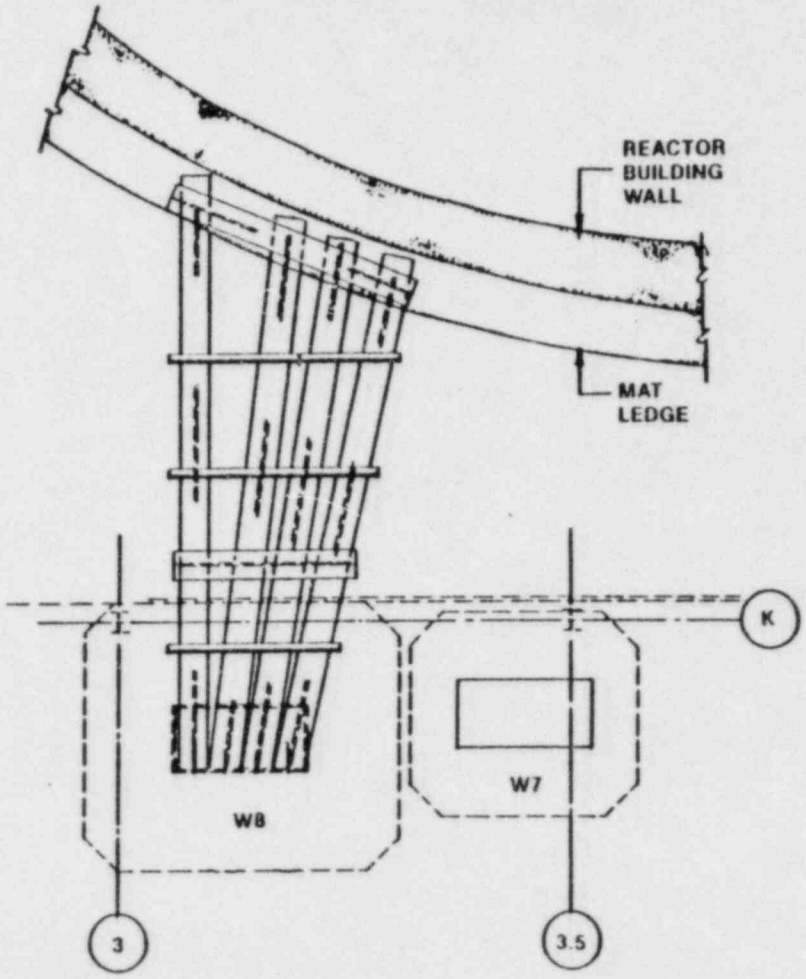


MIDLAND UNITS 1 AND 2
AUXILIARY BUILDING UNDERPINNING 1 12 82

G 1929 05

Installation of Grillage not related to this audit

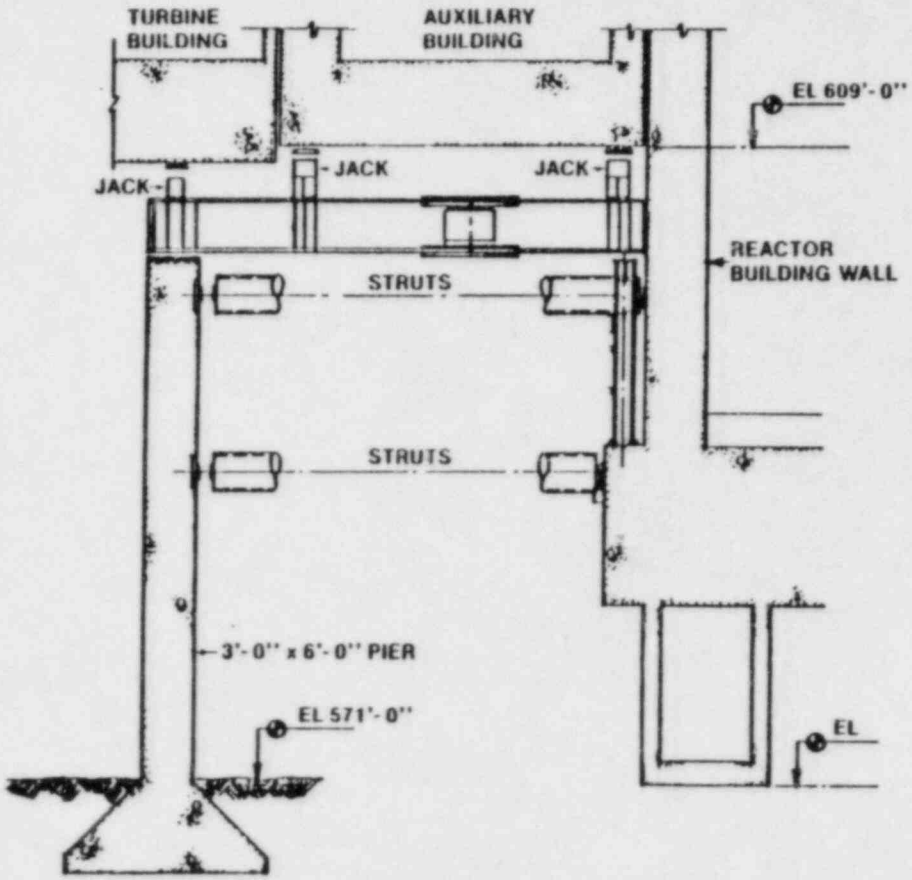
AUXILIARY BUILDING UNDERPINNING GRILLAGE



MIDLAND UNITS 1 AND 2
AUXILIARY BUILDING UNDERPINNING 1 1/ 82

G 1920 09

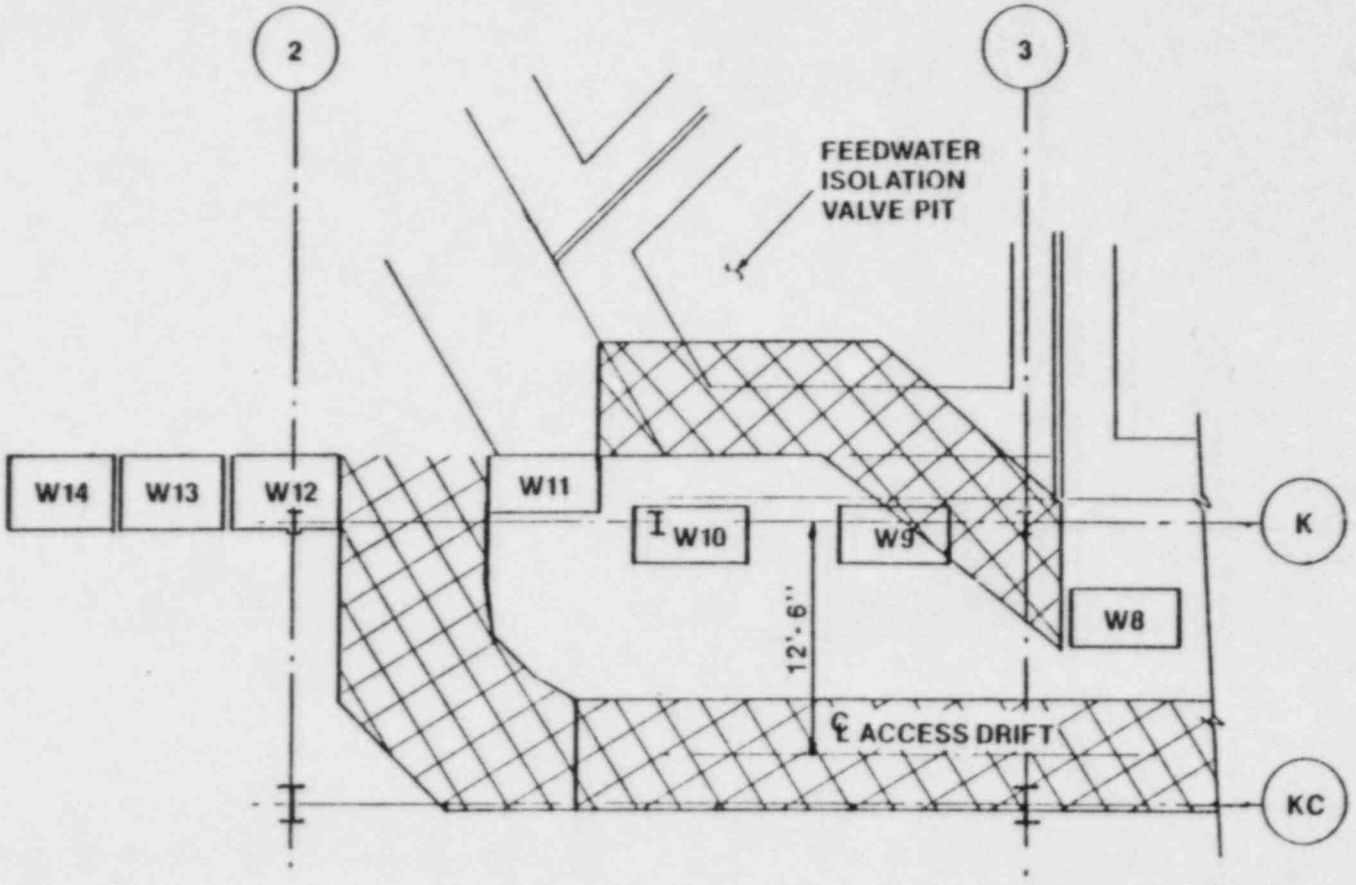
SECTION AT UNDERPINNING GRILLAGE



MEN AND UNITS 1 AND 2
AUXILIARY BUILDING UNDERPINNING 1 12 82

G 1929 11

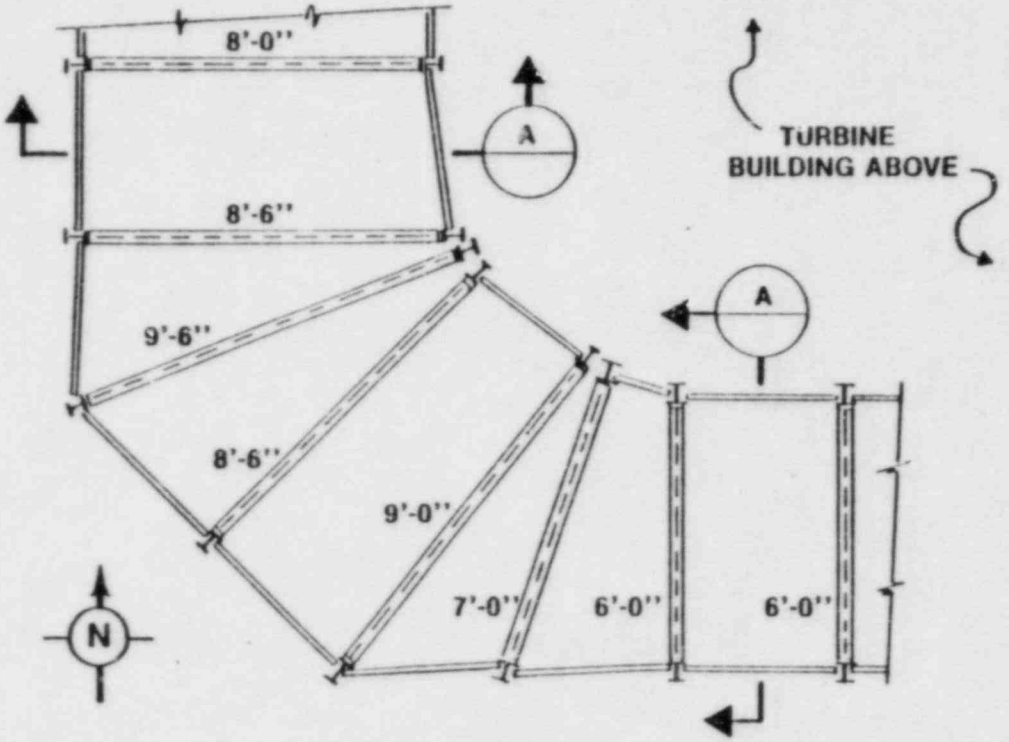
PARTIAL PLAN OF ACCESS DRIFT



MIDLAND UNITS 1 AND 2
AUXILIARY BUILDING UNDERPINNING 1 12 82

G 1929 10

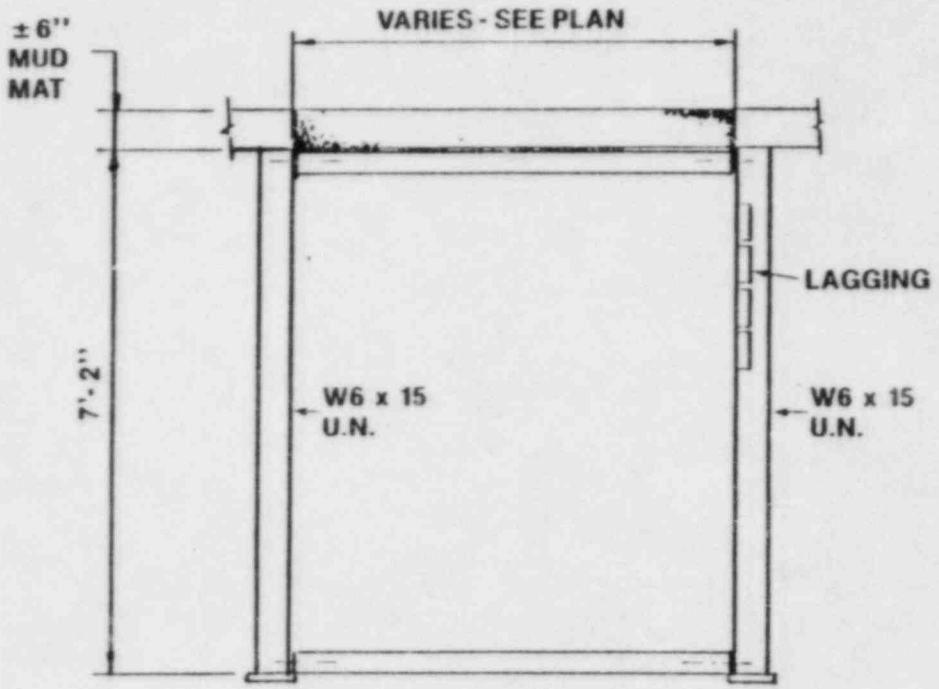
PARTIAL PLAN - ACCESS DRIFT



MIDLAND UNITS 1 AND 2
AUXILIARY BUILDING UNDERPINNING 1-12-82

G 1929 02

TYPICAL ACCESS DRIFT FRAME

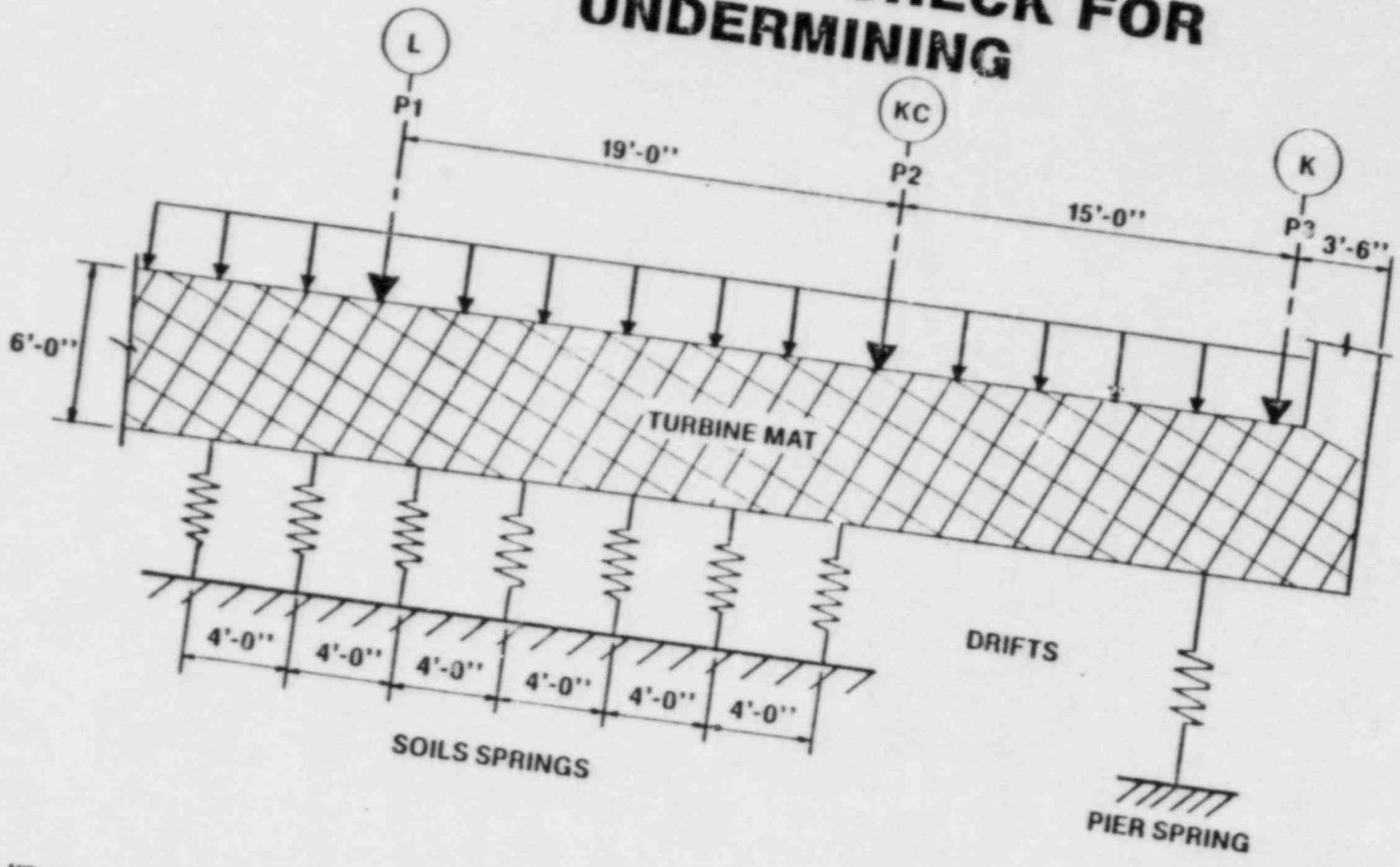


SECTION A

MIDLAND UNITS 1 AND 2
AUXILIARY BUILDING UNDERPINNING 1-12-82

G 1929 06

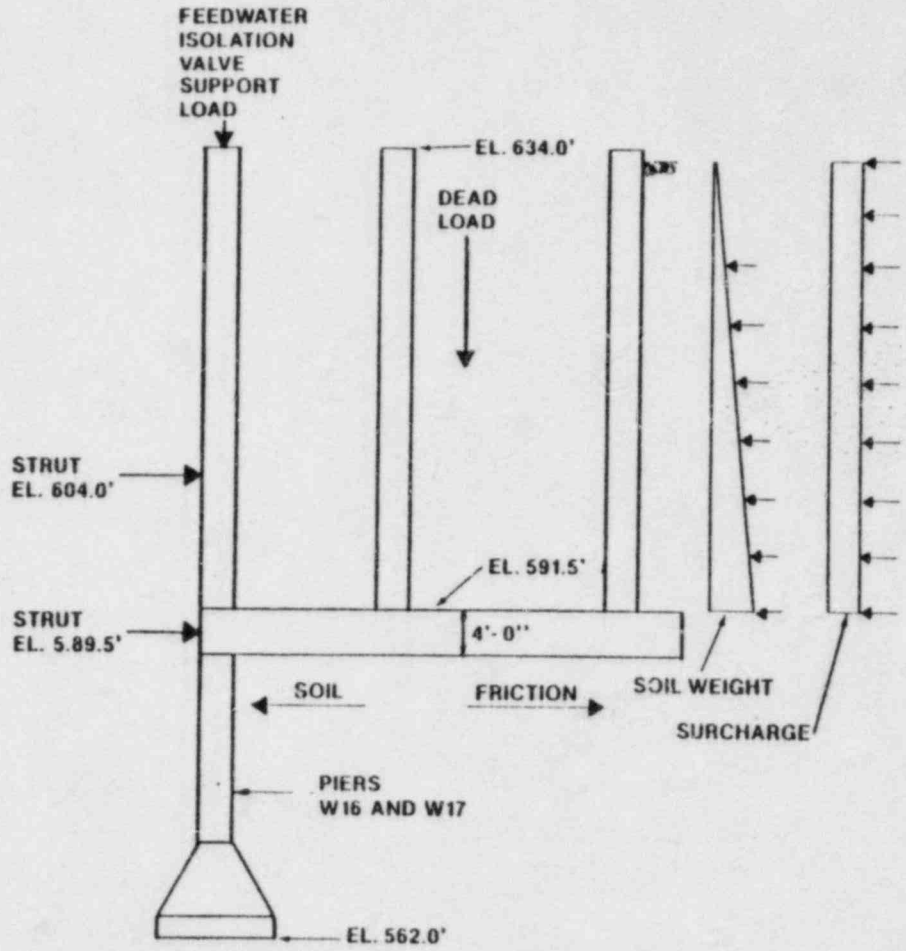
TURBINE MAT CHECK FOR UNDERMINING



MIDLAND UNITS 1 AND 2
AUXILIARY BUILDING UNDERPINNING 1-12-82

G 1929 14

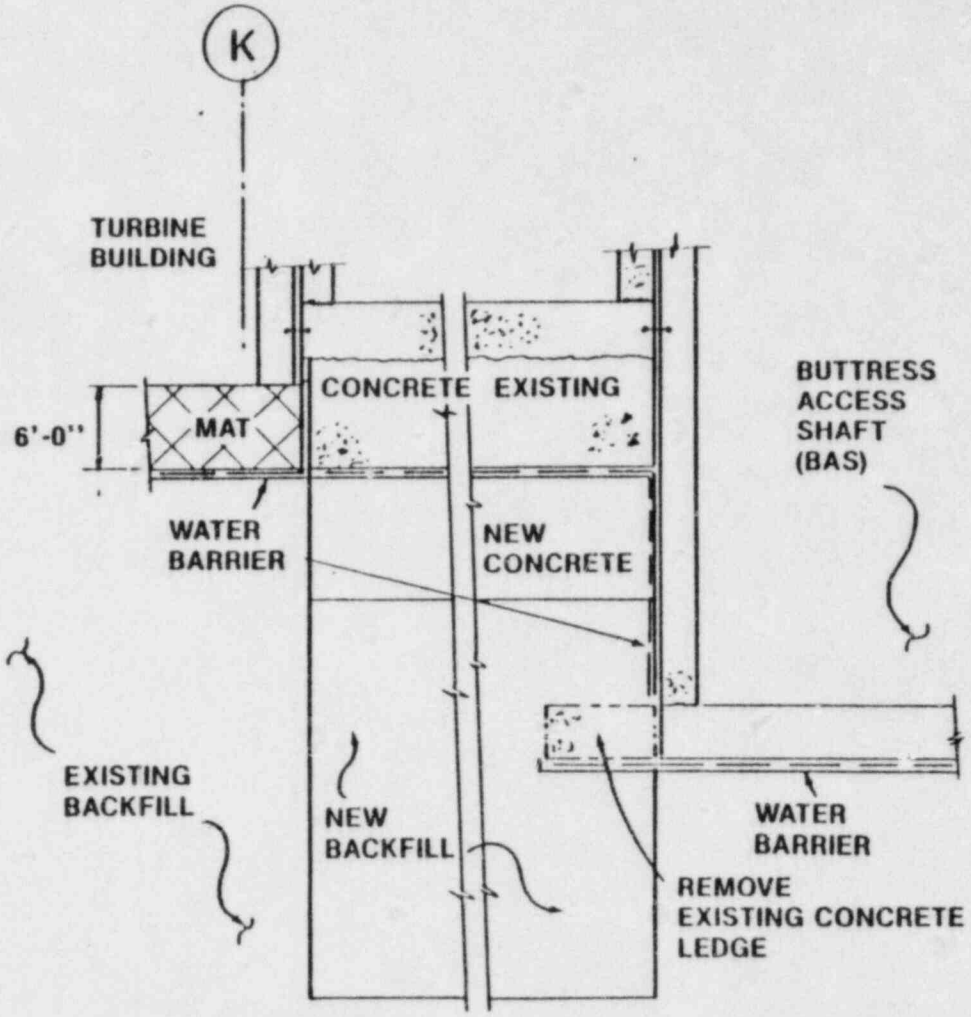
LOADS ON BAS FOR CONSTRUCTION CONDITION



MEA AND UNITS 1 AND 2
AUXILIARY BUILDING UNDERPINNING 1-15-87

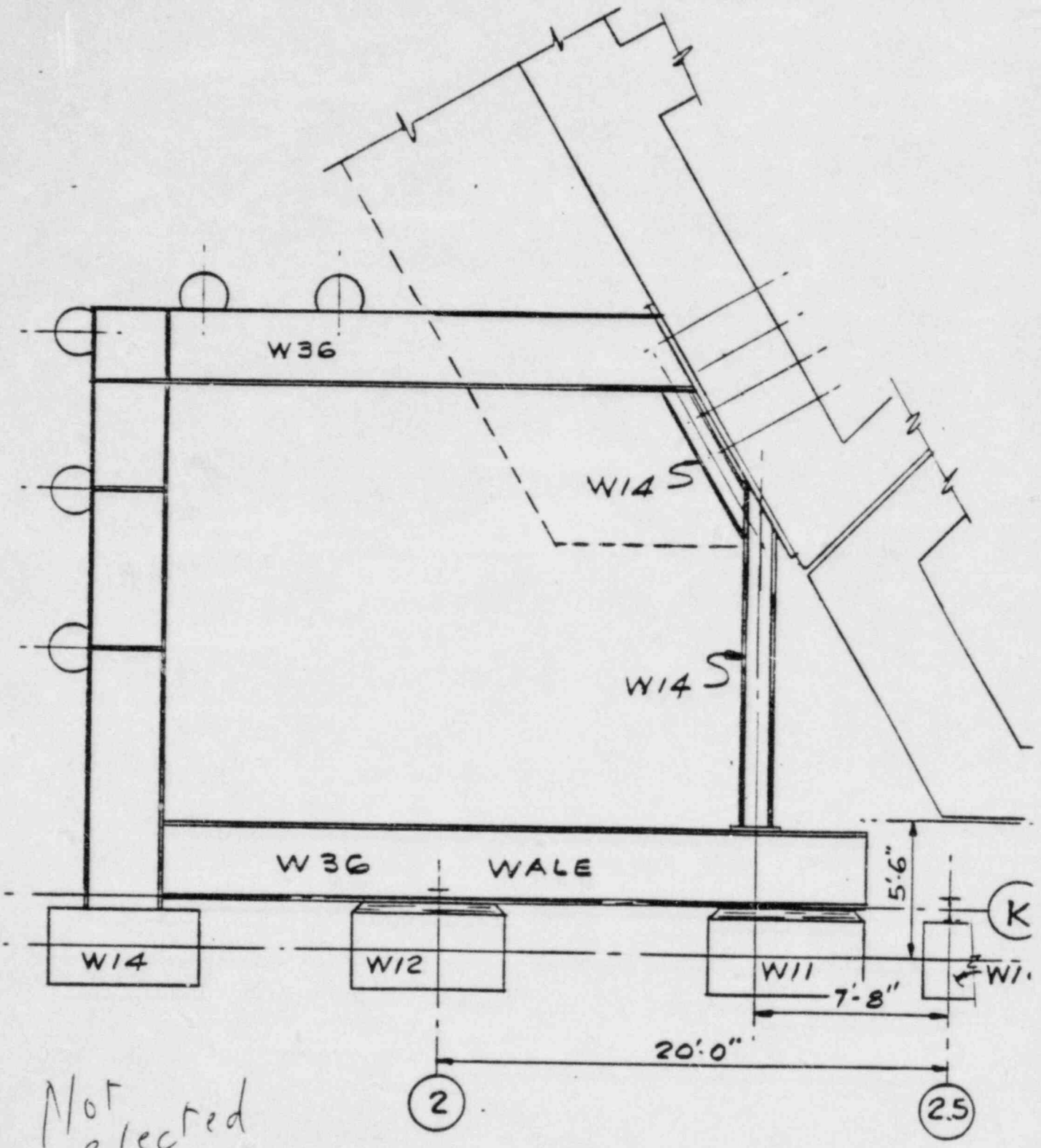
G-1979-15

NEW PERMANENT FOUNDATION CONFIGURATION AT(BAS)



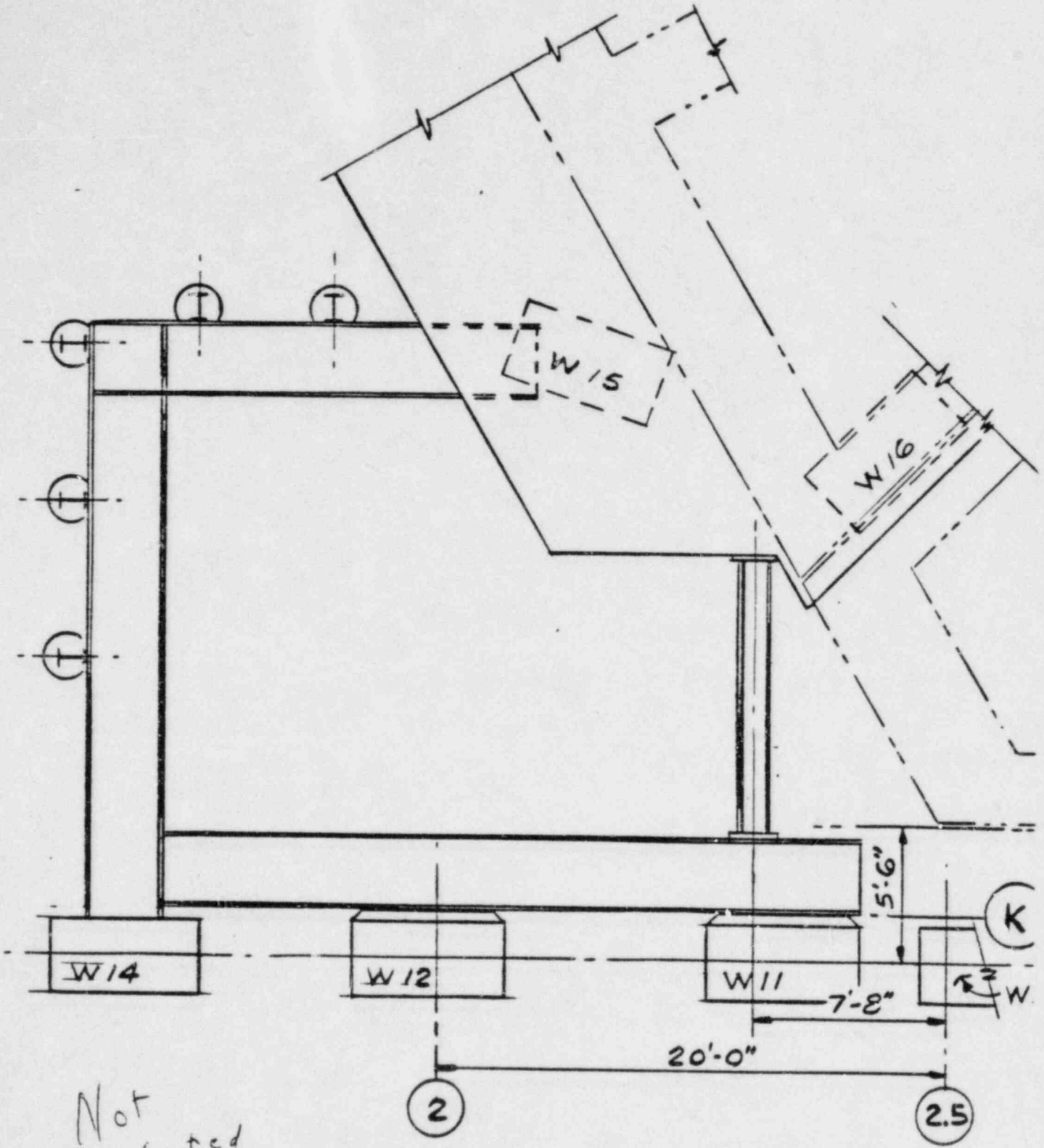
MIDLAND UNITS 1 AND 2
AUXILIARY BUILDING UNDERPINNING 1/12/82

G 1929 13



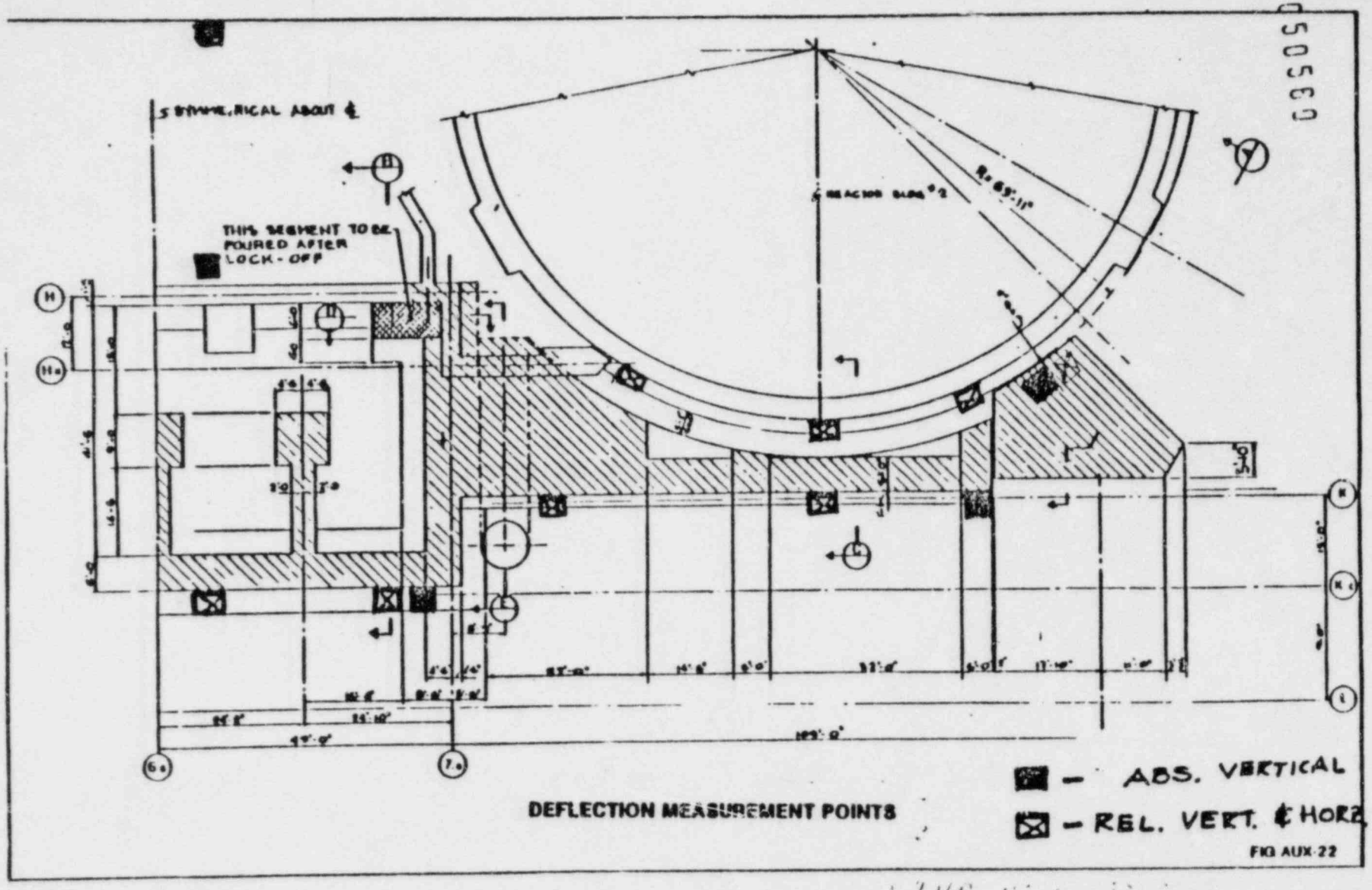
Not elected

PLAN AT EL. 599'-6" (LEVEL C)
(POSSIBLE ALTERNATE)



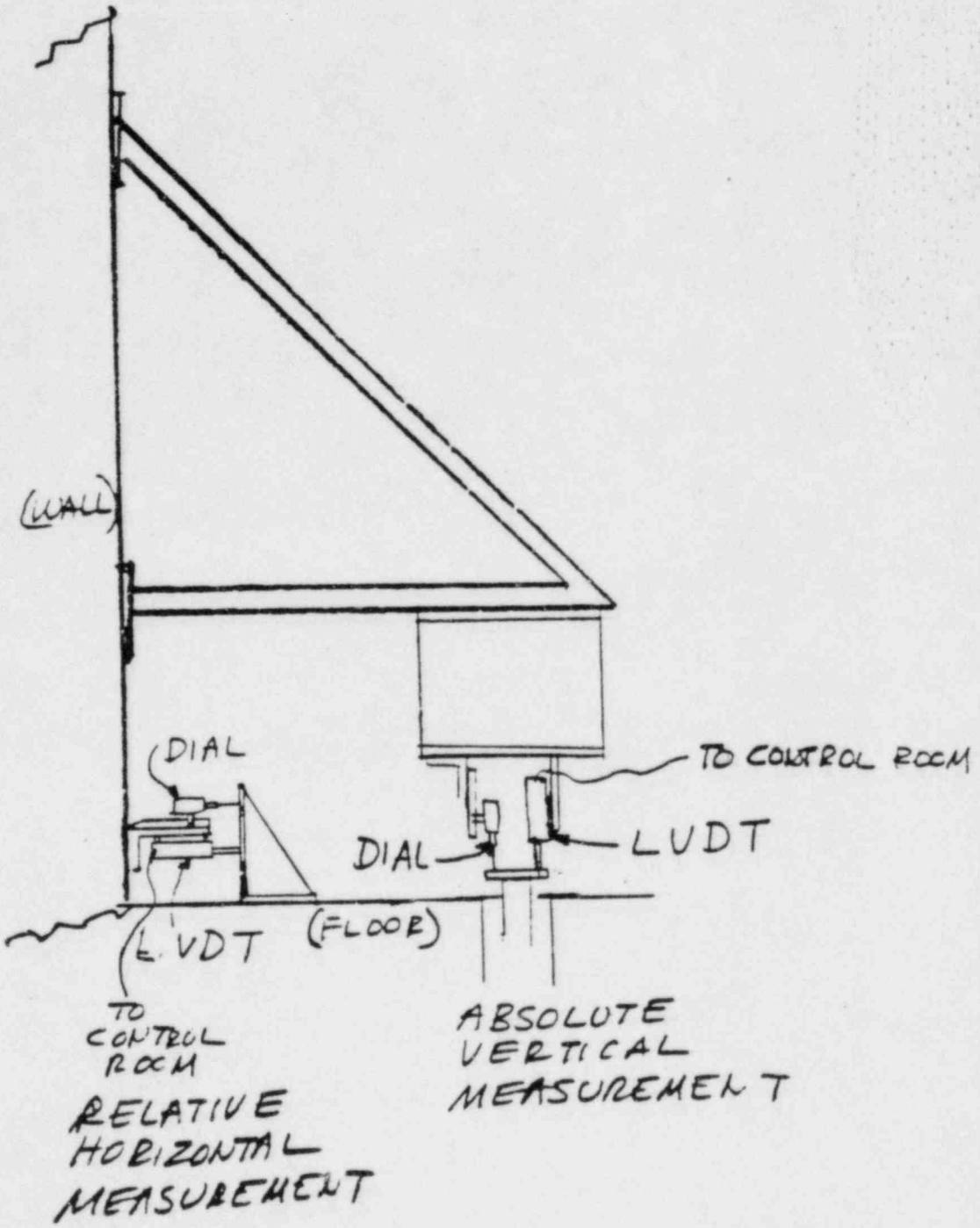
Not elected

PLAN AT EL. 589'-6" (LEVEL D)
(POSSIBLE ALTERNATE)

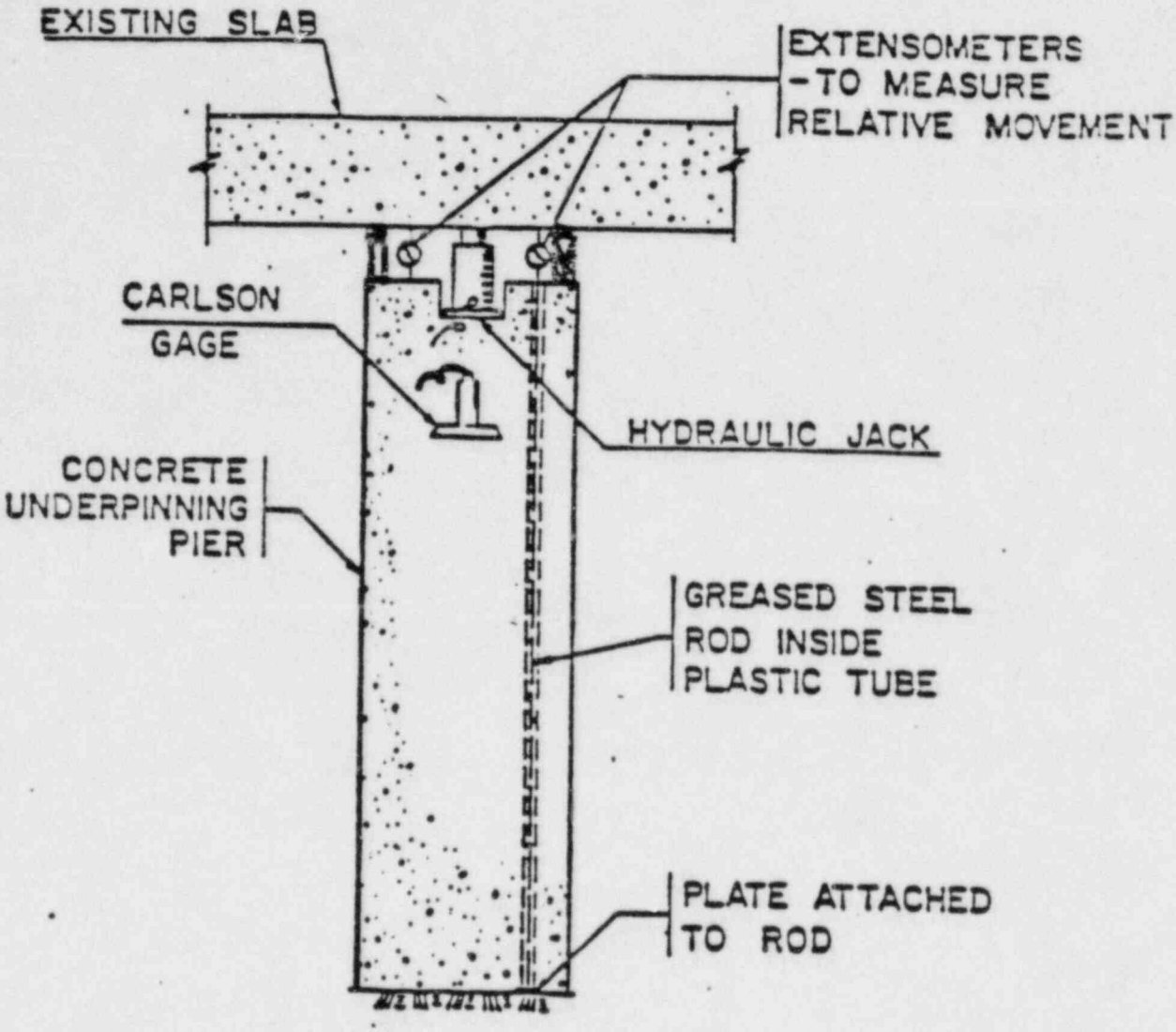


DEFLECTION MEASUREMENT POINTS

FIG AUX-22

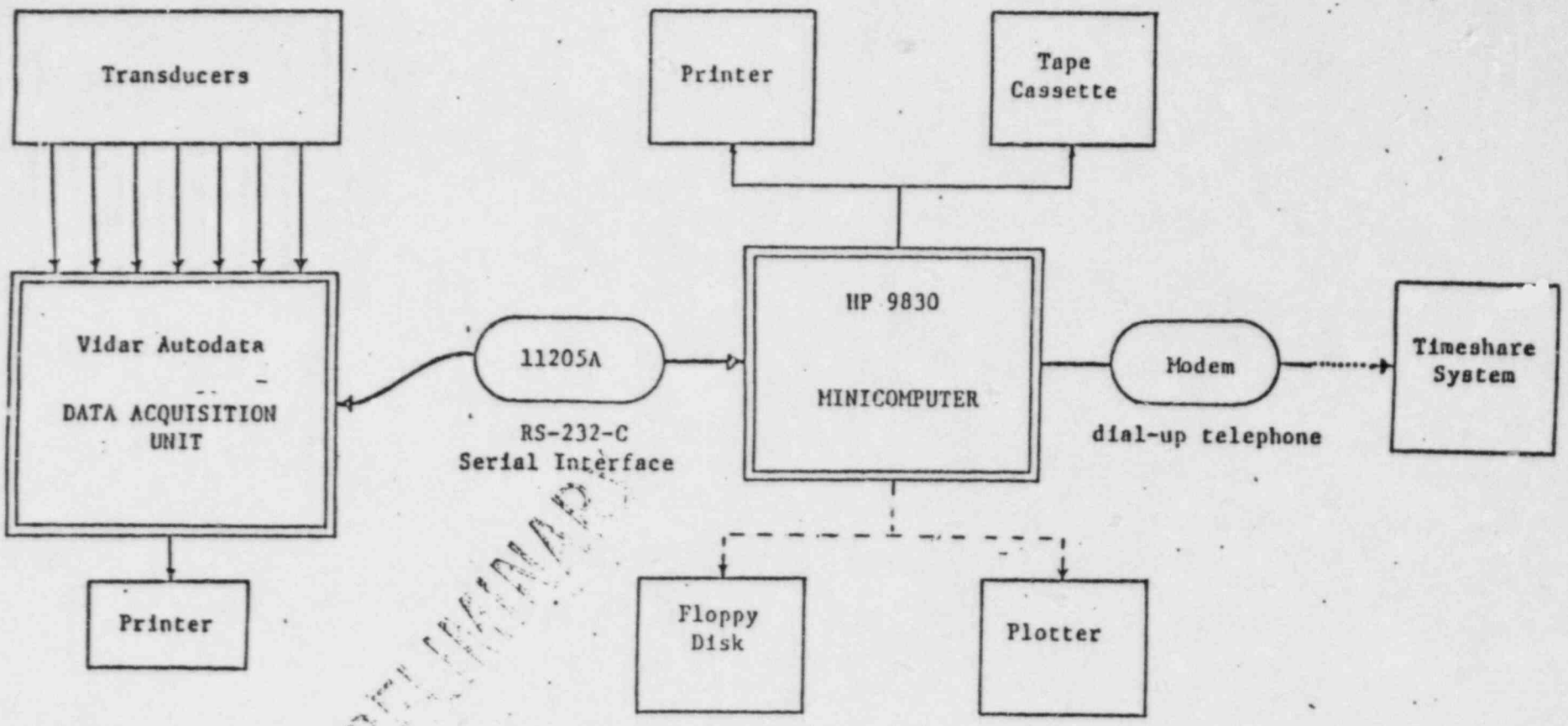

(WALL)
DIAL
TO CONTROL ROOM
DIAL
LVDT
(FLOOR)
LVDT
TO CONTROL ROOM
RELATIVE HORIZONTAL MEASUREMENT
ABSOLUTE VERTICAL MEASUREMENT

36



SECTION THROUGH INSTRUMENTED UNDERPINNING PIER

FIG AUX-32



Data Acquisition and Data Processing System

NRC AUDIT ON JANUARY 18 & 19, 1982

ACTION ITEMS FROM F. RINALDI

1. FIVP TEMPORARY SUPPORT:

- Check diagonal tension in roof slab.
- Check roof slab for moment due to Dead Load superimposed on the moment due to rod.
- Evaluate effect of cut rebars on capacity of anchors and all other applicable calculations during the temporary support and also the final support condition.

2. CONTAINMENT WALL:

- Check containment for moment due to the worst loaded strut. Assume Load dispersion at 45°. Superimpose the resulting stresses on the stresses due to prestressing.

3. BUTTRESS ACCESS SHAFT FOR WALE LOADS:

- Update calc for wall A using #11 @ 8" c/c which gives 1-1/2 bars per foot instead of 2 bars per foot assumed in calc. (A quick check showed that the design is still adequate.)
- Complete calc for wall B. There was a note in the calc that the moment capcity was o.k. Indicate how?

4. RETAINING WALL BRACING:

- Justify with Geotech branch the use of 36° as angle of friction ϕ as against 30°.
- Clarify the origin of loads, i.e., 297^{k}, 449^{k}, 349^{k}, etc., in the calculations. (Note: this comment is for all other calcs as well).

5. BURIED TANK:

- The tank is affected by wale loads at Levels B & C. However, the calcs have used levels A & B for design. Even though the design is conservative, a clarification is needed in design.
- Check the reinforcing which connects the tank to the turbine building for tension and shear. In considering the shear wall action, in each direction, an effective flange may be considered to resist bending and the web may be considered to resist shear.

6. STEEL LAGGING:

- Provide reference in the calculation for the 50% reduction in soil pressure for arching action.

7. FINAL CONDITION OF PIERS 8, 9 & 10:

- Redo calc considering additional piers put under turbine buidling columns.
- Complete drawing, e.g., rebar for bell was not called out on drawing.

8. RING BEAM ALONG CONTAINMENT:

- Check the unbalanced load condition when only half side is loaded. Consider each side for stability.
- The strut size in calc is 26"Ø t=5/8" whereas the drawing shows 28"Ø t=1/2". Update the calc to show adequacy of the strut.
- Provide details of end ties at two ends. How are they tied, etc.
- Complete calculation for level B.

9. GENERAL COMMENT:

- Provide a sketch in the calcs showing how the forces in the various wales and struts are balanced and transferred.
- Provide corrected* copies of FIVP calcs and construction condition calcs to NRC at time of 2/1/82 audit.

* incorporating all above mentioned comments

Subject: Design Issues to be Audited by HGEB at January 18 - 19, 1982 Audit in Ann Arbor, Michigan

License Condition No.	Review Issue	Documentation Anticipated to be Presented to HGEB	Results of Design Audit Jan 18 - 20, 1982 Ann Arbor, Michigan
2a & 2b	Freeze Wall	Show soil types and stratification, groundwater level and estimates of soil permeabilities on Figures 5 through 8 of January 6, 1982, submittal. Anticipate discussions with Consumers on January 6, 1982, submittal (Mooney to Denton) on Freeze Wall Installation.	Location of Piez. to be provided @ Recharge Meeting. Will provide Figures (crossings) w/soil stratification by mail.
2c	NRC Questions Identified in Oct. 30, 1981 Conference Call Attach. 21, Q.3.	Well installation data sheets, pumping well construction summaries and well logs and records of soil particle monitoring for the permanent dewatering wells (including back-up wells) already installed.	Will provide (today) typical records incl. latest soil erosion records for temp & perm well @ SW structure and Aux. Building.
2c	Attach. 21, Q.4.	See above comments on License Condition Nos. 2a & 2b	Resolved
2d	NRC Testimony Nov. 20, 1981, Q.14	HGEB considers the bearing capacity issue to be resolved with the submittal of Consumers testimony (Johnson, Burke, Corley, Sozen and Gould-December 1-3, 1982) and Part 2, Test Results, Auxiliary Building, November 24, 1981).	Resolved
2d	NRC Testimony Nov. 20, 1981, Q.17	Anticipate discussion with Consumers on appropriate preconsolidation pressures to be used for structures founded on glacial till and on history of overburden stresses (e.g., sequence of fill placement and construction of structures).	Resolved
3a	FIVP Stability	Plan and sectional views that show details of transmitting FIVP loads to Turbine Building and Buttress Access Shafts. Calculations which determined imposed loads from FIVP onto Turbine and Buttress Access structures. Location and magnitude of bearing stresses at the top surface of the concrete walls of the Turbine and Buttress Access Shaft structures. Procedure for distributing the additional bearing stresses to the foundations of the Turbine Building and Buttress Access Shafts due to FIVP load transfer.	Provided by handouts Resolved Turbine Bldg. resolved. Revised calculation needed for Buttress Access Shaft to be provided - will send via R. Huston next week.

	Review Issue	Documentation Anticipated to be Presented by HGEB	Results of Design Audit Jan 18 - 20, 1982 Ann Arbor, Michigan
3b	FIVP Stability	Details of an acceptable monitoring program (settlement and lateral deflection) that will demonstrate no adverse impact on FIVP and utilities while it is undermined. Details should include type of monitoring, frequency, location and criteria on tolerable limits of total and differential settlement to be required with engineering basis for these limits. Affected utilities to be identified on plan and sectional views.	Provide instramentation drawings (C-1490 & 1491). Revised botton of deep seated B.M. (EL.425) Revised monitoring location (between Turbine & FIVP & relative movement FIVP & deep seated B.M. Above provided @ next audit (Feb. 1 - 5, 1982) Discuss criteria of 3/8" how established where measured, actions to be taken (jacking when reached, address past settlement, when connected.
	Vert. Access Shaft	In response to ASLB questioning - Anticipate a presentation by CPC on procedure for drilling holes for vertical access shaft and a discussion with NRC on the need for any requirements (e.g., drilling and backfilling one hole at a time, etc.) while work for installing the vertical access shaft is completed (Refer to ASLB transcripts of December 3, 1981).	Will provide letter report which summarizes CPC presentation of 1/19/82 & indicate NRC concurrence. Will not proceed until letter is received by NRC.
		Plan and sectional views showing areal and depth limits of compacted granular backfill beneath FIVP. Discussion on field procedures for placement and compaction and compaction control requirements.	Will provide @ next audit. Indicate measures to be taken to assure separation of jacking slab from reactor & completed underpinning wall.
3c	NRC questions identified in Oct. 30, 1981 Conference Call	(HGEB considers Questions 5, 8, 11, 13, 24, and 26 to be resolved. Refer to D. Hood for any additional resolution required by NRR or I&E Branches).	Resolved
	Attach. 21, Q.12	Calculations for determining the soil Modulus of Elasticity from rebound-reload test results. Verification that Modulus of Elasticity corresponds to the stress level comparable to the actual bearing pressures on foundation soils.	Resolved

Results of Design Audit
Jan 18 - 20, 1982
Ann Arbor, Michigan

Item No.	Review Issue	Documentation Anticipated to be Presented to NRC	Results of Design Audit Jan 18 - 20, 1982 Ann Arbor, Michigan
3c	Attach 21, Q.27	Details of monitoring set-ups for measuring relative movements at critical points (between main Auxiliary Building - Control Tower connection and outer walls of Control Tower, and between EPA-Control Tower connection and free ends of EPA's) Details of calculational procedure for determining relative movement at the above critical points.	Will discuss @ next audit (Feb. 1 - 5, 1982) Data reduction Will provide installation dates for ALL devices, indicate frequency, type of instrument, location, criteria, action level.
3c	Attach. 21, Q.29	Response to Q.29 submitted on Nov. 16, 1981, is inadequate. Provide sketch, locations and typical details of instrumentation as previously requested.	Submit literature on Carlson stress meter. Modification of tell-tale installation (Difference from ASTM). Provide by Jan. 22, 1982.
4a	Effect of Drift Excavation Beneath Turbine Building	Plan & sectional views showing relationship of drift excavation to Turbine Building and Auxiliary Building foundations with analysis that demonstrates no adverse impact on Auxiliary Building. Underground piping and conduits should be identified on plan and sectional views in areas affected by drift excavation and underpinning of Turbine Building. Calculations indicating factors of safety against bearing type failure for required loading conditions and calculations of estimated settlements (total and differential) with engineering evaluation of these results on the foundation stability of the Turbine Building and Buttress Access Shafts and affected conduits and piping.	NRC to respond by Feb. 5, 1982, to Don Bartlett's presentation. Resolved F.S. = 2.5 (Allow Bearing 15 to 17 ksf). Have not checked settlement of Turbine Bldg. Are checking by calculations (soil spring constants) which allows for new interior piers under Turbine Bldg. Will discuss @ next audit.
4b	Effect of Drift Excavation	License condition 4b requirements are self explanatory.	Are covered by other discussions of review issue.

License Condition No.	Review Issue	Documentation Anticipated to be Presented to HGEB	Results of Design Audit Jan 18 - 20, 1982 Ann Arbor, Michigan
4c	Effect of Drift Excavation	Calculations for factor of safety against bearing type failure and settlements (total and differential) for the permanent support system along the north side of the Turbine Building. Discussion of these results with respect to any impact on the Auxiliary Building and underground conduits and piping	Requiring F.S. = 3.0 for long-term Allow. bearing capacity = 15 ksf Resolved Duct banks thru Control Tower involved. Will discuss @ next audit - Support during excavation. (only duct banks involved, no piping involved)
4d	Attach. 21, Q.9	Structural analysis calculations that considered differential settlement with proper load combination and resulting concrete and steel stresses. Provide values of settlement used in analysis. Based on analysis, provide acceptance criteria for differential and absolute settlements for construction underpinning as identified in response to Q.9.	Auxiliary Bldg. & Control Tower Two parts - Construction - Discuss @ next audit. Long-Term or Perm. - Discuss @ May Audit.
4d	Attach. 21, Q.14	Calculations of the bearing pressures and total settlements established at the selected foundation locations. Calculations of the initially determined static soil spring constants and final spring constant values determined by iteration.	Resolved Will furnish calculations. NRC to respond QUICKLY. Response to Q.14 is superseded by approach shown in calculations. @ next audit resolve 20 ksf
4d	Attach. 21, Q.15	Longitudinal sectional view along drift excavation alignment showing location and outline of Cat. I utilities to be encountered.	Will cover @ next audit. Only control tower & duct bank are involved.
4d	Attach. 21, Q.25	Details of deep seated bench marks and instrumentation for monitoring relative and horizontal movement and absolute horizontal movement.	Will be provided by next audit (Feb. 1-5, 1982).

Question No.	Review Issue	Documentation Anticipated to be Presented to HGEB	Results of Design Audit Jan 16 - 20, 1982 Ann Arbor, Michigan
42.	Attach. 21, Q.30	Forms to be used for recording data from the various types of monitoring. (Refer to Pgs. D-5 and D-6, Sect. 3, Par. 3A.1, 3A.2, 3A.3 of Encl. 3 to the Sept. 30, 1981, submittal from J. W. Cook to H. R. Denton).	Both Bechtel & NRC to review. To be discussed at next audit.
		Lateral Earth Pressure — Adopt $\phi = 30^{\circ}$ Discuss @ next audit If $\phi = 36^{\circ}$ is needed, present justification.	Provide calculations for lateral pressure against vertical access shaft (Used in design for walers) along w/justiciation of $\phi' = 36^{\circ}$.
		Crack Monitoring & Sealing	CPC Testimony will provide their plans for sealing cracks. NRC should be prepared to address. Possibly have meeting w/CPC to resolve differences & license conditions

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

MAR 1 6 1982

Docket Nos: 50-329 OM, OL
and 50-330 OM, OL

APPLICANT: Consumers Power Company

FACILITY: Midland Plant, Units 1 & 2

SUBJECT: SUMMARY OF JANUARY 18 & 19, 1982, AUDIT ON PLANS FOR EXCAVATION BENEATH MIDLAND FEEDWATER VALVE PITS AND TURBINE BUILDING FOR AUXILIARY BUILDING UNDERPINNING

On January 18 & 19, 1982, the NRC Staff and its consultants conducted an audit of the plans and preparations for "Phase II" of the construction sequence for the underpinning of the Auxiliary Building at Midland Plant, Units 1 & 2. The underpinning construction is to be conducted in four phases. The first phase provided for installation of vertical access shafts and was approved by the NRC on November 24, 1981. Phase II, the subject of this audit, generally provides for further deepening of the access shaft, construction of limited drifts under the Feedwater Isolation Valve Pits (FIVPs) and Turbine Building, and installation of certain piers. Enclosure 1 describes the construction sequence logic more fully. The audit was conducted in Ann Arbor, Michigan, pursuant to Table A20 of the staff testimony presented during the OM, OL hearing session of December 1-4, 1981. Enclosure 2 identifies the agenda for presentations given by the applicant and speakers. The calculations, specifications and drawings audited are listed by Enclosure 3.

The applicant reviewed Phase I construction to begin in early February 1982, and informed the staff of a change in its plans to use a hollow steam auger for drilling soldier pile holes for the access shaft. The applicant anticipates difficulty in penetrating the hard glacial till with this technique. Instead, the holes will be augered with a solid stem auger driven by a Kelly bar, and will use a bentonite slurry and casing to insure stability of the hole The NRC noted its approval of this alternate procedure. A letter to the staff d licensing board will describe the revised procedures.

Mr. D. Bartlett described the Phase II construction sequence and its effects upon the Auxiliary Building foundation. This discussion is given by Enclosure 4. Mr. Bartlett's viewgraph slides are given by Enclosure 5.

Using the slides from Enclosures 6 & 7, Messrs. S. Lo and N. Rawson described the design details for Phase II underpinning, including the overhead support for the FIVPs, and drift under the FIVP and Turbine Building, and the Turbine Building underpinning. The presentation revealed two recent changes: (1) Piers 11 through 14 will be relocated about 4 feet south so as to be in line with piers 9 and 10, and (2) two 6' X 6' underpinning piers will be added beneath structural columns within the Turbine Building.

~~8203220581~~

The applicant's criteria for settlement of the FIVP is 1/2" vertical movement and 1/8" horizontal. The values are based upon stress in the main feedwater pipe (see FSAR Figure 3.8-18) and were arbitrarily selected (i.e., a higher value could possibly have been selected for the analysis and found acceptable). The 1/2" criterion was determined to result in 9324 psi stress at the anchor point of the feedwater pipe, which is well within allowable stresses for a no-break criterion. A criterion of 3/16" was set during the load transfer of the FIVP to its temporary supports during early May 1981 and is included in the 1/2" criterion. However, the staff found that total settlement since the piping was first installed in 1977 was not known nor included in the calculated stress, and this represented an open item.

Two steam generator drain lines also penetrate each FIVP (see FSAR Figure 10.4-10, sheet 1). These are seismic Category I lines, 2" in diameter, that provide flow of feedwater from the steam generator to the main condenser in the Turbine Building. Plant startup procedures call for isolation of these lines at about 4% power. The line is automatically isolated in the event of a main steam isolation signal to the isolation valve located within the FIVP. These lines are not presently connected through the FIVP-Turbine Building wall and therefore need not be considered in the movement criteria. However, the staff requested that these lines should first be shown not to be limiting if a decision is made to connect them prior to completion of the underpinning construction.

Monitoring details for Phase II construction was described by Mr. R. Adler using the slides of Enclosure 8. In addition to monitoring structural movement, it was agreed that cracks in the FIVP should be monitored at the following construction points:

(1) Base line monitoring before extending access shaft below elevation 609'.

(2) Monitoring during drifting to pier W-9

(3) Monitoring after completion of drift to pier W-9

(4) After completion of all material beneath FIVP

(5) Prior to jacking of permanent underpinning

(6) After completion of jacking of permanent underpinning

(7) At two months maximum intervals if not covered by above events

(8) After any rejacking

Open items identified by Mr. F. Rinaldi of the staff's Structural Engineering Branch during the audit are listed by Enclosure 9. Design issues audited by Mr. J. Kane of the Geotechnical Engineering Staff, and the disposition of these issues at the conclusion of the audit, are listed by Enclosure 10. Several of these items will be discussed during a subsequent audit for Phase III construction which is scheduled for February 3-5, 1982.

Darl S. Hood, Project Manager
Licensing Branch No. 4
Division of Licensing

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As stated

cc: See next page

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May 10, 1982

Harold R Denton, Director
Office of Nuclear Reactor Regulation
Division of Licensing
US Nuclear Regulatory Commission
Washington, DC 20555

MIDLAND PROJECT
MIDLAND DOCKET NO 50-329, 50-330
ASLP SOILS ORDER
FILE: 0485.16.1, 0485.16.5 SERIAL: 17138
ENCLOSURE: 7220 C-45 (Q) YARD-WORK CLASS 1
FILL MATERIAL AREAS

The Atomic Safety and Licensing Board issued an Order, dated April 30, 1982, imposing certain interim conditions on the remedial soils and related work at the Midland site. In accordance with the Order, Consumers Power Company stopped work at affected areas of the Midland site. Work which had previous NRC staff approval or which was otherwise not covered by the Order continues.

The Order covers remedial soils work, as well as "any placing, compacting, excavating, or drilling of soil materials around safety-related structures and systems." For a number of years, the Midland Project Drawing 7220-C-45 has been recognized as defining which soils at the Midland site are safety-related. The enclosed C-45 drawing is being reviewed for completeness relative to the Board Order. The next revision of the drawing will address the ultimate heat sink components and other appropriate areas. In a conference telephone call on May 5, 1982, the Board concurred that in the absence of disagreement from the NRC staff, the term "around safety-related structures and systems" as used in the Order may be interpreted as coextensive with safety-related soils as designated on the C-45 drawing.

Remedial soils work previously approved by the NRC is continuing. Concurrence as to the scope of this work was obtained from Mr Darl Hood, and is as defined below:

I. a. phase I work (Auxiliarly Building underpinning),

b. access shaft (Auxiliary Building underpinning),

c. freeze wall installation, underground utility protection, soil removal cribbing and related work in support of the freeze wall installation, freeze wall monitoring and freeze wall activation,

d. installation and operation of the permanent site dewatering system,

e. operation of existing construction dewatering wells,

f. FIVP proof load test.

In addition to the above, NRR or Region III have specifically approved other work that is not presently underway. This work, as defined below, will be started at the appropriate time:

II. a. installation and activation of dewatering system for the service water pump structure,

b. the repair of cracks in the borated water storage tank ring wall,

c. installation of Auxiliary Building monitoring system cable.

In addition to the above, when the Order was issued Consumers Power was proceeding with certain other soils remedial work with full awareness and concurrence of the Staff; however, explicit written approval for that work had not been obtained. This work, as defined below, has been stopped in accordance with the order:

III. a. installation of deep-seated benchmarks,

b. installation and operation of construction wells that were not previously operating (previously installed and operating wells are noted in Ie above),

c. installation of monitoring system instruments and mounting.

Consumers Power Company believes it did have staff approval for this work because of the extensive review of the installation details of the systems and final agreement on the installation techniques. Accordingly, Consumers Power Company requests the staff to verify in accordance with the Order its earlier concurrence so that work in these areas can be reactivated.

Confirming recent telephone communications, we have increased from 9 to 12 the number of deep benchmarks for monitoring auxiliary building movements. Two of three additional benchmarks still need to be installed. These benchmarks will be installed in the same manner as the earlier nine, and the final system will be subject to final staff concurrence. Regarding benchmark installation, Consumers Power Company believes it had Staff concurrence following the auxiliary building audit, site visit and letter of March 22, 1982. The March 22, 1982 letter instructs the Applicant to have additional benchmarks installed before beginning Phase II work. Consumers now requests written confirmation of staff approval for the balance of this work.

When the Order was issued, additional area dewatering wells were being installed to dewater the site for activation of the freeze wall and resulting construction. These wells are needed to complete installation of the freeze wall and dewater construction areas. They were and will be installed to the acceptance criteria agreed upon by the Staff for installing and operating dewatering wells in a safe manner. Consumers Power Company believes the agreement reached with the Staff on acceptance criteria for construction dewatering, together with the authorization to install and operate the freeze wall, for which the dewatering is necessary, constitute previous staff approval of this work, and, therefore, requests explicit written confirmation at this time.

The work on the monitoring system instruments and mounting for the auxiliary building is presently stopped because the Region III concurrence has not been obtained. We understand the remaining proposed work in this area will be reviewed by Region III in the near future. Such work is on the critical path and will start as soon as approval is obtained.

The Order also requires that certain work specified therein be covered by a quality assurance plan approved by the NRC Staff. The "Quality Plan for Underpinning Activities" (MPQP-1) was written specifically to provide nuclear quality assurance coverage of certain subcontractors which did not themselves have nuclear QA programs (Mergentime, Spencer White & Prentiss and their subcontractors). MPQP-1 was approved by the Staff, subject to certain questions as to coverage , at a March 10 meeting with Consumers. Resolution of the coverage questions was achieved at meetings with the NRC Staff on March 30, 1982, as documented in a letter from J W Cook to Mr J G Keppler dated April 5, 1982. In the April 5 letter, Consumers agreed to place all to-go underpinning work, with certain specific exceptions, under the coverage of the quality plan for underpinning activities. The latest revisions of MPQP-1 encompass the installation and operation of the structural monitoring system, as performed by Wiss Janey, in addition to the auxiliary building and service water pump structure underpinning.

Activites being performed wholly by Consumers, Bechtel or specific subcontractors which have in-place nuclear quality assurance programs are not specifically subject to MPQP-1, (which was designed for subcontractors without nuclear QA programs). We interpret the existing quality assurance programs and procedures of those organizations not covered by MPQP-1 as meeting the Order's requirement of an approved QA "plan". Such quality assurance programs and procedures have been approved by the Staff previously or by CP Co under procedures normally used to review contractor QA programs. Of course, the specific construction implementing procedures for activities carried out under these QA programs are subject to review by the Staff to the extent it deems necessary.

With regard to the items listed under III, above, the installation of deepseated benchmarks is being carried out by Woodward Clyde, which is subject to its own quality assurance program and procedures approved by Consumers and previously subject to NRC Staff inspections. The construction dewatering wells under item III(b) are to be installed subject to the quality requirements agreed upon with the Staff. As indicated above, the installation

of monitoring systems for the auxiliary building underpinning as performed by Wiss Janey (item C, above) is covered by MPQP-1, and as performed by Bechtel is subject to the overall site quality assurance program.

In summary, after issuance of the April 30, 1982 Order, the Company stopped certain work pending written confirmation of NRC Staff approval, previously given, that such work could be completed. Consumers Power Company requests Staff confirmation on these work activities so that they can be resumed as soon as possible.

James W. Cook

JWC/JEB/dsb

CC Atomic Safety and Licensing Appeal Board, w/o
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RJCook, Midland Resident Inspector, w/o
RSDecker, ASLB, w/o
SGadler, w/o
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DSHood, NRC, w/a (2)
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WHMarshall, w/o
JPMatra, Naval Surface Weapons Center, w/a
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CONSUMERS POWER COMPANY
Midland Units 1 and 2
Docket No 50-329, 50-330

Letter Serial 17138 Dated May 10, 1982

At the request of the Commission and pursuant to the Atomic Energy Act of 1954, and the Energy Reorganization Act of 1974, as amended and the Commission's Rules and Regulations thereunder, Consumers Power Company submits a summary of action it has taken in response to the ASLB order dated April 30, 1982. Furthermore we are requesting explicit written approval for continuation of certain construction activities.

CONSUMERS POWER COMPANY

By /s/ J W Cook
J W Cook, Vice President
Projects, Engineering and Construction

Sworn and subscribed before me 12th day of May 1982

Barbara P Townsend
Notary Public
Jackson County, Michigan

My Commission Expires September 8, 1984

mi0382-0087b100

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD

Before Administrative Judges:
Charles Bechhoefer, Chairman
Dr. Frederick P. Cowan
Ralph S. Decker

In the Matter of	Docket Nos. 50-329 OM 50-330 OM
CONSUMERS POWER COMPANY	Docket Nos. 50-329 OL 50-330 OL
(Midland Plant, Units 1 and 2)	
	April 30, 1982

MEMORANDUM AND ORDER
(Imposing Certain Interim Conditions
Pending Issuance of Partial Initial Decision)

Pending before this Licensing Board are consolidated proceedings arising out of the NRC Staff's December 6, 1979 Order Modifying Construction Permits No. CPPR-81 and No. CPPR-82 (OM proceeding), and the application by Consumers Power Co. for operating licenses for Midland Nuclear Power Plant, Units 1 and 2 (OL proceeding).[1/] The facility, currently under construction, consists of two pressurized water reactors located in Midland, Michigan.

The Modification Order was generated as a result of the excessive settlement which occurred with respect to the facility's diesel generator

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1/ The proceedings were consolidated at the request of Consumers Power Co., the Applicant in the OL proceeding and the Licensee in the OM proceeding (hereinafter referred to as "Consumers"). See Prehearing Conference Order, dated October 24, 1980 (unpublished).

building and other plant structures. Hearings which have been held to date concern the soils settlement issues raised by the Modification Order, as well as related contentions of intervenors in each of the proceedings. (The majority of the soils settlement contentions have been sponsored by Ms. Barbara Stamiris, an intervenor in the OM proceeding.) As reflected in our Memorandum[2/] of October 2, 1981, we have determined to issue separate partial initial decisions dealing with various aspects of the soils issues. The first, now under preparation, deals with quality assurance/quality control (QA/QC) and management attitude issues, as delineated in the October 2, 1981 Memorandum. With limited exceptions, the record on these matters was closed on February 19, 1982, following some thirty-five days of hearings.[3/] The second will deal with proposed remedial actions to correct the soils settlement problems. Hearings on these matters are not yet completed, partially as a result of the as-yet developing positions of all parties on these questions.

With respect to the QA/QC and management attitude issues, proposed findings of fact and conclusions of law, and supplemental proposed findings and conclusions covering matters as to which the record was reopened, have been received from all interested parties, and Consumers has just recently filed its replies to each of the proposed and supplemental proposed findings and conclusions of the other parties. During the course of our

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2/ Memorandum (Concerning Telephone Conference Call of September 25, 1981 and Applicant's Motion for Partial Decision), dated October 2, 1981 (unpublished).

3/ Certain aspects of these issues will remain open until our second partial initial decision.

review of these various filings, as well as of the entire record, we have determined that certain conditions governing further construction, as set forth in Section VI of this Memorandum and Order, should be put into effect immediately, pending the completion of our review and the issuance within approximately two or three months of our first Partial Initial Decision.[4/] Our reasons follow.

I. Background

Under construction permits such as are in effect for the Midland plants, a permittee may normally engage in construction activities in accordance with the principal architectural and engineering criteria and environmental commitments set forth in the application for the facility and the construction-permit hearing record, without seeking prior approval of the NRC Staff. The permittee undertakes such activities at its own risk; they are subject to Commission approval before an operating license may be granted. See 10 C.F.R. §50.57; Cf. Northern Indiana Public Service Co. (Bailly Generating Station, Nuclear-1), CLI-79-11, 10 NRC 733 (1979), reversed on other grounds, sub nom. People of the State of Illinois v. NRC

4/ This procedure has been previously utilized by the Appeal Board with respect to these very same reactors. ALAB-106, 6 AEC 182 (1973).

We note that, in a telephone conference call on April 28, 1982, the Staff indicated that it might reconsider certain earlier testimony expressing reasonable assurance that Consumers' QA program will be appropriately implemented with respect to future soils construction activities (Keppler, prepared testiony, p. 9, fol. Tr. 1864). It requested that we cancel certain near-term hearings which we had scheduled, and we did so. Memorandum and Order (Cancelling Evidentiary Hearings and Conference of Counsel or Representatives), dated April 28, 1980 (unpublished). As a result, our first Partial Initial Decision could be delayed beyond the time frame we are now projecting.

(D.C. Cir. No. 80-1163, July 1, 1981). The December 6, 1979 Modification Order would have modified this regime by prohibiting certain construction activities with respect to safety-related structures and systems affected by the soils settlement problems which have been aired in the ongoing consolidated proceeding. The prohibited activities could not be undertaken absent (1) submission of an amendment to the application seeking approval of remedial actions, and (2) issuance of an amendment to the construction permits authorizing the remedial actions.5/ The Modification Order further provided that a hearing could be requested by Consumers or other interested person and, if it were, the Order would go into effect only as a result of an order made following the hearing.6/

The construction activities which the Modification Order would have prohibited consist of the following:7/

(a) any placing, compacting, or excavating soil materials under or around safety related structures and systems;

(b) physical implementation of remedial action for correction of soil-related problems under and around these structures and systems, including but not limited to:

(i) dewatering systems

(ii) underpinning of service water building

5/ Modification Order, Part IV. The Modification Order has been admitted into evidence as Stamiris Exh. 3, Attachment 15 (Tr. 2479).

6/ Modification Order, Part V.

7/ Modification Order, Part IV.

(iii) removal and replacement of fill beneath the feedwater isolation valve pit area

(iv) placing caissons at the ends of the auxiliary building electrical penetration areas

(v) compaction and loading activities;

(c) construction work in soil materials under or around safety-related structures and systems such as field installation of conduits and piping.

Had the hearings in the OM proceeding not been requested, Consumers could not have undertaken any of the foregoing activities without submitting an amendmert to its application and obtaining construction- permit amendments authorizing such activities. Since the hearing was requested, the normal construction permit authority remains in effect, and no construction permit amendment (or other NRC authorization) needs to be sought in order for Consumers to engage in the activities in question.

Both the Modification Order (Part V) and the Commission's Notice of Hearing of March 14, 1980 (45 Fed. Reg. 18214, March 20, 1980) stated that this Board is to consider and decide the following issues:

(1) Whether the facts (concerning quality deficiencies) set forth in Part II of the Order are correct; and

(2) Whether that Order should be sustained.

II. Facts Underlying Modification Order

One of the bases for the Modification Order was the allegation that there had been a breakdown in quality assurance related to soils. Another

basis was that Consumers had not provided the information which the Staff and its consultants required to permit a thorough safety review of proposed remedial actions.[8/] As a result of these deficiencies, the Staff concluded that it did not have reasonable assurance that the safety-related portions of the Midland facilities would be so constructed that they could be operated without undue risk to public health and safety.

With regard to the first basis, Consumers and the Staff entered into a stipulation on June 5, 1981, in which Consumers conceded that prior to December 6, 1979 there were quality assurance deficiencies related to soil construction activities. Consumers agreed not to contest the Staff's conclusion that these deficiencies constituted a breakdown in quality assurance with respect to soils placement at Midland, and it acknowledged that the deficiencies constituted an adequate basis for issuance of the Order.[9/] With regard to the second basis for the Order, the Staff and Consumers entered into two additional stipulations in which Consumers agreed not to contest that, as of December 6, 1979, the NRC Staff had insufficient information to evaluate the proposed remedial actions for the auxiliary building, for the borated water storage tanks and underground piping.[10/]

8/ We are here making no findings and reaching no conclusions with respect to a third basis for the Order, an alleged material false statement. Hearings on that subject are not yet completed although we have heard testimony on the management-attitude aspects of the alleged statement.

9/ Applicant/Staff Joint Exh. 1, following Tr. 1175, admitted at Tr. 1188.

10/ Applicant/Staff Joint Exhs. 2 and 3, dated December 1, 1981 and February 9, 1982, respectively (Tr. 5447, 7164).

As a result of these stipulations, we are able at an early stage of our review to conclude, with respect to the first hearing issue, that the facts set forth in Part II of the Modification Order (to the extent they relate to soils QA deficiencies and the adequacy on December 6, 1979 of the Staff's information to review remedial actions) are correct and constituted an adequate basis for issuance of the Order. Consumers, the NRC Staff, and intervenor Barbara Stamiris each submitted proposed findings to this effect.11/

III. Facts Giving Rise to Interim Requirements

We have not yet completed our review of the second hearing issue--i.e., whether and, if so, to what extent, the Modification Order should be sustained. Consumers has described this issue as "whether the safety issues [giving rise to the facts set forth in Part II of the Modification Order] have been resolved so that the quality assurance program with respect to soils is now being properly implemented and there is reasonable assurance such implementation will continue through the construction process."12/ Ms. Stamiris has described it somewhat similarly, as "whether as a result of revisions, improved implementation, and other factors, this Board has reasonable assurance that the QA and QC programs will be appropriately implemented with respect to future soils construction and remedial activities".13/ However, they reach different answers to this question.

11/ Consumers Proposed Findings ¶ 35; Staff Proposed Findings, ¶¶ 236-237; Stamiris Proposed Findings, ¶ 10.

12/ Consumers Proposed Findings, ¶ 37 [sic; should be 36].

13/ Stamiris Proposed Findings, ¶ 10.

Consumers asserts that, as a result of organizational and procedural changes which it has put into effect since the issuance of the Modification Order, its QA program is now being properly implemented. It urges us to find reasonable assurance that the future soils construction activities including the remedial actions taken as a result of inadequate soils placement will be accomplished in accordance with QA principles of public health and safety.14/ On the other hand, although Ms. Stamiris concedes that Consumers' organizational changes represent a "positive response",15/ she nonetheless concludes that the implementation of QA at Midland is inadequate16/ and that the same kind of problems and weaknesses currently exist as had lead to problems in the past.17/ She would have us put the Modification Order into effect and shut down soils-related construction immediately.18/ The NRC Staff also gave its reasonable assurance that the QA program would be properly

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14/ Consumers Proposed Findings, ¶¶ 81-83.

15/ Stamiris Proposed Findings, ¶ 222.

16/ Stamiris Proposed Findings, ¶ 221.

17/ Stamiris Proposed Findings, ¶ 225.

18/ Stamiris Proposed Findings, ¶ 254; Part III.C.

implemented,[19] although at least one of its witnesses expressed some reservations (Tr. 2441-42 (Gallagher)).[20]

We do not at this point in our review express any opinion with respect to those positions--except to note that none of them is baseless and all have evidentiary support. The resolution of this broad issue will, as we have seen, affect the degree to which and the manner in which soils-related construction activities (and particularly remedial actions) will be permitted to continue.[21]

As background for our approach to this question, we deem it important to note that the QA/QC deficiencies which are addressed by the Modification Order are not the first instances where Consumers has experienced difficulty in properly implementing its QA/QC program. The Appeal Board pinpointed one such instance in ALAB-106 (fn. 4, supra), and it imposed conditions designed to alleviate the deficiencies which it found to exist. Later, questions were raised concerning the QA/QC organization being utilized for this facility. ALAB-132, 6 AEC 431 (1973); ALAB-147, 6 AEC 636 (1973); ALAB-152, 6 AEC 816 (1973). Subsequently, the Staff issued a show-cause order which

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19/ NRC Staff Proposed Findings, ¶ 375.

20/ Mr. Gallagher stated that he supported Mr. Keppler's conclusions concerning implementation of the QA program "entirely" but added that he "would like to see some other things to be included" (Tr. 2455). See also fn. 4, supra, ¶ 2.

21/ As we have pointed out (pp. 4-5, supra), the most stringent condition we could impose on those activities under the Modification Order would be to prohibit such activities pending submission of an amendment to the applications and issuance of construction-permit amendments authorizing remedial action. All or any portion of that condition could be put into effect. Cf. Public Service Co. of Indiana (Marble Hill Nuclear Generating Station, Units 1 and 2), CLI-80-10, 11 NRC 438 (1980); Wisconsin Electric Power Co. (Point Beach, Unit 1), CLI-80-38, 12 NRC 547 (1980).

was founded on other QA/QC deficiencies, and additional corrective actions were mandated. ALAB-283, 2 NRC 11 (1975), clarified, ALAB-315, 3 NRC 101 (1976). During that show-cause proceeding, the Appeal Board remarked that "non-compliance with the Commission's quality assurance regulations is * * * a problem which has plagued the construction of this facility." ALAB-270, 1 NRC 473, 476 (1975).22/

With this history before us, early in this proceeding we expressed concern about the adequacy of and the potential safety impact of ongoing construction activities (Tr. 754-55). On the opening day of the hearing, the Staff responded to our inquiry by presenting testimony regarding soils-related construction of the type that would be going on during the period of time before we could issue a decision governing construction encompassed by the Modification Order.23/ From that testimony, it appeared to us that Consumers was at that time consulting with and seeking approval of the Staff before engaging in any of the construction activities there under consideration--i.e., installation of 20 permanent back-up interceptor wells in the area near the Service Water Structure and the Circulating Water Intake Structure, and surcharging of the two valve pits

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22/ See also Board Exhs. 1A and 1B (Tr. 1875), which contain a summary of problems experienced at Midland since the start of construction.

23/ Testimony and Supplemental Testimony of Darl S. Hood, both following Tr. 1097.

which are adjacent to each of the Borated Water Storage Tanks.[24] Altnough all of the outstanding questions raised by the Staff concerning those proposed remedial activities had not then been resolved, the Staff expressed its "reasonable assurance" that the activities would be performed in an acceptable manner.[25] We interpret that reasonable assurance conclusion as premised upon Consumers' affording the Staff the opportunity to review the proposed resolution of the unresolved questions.[26]

In addition, Consumers advised us that, in February, 1980, it had voluntarily committed not to proceed with further remedial actions without Staff review and concurrence.[27] (Insofar as the record reflects, this commitment appears to have been an oral one, not reduced to writing prior to its incorporation into testimony in this proceeding.) That Consumers will provide the Staff with sufficient information to permit a thorough safety review is inherent in this commitment.

We find no indication in the record that Consumers has failed to honor this commitment. For its part, the Staff agreed that it would accept information through meetings and presentations rather than an amendment to

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24/ Hood, prepared testimony, p. 2. Those were the only two soils-related activities then under way or planned to be undertaken by Consumers in the near term (Tr. 1112).

25/ Hood, supplemental testimony, p. 3. Subsequently, on December 10, 1981, the Staff approved the installation of 5 additional temporary dewatering wells. Staff Exh. 13 (Tr. 6901).

26/ Hood, prepared testimony, p. 3; supp. test., pp. 2,3; Tr. 1113-14, 1119.

27/ Testimony of Gilbert S. Keeley, fol. Tr. 1163, p. 13.

the application. Beyond the two matters about which the Staff initially testified, the Staff has utilized this arrangement to approve such activities as construction of access shafts and a freezewall in preparation for underpinning the auxiliary building and feedwater isolation valve pits,[28/] and any drilling activities near seismic Category I underground utilities and structures (Tr. 5485-86). During the hearing, Consumers agreed that the commitment would be extended to the matter of crack evaluation, a question which Consumers judged to be less important than does the Staff (Tr. 5735-38). As far as we are aware, certain additional remedial actions to which the commitment is being applied are currently under review or in progress.

From the present stage of our review, it appears that Consumers' voluntary agreement has resulted in adequate Staff surveillance of the proposed remedial actions covered thereby, prior to Consumers' commencement of the remedial actions. Consumers itself has acknowledged the usefulness to it of its consultation with the Staff prior to the initiation of remedial activities (Tr. 5660-61). At this time, we are making no changes to the procedures utilized under this arrangement.

It is important to note, however, that Consumers' commitment does not extend to all the activities which Part IV of the Modification Order would have prohibited (Tr. 1202-1212, 1390). The scope of the oral commitment is not clearly defined. While it appears essentially to cover those major

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28/ Letter dated November 24, 1981, from Darl Hood (NRC) to James W. Cook (CPC) (Staff Exh. 5, Tr. 5467).

remedial actions within the scope of Section 1(b), but not activities falling within Sections 1(a) and 1(c), of Part IV of the December 1979 Order (Tr. 1420-1422), there is some ambiguity whether certain activities may fall within Section 1(b) or one of the other categories.

Although we have no objection to the Staff/Consumers working relationship for those portions of the remedial work to which the commitment applies, several matters of record cause us to be dissatisfied with the limited scope of activities covered. More specifically, as a result of the matters described in this section of this Memorandum and Order, augmented by the related information appearing in Part IV, we are of the view that certain activities outside the scope of Consumers' commitment but within the coverage of the prohibition in the Modification Order should be subject to prior Staff review and approval.

The first of these matters which gives us concern is that of underground piping. Consumers proceeded with work associated with underground piping which carries cooling water essential to safety without seeking or receiving formal Staff concurrence (Tr. 7784, 7788a). This work would clearly have been prohibited under Part IV, Section 1(c) of the Modification Order, and it could also be interpreted as falling within Section 1(b) (Tr. 7788c). The record is confusing as to whether the Staff regarded Consumers' commitment as in fact covering that type of remedial action (Tr. 7781-7783, 7788a-7790, 7894-7901).29/ The Staff expressed

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29/ We disagree with Consumers' response to Ms. Stamiris' Proposed Findings and Conclusions, ¶ 8, pp. 6-7.

the opinion that underground piping should be covered by the commitment (Tr. 7788c, 7789, 7899). Underground piping was of concern to the Staff prior to its issuance of the Modification Order.30/ One reason we believe it essential that safety-related activities such as the rebedding of piping should have prior full Staff review and concurrence is that once such work is performed and the piping then recovered with earth, it is no longer accessible for inspection for such concerns as have been identified during the course of this hearing--e.g., corrosion (Tr. 7683-86, 7827-35), deformation (Tr. 7913-14), quality of foundation soils (Tr. 7911), pipe welds (Tr. 7652-56), and condition of pipe wrapping materials (Tr. 7860, 7914-15). Therefore, adequate QA/QC surveillance is fundamental to assuring safety. The Staff has expressed its desire, in fact, to review such matters as compaction criteria and procedures prior to the work taking place, and to be able to inspect the work while being performed (Tr. 7899). Moreover, the Staff has stated that it had insufficient soil-profile information to evaluate distortion in pipes buried in soils which have settled.31/

The second reason for our requiring further Staff review and approval prior to the start of soils-related construction differs from the first in that it does not stem from a single type of construction activity. Rather, it pervades the entire spectrum of soils-related construction activities. As a result of Board questioning, we have some doubt whether, in the absence

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30/ I.E. Rept. 79-06, dated April 4, 1979 (Stamiris Exh. 3, Att. 8, at p. 5).

31/ Kane, prepared testimony, fol. Tr. 7752, p. 3.

of Staff review and approval, Consumers would carry out certain remedial soils activities using appropriate QA procedures and principles. Its witnesses presenting the remedial plans for the auxiliary building were unsure of the manner in which QA principles would be applied to that operation (Tr. 5530-32). With respect to the engineering of the remedial actions, Consumers was able to describe the QA procedures it had already followed (Tr. 5718-20), but it also indicated that it did not consider the engineering a problem area and was therefore not applying any specialized procedures to those activities (Tr. 5622)--despite the fact that it had to formulate and rework its plans four different times before it obtained a system acceptable to the Staff (Tr. 5647-58). Consumers does not appear to have obtained Staff approval with respect to the engineering QA procedures which it had followed (Tr. 5750). Furthermore, Consumers seems to have a tendency to treat as many structures as possible as non-Q-listed (and, hence, as not subject to QA controls) (Tr. 5626, 5671-72).

For these reasons, we are not completely satisfied as to the extent to which QA plans and controls are to be applied by Consumers to underpinning activities. In particular, we are concerned about areas adjacent to, but not necessarily directly under, safety-class structures. These activities include boring of large diameter, closely spaced holes for soldier piles which would penetrate low shear-strength soil layers at elevations below the foundations of adjacent safety-class structures (Tr. 5674-79; 5765-71), and essentially all underpinning activities beneath the turbine building the failure or tilting of which might influence the safety or future seismic

resistance of the adjacent safety-class structures (Tr. 6083-85; 7125-27). These potential QA/QC gaps lead us to believe that, at least in the near future, the commencement of safety-related activities of this type should be subject to the Staff's approval--particularly as to whether specific activities are to be covered or not covered by an appropriate QA plan.32/

IV. Related Matters Substantiating The Need for Interim Conditions

Certain matters which have been the subject of notifications by various parties to the Board tend to accentuate what we regard as the need for the interim conditions we are imposing. These matters have not yet been the subject of evidentiary hearings, and we express no final view as to their accuracy or import. Nonetheless, we regard these matters as closely relevant to the facts on which we have taken evidence and pertinent to our determination that interim conditions should be imposed.

As one example of this type, representing an activity we believe should be covered by the commitment, the Board has been informed by way of a Consumers' Non-Conformance Report that a 42-inch diameter hole was drilled to a depth of 40 feet within the "Q" fill area, apparently without proper authority; without the development of, or adherence to, written procedures;

32/ We understand that Consumers later indicated that monitoring instruments would be placed before commencing underpinning activities to measure horizontal movements between the turbine building and adjacent structures "in response to questions raised by the Atomic Safety and Licensing Board". Memorandum dated March 11, 1982 from Darl Hood, Summary of March 8, 1982 Telephone Conversation Regarding Soil Spring Stiffnesses for Auxiliary Building Underpinning and Phase II Construction.

without the participation of the On-Site Geotechnical Engineer; and without adequate QA/QC surveillance, if any.33/ We hasten to point out that we have not yet heard evidence on this report and express no view as to its accuracy. It appears, however, to describe the type of activity which is encompassed by the prohibition in Part IV, Section 1(a) of the Modification Order. Moreover, if the NCR is accurate, the activity would constitute a prime example of the kind of work which we believe should be subject to prior Staff review and concurrence.

Additionally, we have also recently been notified of loose sands located in the plant fill north of the Service Water Structure and Circulating Water Intake Structure. This loose sand reportedly underlies about 500 feet of seismic Category I pipe. We understand that Consumers has decided to remove and replace this material to avoid potential liquefaction problems.34/ Once again, we express no view as to the validity of this information. But considering the vagueness as to the limits of Consumers' commitment and the apparent potential effect on public safety of these construction activities should the plant later be allowed to operate, we deem it necessary at this time to eliminate any uncertainty and

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33/ NCR # M01-4-2-008 Rev.1, dated February 25, 1982, transmitted to the Board and parties by letter dated March 12, 1982, from James E. Brunner, CPC. The Board requested that it be provided with audit reports of this type (Tr. 5975-76).

34/ Memorandum from Darl Hood, Notification of Loose Sands Beneath Service Water Piping, March 16, 1982. See also letter from James W. Cook to Harold R. Denton, Additional Information Concerning Safety Grade Buried Piping, March 16, 1982.

to require that any remedial actions intended to rectify this matter receive full Staff review and concurrence before being undertaken.

Finally, the Board notes that the Staff has disagreed with Consumers[35/] over the extent of QA coverage and control of the underpinning activities beneath the safety-class and adjacent non-safety class buildings. The disagreement apparently has been resolved by Consumers' agreeing that essentially all underpinning activities would be subject to Q-controls, except for certain already completed activities and certain agreed-upon non-critical activities.[36/]

Although the Board recognizes that these disagreements may reflect genuine differences of interpretation of requirements in Appendix B to 10 C.F.R. 50, we deem it important to public safety that, pending the completion of our QA review, the Staff's more conservative interpretation should apply to remedial work activites, some of which are, or shortly will be, in progress. Accordingly we have made the elements of that agreement part of this Interim Order. Again, while we express no views as to the validity of those matters brought to our attention outside the actual hearings, they represent the kinds of issues that were alleged in the December 6, 1979 Modification

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35/ Memorandum dated March 12, 1982, from Darl Hood, subject: Summary of March 10, 1982 Meeting Concerning Quality Assurance To Be Applied To Remedial Foundation Work.

36/ Letter, James W. Cook (CPC) to J. G. Keppler (NRC), dated April 5, 1982, subject: Quality Assurance for Remedial Foundation Work.

Order, and that were the subject of ongoing efforts by the Staff and Consumers to resolve them.

V. Description of Interim Requirements

As a result of the various safety problems which we have described in Section III, above, the potential and related problems described in Section IV, above, and the imminence of the commencement of additional safety-related work activities on remedial measures for the soils settlement problems which we have been considering, we find it necessary to act now to remove ambiguities in Consumers' commitment to obtain prior Staff approval for remedial measures. Pending the completion of our review of the record and issuance of a partial initial decision, we are requiring that the construction permits be amended to prohibit (in the absence of Staff approval) the same activities as would have been prohibited by Section IV of the Modification Order. (We are updating the requirement to take account of certain developments which have occurred since December 6, 1979.) This requirement would not apply to any of the activities as to which the NRC has already given its approval. Nor does it dictate the manner in which the Staff may exercise its review--i.e., whether piecemeal (individual construction steps) or as an integrated package. In addition, for the reasons we have outlined, we are requiring that certain of these activities

be governed by a QA plan.38/ We have pointed out that some of the material which we have considered in this order has not yet been the subject of a completed evidentiary hearing; indeed, the scope of our QA requirement is premised in part upon an apparent agreement between Consumers and the Staff contained in material of this sort. Letter of James C. Cook, fn. 36, supra. We expect Consumers and the NRC Staff to present testimony on these open items at a later evidentiary session.

We stress that in our forthcoming Partial Initial Decision we will reexamine the terms and conditions which we are here imposing on an interim basis. At that time, we may reaffirm, expand or remove them. Until such time, however, we find that the Modification Order should be made effective to the extent which we have described. We stress that we are not at this time requiring the submission or approval of any amendments to the applications for construction permits (as provided by the Modification Order). In our opinion, the Staff consultation and approval which we are requiring will achieve the substantive results we believe necessary without adding certain procedural requirements of an application for a construction permit amendment which, in the present context, do not appear to be necessary to attain the safety goals which we believe should be achieved.

38/ To require a QA plan for safety-related remedial soils construction activities is consistent with the requirements of 10 C.F.R. §50.34(a)(7). We note that the large-scale underpinning and other remedial activities which are being undertaken are sufficiently distinct from the activities contemplated during the construction-permit review as to warrant a supplementation of the applicable QA program.

VI. Order

Based on the foregoing, it is, this 30th day of April, 1982

ORDERED

That the Director of Nuclear Reactor Regulation, in accordance with 10 C.F.R. §2.764(b), is authorized to amend Construction Permits CPPR-81 and CPPR-82 as follows:

(1) Construction Permits CPPR-81 and CPPR-82 shall be amended to require that the permit holder obtain explicit prior approval from the NRC Staff (to the extent such approval has not already been obtained) before proceeding with the following soils-related activities, and that these activities, with the exception of those already approved by the NRC, and those that the Staff agrees are not critical, shall be controlled by a Staff-approved Quality Assurance Plan:

(a) any placing, compacting, excavating, or drilling soil materials around safety-related structures and systems;

(b) physical implementation of remedial action for correction of soil-related problems under and around safety-related structures and systems, including but not limited to:

(i) dewatering systems

(ii) underpinning of service water building

(iii) removal and replacement of fill beneath the feedwater isolation valve pit areas, auxiliary building electrical penetration areas and control tower, and beneath the turbine building

(iv) placing of underpinning supports beneath any of the structures listed in (iii) above

(v) compaction and loading activities;

(c) construction work in soil materials under or around safety-related structures and systems such as field installation, or rebedding, of conduits and piping.

(2) Paragraph (1) above shall not apply to remedial actions approved by the NRC Staff prior to the effective date of this Order, nor to any exploring, sampling, or testing of soil samples associated with determining actual soil properties on site which has the approval of the Director of Region III, Office of Inspection and Enforcement. These testing activities, however, shall be controlled by a Staff-approved Quality Assurance plan which includes procedures for controlling excavation or drilling activities more than 6-feet deep in "Q" areas.

In accordance with 10 C.F.R. §§ 2.760, 2.762, 2.764(a), 2.785 and 2.786, this Memorandum and Order shall be effective immediately upon issuance and shall constitute the final action of the Commission on the matters considered herein forty-five (45) days after issuance, subject to any review pursuant to the above-cited Rules of Practice. Exceptions to this Memorandum and Order may be filed by any party within ten (10) days after its service. A brief in support of the exceptions shall be filed within thirty (30) days thereafter (forty (40) days in the case of the NRC Staff). Within thirty (30) days of the filing and service of the brief of

the appellant (forty (40) days in the case of the NRC Staff), any other party may file a brief in support of, or in opposition to, the exceptions.

THE ATOMIC SAFETY AND
LICENSING BOARD

Charles Bechhoefer

Charles Bechhoefer, Chairman
ADMINISTRATIVE JUDGE

Frederick P. Cowan CB

Dr. Frederick P. Cowan, Member
ADMINISTRATIVE JUDGE

Ralph S. Decker

Ralph S. Decker, Member
ADMINISTRATIVE JUDGE

Dated at Bethesda, Maryland

this 30th day of April, 1982.

Judge Jerry Harbour, who has served as a technical interrogator and an alternate Board member during portions of the hearings concerning management attitude and quality assurance matters, and who has replaced Judge Decker for the forthcoming segments of the consolidated OL-OM proceeding (with the exception of the first Partial Initial Decision and orders, such as this one, which are integral to that Decision), supports the rulings and reasoning included in this Memorandum and Order.

25 CH1

Feeding

Rudy / Chuck Butterfield

Bob Sero - Jack Deshaw rubber Stamp what Sero Says

Removed

Bryan

Mark Butterfield } Showed off
Rudy

/ Civil

Certs of Bobs people no inspection signed off for 1982

Croy - Coatings

C-45 - Designated area for ℄ fill
underpin out of control

Even though drift under non ℄ bldg - turbine bldg - comes within 2 ft of aux bldg
∴ make all the drifts - ℄ because of large amount of material will effect ℄ structure

//

Need all the instrumentation effect in before set below 609 ft or jack the valve pits

Limited by jack end of this week.

For Freeze Wall - always catch up on proc & instrumentation
Spec C-195 not approved yet - underpinning spec

Get all procedures for service water bldg in place before starting the work

→ short time to approve procedure

The governing spec C-195 controls other specs.

// No advance scheduling lets QC cover Preexcavation - Set up so that whenever ℄ soils work is being done then need QC & Geotech here

// Would like to start next phase - with all procedures - organization - people in place - Spec. - Not like like first phase where procedures are being written

Exit Landeman / Gardner March 19, 82

Jim Mooney Telephone
John Shaf
Al Boos

Stop work on Instrument Installation - Landeman
Confirm Action letter.

Unresolved: Misses on pulling plant Cables
upgrade to non-Compliance - Clo agrees.

Ben
Attention to I.D. of qual activities with that work.

Underpinning to quake-proof A-plant

A New Jersey contractor has come up with a $120-million underpinning scheme to replace improperly compacted fill under two buildings at a Midland, Mich., nuclear station so both structures can meet revised Nuclear Regulatory Commission seismic standards.

To install the new foundation, Mergentime Corp., Flemington, N.J., will tunnel to the edge of the plant's auxiliary building, install a temporary support system, excavate 36 ft of fill down to glacial till and build two new support walls.

The owner of the 1,300-Mw Midland nuclear project, Consumers Power Co., Jackson, Mich., discovered soil compaction problems in 1978 when the diesel generator building sank more than 3 in.—more than the total settlement projected for the 40-year life of the $3.3-billion powerplant (ENR 12/7/78 p. 16). Consumers handled the problem by surcharging the building with sand to sink it as far down as possible.

Next, the utility began an exploratory boring program and discovered that fill underlying the south end of the auxiliary building and a service water pump building was not properly compacted. The auxiliary building consists of the plant control tower, two electrical penetration areas that connect the tower to the two reactors, and two feedwater isolation valve pits.

Soils at the site were to have been compacted to 95% of maximum density, reports Gilbert S. Keeley, utility project manager for the Midland plant. But either contractors misread specifications or the specifications were inaccurate because in some areas the utility found that the sand and clay soil wasn't even close to the required density, he says.

Wobbling tower? Although the auxiliary building, which sits between the two reactors, had not settled, test borings showed that it would not hold up in an earthquake, says Keeley. The joint connecting the control tower to the rest of the building—which sits on glacial till—would be overstressed.

"The borings indicated that in an earthquake it would wobble around a bit," he says.

In 1979, the utility proposed jacking nine 4-ft-wide, concrete-filled caissons under each side of the building to support the joint. But by 1980, the Nuclear Regulatory Commission released new seismic standards based on projected earthquake forces 1.5 times greater than those the utility had originally been required to meet. The caissons couldn't provide enough strength to support the control tower and wing areas under the higher seismic assumptions, explains Keeley.

Back to the board. To meet the new standards, prime contractor Bechtel Power Corp., San Francisco, and Mergentime have designed and are building three reinforced concrete walls to supplant the existing foundation beneath the south end of the auxiliary building. One 339-ft-long wall will run east to west along the southern edge of the building, supporting the control tower and, on either side, the wings and feedwater isolation valve pits. Two 45-ft-long walls will run north to south, supporting the juncture of the control tower and the wings, which house the electrical penetration areas. Wall thickness will vary from 6 to 12 ft and together will carry a load of 28,000 tons.

To prevent ground movement, Mergentime is installing a freeze wall by drilling a series of 44-ft-deep holes at 4-ft intervals and running pipe filled with glycol through the holes to freeze the ground. Next, the contractor will dig two 63-ft-deep access shafts on either side of the building and tunnel to the edge of the auxiliary building to install the temporary support system.

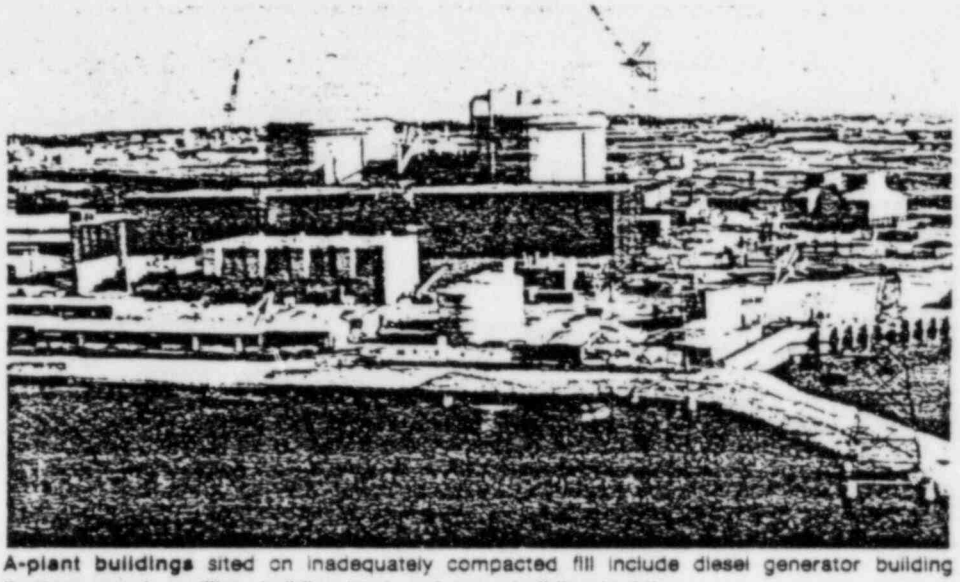
During construction, the existing foundation will be supported by jacks resting on top of steel I-beams supported at one end by cast-in-place concrete columns and at the other end by the reactor containment building foundation. Once the supports are in place, 12 columns under each building wing, workers will remove 14,000 cu yd of soil.

Excavation will be done in three stages. First, workers will dig down 20 ft. Second, concrete chunks buried under the building will be removed and, finally, the fill will be excavated down to glacial till, about 36 ft below the bottom of the auxiliary building. Workers will then place the permanent concrete walls to form the new foundation.

The underpinning on the service pump structure will be similar to that underlying the auxiliary building, but no temporary support structure will be required.

Contractors have begun digging the access shafts for the auxiliary building underpinning and the project is scheduled to be completed in June, 1983—one month before fuel loading begins.

The job is "getting to be a critical path," says Keeley. "We want to be out of the area by the fuel-load date." □



A-plant buildings sited on inadequately compacted fill include diesel generator building (bottom arrow), auxilliary building (top), and pump building (right).

EPA releases revised superfund cleanup plan

After months of waiting for the Environmental Protection Agency to come up with a national plan under which to administer superfunded hazardous waste site cleanup, the agency last week finally released a revised scheme for public comment.

Although EPA has taken action on some abandoned sites, the agency has been proceeding without what many consider to be the cornerstone of the superfund program—the revised national contingency plan.

The plan will provide the framework to evaluate and rank the 400 identified sites to be considered for remedial action. It will also establish guidelines for coordinating federal and state responses, define when to take emergency or remedial

2 SCH

Don - Please proof out & make distribution as necessary. per A. Boos. 3/12/82.

March 12, 1982 2:08 p.m.

Conference telephone call between Bechtel/Consumers and NRC.

Call initiated by Don Horn/Al Boos to Dr. Ross Landsman, NRC, Region 3.

In attendance:

BECHTEL/CPCo	NRC-Region III -Chicago
Al Boos	Ross Landsman
J. Fisher	Mr. Boyd
R. Cook (NRC - Site)	
D. Horn	
J. Schaub	
Jim Moore	
Ben Marguglio	
J. Simpson	
Bob Sevo	
Dave Ronk	
Gary Rogers	
Ray Oberleitner (Mergentime)	
Ken Vanderjack	

Boos: Hello, Ross, this is Al Boos, with Don Horn.

Who is there with you?

Ross: Landsman and Boyd.

Boos: Who else?

~~Ross~~ BOYD: That is it.

Were you able to get through to the NRR or not?

Couldn't raise anybody - will handle without them.

Boos: (Brief introductory remark) With respect to remedial soils work, it was the staff's position that all items were Q unless applicant could demonstrate that certain activities should be non-Q data. When I came back to Michigan, we have a weekly coordination meeting and one of the first things we did this morning was to draw up a list of those items which either have been completed or in process or are proposed which we feel can, in fact, be treated as non-Q items. Since we are working under the

business as usual concept of you making audits, we felt it was prudent to review with you this list prior to making inspection so that we would have a very clear dialogue in terms of those items remaining Q, primarily because in some respects we elect to bid it may not be physically possible to replace that item - like removing ~~log wood~~ wood lagging or drift. Since we don't want to be cited, we are going to attempt to identify items we feel are non-Q. We feel it is essentially a complete list. May be a need from time to time to offer other items. We will try to do it before we undertake the work. I will ask Don to take us through this.

Boos: Access shafts below 609 - drifts, the piers and instrumentation. (Ron Cook has a copy of it. If necessary for interpretation, he can help me).

1. Access shafts below 609 - Soldier Piles.

It may help you if you have a clean sheet of paper to put down four column headings. I will try and summarize. With respect to soldier piles, we have procured those piles and have installed them as non-Q as you are aware.

With respect to access shafts below 609. In this case, in general, other than just access shafts at 609, we feel that the purchase of tools and equipment like torque wrenches, jacks, gauges and threading machines should be non-Q. Our rationale is that there is either provision for calibration or an end inspection of the fabrication, like the reinforcing steel that is threaded by the threading machine. Again, tools and equipment is intended to be a generic comment.

Question: Is this construction equipment?

Answer: Yes, tools and equipment.

Cook: (This is being transcribed for purposes of preparing a telephone summary. QA required it.)

3. Access shafts below 609. Purchaseof steel and wood ~~legging~~ logging and I believe we talked about that the other day in Bethesda.

J. Fisher: To differentiate - steel shape = whalers in wood ~~legging~~ logging.

Ross: When we talked on the Washington, we were talking about the no certs.

Al: That is what makes it a Q purchase. We would not be buying this with mill certs because this steel doesn't stay in - it is temporary and non permanent. Standard manufactured item.

Ross: We are just talking about the mill cert?

Al: We are not talking about buying it Q.

Cook: The tons of concrete that you pour around here - did you have mill certs on the wood forms you used before? Why on this particular job? Isn't wood ~~legging~~ logging steel shapes?

Al: That is right - We didn't think it needs to be bought Q.

Cook: You didn't talk about this before.

Al: This is a whole new thing.

Cook: NRC - what is the meaning of all this?

Al: We were directed that everything was to be Q unless the applicant could demonstrate that item could be classified as non-Q - we feel that it is imperative for us to check off with you even though you may say ~~thay~~ they need not be purchased Q. We want to leave a trail that is crystal clear.

Cook: The point is that historically we never have approved anything. Our function is that you are obligated to assure the world that you have done all things appropriate and have invoked QA. We cannot either agree or disagree.

Al: I am not asking for you - I am making a statement of our policy in advance. We will know in an audit what our position is. If he is not in agreement with that position it is in our mutual interests for us to know now from a cost, schedule, quality and personnel safety standpoint.

Cook: Go ahead and revert back to the fact that you poured tons of concrete.

Fisher: We are doing this because of what you told us the other day.

Al: Last item under access shafts below 609 is purchase of rock bolts.

Ross: Which rock bolts?

Al: Rock bolts Turbine Building and buttress access shaft. Again, purchase Non Q, installation would be handled as Q. In all of these cases, I have talked about you will note I have talked about only procurement of material with exception of soldier piles. Tools and equipment, etc. Installation would be Q.

Ross: Continue.

Al: New subject - drifts. We are planning to procure the material for the steel sheets which are basically the box-shaped frames that accept lagging in the drift as non-Q. Fabrication of those steel sheets would be Q and installation.

Al: The next item - the procurement of the wood ~~legging~~ lagging and wood wedges for the drifts would also be non-Q. Procurement. Procurement of the back packing material for the drifts would be non-Q. And as a 4th item, the procurement of the rock and earth anchors would be non-Q. Those are the sets of items under the classification of drifts. Under piers - - -

Don has asked me to again reiterate that fabrication and installation of the drifts classification items would be Q. Under classification of piers, Ross, you may be aware that there is Ethifoam to be put behind metal ~~leggings~~ lagging as back packing. May be gluing Ethifoam to steel . We will propose to procure that glue as a non-Q commodity. Verification that is in place would be a Q-listed activity. That is the only entry I have under piers.

Last item is instrumentation. We are talking about the settlement monitoring instrumentation, pier monitoring instrumentation, etc.

Our position here is that the raceway, the wire and the brackets that would accept the instrumentation would be procured and installed as non-Q. The checkout of the system and the ~~making~~ taking of the reading would be Q.

Ross: What would you say about the instrumentation in that area?

Al: Instrumentation has been purchased Q.

The instrumentation system is in a data room - it has been procured and installed with environmental controls as non-Q.

Al: The last item which is essentially a repeat of that above under access shafts gauges, backup gauges, have been procured as non-Q but would be calibrated under a Q program. These are existing dial gauges. Our instrumentation is essentially well under way. Wiring has been pulled - raceway has been installed, etc. Those are the only comments I have.

Ross: Okay. Let us talk here a minute and we will get back with you in just a second.

B. Marguglio: Didn't those dotted lines mean all non Q?

Al: Yes, across the board.

BM: Did that come across in the conversation?

Al: I will reiterate it. It becomes Q at the checkout of the system.

Cook: I am here.

Ross: Feel free to make your own comment.

Boyd: We would like to digest this list and get back with your designated person on Monday. We'd like to sit down and look it over and get back with you, but not to say that we approve or disapprove. If we have any problems or = does not constitute approval - it means we don't have any problems with what is here.

Al: We recognize that you are not going to sign anything as co-approvers.

Boyd: But we can look over and make judgments whether we have any problems and identify anything that does give us problems. Who should we get back with on Monday?

Al: Don Horn.

Boyd: Okay.

Boyd: Ron, do you have any problems with that?

Cook: I think that can be quite livable. We might appear not to have any problems but later on we get into construction and problem is created. I don't want to have relinquished our right to enforcement in that area.

Ross: That is exactly why we don't go into approval process. My judgment is there will be very ~~fes~~ law that will happen that way but we want the door open.

Ross: Okay.

Al: Very good. The rest of us in the room will wait to hear from you and your results on Monday.

BM: I have a question. Will it be both of you gentlemen calling Don Horn Monday?

Boyd: Ron Cook and Ross and myself will get together and talk - one of us will make the call. We will get back with you on Monday with our findings.

Al: To clarify one point, to make sure I didn't mislead the people in Chicago - with respect to the raceway material - the wire, the fabrication of brackets that, ~~except~~ except instrumentation, and termination of wire that we are talking about that, with respect to procurement through installation.

Boyd: Could you give Ron Cook a copy of that so he can fax it to us?

Cook: I will try to fax it to you right away.

Boyd: I think that is important.

Al: Thank you very much.

Overall Licensee Performance Evaluation

During the evaluation period, the licensee's performance is assessed to be Category 3 in the technical areas of resolving the soils settlement issues; installation of piping and pipe suspension systems - particularly small bore piping; and electrical installations.

In the past three years there has been an abundant amount of activity associated with soils settlement issues. In spite of this, the enforcement history in this area shows the licensee has demonstrated a lack of attention to detail. Therefore, the licensee is considered to be in performance Category 3 in this area. Continued enforcement in the soils area may cast dispersions on the licensee's ability to successfully perform proposed resolution to the soils settlement issues and envoke further escalated enforcement action in this area.

In the area of control of piping and pipe support systems, the licensee had received (during the evaluation period) escalated enforcement action. While in the process of attempting to correct these deficiencies, the licensee received additional items of noncompliance and escalated enforcement as a result of the NRC review into their resolution of the original items. This happened immediately after the end of the evaluation period. Since then, the licensee's performance appears to be improved. However, the test of time will ensure that the licensee has actually improved their performance in control of piping and pipe supports systems or whether their improvement was only as a result of responding to escalated enforcement action.

In the electrical area, the licensee had embarked on an ambitious "pulling schedule" commencing half way through the evaluation period. Prior to this, the NRC had verbally advised the licensee to have adequate number and quality of QC and QA personnel available when escalated electrical installation activities commenced. The enforcement history identified during the evaluation period indicates a lack of rigorous QC coverage. Since this enforcement, the licensee has increased the rigor and frequency of overview inspections, performed a detailed audit pertaining to material storage and brought upper management's attention to the findings, and is presently inquiring (at the insistance of the NRC) into the adequacy of electrical QC coverage. Similarly, to the installation of piping and pipe support systems, time will establish the sincerity of corrective actions.

In the less technical, but more managerial, areas of corrective action and reporting and design control, the licensee has demonstrated during the evaluation period that the Category 3 performance classification is warranted by not having a strong resolution to perpetually avoid the indicators discussed in the body of this report. The licensee's argumentative attitude toward responses to NRC enforcement issues has invoked management meetings with the licensee subsequent to the SALP evaluation period where the NRC has delineated what information constitutes an adequate response. Should the licensee offer strong responsible management conviction to resolving the reporting and design control issues, a turn-around in these areas could be expedited.

It is intuitively obvious from the above and the body of the report that the licensee's overall performance is considered to be Category 3.

IV. PERFORMANCE ANALYSES

1. Soils and Foundations

a. Analysis

During the evaluation period, inspections have been performed to examine the licensee's implementation of corrective actions regarding the 10 CFR 50.54(f) request for additional information pertaining to soils settlement; observation of soils work activities and to witness taking of soil borings requested by NRC reviewers and consultants.

Since 1978, the soils settlement issues have been paramount in the amount of attention given by the NRC to this licensee. This activity has resulted in an order issued in December 1979 which is the basis for a hearing on soils settlement issues. A multitude of effort has gone into soils testing and major re-review of the FSAR and design control. In spite of this attention, every inspection involving Regional based inspectors and addressing soils settlement issues has resulted in at least one significant item of noncompliance, and the following enforcement history for the soils settlement area has existed during the SALP evaluation period:

Two level IV violations were identified in NRC Inspection Report No. 50-329/80-32; 50-330/80-33.

1) Failure to initiate preventive action to preclude repetition of not identifying design documents as references to which the FSAR was to be reviewed against.

2) Three examples of failure to translate applicable regulatory requirements and design criteria into design documents.

   a) Failure to maintain a coordination log of specification change notices (SCN).

b) Failure to correctly translate Specification Change Notice No. SCN-9004 as a requirement into Rev. 20 of specification C-208.

c) Failure of Engineering Department Project Instruction No. EDPI 4.25.1, Rev. 8 to establish adequate measures for design interface requirements.

One level V violation and a deviation were identified in NRC Inspection Report No. 50-329/81-01; 50-330/81-01.

1) Failure to establish test procedures for soils work activities.

2) Failure to supply an onsite geotechnical engineer.

One level V violation was identified in NRC Inspection Report No. 50-329/81-09; 50-330/81-09 which is discussed under the Quality Assurance Section. However, the finding of lack of QA was a result of attempting to review the QA associated with procuring soil boring samples.

Failure to evaluate the technical capabilities of Woodward-Clyde (principal supplier of services for soil boring activities) prior to procurement of a drilling contractor.

b. Conclusion

Because of the above enforcement history, the licensee is considered to be in a performance Category 3 in the area of soils and foundations.

c. Board Recommendation

The Board recommended an NRC escalated inspection activity for each major evolution in the resolution of soils settlement issues. The Board also noted that there was an increased inspection frequency recommended in the SALP 1.

2. Containment and Other Safety Related Structures

a. Analysis

During the evaluation period, containment prestressing system procedures were reviewed; selected work activities associated with tendon insertion and buttonheading for Unit 1 were observed and prestressing system material records for Unit 1 and quality records for Units 1 and 2 were reviewed.

Also during the evaluation period, the Senior Resident Inspector witnessed portions of the atmospheric hydrostatic test placed on the borated water storage tanks (BWST). The Senior Resident Inspector observed Quality Control and the Authorized Nuclear Inspector examine the tanks. The hydrostatic test was done in an acceptable manner. Although the hydrostatic test was completed without complications, loading of the BWST with water resulted in cracks developing in the valve pit area associated with these tanks. This cracking in the valve pit support walls is subsequently related to soils issues.

b. Conclusions

During the previous reporting period the licensee experienced difficulty in installation of prestressing tendons. However, these difficulties did not exist during this evaluation period. Therefore, the licensee is considered to be in a performance Category 2 for containment and safety related structures.

c. Board Recommendations

None

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9. Quality Assurance

a. Analysis

Effective August 15, 1980, Consumers Power Company reorganized the site QA functions by creating the Midland Plant Quality Assurance Department (MPQAD) which was composed of both Consumers Power Company and Bechtel Power Corporation personnel. This reorganization was instituted in the interest of more comprehensive coverage of QA and more timely resolution of noted discrepancies. Consumers Power Company retains the lead responsibility for QA.

Also during the reporting period, Consumers Power Company assumed responsibility for all on-site QA and QC functions for installation of HVAC systems. These functions and controls were previously handled by The Zack Company. The changes in responsibility were implemented to "establish more effective QA/QC interface; provide increased technical support; and provide a mechanism to improve inspection performance".

Because of changes in QA organization and changes in the Site QA Superintendent, the NRC regularly evaluated the impact of these changes on the overall QA aspects of the site and performed a Team Inspection in May 1981. A portion of this Team Inspection consisted of making a determination of the adequacy of QA and the influence of production considerations on the independance of QA/QC. This inspection revealed that the number and qualifications of personnel in the Consumers Power Company QA organization were above average. The QA programs and overview inspection and audit functions were also above average. However, a severity level IV item of noncompliance was written against management's failure to take prompt comprehensive corrective action in response to the identification of adverse quality trends (Inspection Report No. 50-329/81-12; 50-330/81-12). This item of noncompliance is indicative of Consumers Power Company QA Management exhibiting a hesitancy to determine the "root cause" of increases in deficiencies. This same weakness was identified during the previous SALP period.

A second item of noncompliance was identified which is indicative of questionable managerial QA control. This item pertained to the licensee's failure to evaluate the technical capability of the principal supplier of services for soil boring activities (Inspection Report No. 50-329/81-09; 50-330/81-09). During the inspections prior to taking soil borings, 15 items requiring QA resolution were identified by the NRC prior to any drilling activities but during the period when "setting up" for the drilling operations was being anticipated.

b. Conclusion

When considering an overall performance category for the licensee's Quality Assurance capability, a Category 2 performance is realized with two major infractions being identified in two confined areas.

c. Board Recommendation

None

12. Design and Design Changes

a. Analysis

During the evaluation period, three items of noncompliance were identified against 10 CFR 50 Appendix B, Criterion III, Design Control and one item against Criteria XVI, Corrective Action which was closely related to deficiencies in design control. These items of noncompliance have been addressed in other sections of this SALP report. However, the common bond between these items of noncompliance is that each addresses inadequate design control.

The following is a reference list of these items of noncompliance:

1) Section 1, Soils and Foundations

(a) Failure to initiate preventive action to preclude repetition of not identifying design documents.

(b) Three examples of failure to translate applicable regulatory requirements and design criteria into design documents.

2) Section 3, Piping Systems and Supports

Failure to prepare, review and approve small bore pipe and piping suspension system designs performed onsite in accordance with design control procedures.

3) Section 6, Electrical Power Supply and Distribution

Failure to translate design criteria into drawings and specifications.

In addition to the enforcement items listed above, an Immediate Action Letter was issued by the NRC pertaining to design control and issuance of drawings for the installation of small bore piping. This item was previously iterated in Section 5, Piping and Hangers.

Also, the following five 10 CFR 50.55(e) summaries, which were among the twelve Construction Deficiency Reports submitted demonstrates there was lack of QA in design control and these instances should have been licensee controllable.

1) High Energy Line Break Analysis (HELBA), steady state thrust forces rather than transient peak thrust forces were used in the energy balance techniques for the design of HELBA pipe whip restraints.

2) Component Cooling Water (CCW) Design, CCW system susceptibility to Loss of Coolant Accident (LOCA) induced failures.

3) Seismic model of Auxiliary Building has incorrect assumption that control tower and main portion of Auxiliary Building are an integral unit between elevation 614 and 659.

4) Borated Water Storage Tank Foundation stress cracks.

5) Shear reinforcement at major containment penetrations.

The fact that the licensee is able to often times identify design deficiencies through their audit programs and take appropriate action is commendable. However, these design deficiencies would not occur if there were more stringent control at the source of these design errors and deficiencies.

b. Conclusion

Considering the above indicators which suggest questionable design control and the amount of re-engineering which has transpired in electrical, civil, and piping areas, the licensee's performance is considered to be Category 3.

c. Board Recommendation

None

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V. SUPPORTING DATA AND SUMMARIES

1. Noncompliance Data

Facility Name: Midland Nuclear Power Plant UNIT: 1 DOCKET NO: 50-329

Inspections No. 50-329/80-17 through No. 50-329/80-37

No. 50-329/81-04 through No. 50-329/81-12

Functional Areas	Noncompliances and Deviations[1]									
	Severity Levels						Categories			
	I	II	III	IV	V	VI	Viol.	Infr.	Def.	Dev.
1. Soils & Foundations				(2)	(1)					(1)
2. Containment & Other Safety Related Structures										
3. Piping System & Supports				(1)	(4)			(1)		
4. Safety Related Components										
5. HVAC Systems					(1)			(15)	(3)	
6. Electrical Power Supply/Dist					5					
7. Instrumentation & Control Sys.										
8. Licensing Activities										
9. Quality Assurance				(1)	(1)					
10. Fire Protection										
11. Preservice Inspection										
12. Design and Design Changes										
13. Reporting Requirements								(1)		
14.										
15.										
16.										
17.										
18.										
19.										
20.										
21.										
TOTALS				4	12			17	3	1

1/ Numbers in parenthesis indicate noncompliances common to both units.

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V. SUPPORTING DATA AND SUMMARIES

1. Noncompliance Data

Facility Name: Midland Nuclear Power Plant UNIT: 2 DOCKET NO: 50-330

Inspections No. 50-330/80-18 through No. 50-330/80-38

No. 50-330/81-04 through No. 50-330/81-12

Functional Areas	Noncompliances and Deviations[1]									
	Severity Levels						Categories			
	I	II	III	IV	V	VI	Viol.	Infr.	Def.	Dev.
1. Soils & Foundations				(2)	(1)					(1)
2. Containment & Other Safety Related Structures										
3. Piping System & Supports				(1)	(4)			2		
4. Safety Related Components					2					
5. HVAC Systems					(1)			(15)	(3)	
6. Electrical Power Supply/Dist					(4)	1				
7. Instrumentation & Control Sys.										
8. Licensing Activities										
9. Quality Assurance				(1)	(1)					
10. Fire Protection										
Preservice Inspection										
Design and Design Changes										
Reporting Requirements								(1)		
TOTALS				4	13	1		18	3	1

/ Numbers in parenthesis indicate noncompliances common to both units.

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2. Licensee Report Data

a. Construction Deficiency Reports (CDR's)

Twelve (12) Construction Deficiency Reports (CDR's) reported pursuant to 10 CFR 50.55(e), were received by the regional office during the period of July 1, 1980 and June 30, 1981. The following list is a summary of each reportable item.

*1. High Energy Line Break Analysis (HELBA), steady state thrust forces rather than transient peak thrust forces were used in the energy balance techniques for the design of HELBA pipe whip restraints.

2. Sway Strut Rod Ends Deficiency, ITT Grinnell supplied sway struts, snubbers and shock suppressors have loose or totally disengaged rod end bushings.

*3. Component Cooling Water (CCW) Design, CCW system susceptibility to Loss of Coolant Accident (LOCA) induced failures.

4. Nuclear Steam Supply System (NSSS) analysis, anomalies identified in the NSSS seismic and Loss of Coolant (LOCA) analysis of the primary system.

5. Emergency Core Cooling Actuation System (ECCAS) vendor wiring in the ECCAS cabinets 1C45 and 2C45 was inconsistent with redundant subsystem modules in the cabinets.

6. Low alloy quenched and tempered bolting 1½ inches and greater in support of safety related systems.

7. Underrated Terminal Strips on Limitorque Operators.

*8. Seismic model of Auxiliary Building has incorrect assumption that control tower and main portion of Auxiliary Building are an integral unit between elevation 614 and 659.

Number and Nature of Deficiency Reports (cont)

*9. Borated Water Storage Tank Foundation stress cracks.

10. ITE Gould Class 1E equipment, unqualified cable used to wire equipment and/or controls.

*11. Shear reinforcement at major containment penetrations.

12. Operation of reactor cavity cooling system.

*Indicates may have been licensee controllable and are indicative of lack of QA in design control.

b. Part 21 Reports:

No Part 21 reports were initiated by the licensee during the reporting period.

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3. Licensee Activities

The licensee continued to construct both units at the same rate and achieved approximately 70% completion during the reporting period. Safety related electrical installation was recommenced with vigor after a period of reduced activity while additional engineering was performed. Assembly of vessel internals, closure head and reactor coolant pumps aggressively continued during the period. As a portion of the resolution for soils settlement issues , extensive soil samples and borings were taken and work commenced on dewatering wells.

4. Inspection Activities

A major "team" inspection was accomplished on May 18-22, 1981, which resulted in an issue of an Immediate Action Letter pertaining to installation of small bore piping.

Heavy inspection effort was expended to follow the resolution of soils settlement issues and taking of soil samples. Inspections in the electrical area have increased to be commensurate with the increase in licensee efforts in this area.

5. Investigations and Allegations

None were pursued during the evaluation period.

6. Escalated Enforcement Actions

a. Civil Penalty

On January 7, 1981, a $38,000 civil penalty was issued by the NRC as a result of an investigation pertaining to the installation of heating, ventilating and air conditioning equipment and systems. Nineteen items of noncompliance were identified in 10 of the 18 Appendix B criteria (10 CFR 50 Appendix B). The investigation was completed in July 1980.

b. Orders

None

c. Immediate Action Letters

On May 22, 1981, an Immediate Action Letter was issued by the Region III Office of Inspection and Enforcement concerning the issuance of fabrication and construction drawings for the installation of the safety related small bore piping and piping suspension systems.

d. Confirmatory Action Letter

1. On January 22, 1981, Consumers Power Company issued a letter to the Director of Region III stating that their Stop Work Order of January 16, 1981 to B&W for installation of Core Support Assembly Vent Valves would remain in effect until the procedures were revised, training of personnel was completed, and the overview inspection plan was revised. This action was taken in lieu of Region III, Office of Inspection and Enforcement issuing an Immediate Action Letter.

2. On July 27, 1981, Consumers Power Company issued a letter to the Director, Region III delineating those actions to be taken to control modification to drawings which do not have the required Committed Preliminary Design Calculations (CPDC) and that the methodology for modifications to be fully documented and submitted to the Regional Office for review. This action was taken in lieu of Region III Office of Inspection and Enforcement issuing an Immediate Action Letter.

7. Management Conferences

Three meetings were held with Consumers Power Corporate Management during the appraisal period.

a. The first meeting was held on November 24, 1980 and continued on December 2nd and 17th, 1980. The purpose of the meeting was to discuss the Systematic Assessment of Licensee Performance (SALP) and to be present for the licensee's presentation of the recently reorganized QA organization. (Inspection Report No. 50-329/80-36 and 50-330/80-37)

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b. The second meeting was held March 13, 1981 to discuss the Midland Project Organization, Midland QA Program evaluation and the new external quality consultation. (Inspection Reports No. 50-329/81-05 and 50-330/81-05)

c. The third meeting was held on May 22, 1981 to discuss the results of the team inspection of 5/18 to 5/22/81. (Inspection Report No. 50-329/81-12 and 50-330/81-12)