JAN 2 8 1985

Note to: Sherwin E. Turk
Deputy Assistant Chief Hearing Counsel, OELD

From: J. T. Chen, Geotechnical Engineer
SGEB/DE/NRR

Subject: APPLICANT'S RESPONSE TO STAFF AFFIDAVITS FILED IN THE WATERFORD PROCEEDING

Responding to your request of January 11, 1985, I have reviewed the subject documents. My views of these documents are as follows.

1. I am glad to learn that LP&L does agree in general with my assessment about the causes of the cracks (Ehasz Affidavit, page 10-13). However, I am sorry that BNL has to admit that they made a mistake about the construction sequence to LP&L and modify its conclusion (Ehasz Affidavit, page 13). Had BNL confirmed a thorough review of LP&L's March submittal as BNL should have or objectively reviewed my April 1984 assessment, BNL would still be considered as an "infallible expert". NRC would not find itself in this awkward situation, either. The fundamentally wrong concept, as believed by BNL until December 1984, that the cracks were caused by dead load before the placement of backfill , would not be used as cornerstone to form the NRC's "Staff's Position". Neither the concurred branch positions would be labelled as "differing opinions" in the "Staff's Affidavit".

2. LP&L appears to be trying to paint a picture that soil settlement due to consolidation would have an insignificant effect on the basemat (Ehasz Affidavit, page 12, "The adjacent block was placed level with the previously placed block, and then underwent settlement starting at the level of the already partially settled first block. Thus, the second block had to undergo all of its settlement while the first block only had a percentage left to go.") However, the actual measured data did not lend its hand to support this claim. Instead, the measurements showed that the first placed block #6 settled about an inch when the second placed block #1 was placed and the block #6 went on to settle an additional 10 inches. This additional settlement of 10 inches is not a percentage as claimed; it is a thousand (1000%) percentage, rather. This type settlement is very significant and its impact on the basemat, in terms of current stress conditions and future behavior, is still an unknown.

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3. Figure 2 was used to illustrate the convexity of the basemat during construction (Ehasz Affidavit, page 13). However, the validity of this figure is questionable because it lacks measured data in the containment area to back it up. Based on LP&L's March 1984 submittal, settlements within the containment area were not surveyed since mid March 1976 due to the inaccessibility to the surveying pins. Therefore, the "actual curve" within the containment area as shown in Figure 2 was imagined by LP&L, not necessarily be real. The measured settlements outside the containment area, however, showed that the top of the basemat has a concaved shape (see Figure 3). The only available directly measured data within the containment (March 1976 data), also, showed a somewhat concaved shape (see Figure 4). Therefore, LP&L's statement about the convexity of the basemat, "As illustrated in Figure 2...reactor building centerline.", is somehow questionable!

4. I agree that LP&L did anticipate some differential settlement and did plan a reasonable construction sequence to minimize the impact of the differential settlement (Ehasz Affidavit, page 14). But, LP&L had not anticipated that the maximum heave would be 3 to 4 times the heave estimated in the soil design and the "uniform" soil was far from uniform. Those unanticipated conditions encountered during construction were not properly evaluated up to this date.

5. As claimed, LP&L did map the soil several feet above the foundation level in detail. However, this does not mean that the soil condition at the foundation level would not be different from what was mapped. Mud spurt, standing water in the excavtion, and difficulties in the compaction of the shell blanket were some of the indications of the local foundation soil conditions.

6. The "relatively symmetric" differential settlement experienced by the basemat was cited as an indication of soil being uniform. However, LP&L did not reveal that the "measured" initial settlement data of the 28 concrete blocks was not all measured. The initial settlements of the 28 block pours, with the exception of four, were all assumed to have an initial settlement of .75 inches. How can one use this "measured" data to conclude that the foundation soil is "uniform". BNL's statement in the "Staff's" Affidavit, the measured immediate settlements of all the block pours were about .75 inches as evidence of soil being uniform, was cited to reinforce LP&L's conclusion (Applicant's Reply, page 10). Unfortunately, BNL's statement is founded on "assumed" initial settlements also. If BNL carefully reviewed the LP&L's submittal, such a statement would not have been made.

The measured data, in terms of absolute elevations against a benchmark external to the excavation, clearly showed that blocks founded on excavation strip #2 settled more than those blocks founded on the other strips initially. Strip #2 is the excavation strip which showed the least compaction of the filter blanket and encountered the most problems during construction. The earlier measurements of the blocks #8A (which was founded mostly on strip #2) and #8B (which was founded mostly on strip #3) showed qualitatively that block #8A settled about 30% more than the block #8B in March 1976 (see Figure 4). However, as all the other blocks were placed, the basemat would redistribute the structural load on the foundation soil and the appearance of soil non-uniform type settlement can no longer be detected from the measured settlement data.

5. The cracking pattern was cited to be symmetric with the centerline of the reactor building (Ehasz Affidavit, page 15). However, the NDT results, as presented in Figure 1, clearly indicated that the cracking pattern is far from symmetric--5 major cracks were detected in the northern half of the reactor building while only 2 major cracks were detected in the southern half of the reactor building (see Figures 1 & 5).

6. It is true that the differential settlement has essentially stopped (Ehasz Affidavit, page 16). However, the impact of those reconstruction related problems in terms of induced residual stresses has not been assessed yet. Therefore, the current stress state of the basemat is still in the dark. If these stresses were indeed insignificant, then, I would agree with LP&L's claim that what caused the differential settlement is academic (Applicant's Reply, page 11). The NDT results, as presented in Figure 1, seems to indicate that more cracks were developed under the reactor building since 1977 (see Figures 1 & 6). This seems to indicate that the cracks are still in progress. Therefore, to pin down the cracking causes is very crucial in order to determine the future behavior of the basemat.

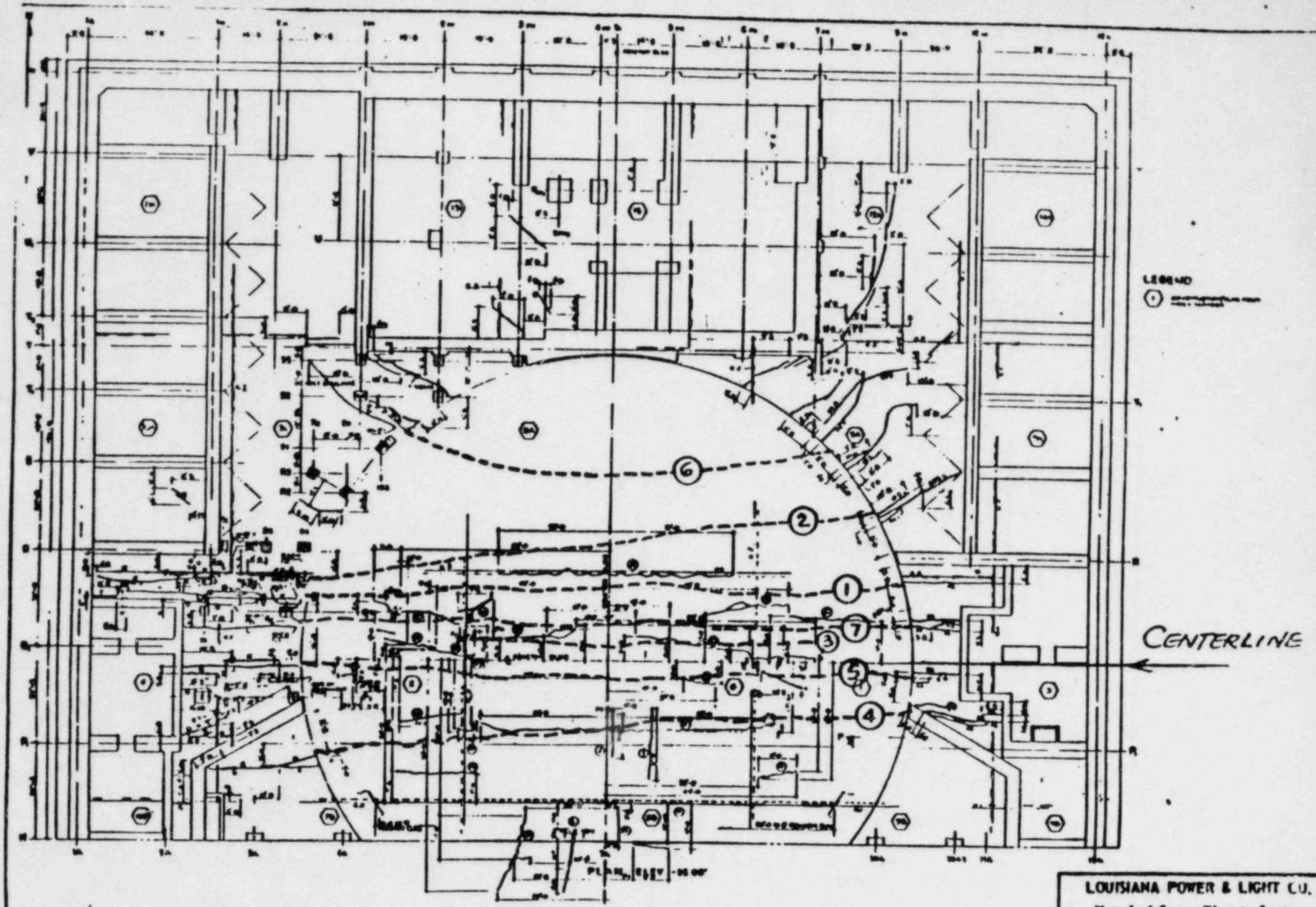
7. It now appears that the safety function of the Waterford basemat can not be assured without the compressive forces due to the applied soil backfill and water pressures acting across the cracks (Applicant's Reply, page 10; Ehasz Affidavit, page 8; Holley Affidavit, page 8-9). This seems to constitute a major change from the original design of the basemat. I agree with LP&L's earlier statement that ignoring those compressive forces in the original design of the basemat was on the conservative side (Ehasz Affidavit, Attachment page 20). However, if those forces were indeed required to assure the safety function of the basemat, then, appropriate analyses would have to be performed to demonstrate quantitatively that

the basemat would perform its intended safety function. The cracks in the basemat should be modelled truthfully and the presence of the non-safety turbine building, which may affect the distribution of those compressive forces at the south of the nuclear island, should be addressed in the analyses.

J. T. Chen

SGEB/DE/NRR

c.c.: D. Denton
E. Eisenhut
R. Vollmer
J. Knight
D. Crutchfield
G. Lear
L. Heller
J. Ma
J. Sirta



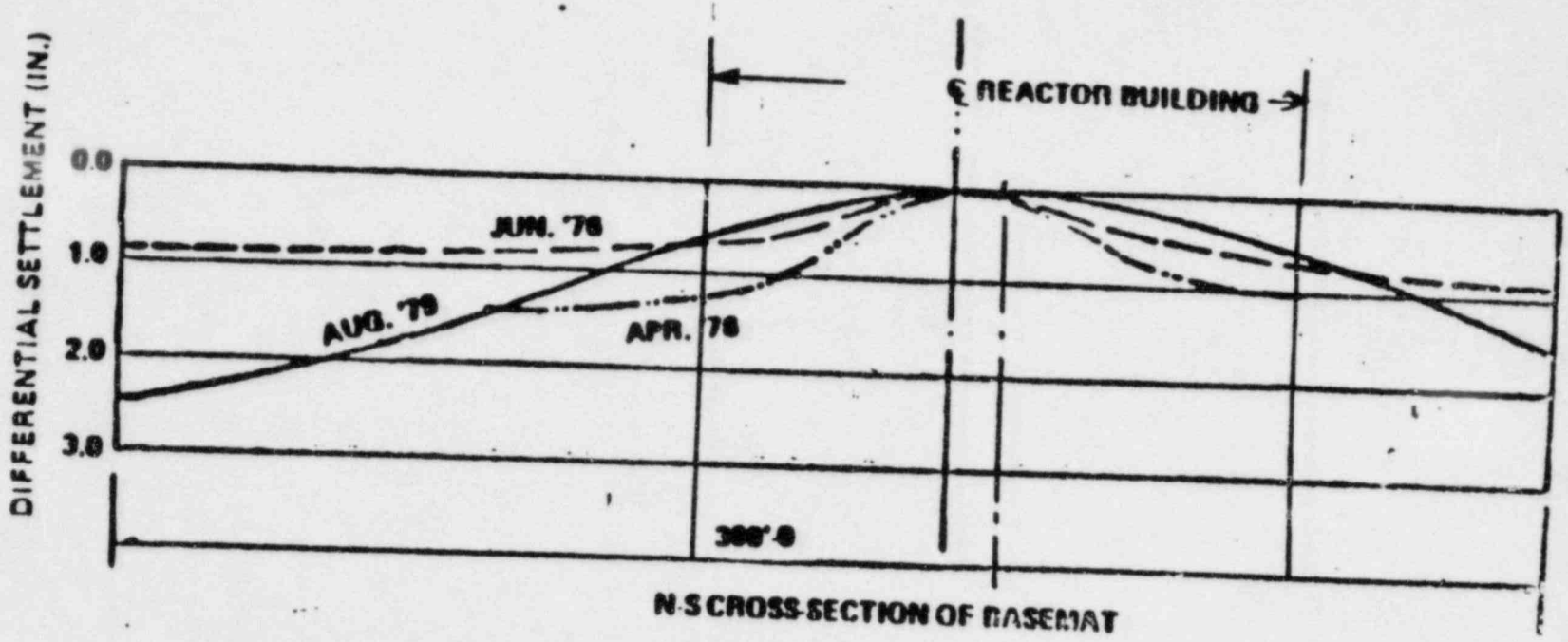
LOUISIANA POWER & LIGHT CO.
Waterford Steam Electric Station

BASE MAT
CRACK MAP

FIGURE 1

LOUISIANA POWER & LIGHT CO.
Waterford Steam Electric Station

BASEMAT CURVATURE

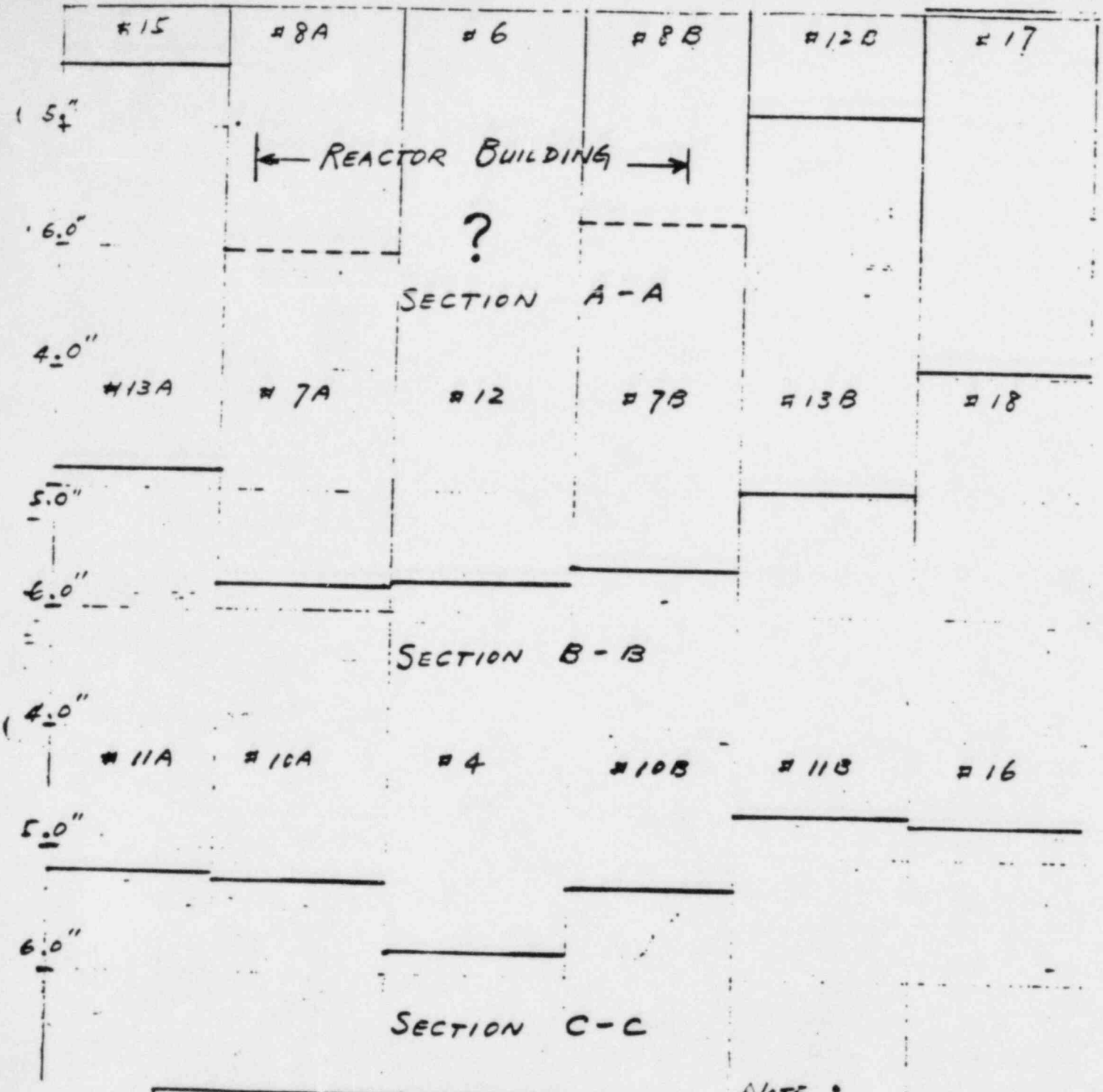


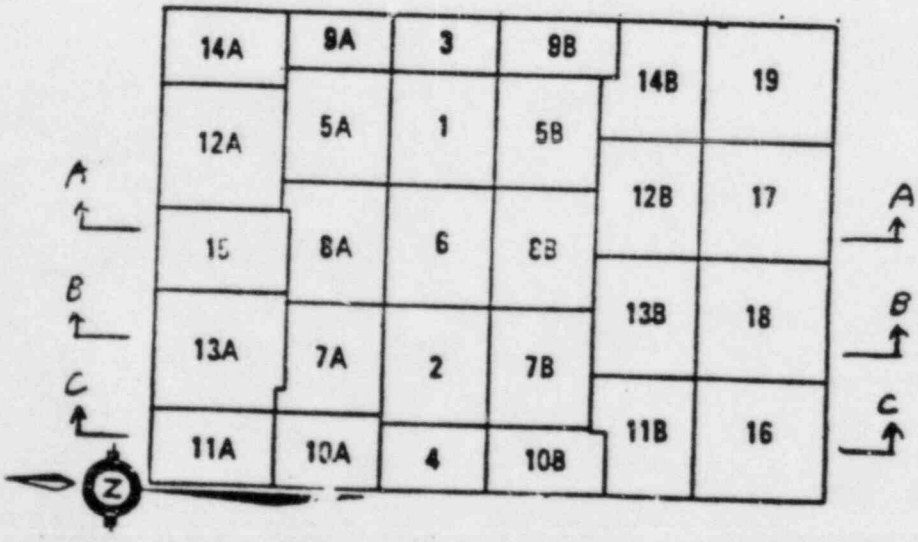
NOTES:

VERTICAL EXAGGERATION - 300

DIFFERENTIAL SETTLEMENT IS FROM DAY OF PLACING AND INCLUDES SETTLEMENTS AT VERY EARLY AGES OF EACH CONCRETE PLACEMENT

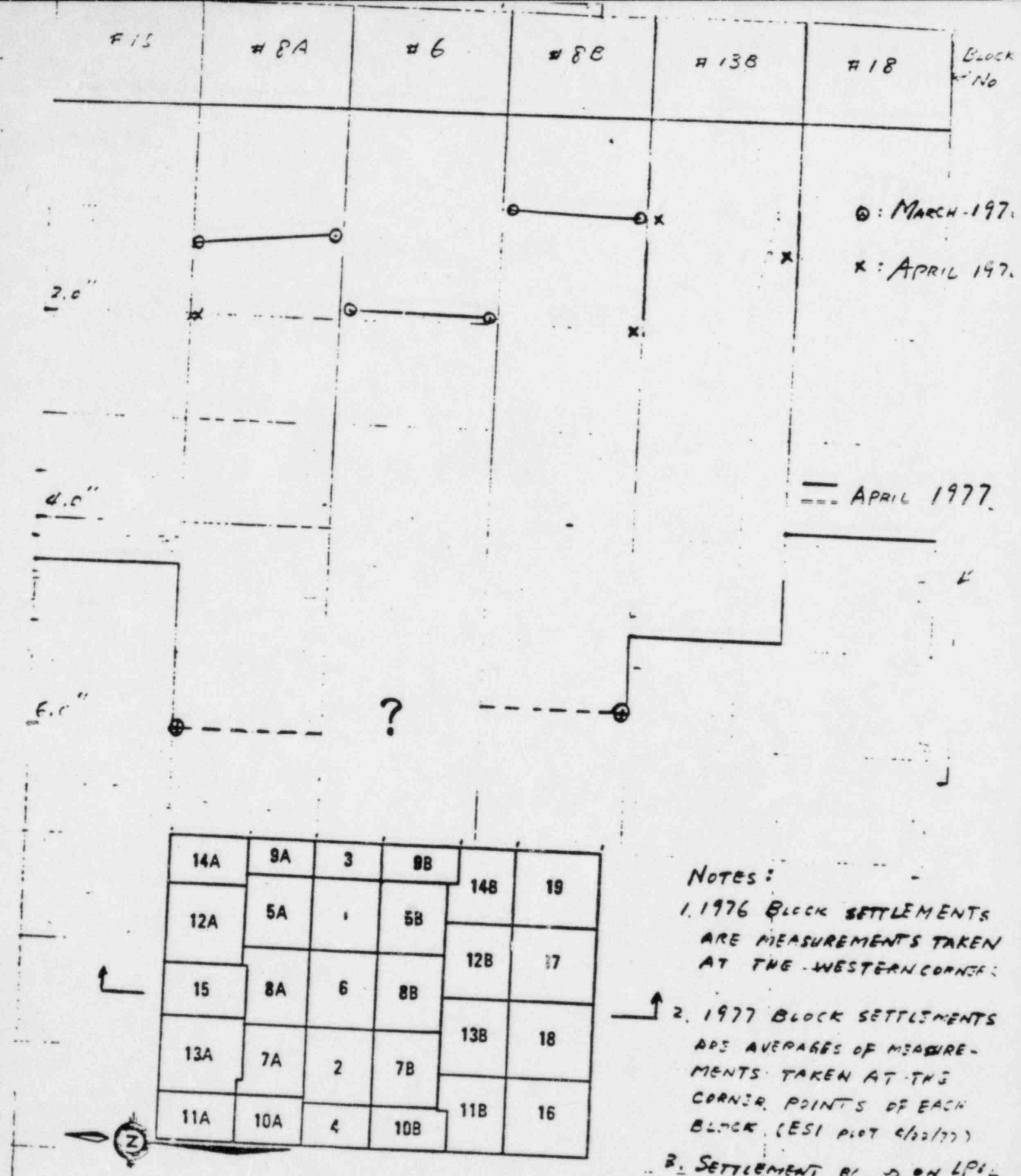
Figure 2





NOTE :
ALL SETTLEMENTS ARE AVERAGES BASED ON ESI PLOT DATED 4-22-77 SUBMITTED TO NRC IN MARCH 1984

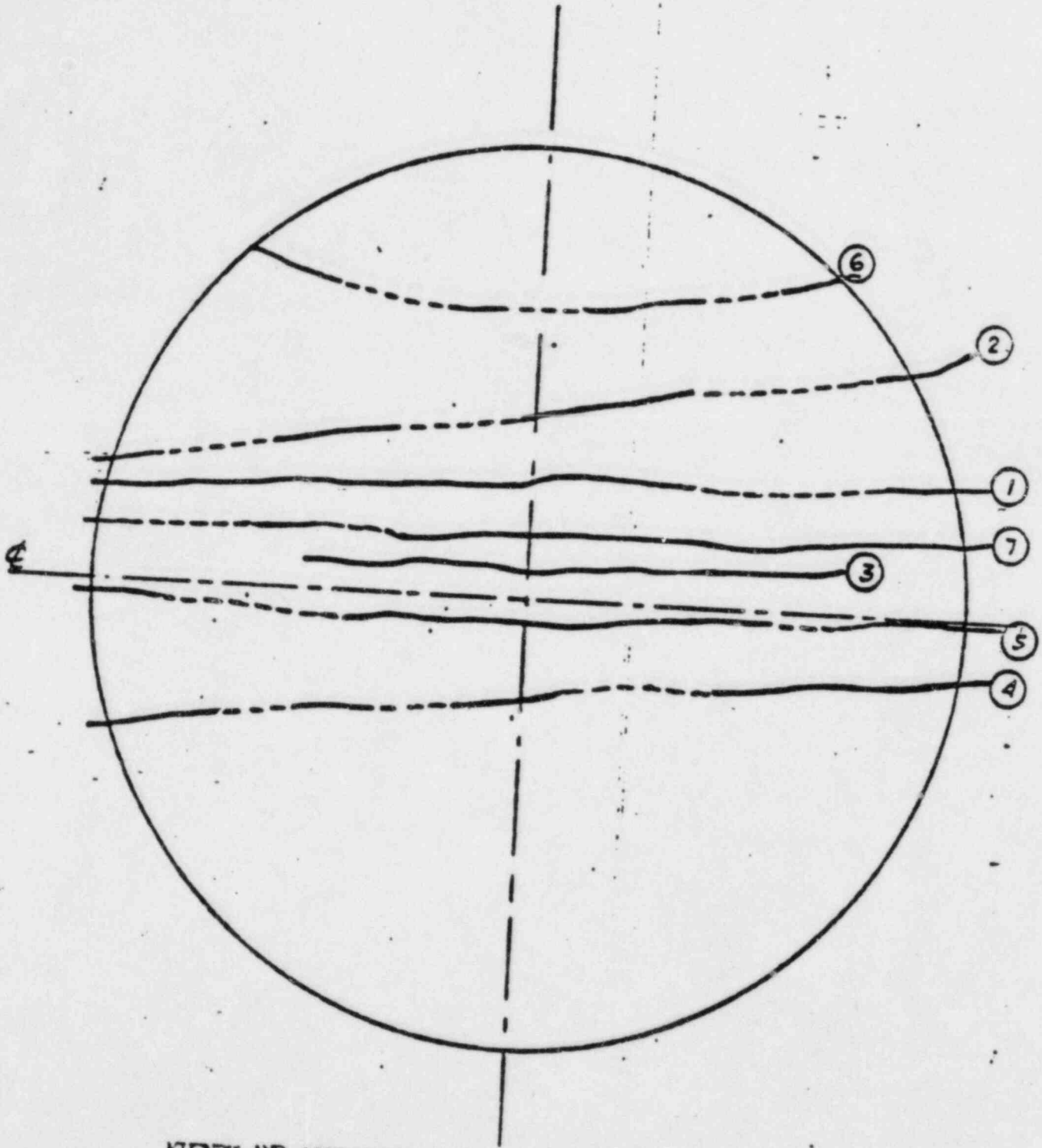
FIGURE 3



NOTES:

1. 1976 BLOCK SETTLEMENTS ARE MEASUREMENTS TAKEN AT THE WESTERN CORNER.
2. 1977 BLOCK SETTLEMENTS ARE AVERAGES OF MEASUREMENTS TAKEN AT THE CORNER POINTS OF EACH BLOCK. (ESI PLOT 6/22/77)
3. SETTLEMENT BY ∅ ON LPI MARCH 1984 SUBMITTAL

FIGURE 4



KLEINOW AND ASSOCIATES, INC. CHARLOTTE, NORTH CAROLINA
LOUISIANA POWER AND LIGHT WATERFORD NO. 3
NONDESTRUCTIVE TEST EVALUATION OF BASE MAT CONCRETE

CRACK DEPTH AND ORIENTATION GRAPHIC SHEET
60° TRANSDUCER

FIGURE 5

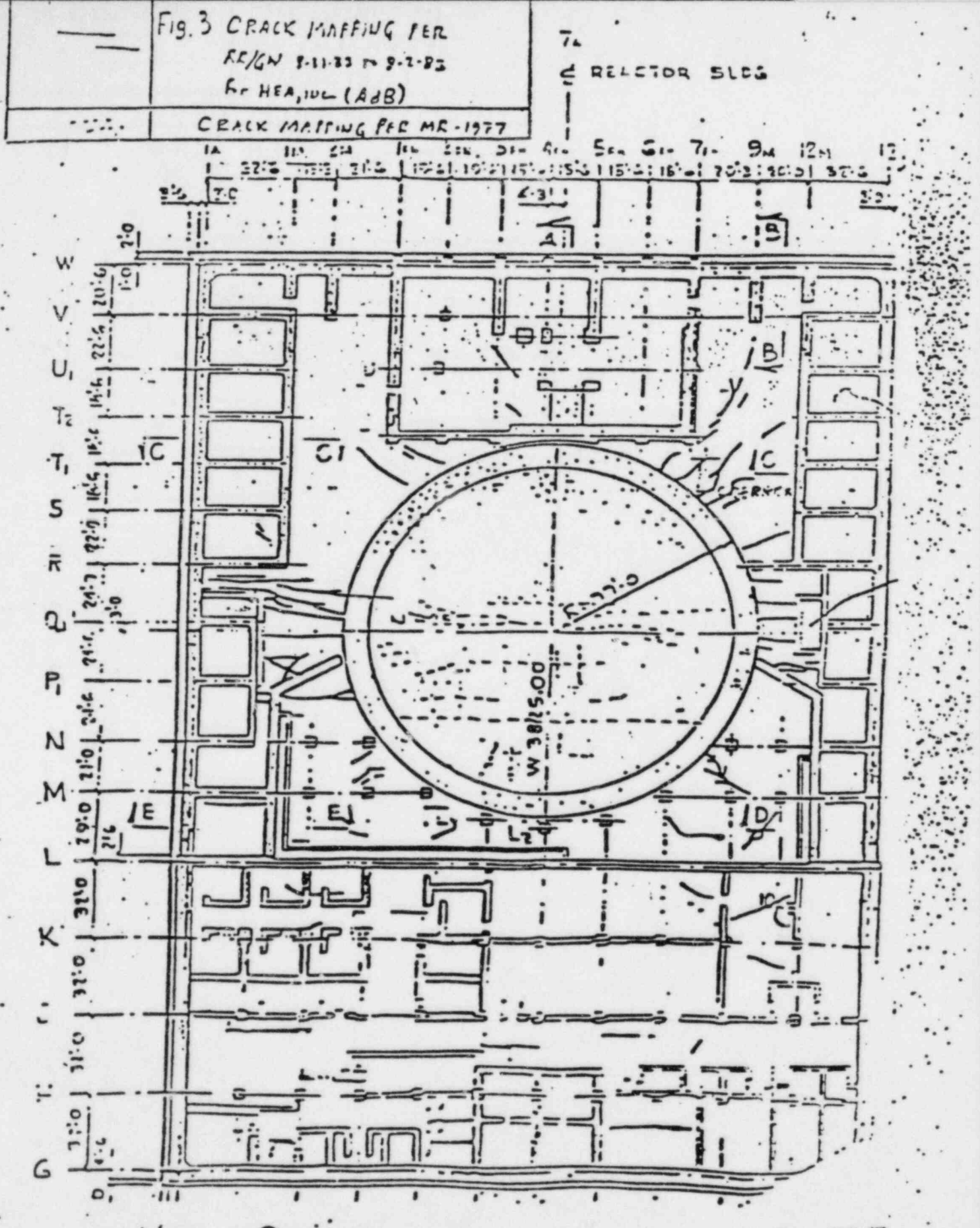


Fig. 3 CRACK MAPPING PER
RE/GN 8-11-83 TO 9-2-83
BY HEA, INC. (A&B)
CRACK MAPPING PER MR-1977
REACTOR SLAB
REACTOR
W 38'5.00
NOTE: CRACKS MAPPED BY HEA INC. (1977)

FIGURE 6