

Washington Public Power Supply System

P.O. Box 968 3000 George Washington Way Richland, Washington 99352 (509) 372-5000

Docket No. 50-397

September 16, 1983
G02-83-839

Mr. J. B. Martin
Regional Administrator
U. S. Nuclear Regulatory Commission
Region V
1450 Maria Lane, Suite 210
Walnut Creek, CA 94596

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Subject: NUCLEAR PROJECT 2
NRC INSPECTION REPORT 50-397/83-38 NOTICE OF VIOLATION

Reference: 1) Letter, D. M. Sternberg to C. S. Carlisle, dated August 30,
1983

Washington Public Power Supply System hereby replies to the Notice of Violation designated "E" in Appendix A of the referenced letter dealing with concrete reinforcing steel placement. For your information, the Supply will be responding to Items A through F via several letters rather than a single transmittal.

Statement of Violation

"Washington Public Power Supply System Docket No. 50-397
P. O. Box 968 Construction Permit No. CPPR-93
Richland, Washington 99352

As a result of the special inspection conducted by the NRC Construction Appraisal Team on May 16-27 and June 6-22, 1983, and in accordance with the NRC Enforcement Policy, 10 CFR, Part 2, Appendix C, the following violations were identified:

Criterion V of 10 CFR 50 Appendix B requires, in part, that 'Activities affecting quality shall be prescribed by documented instructions, procedures, or drawings of a type appropriate to the circumstances and shall be accomplished in accordance with these instructions, procedures or drawings. Instructions, procedures or drawings shall include appropriate quantitative or qualitative acceptance criteria for determining that important activities have been satisfactorily accomplished'.

The FSAR for the WNP-2 project, Section 17.1.1.5, accordingly describes that activities affecting quality are described in procedures, instructions, and drawings and that activities are conducted in accordance with these documents. Procedures, instructions, and drawings include adequate quantitative and qualitative acceptance criteria to ascertain that the prescribed activities have been satisfactorily accomplished."

- "E. The WNP-2 project design and placement drawings (S-703, S-710, S-712, S-715, S-721, S-749, BS-RB-63, -73, -84, -125, -132) define reinforcing steel placement requirements. These include placing of lap splices vertically and required number of bars.
1. Contrary to Criterion V, 10 CFR, Appendix B, cited above, and the above requirement, 1 of 8 reinforcing steel dowels was apparently omitted from Beams 2B11 and 3B18, as observed in excavations during the inspection.
 2. Contrary to Criterion V, 10 CFR 50, Appendix B, cited above, and the above requirement, reinforcing steel bars, for concrete beams 2B3, 2B5, 2B11, 2B25, 3B10, 3B18, and 6B9 were placed with lap splices horizontally and with horizontal and vertical clear space between bars of a little as 1/8". As a result, honeycomb and voids had occurred in the concrete, as observed in excavations during the inspection.

This is a Severity Level IV Violation, (Supplement II)."

Supply System Response

In order to resolve the items addressed in the Notice of Violation, a formal destructive examination and documentation review was conducted.

- o Eight beams with congested rebar were selected for review. In addition, two exterior walls, a pilaster, a wall of the dryer separator pool, a fuel pool wall/beam, the foundation mat and a slab were selected. The sample was representative of the Quality Class I work done by three contractors during a three-year time period, during which the majority of concrete work for the project was accomplished. The sample was biased because members with congested reinforcing bar were specifically selected.
- o As-builts of the reinforcing steel exposed by the excavations were prepared, checked, and compared with fabrication drawings. Photographs of each excavation were prepared. The NRC was contacted to view each excavation and questions of the accuracy of two as-built sketches were raised by the inspectors, as noted in Inspection Report 83-36. The sketches have been reviewed, revised, and discussed with the Resident Inspector. It is our understanding that this issue is resolved.

- o In Item 1, the Notice of Violation notes one of eight dowels as apparently omitted from beams 2B11 and 3B18. Supplementary excavation in beam 2B11 has exposed all eight dowels in that beam. Supplementary excavation in beam 2B5 and the north wall of the spent fuel pool also exposed steel initially thought to be missing. Additional review of the design and placement drawings for beam 3B18 indicates that the dowel apparently missing may be there, but not exposed. Engineering analysis of beam 3B18 demonstrates that if the dowel were assumed to be missing, the strength of the beam as built would still meet the design objective. These facts support a project conclusion that further excavation of beam 3B18 is not warranted.
- o Reinforcing steel bars for the concrete beams identified in Item 2 of the Notice of Violation are located closer than specified and this resulted in honeycomb and voids in two of the beams. Investigation has found good bond between the concrete and reinforcing steel in all the sample excavations except beams 2B11 and 2B25. The honeycombed areas in these beams have been excavated to sound concrete and will be repaired. Engineering analysis of beams 2B11 and 2B25 show that their strengths meet the design objectives.
- o The findings of the formal destructive investigation program briefly set forth above are that the deviations noted in the Notice of Violation have no detrimental impact on the biased sample of structures evaluated and these conclusions have been reviewed by consultants considered expert in their knowledge of reinforced concrete structures. Their written assessments are appended to the attached report. The structural capacity of all 17 members evaluated fully meet the original design objectives. The Supply System, therefore, concludes that the quality of reinforced concrete placed in the project is adequate.

Corrective Action to Preclude Repetition

Corrective action included the examination of concrete beams and structures other than those identified in the Notice of Violation. This examination has not identified any deviation which would cause any beam or structure evaluated to be of questionable adequacy; therefore, no additional actions are planned.

Date of Full Compliance

Submission of the attached report completes action on this item.

Our detailed reply, pursuant to the provisions of Section 2.201 of the NRC's "Rules of Practice", Part 2 Title 10 Code of Federal Regulations, consists of this letter and Attachment 1, which contains our detailed response to the Notice of Violation.

Mr. J. B. Martin

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September 16, 1983

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If you have any questions or desire further information, please contact Hugh Crisp at (509) 377-2501, extension 2795.

C. S. Carlisle

C. S. Carlisle - 901A

Program Director, WNP-2

HAC/lkh

Attachments: Attachment 1
Appendix A, B, C, and D

cc: Mr. R. C. DeYoung, NRC IIE
Mr. R. T. Dodds, NRC RV
Mr. R. F. Heishman, NRC QASIP IE
Mr. A. D. Toth, NRC Resident, WNP-2

Attachment 1

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
NUCLEAR PROJECT NO. 2
DOCKET NO. 50-397
LICENSE NO. CPPR-93

RESPONSE TO INSPECTION REPORT 83-38
NOTICE OF VIOLATION

EVALUATION OF CONCRETE AND REINFORCING STEEL
FOR
WASHINGTON PUBLIC POWER SUPPLY SYSTEM UNIT 2

Executive Summary

This report describes the results of an evaluation performed to assure the adequacy of the design and construction of the reinforced concrete structural members in the Reactor Building. This program was commenced during the special investigation conducted by the NRC Construction Appraisal Team (CAT) who were on site during May 16 through 27 and June 6 through 22, 1983. The program was further reviewed with NRC personnel on site on July 25 through 27, 1983. This report specifically addresses Section E of the Notice of Violation which was issued following the CAT inspection and stated:

"The WNP-2 project design and placement drawings (S-709, S-710, S-712, S-715, S-721, S-749, BS-RB-63, -73, -84, -125, -132) define reinforcing steel placement requirements. These include placing of lap splices vertically and required number of bars.

- 1) Contrary to Criterion V, 10 CFR, Appendix B and the above requirement, 1 of 8 reinforcing steel dowels was apparently omitted from Beams 2B11 and 3B18, as observed in excavations during the inspection.
- 2) Contrary to Criterion V, 10 CFR 50, Appendix B . . . and the above requirement, reinforcing steel bars, for concrete beams 2B3, 2B5, 2B11, 2B25, 3B10, 3B18, and 6B9 were placed with lap splices horizontally and with horizontal and vertical clear space between bars of as little as 1/8". As a result, honeycomb and voids had occurred in the concrete, as observed in excavations during the inspection."

In order to address these items, a formal destructive examination and documentation review was conducted. Eight beams with congested rebar were selected for review. In addition, two exterior walls, a pilaster, a wall of the dryer separator pool, a fuel pool wall/beam, the foundation mat and a slab were selected. All of the items listed above were evaluated in detail and were checked. The sample was a biased one because members with congested rebar were selected.

The reinforcing steel dowels identified in Item 1 of the violation as apparently omitted were investigated further. Additional excavation of Beam 2B11 located the apparently omitted dowel.

Excavation of beam 3B18 did not locate one of the dowels. The beam was evaluated conservatively assuming that the dowel was missing rather than just mislocated. This evaluation showed the beam to be adequate for all specified loads.

Reinforcing steel bars for the seven concrete beams identified in Item 2 of the violation are located closer than specified. The minimum spacing is specified to permit concrete to flow between the bars such that concrete could be placed without honeycomb or voids. Investigation of five of the beams showed no honeycomb or voids and demonstrated good to excellent bond between the concrete and reinforcing steel. Honeycomb and voids had been reported in prior nonconformance reports in the other two beams (2B11 and 2B25). These two beams were heavily reinforced, because of the demand generated due to construction loads greater than those specified during operation. Evaluation of the structural members demonstrated adequate structural capacity of all members for the specified loads.

The evaluation has been reviewed by Lewis Tuthill and Westinghouse as independent third parties. Lewis Tuthill inspected each of the excavations. Westinghouse inspected the excavations and performed a detailed review of all the documentation. Both parties concurred with the general conclusion of the evaluation.

In summary, the questions raised in the Notice of Violation have been addressed. The detailed evaluation of 17 structural elements with 23 discrete excavation locations indicates that the as-built structures are structurally adequate for all specified loads. In many cases there is substantial margin, since the future operating loads are lower than those specified and experienced during construction.

1. Introduction

Beams 2B3, 2B11, and 2B25 were constructed in May 1976 and were the subject of Nonconformance Report 6426-01851 dated August 4, 1976. This nonconformance report identified honeycombing in each of the beams, which were subsequently repaired. When these repair patches were reinspected and sounded in 1983, it appeared that the patches were deficient and it was decided to perform destructive examination of these beams. The concrete was partially excavated when the CAT visited the site. CAT expressed concerns after viewing the exposed reinforcing steel. These concerns led to the additional excavation and evaluation described in this report. Some of this work was performed while the CAT team was originally on the site. Additional excavation performed after the CAT team left the site was inspected in a subsequent NRC visit on July 25 through 27, 1983. Further examination and evaluation was performed subsequent to this visit.

2. Structural Members Evaluated

A total of 17 members with 23 locations was selected for evaluation. These were members with congested rebar. Based on past experience, it is known that structures with congested rebar are the ones most susceptible to lack of bond, honeycomb area, misplacement of reinforcement, changes from design drawings in preparing shop drawings, and changes in design drawings from calculations. The samples are thus biased in the direction of those most likely to show deviations from the original design.

To illustrate the method of selection, the concrete beam schedule for elevation 471'0" is shown in Table I. The beams selected at elevation 471'0" were 2B3, 2B5, 2B11, and 2B25. In addition, three excavation locations were selected for 2B11 and two excavation locations were selected for 2B25. It should be noted that rebar dowel splices were required, so a total of 48 bottom bars were required for beams 2B11 and 2B25. The design drawings called for three layers of bottom bars for 2B11 and 2B25. With these closely-spaced bars and dowels, if lack of consolidation were to occur, this would be the most likely location.

A similar selection procedure was used to select the following structural elements:

- a. Beams 3B10, 3B18 (four excavation locations), (Elevation 501'0")
- b. Beam 4B30 (Elevation 522'0")
- c. Beam 6B9 (Elevation 572'0")
- d. West and east exterior walls (Elevations 493'0" and 476'0").
- e. Pilaster/column of column lines 3.4 and M (Elevation 448'0").
- f. Dryer separator pool, north wall (Elevation 578'7 1/2").
- g. Fuel pool north wall/beam (Elevation 588'2 1/2").
- h. Foundation mat (three excavation locations) (Elevation 422'3").
- i. Slab (Elevation 471'0").

3. Details of the Evaluation

The detailed procedure for evaluation of structural elements (Appendix B) called for a review of documentation and physical destructive examinations. The documentation review consisted of:

- a. The design drawings on each member were checked against the design calculations.
- b. The shop drawings were checked against the design drawings.
- c. The excavated areas shown on the as-built drawings were checked against the shop drawings.

- d. For the cases where reinforcing bars were not found or where bond was determined to be questionable in the excavated areas, the structural capacity was checked against the structural design loads.
- e. The pour records were reviewed for Requests for Information (RFIs) and Nonconformance Reports (NCRs) indicating changes to design or shop drawings.

The physical inspection consisted of excavating the concrete in the selected locations and preparing as-built sketches. The results of the evaluation including the "as-built" sketches for each beam are included in Appendix C.

4. Design and Construction Process

This section describes the process followed during the original design and construction in order to show the relationship between the various design and construction documents. These documents were prepared sequentially and the predecessor documents such as the design drawings were not required to be updated to reflect changes incorporated in the later documents such as shop drawings, RFIs or NCRs. The as-designed condition is represented by the latest documents in the total documentation package.

- a) Design computations were prepared and checked by structural engineers.
- b) Design drawings were prepared and checked by design draftsmen and were approved by the structural engineer.
- c) Shop drawings were prepared by the reinforcement steel fabricator and were checked and approved by the structural engineer in accordance with approved procedures. Design draftsmen checked the shop drawings against the design drawings and detailing requirements of the ACI Code. The structural engineer coordinated this review as well as checked any areas of reinforcing not delineated on the design drawings.

The shop drawings represent the input provided to construction. At each step of the design process, additional detail is defined. Approval by the structural engineer confirms that the additional detail conforms to his design computations.

- d) During construction, the contractor requested changes to resolve interferences, ease of placement or other construction reasons. These changes were documented on Requests for Contract Change (RCCs) or Requests for Information (RFIs) which were reviewed and approved by the structural engineer.
- e) If nonconformances were identified after the construction work was completed, it was documented in a nonconformance report which required review and disposition by the structural engineer.

- f) Each contractor furnished his own quality control inspection. Each completed checklist, covering all phases of concrete construction prior to, during and after concrete placement, was signed off by quality control personnel. The contractor was responsible for assuring that all approved changes were incorporated in the construction.

5. As-Designed Versus As-Built Comparison

The comparison of the design documentation against the as-built condition revealed a few discrepancies which are detailed for each structural member on the evaluation sheets in Appendix C. The comparison confirmed that the as-designed condition was adequately supported by design calculation. Discrepancies in the as-built condition identified in the NRC Notice of Violation were in one of the following categories:

- a) Clear spacing between horizontal bars was less than that required by Paragraph 7.4.1 of ACI-318. This was particularly noted in the dowel region of heavily reinforced beams, where the dowels were located in the same horizontal layer as the main bars, and was aggravated by inserts also located in these regions.
- b) Poor bond, honeycomb and voids were found in two beams at the location that had been repaired in response to the prior nonconformance reports. No lack of bond or voids were found in structural members that had not previously been identified in nonconformance reports.
- c) One dowel bar was not located in beam 3B18.

6. Evaluation of As-Built Discrepancies

The evaluation sheets for each structural member in Appendix C show the results of the evaluation of each discrepancy. All members were found to be adequate. This section describes the consideration in performing these evaluations.

6.1 Rebar Spacing

Rebar clearance has been discussed among structural engineers and constructors for decades. ASCE has a committee to study the problems related to nuclear power plants. Nuclear power plants are usually built to ACI 301, ACI 318, ACI 349, or ACI 359. All of the codes specify clearances that are desirable. For example, it is desirable that the maximum-size aggregate pass between the rebar. This is rarely practical on all parts of the plant. For example, at containment openings, shell-to-base mat intersections and on heavily reinforced plates and beams so much rebar is required that the spacing is very close. Beam 2B11 is a good example of the problems that are often encountered in heavy-engineered construction.

The clear distance limitations in ACI 318 were established to permit concrete to flow readily into spaces between bars and to insure against concentration of bars on a line that may cause shear or

shrinkage cracking. The code permits lesser spacing if, in the judgment of the engineer, workability and methods of consolidation are such that concrete can be placed without honeycomb or voids. Rebar spacing should, therefore, be evaluated in terms of the resulting quality of concrete placement. The excavations have shown that, with only a few exceptions, the final structure is free of honeycomb and voids. The average spacing across the full width of the beam meets ACI Code minimum requirements. The low stress in the rebars under operating loads, together with the closely-spaced stirrups in each beam, will mitigate any tendency to crack along the plane of the rebar.

6.2 Rebar Splicing

The WNP-2 project design and shop drawings did not clearly define whether the splices of the dowels at the bioshield wall should be oriented vertically or horizontally. This left the option to the constructor to splice the bars in either orientation. Splicing of dowels above or below the bar being spliced is good practice in the case of one layer of rebar. In the case of multiple layers, the practice comes into question because of the almost vertical cut, with essentially zero clearance, produced in the concrete at the rebar location. Horizontal dowel splicing is not unusual in this type of multiple-layer construction. Various placing techniques are used to minimize lack of consolidation. Often bars are left loose or moved until the lower elevations are filled with concrete. Pea gravel mixes or grout are sometimes used. Field changes in mixes may be allowed to produce the best possible consolidation. In spite of all the precautions, lack of consolidation exists on all projects. It is for this reason that patching procedures are covered in the ACI Code and project procedures.

6.3 General Comments on Design and Design Criteria

During the review of the design calculations, it became clear that the structures with the congested rebar were generally governed by the construction load case. The operating load case that governed consisted of dead load, live load, seismic and thermal. For this case, the amount of rebar required was generally much less than that required for the construction load case. Since it is difficult to estimate the construction loads early in the project, conservative loads and methods of analysis were generally used. In addition, as is usually the case, the actual concrete strengths (including bond, shear and tensile strength) greatly exceeded the minimum specified strengths.

6.4 Beam 2B11

This section describes the evaluation for a typical beam in which a number of discrepancies were identified. The design drawings for beam 2B11 called for a width of 3'-6" and for 24-#11 bottom bars to be placed in three layers. Although the ACI Code only requires that one-fourth of the positive moment reinforcement be extended into the

biological shield, the shop drawings call for dowels for all 24 bars, resulting in a total of 48 bars specified at the section excavated (section B-B on sketch #SK-3 in Appendix C). In addition, inserts were specified that prevented the bars from being uniformly spaced.

The excavation at section B-B exposed 24-#11 bars. The bottom layer shows 16-#11 bars (8 main bars plus 8 dowels from the bioshield wall). Bars are placed close together in some cases to clear the inserts. The ACI Code permits contact splices between the main bars and corresponding dowel but imposes a minimum clear distance between the contact lap splices and adjacent bars or splices. This minimum clear distance is not satisfied at some locations at the excavation. On the bottom layer, seven of the dowels are placed alongside the main bars and one above; on the second layer, eight #11 bars are exposed of which two are dowels located above the main bars.

After concrete placement, honeycombing was reported in the dowel region. This honeycombing was repaired, although the recent re-excavation of the deficient patch indicated minor honeycombing. It was not determined whether this honeycomb was in the original concrete or in the patched area.

Review of the design calculations for the beam indicated that loads during construction determined the reinforcement required (24-#11 bars). Review of all load conditions subsequent to construction showed that only 8-#11 bars are required at mid-span and only 2 of these are required to extend into the biological shield wall. An investigation of the actual loads experienced during construction concluded that the beam experienced loads during construction that exceed those specified during operation.

In summary, the evaluation of beam 2B11 has shown that there was honeycombing and voids during construction, primarily due to the close spacing of the reinforcing steel. However, due to the fact that the beam has experienced significant construction loads and that the number of bars required for operating loads is significantly less than the as-built condition, it is concluded that the beam is structurally adequate.

7. Summary and Conclusions

The purpose of this evaluation was to assure the adequacy of the design and construction of the concrete structural members in the Reactor Building.

A total of 17 structural members with 23 discrete excavation locations were conservatively selected. A detailed destructive examination was performed at each location and an analysis was made on each structure to determine the as-built capacity. In all cases, the structures were found to be adequate. The results show that for two cases some bond was not available on all the bars. This inadequacy occurred at dowel splice

locations where honeycomb and voids would be most likely. Of all the cases studied, only one bar may be missing (limited excavation was done in this area). Minor relocation of rebar from the placing drawings was to be expected with the very congested design which was dictated by the construction loads. The method of rebar placement for multilayer splices is not unique for this type of construction.

In conclusion, all of the members examined are adequate and there is reasonable assurance that all of the design and construction of concrete in the Reactor Building is adequate to meet the design conditions. This conclusion is endorsed by the independent reviewers, as shown in their letter reports in Appendix A (Lewis Tuthill) and Appendix D (Westinghouse).

TABLE I

MARK	WIDTH	DEPTH	BOTTOM BARS	TOP BARS
2B1	1'-0"	2'-6"	3-#8	3-#6
2B2	2'-0"	3'-0"	4-#9	3-#10
*2B3	2'-6"	4'-2"	14-#11	7-#11
2B4	1'-4"	2'-6"	3-#8	3-#8
*2B5	2'-6"	4'-6"	14-#11	7-#11
2B6	3'-0"	4'-6"	12-#11	6-#9
2B7	2'-0"	3'-4"	6-#11	4-#9
2B8	1'-6"	2'-6"	4-#7	2-#6
2B9	1'-6"	3'-0"	6-#11	4-#9
2B10	2'-0"	4'-0"	5-#9	3-#7
*2B11	3'-6"	5'-0"	24-#11	12-#11
2B12	2'-6"	4'-2"	8-#8	4-#11
2B13	3'-0"	2'-6"	4-#6	2-#6
2B14	1'-6"	3'-0"	4-#11	3-#10
2B15	3'-0"	4'-2"	6-#11	3-#10
2B16	3'-0"	4'-0"	6-#9	4-#9
2B17	2'-2"	4'-2"	8-#10	4-#9
2B18	1'-6"	2'-6"	4-#9	4-#9
2B19	1'-6"	3'-0"	3-#9	2-#8
2B20	3'-0"	5'-0"	17-#9	7-#9
2B21	2'-0"	3'-0"	4-#10	3-#8
2B22	3'-0"	3'-4"	7-#9	3-#9
2B23	3'-0"	3'-6"	5-#9	3-#9
2B24	3'-0"	3'-6"	6-#8	3-#7
*2B25	3'-6"	5'-0"	24-#11	12-#11
2B26	2'-6"	4'-2"	8-#9	4-#7
2B27	1'-9"	2'-0"	3-#8	3-#6
2B28	1'-0"	1'-6"	2-#6	2-#6
2B29	3'-0"	2'-0"	6-#9	4-#9
2B30	2'-0"	3'-0"	5-#10	5-#10
2B31	2'-6"	3'-6"	6-#11	4-#10
2B32	2'-0"	2'-6"	4-#10	4-#10
2B33	4'-8"	2'-0"	8-#8	8-#8
2B34	2'-0"	3'-0"	4-#10	4-#9
2B35	2'-0"	3'-6"	6-#11	4-#9

*Beam selected (bottom reinforced in two or more layers)

APPENDIX A

LEWIS H. TUTHILL
Concrete Engineering Consultant

4617 Cabana Way
Sacramento, California 95822
(916) 457-9007

June 11, 1983

To: Neil Powell
Project Engineering Manager
Bechtel Power Corporation
WNP-2
P. O. Box 600
Richland, Washington 99352

From: Lewis H. Tuthill

Subject: Washington Public Power Supply System
WNP-2 Nuclear Project
Review of Concrete Placing on Beams 2B11 and 2B25

1. Questions as to the adequacy and security of the subject beams have been raised by a final inspection team representing the Nuclear Regulatory Commission (NRC). Apparently for several feet near one support of the subject two beams, it was evident when the support forms were removed that concrete in the under face was not well consolidated. Repairs of reported poor quality were made that looked good but on sounding, some areas proved to be drummy. Some of the No. 11 bars, at least in the visible lower two of three layers are rather close together. Thus, it was not easy to get concrete down and around them without special precautions not provided initially. Removal of this poor and questionable concrete has continued until only a small portion of questioned value remains between and above this middle layer of bars.

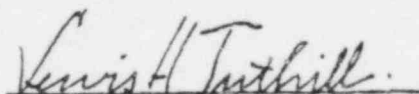
2. Of course this is not the first time in the construction industry that such imperfections have occurred in the underside of a concrete beam. It is by no means unique. The 'state-of-the-art' procedure has been to remove the imperfection back up to sound concrete and replace it with a suitable repair. Even though many repairs such as these could have been done better, there is no record of failure in service because of them. Many were not as strongly designed as the subject beams. Earthquakes may wreck buildings and bridges but in such cases there are vastly more structural failures than where some of the beams have been repaired, or even poorly repaired. This all leads to the following conclusions and opinion:

a) That when such underside imperfection in the subject beams has been visibly fully removed as discussed above, it may well be presumed, certainly for all practical purposes, that no significant, invisible, unsound concrete exists above such a lower zone of replacement, that will impair its intended performance.

b) That when on all form removal, concrete beams exhibit on all faces, fully consolidated concrete without other than superficial imperfections, they can be considered solid and without voids other than some entrapped air bubbles. With proper curing such beams are widely considered ready to carry their design loads with ample safety. If they do not, something other than the workmanship in placing the concrete will be at fault. If for some reason there is doubt, sounding in those areas might be reassuring.

c) Within the facility, enroute to inspect the questioned bottom areas of the subject beams, it was noted from its general appearance that workmanship in forming and placing the concrete had been amply good. Installation of reinforcement could be judged only from job photographs and the few square feet where it was exposed at the underside of those two beams. Nothing unfavorable could be identified in the photographs as there were none of detail placement in critical or congested places. The general grids appeared to be evenly spaced and uniform. That exposed under the beams could have been more uniformly spaced but the two hanger inserts required, caused much of the crowding. Rebars are understood to perform fully as well despite some variation in spacing.

3. I trust the foregoing adequately covers the principal points in question which we observed and discussed during my visit June 9 and 10. If further clarification or amplification is desired, please advise.



Lewis H. Tuthill

LHT:at

APPENDIX A

LEWIS H. TUTHILL
Concrete Engineering Consultant

4617 Cabana Way
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(916) 457-9007

July 19, 1983

To: Neil Powell
Project Engineering Manager
Bechtel Power Corporation
WNP-2
P. O. Box 600
Richland, Washington 99352

From: Lewis H. Tuthill

Subject: Washington Public Power Supply System
WNP-2 Nuclear Project
Review of concrete placing in beams and elsewhere,
exposed since June 9, 1983.

Since my report of June 11, 1983, discussing beams 2B11 and 2B25, as noted during my inspection of them June 9, a number of exposures of concrete at reinforcing in other beams and locations were made in answer to certain questions raised by the NRC representatives.

As requested, I visited the project July 18 to examine these new exposures. It is my observation and opinion after looking closely at each of them, that

1. All concrete made visible since my visit May 9 is perfectly sound and without imperfection. It is well-consolidated and therefore well-bonded around the reinforcing bars.
2. The overall quality of workmanship is good.
3. There is no reason to question the integrity of the structure.
4. Apparently everything that should be there is in these exposed features of the structure, and, by the implications of this generous sampling, elsewhere as well.

Lewis H. Tuthill

Lewis H. Tuthill

LHT:at

BURNS AND ROE, INC.
PROCEDURE FOR EVALUATION OF CONCRETE
FOR
WASHINGTON PUBLIC POWER SUPPLY SYSTEM
UNIT 2
AUGUST 24, 1983

1. PURPOSE

The purpose of this evaluation is to assure the adequacy of the design and construction of the concrete structural members in the Reactor Building.

2. DOCUMENTATION TO BE EVALUATED

The following documentation will be evaluated in detail to determine the structural adequacy of the members. The selection of specific members will be discussed in Section 4 of this procedure.

- a. The design drawings on each member will be checked against the design calculations.
- b. The shop drawings will be checked against the design drawings.
- c. The excavated areas shown on as-built sketches will be checked against the shop drawings (as practical and to determine where rebar placement is adequate).
- d. For the cases where reinforcing bars appear to be missing or where bond is questionable in the excavated areas, the structural capacity will be checked against the structures' design loads.
- e. The pour record will be reviewed for RFIs and NCRs indicating changes to design or shop drawings.

3. PHYSICAL INSPECTION

A detailed physical inspection will be made of each excavation in each structure to be evaluated. The results of the physical inspection will be recorded on as-built sketches which show: number, size, spacing and location of rebar.

4. STRUCTURES TO BE EVALUATED

The structures selected for detailed review were chosen because they represent the part of the structures with the most complex and congested rebar details. It is known from past experience that such structures are the ones most susceptible to lack of bond, honeycomb areas, misplacement of reinforcement, changes from design drawings in preparing shop drawings, and changes in design drawings from calculations. The samples are thus biased in the direction of those that are most likely to show deviations from the original design. In addition, the structures selected represent beams, pilasters, walls, foundation mat, and slabs.

The selected members are:

- a. Beams 2B3, 2B5, 2B11 (3 locations), 2B25 (2 locations), 3B10, 3B18 (4 locations), 4B30, 6B9.
- b. West and east exterior walls.
- c. Pilaster/column at column lines 3.4 and M.
- d. Dryer separator pool, north wall.
- e. Fuel pool north wall/beam at elevation 588'-2½".
- f. Foundation mat (3 locations).
- g. Elevation 471' slab.

5. DOCUMENTATION

An evaluation form, Attachment I, will be completed for each member.

The results of the evaluation, including the evaluation forms, the as-built drawings and the computations, will be kept for future evaluation and examination.

6. REPORT

A report will be prepared to summarize the evaluation. The report will contain the following sections:

- a. Executive Summary
- b. Purpose
- c. Events that led up to evaluation
- d. Documentation evaluated
- e. Members evaluated
- f. Study of reinforcing bar clearance and substitution of alternate concrete mixes
- g. Results of evaluation
- h. General comments on design and design criteria
- i. Summary and conclusions

ATTACHMENT I

Date: _____ Rev. _____

STRUCTURAL MEMBER IDENTIFICATION _____

1. Design drawings checked against design calculations, and code/standard requirements: _____

Comments: _____ Engineer _____ Checker

2. Shop drawings checked against design drawings:

Comments: _____ Engineer _____ Checker

3. As-built sketches of excavated areas checked against shop drawings:

Comments: _____ Engineer _____ Checker

Date: _____ Rev. _____

4. Concrete consolidation and bond

Engineer _____ Checker

Comments:

5. Member as-built:

(Adequate or Inadequate)_____
Engineer _____ Checker

Comments:

List Discrepancies

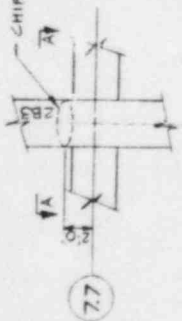
Engineering Disposition

N

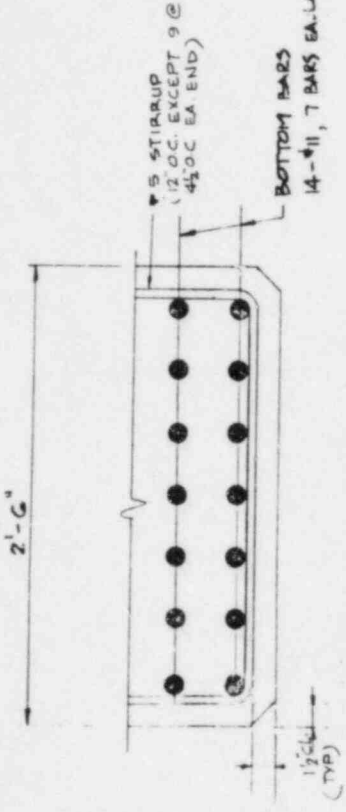
(J)

OUTSIDE FACE OF
BIOSHIELD WALL

CHIPPED AREA



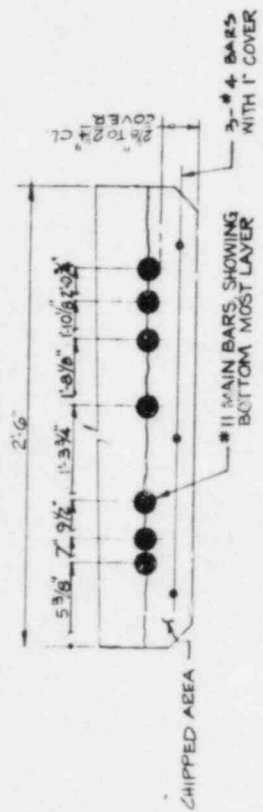
LOCATION PLAN



BEAM 2B3 (2'-6" x 4'-2")

SEE NOTE 243
CONCEPTUAL LAYOUT OF BM. STEEL

AS-BUILT



SECTION A-A

NOTES

1. AS BUILT MEASUREMENTS VERIFIED BY P. BONNET (INVESTIGATOR) AND M. FISHER (CONTRACTOR) (BECHTEL POWER CORP.)
2. FOR DESIGN REQUIREMENTS SEE B-M-DWG'S 5709/5759/5749 FOR REBAR DETAILS SEE BECHTEL STEEL DWG. BS-RB-22/8+8 FILE # 206-00-17971 BS-RB-29/812 FILE # 206-00-3150
3. (1) BOTTOM BARS HAVE DOWELS AT BIOSHIELD WALL NO DOWELS AT WEST SUPPORT

REV	DESCRIPTION	DATE	BY	CHK	APP
1	ADDED NOTE	10/10/00	NA	NA	NA

BEAM 2B3

AS-BUILT VERIFICATION			
BY	DATE	CHK	APP
NA	NA	NA	NA
DATE	10/10/00	FILED	10/10/00
WHP-2	SK-1		

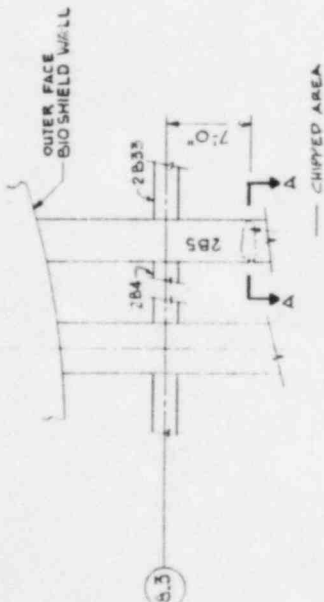
Appendix C

STRUCTURAL COMPONENT BEAM 2B3, ELEV 471'-0", CONC/REINF BY CONTRACT 6426 (SEE SKETCH NO. SK 1)

SHEET 1 OF 1

REINFORCEMENT REQUIRED BY ORIGINAL DESIGN AND SHOWN ON DESIGN DRAWINGS	REINFORCEMENT REQUIRED BY ANALYSIS FOR MOST CRITICAL OPERATING/SSE LOAD CONDITION	AS-BUILT CONDITIONS (SEE SKETCH NOTED)			DISCREPANCIES
		LOCATION OF EXCAVATION	BOTTOM BARS EXPOSED	DOWELS EXPOSED	
<u>SECTION A-A</u>	<u>SECTION A-A</u>				<u>ALL EXCAVATIONS</u>
Bottom Bars: 14-#11 in 2 layers	Bottom Bars: 7-#11	2'-0" East of column line 7.7	7-#11	None - Not required	1) Rebar spacing deviation partly to accommodate installation of 2 rows of Richmond inserts parallel to axis of beam.
Bottom Bar Dowels: Not required	Bottom Bar Dowels: Not required				
Top Bars: 7-#11	Top Bars: 5-#11				
RESOLUTION OF DISCREPANCIES:				COMMENT:	
1) Excavation demonstrated that concrete is fully consolidated and is tightly bonded to rebars. The rebar spacing deviation has not ad- versely affected placement of concrete and is acceptable.				1) Beam 2B3 has been reanalyzed and checked and found to be structurally adequate. Reanalysis indicates a large design margin.	
				2) Dimensions and bar sizes shown on as-built sketch SK-1 have been verified.	
				3) Honeycomb, which was originally identified in Nonconformance Report 1851, was repaired prior to the NRC CAT inspection.	

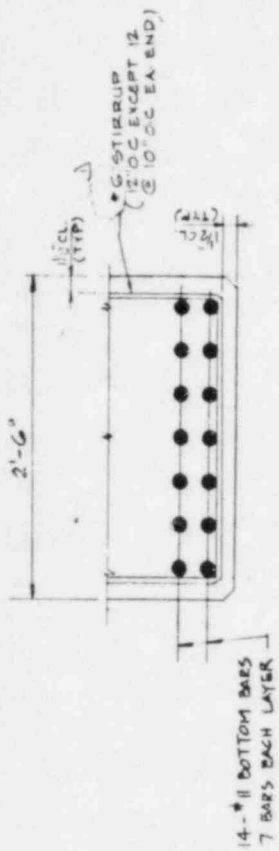
N



LOCATION PLAN

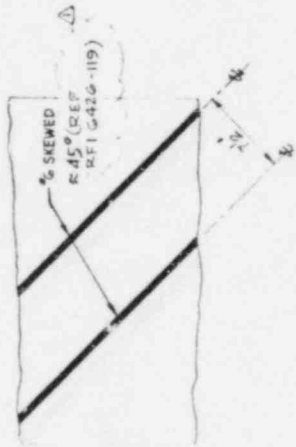
NOTES:

1. AS-BUILT MEASUREMENTS VERIFIED BY P. DOWNEY (WESTINGHOUSE ELECTRIC CORPORATION) AND M. FISHER (BOCARTEL POWER CORPORATION)
2. FOR DESIGN REQUIREMENTS SEE BAR DMS 519, 5149 AND 5753. FOR REBAR DETAILS SEE DETAIL 1000
3. STEEL DMS 85-88 12 (SEE FILE #24-88-2777)
4. STEEL DMS 85-88 29 (SEE FILE #24-88-2150)
5. MECHANICAL SPICES (WELDED) AT BIO-SHIELD WALL (REF. 2420-33)
6. BOTTOM REBAR DEVELOP DIRECTLY INTO WEST WALL. NO DOWELS REQUIRED AT WEST SUPPORT

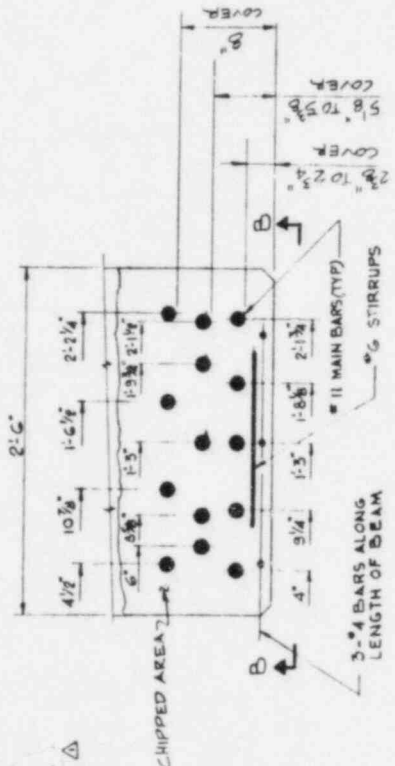


BEAM 2B5 (21'0" x 4'6")
SEE NOTES 1, 2 & 3
(CONCEPTUAL LAYOUT OF BEAM STEEL)

AS-BUILT



SECTION B-B



SECTION A-A

AS-BUILT VERIFICATION			
BY	DATE	APPROVED	REV
DCI	08/1/82		1
DATE	12/1/82	WJP-2	SK-2

REV	DESCRIPTION	DATE	BY	APPROVED
1	CORRECTED STIRRUP SIZE AND ADDED REFERENCE AND NOTE	12/1/82	WJP	WJP

Appendix C

STRUCTURAL COMPONENT BEAM 2B5, ELEV 471'-0", CONC/REINF BY CONTRACT 6426 (SEE SKETCH NO. SK 2)

SHEET 1 OF 2

REINFORCEMENT REQUIRED BY ORIGINAL DESIGN AND SHOWN ON DESIGN DRAWINGS	REINFORCEMENT REQUIRED BY ANALYSIS FOR MOST CRITICAL OPERATING/SSE LOAD CONDITION	AS-BUILT CONDITIONS (SEE SKETCH NOTED)			DISCREPANCIES
		LOCATION OF EXCAVATION	BOTTOM BARS EXPOSED	DOWELS EXPOSED	
<u>SECTION A-A</u>	<u>SECTION A-A</u>				<u>ALL EXCAVATIONS</u>
Bottom Bars: 14-#11 in 2 layers	Bottom Bars: 4-#11	7'-0" West of column line 8.3	14-#11 in 3 layers	None required	1) Bottom bars in 3 layers instead of 2 layers.
Top Bars: 7-#11	Top Bars: 5-#11				2) NRC Construction Appraisal Team noted as discrepancies: a) 2 of 7 bars missing from bottom rebar layer. b) Spacing deviation between first and second layers and second layer bars not directly above first layer bars.
RESOLUTION OF DISCREPANCIES:				COMMENT:	
1) Further excavation after NRC CAT inspection found 5 bars in bottom-most layer, 5 in middle layer, and 4 in top layer as shown on SK-2. The deviation in bar and layer spacing would be acceptable provided the concrete was adequately consolidated. Beam 2B5 was found to have fully consolidated concrete tightly bonded to the rebars with no honeycomb. Placement of the rebar in 3 layers did not change the conservative effective depth used in the original calculations.				1) Beam 2B5 has been reanalyzed and checked and found to be structurally adequate.	
2) a) See 1) All bars have been found; none are missing.				2) Dimensions and bar sizes shown on as-built sketch SK-2 have been verified.	

Appendix C

STRUCTURAL COMPONENT BEAM 2B5, ELEV 471'-0", CONC/REINF BY CONTRACT 6426 (SEE SKETCH NO. SK 2)

SHEET 2 OF 2

REINFORCEMENT REQUIRED BY ORIGINAL DESIGN AND SHOWN ON DESIGN DRAWINGS	REINFORCEMENT REQUIRED BY ANALYSIS FOR MOST CRITICAL OPERATING/SSE LOAD CONDITION	AS-BUILT CONDITIONS (SEE SKETCH NOTED)			DISCREPANCIES
		LOCATION OF EXCAVATION	BOTTOM BARS EXPOSED	DOWELS EXPOSED	
RESOLUTION OF DISCREPANCIES:				COMMENT:	
<p>b) ACI 318-71 (7.4.2) requires only one inch clear distance between layers. NRC CAT noted that 1 1/2" was furnished, therefore there is no discrepancy.</p> <p>It is apparent that the staggered spacing of bars in the levels (with a maximum of 5 bars in a 30 inch beam width) did not adversely affect concrete placement.</p>					

FILE	DESCRIPTION	IN	CD	MAI	INC	APPROVED
△	REMOVED TO SHOW INFO FOR ADOL CHURCHING AND CLARIFIED REFERENCE	12	12	12	12	12
						Delaney

Appendix C

STRUCTURAL COMPONENT BEAM 2B11, ELEV 471'-0", CONC/REINF BY CONTRACT 6426 (SEE SKETCH NO. SK 3)

SHEET 1 OF 2

REINFORCEMENT REQUIRED BY ORIGINAL DESIGN AND SHOWN ON DESIGN DRAWINGS		REINFORCEMENT REQUIRED BY ANALYSIS FOR MOST CRITICAL OPERATING/SSE LOAD CONDITION		AS-BUILT CONDITIONS (SEE SKETCH NOTED)		DISCREPANCIES	
				LOCATION OF EXCAVATION	BOTTOM BARS EXPOSED	DOWELS EXPOSED	
<u>SECTION A-A</u>		<u>SECTION A-A</u>					<u>ALL EXCAVATIONS</u>
Bottom Bars: 24-#11 in 3 layers		Bottom Bars: 8-#11		Near exter- ior face of the bio- shield wall	7-#11 (see Com- ment 5)	7-#11 (see Com- ment 5)	1) Deviations in rebar spacing partly due to relocation of bars to accommodate installation of 2 rows of Richmond inserts parallel to the axis of the beam.
Bottom Bar Dowels: 24-#11 in 3 layers		Bottom Dowels: 2-#11 (code minimum)					
Top Bars: 12-#11 in 2 layers		Top Bars: 7-#11					
<u>SECTION B-B</u>		<u>SECTION B-B</u>					
Bottom Bars: 24-#11 in 3 layers		Bottom Bars: 8-#11		7'-6" East of column line 8.3	8-#11	8-#11	2) Honeycomb in dowel splice area. 3) Defective patch. 4) Richmond inserts were not tagged to derate capacity. 5) Stirrup exposed in Section A-A has inadequate cover.
Bottom Bar Dowels: 24-#11 in 3 layers		Bottom Dowels: 2-#11 (code minimum)					
Top Bars: 12-#11 in 2 layers		Top Bars: 7-#11					
RESOLUTION OF DISCREPANCIES:						COMMENT:	
1) The deviations in rebar spacing would be acceptable provided that concrete was adequately consolidated around the bars. As noted in Nonconformance Report 1851, honeycomb and voids were observed after stripping the forms. Upon completion of patching, the concrete will be adequately consolidated and the discrepancy, therefore, will be resolved.						1) Beam 2B11 has been reanalyzed and checked and found to be structurally adequate.	
2) Honeycomb has been removed and its effect has been evaluated.						2) ACI 318-71 requires that only one-fourth of the positive moment reinforcement (bottom bars) extend into the support. The shop drawing shows dowels for all (24) bottom bars which is in excess of minimum requirements.	
3) The defective patch has been completely removed.						3) A dowel which appeared to be missing or mislocated during the NRC CAT inspection has been found after further excavation and is shown on SK-3.	
4) Derating tags will be re-attached to pertinent inserts upon completion of patching.							

Appendix C

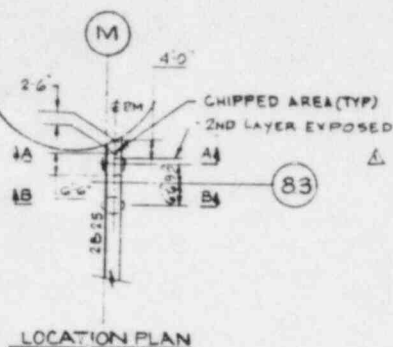
STRUCTURAL COMPONENT BEAM 2B11, ELEV 471'-0", CONC/REINF BY CONTRACT 6426 (SEE SKETCH NO. SK 3)

SHEET 2 OF 2

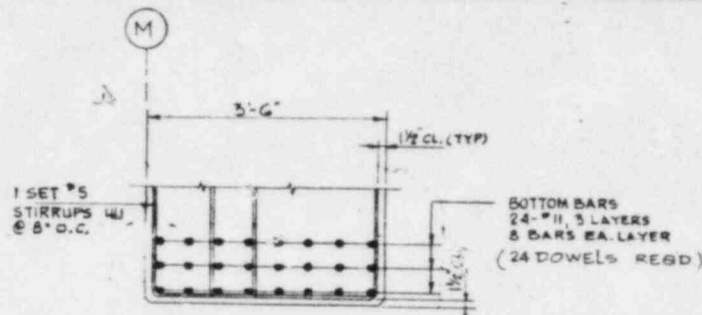
REINFORCEMENT REQUIRED BY ORIGINAL DESIGN AND SHOWN ON DESIGN DRAWINGS	REINFORCEMENT REQUIRED BY ANALYSIS FOR MOST CRITICAL OPERATING/SSE LOAD CONDITION	AS-BUILT CONDITIONS (SEE SKETCH NOTED)			DISCREPANCIES
		LOCATION OF EXCAVATION	BOTTOM BARS EXPOSED	DOWELS EXPOSED	
<u>SECTION C-C</u>	<u>SECTION C-C</u>				<u>ALL EXCAVATIONS</u>
Bottom Bars: 24-#11 in 3 layers	Bottom Bars: 8-#11	2'-6" West of column line 8.3	8-#11	-	6) NRC Construction Appraisal Team identified as a discrepancy the placing of the lap splices in a horizontal plane instead of a vertical plane.
Top Bars: 12-#11 in 2 layers	Top Bars: 7-#11				
Bottom Bar Dowels: None required	Bottom Bar Dowels: None required				7) NRC CAT identified as a discre- pancy the size and spacing of stirrups shown on the drawings did not agree with those shown in the calculations.
RESOLUTION OF DISCREPANCIES:				COMMENT:	
5) During patching, adequate cover will be provided over the stirrups.				4) Dimensions and bar sizes shown on as-built sketch SK-3 have been verified.	
6) The orientation of lap splices was not clearly defined on the shop drawings and was left to the contractor. Lap splices can be in either plane. This does not represent a discrepancy.				5) As noted on sketch SK-3, two bars exposed in the area at Section B-B slope upward. The slope prevented their exposure in the relatively shallow excavation of Section A-A.	
7) A checked and approved original calculation sheet, not viewed by the NRC CAT, notes size and spacing of stirrups for 2B11 which agree with those shown on the design drawings.					

N

OUTSIDE FACE
BIOSHIELD
WALL



LOCATION PLAN



BEAM 2B25 (3'-6" x 5'-0")

SEE NOTE #2 & 3

CONCEPTUAL LAYOUT OF BEAM STEEL

NOTES:

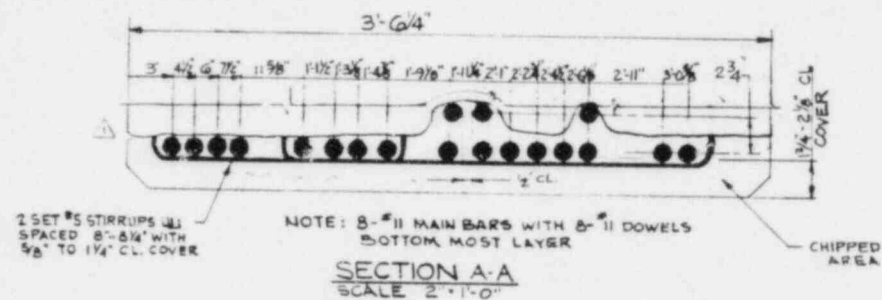
1) AS BUILT MEASUREMENTS VERIFIED BY P. BONNET (WESTINGHOUSE ELECTRIC CORP.) AND M. FISHER (BECHTEL POWER CORP.)

2) FOR DESIGN REQUIREMENT SEE BRDNG 5703, 5743 & 5755. FOR REBAR DETAIL, SEE BETWEEN STEEL DWS 85-RB-23 (RFR FILE #104-00-3150) & 85-RB-27 (RFR FILE #206-00-1755).

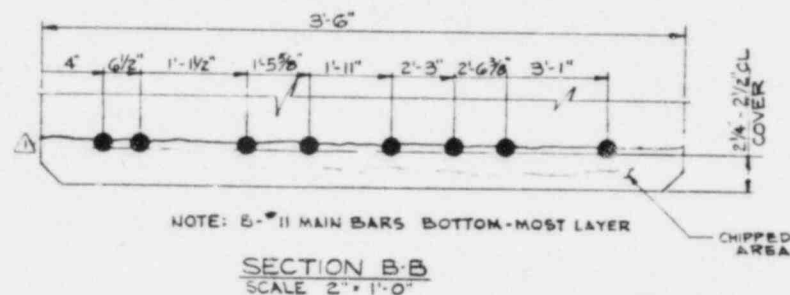
3) CONCEPTUAL PLACEMENT OF DOWELS SEE DWG. "SK-3"

REV.	DESCRIPTION	DESIGNED	DRI	BPC	APPROVED
1	CLARIFIED PICTORALLY AND ADDED INFO. OF ADD'L CHIPPING AND ANCHORING	WNP	WNP	WNP	WNP

AS - BUILT



SECTION A-A
SCALE 2" = 1'-0"



SECTION B-B
SCALE 2" = 1'-0"

BEAM 2B25

AS-BUILT VERIFICATION

BY DRI BPC WNP
ENGR. WNP WNP WNP

DATE 1/16/91 1/16/91 1/16/91

WNP-2 SK-4

REV 1

Appendix C

STRUCTURAL COMPONENT BEAM 2B25, ELEV 471'-0", CONC/REINF BY CONTRACT 6426 (SEE SKETCH NO. SK 4)

SHEET 1 OF 2

REINFORCEMENT REQUIRED BY ORIGINAL DESIGN AND SHOWN ON DESIGN DRAWINGS	REINFORCEMENT REQUIRED BY ANALYSIS FOR MOST CRITICAL OPERATING/SSE LOAD CONDITION	AS-BUILT CONDITIONS (SEE SKETCH NOTED)			DISCREPANCIES
		LOCATION OF EXCAVATION	BOTTOM BARS EXPOSED	DOWELS EXPOSED	
<u>SECTION A-A</u>	<u>SECTION A-A</u>				<u>ALL EXCAVATIONS</u>
Bottom Bars: 24-#11 in 3 layers	Bottom Bars: 9-#11	9'-0" East of column line 8.3	8-#11	8-#11	1) Deviations in rebar and layer spacing partly due to relocation of bars to accommodate installation of 2 rows of Richmond inserts parallel to the axis of the beam. 2) Bars in second layer were not directly above bars in the first layer. 3) Honeycomb visible in local area concentrated between bars; local void visible above bars. 4) Defective patching. 5) Richmond inserts were not tagged to derate capacity.
Bottom Bar Dowels: 24-#11 in 3 layers	Bottom Bar Dowels: 3-#11				
Top Bars: 12-#11 in 2 layers	Top Bars: 9-#11				
<u>SECTION B-B</u>	<u>SECTION B-B</u>				
Bottom Bars: 24-#11 in 3 layers	Bottom Bars: 9-#11	6'-6" West of column line 8.3	8-#11	None required	
Top Bars: 12-#11 in 2 layers	Top Bars: 9-#11				
RESOLUTION OF DISCREPANCIES:				COMMENT:	
1) The deviations in rebar and layer spacing would be acceptable provided the concrete was adequately consolidated around the bars.				1) Beam 2B25 has been reanalyzed and checked and found to be structurally adequate.	
2) See 1) above.				2) Dimensions and bar sizes shown on as-built sketch SK-4 have been verified.	
3) Honeycomb has been removed. Effect of honeycomb and void on structural adequacy has been evaluated.					
4) The patch has been removed completely and will be replaced.					
5) Derating tags will be reattached permanently to pertinent inserts upon completion of patching.					

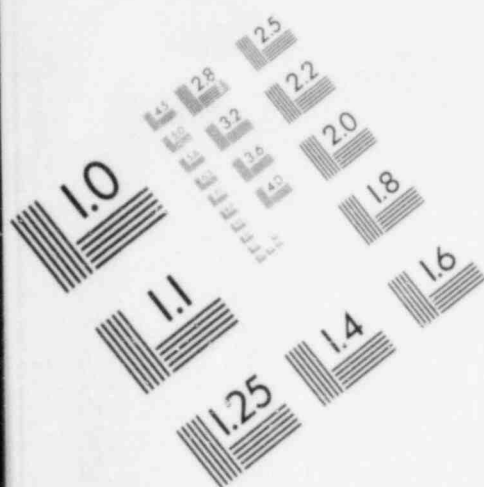
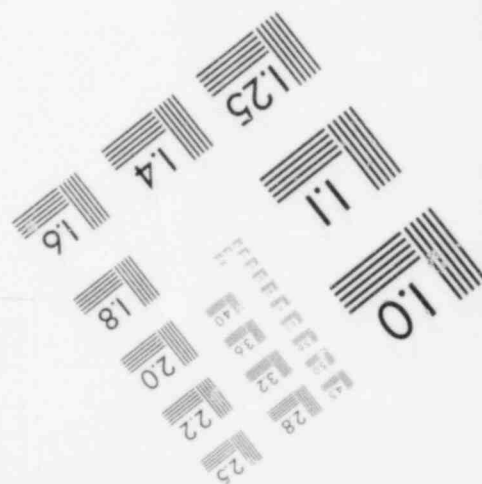
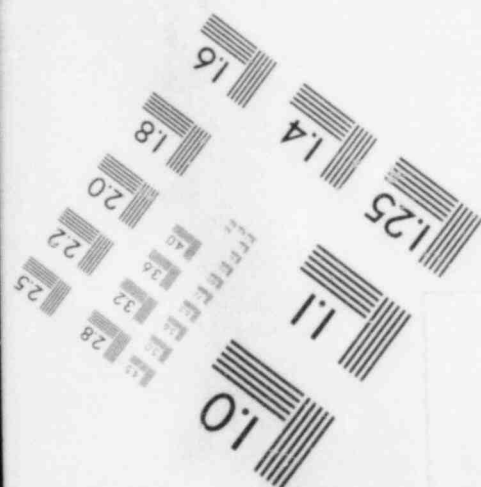
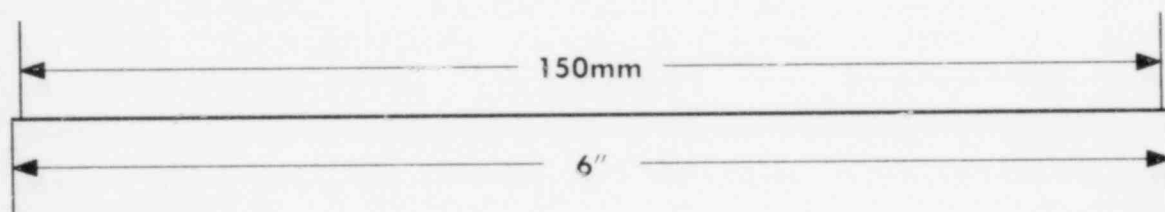
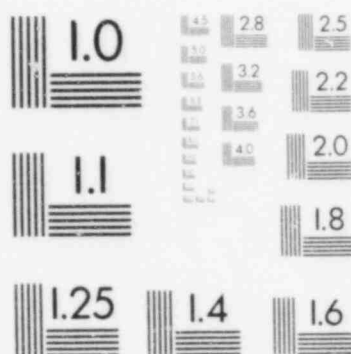
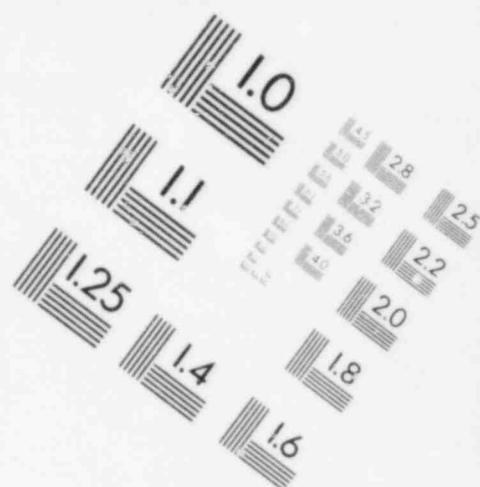


IMAGE EVALUATION TEST TARGET (MT-3)



Appendix C

STRUCTURAL COMPONENT BEAM 2B25, ELEV 471'-0", CONC/REINF BY CONTRACT 6426 (SEE SKETCH NO. SK 4)

SHEET 2 OF 2

REINFORCEMENT REQUIRED BY ORIGINAL DESIGN AND SHOWN ON DESIGN DRAWINGS	REINFORCEMENT REQUIRED BY ANALYSIS FOR MOST CRITICAL OPERATING/SSE LOAD CONDITION	AS-BUILT CONDITIONS (SEE SKETCH NOTED)			DISCREPANCIES
		LOCATION OF EXCAVATION	BOTTOM BARS EXPOSED	DOWELS EXPOSED	
					<u>ALL EXCAVATIONS</u> 6) NRC Construction Appraisal Team indicated the following discrepancies: a) Reinforcement lapped horizontally instead of vertically. b) Nonconformance Report 1851 did not indicate adequate investigation of initial honeycomb and did not identify deviations in rebar placement.
RESOLUTION OF DISCREPANCIES:				COMMENT:	
6) a) The orientation of lap splices was not clearly defined on the shop drawings and was left to the contractor. Lap splices can be in either plane. b) See 1) and 3) above (on preceding page).					



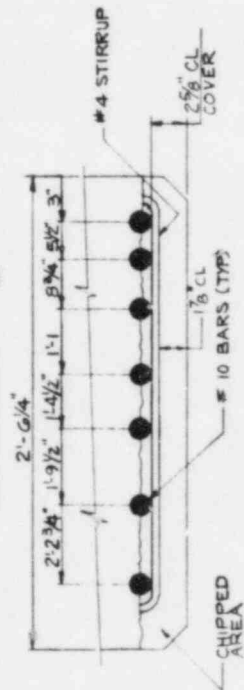
BEAM 3B10 (2'6" x 4'6")

SEE NOTE 203

CONCEPTUAL LAYOUT OF BM STEEL. Δ



AS-BUILT A



SECTION A-A

REV	DESCRIPTION	DRAWN BY	R/C	APPROVED
①	ADDED NOTE	NO. 100-100000	N/A	P. Lanning

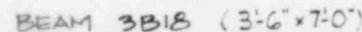
BEAM 3B10	AS PLANT VERIFICATION			
	BY	DATE	BYC	(W)
	W-104	7/11/82	W-104	W-104
	DATE	7/11/82	BYC	W-104
WNP-2	SK-5	1		

Appendix C

STRUCTURAL COMPONENT BEAM 3B10, ELEV 501'-0", CONC/REINF BY CONTRACT 6426 (SEE SKETCH NO. SK 5)

SHEET 1 OF 1

REINFORCEMENT REQUIRED BY ORIGINAL DESIGN AND SHOWN ON DESIGN DRAWINGS	REINFORCEMENT REQUIRED BY ANALYSIS FOR MOST CRITICAL OPERATING/SSE LOAD CONDITION	AS-BUILT CONDITIONS (SEE SKETCH NOTED)			DISCREPANCIES
		LOCATION OF EXCAVATION	BOTTOM BARS EXPOSED	DOWELS EXPOSED	
<u>SECTION A-A</u>	<u>SECTION A-A</u>				<u>ALL EXCAVATIONS</u>
Bottom Bars: 7-#10	Bottom Bars: 4-#10	4'-9" West of column line 8.3	7'-#10	None - Main bars extend dir- ectly into supports.	1) One bar spacing deviation.
Top Bars: 4-#9	Top Bars: 3-#9				
RESOLUTION OF DISCREPANCIES:				COMMENT:	
1) Excavation demonstrated that concrete is fully consolidated and tightly bonded to rebars, indicating that the deviation has not adversely affected concrete placement.				1) Beam 3B10 has been reanalyzed and checked and found to be structurally adequate. 2) Dimensions and bar sizes shown on as-built sketch SK-5 have been verified.	



see note #2 & 3

SEE NOTE #2 & 3
⚠ CONCEPTUAL LAYOUT OF BEAM STEEL

1. AS-BUILT MEASUREMENT
VERIFIED BY P. BONNET
(WESTINGHOUSE ELECTRIC
CORPORATION) AND
M. FISHER (BECHTEL
POWER CORPORATION).

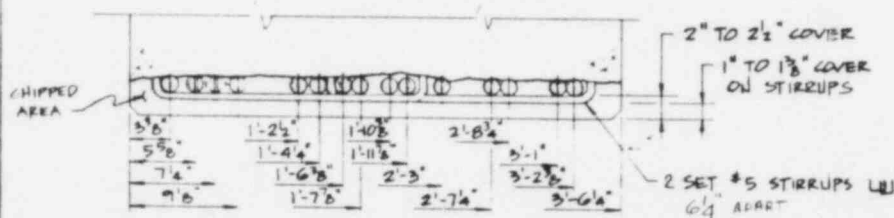
2. FOR DESIGN REQUIREMENT
SEE BERDOW 5712, 5749
AND 5753. FOR REBAR
DETAILS SEE BETHLEHEM
STEEL DWGS BS-RR-75
(BAR FILE #6809-CO-7074;
LS-RR-63 (BAR FILE
#6809-CO-7140).

3) CONCEPTUAL PLACEMENT
OF TOWELS SEE DWG 303

REV	DESCRIPTION	DWG	CLD	BRD	DOC	GW	APPROVED
1	SHOWN ADDL CHIPPING AND GENERAL CLARIFICATION	WD	10/20/11	11/1/11	11/1/11	11/1/11	11/1/11

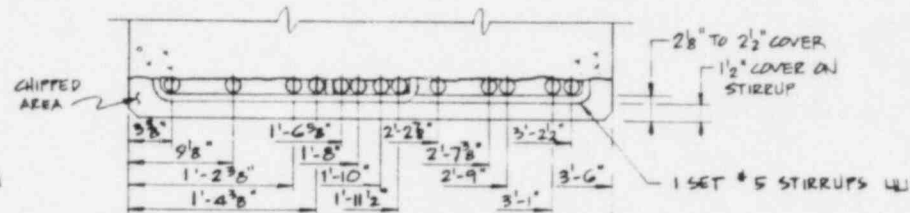
NOTE 3-#11 MAIN BARS WITH 7-#11 DOWELS
BOTTOM-MOST LAYER.

SECTION C-C



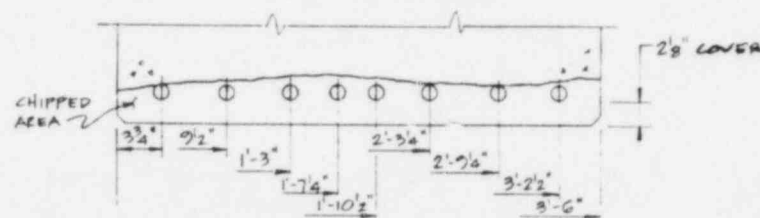
NOTE: 5-#11 MAIN BARS WITH 7-#11 DOWELS
3" ON MOST LAYER.

SECTION B-B



NOTE: 8-#11 MAIN BARS WITH 5-#11 DOWELS
BOTTOM-MOST LAYER

SECTION A-A



NOTE: 8-#11 MAIN BARS, BOTTOM-MOST LAYER MAIN BARS EXTEND DIRECTLY INTO WEST SUPPORT DOWELS NOT REQUIRED.

SECTION D-D

R MAIN		TEAM 3B18	
SUPPORT		AS-BUILT VERIFICATION	
BY	CHK	BY	CHK
ENGR	SPM	ENGR	SPM
DATE	TIME	DATE	TIME
1/26/81	11:00	1/26/81	11:00
APPROVED		WNP-2 SK-C	
CHK	SPM	CHK	SPM
1/26/81	11:00	1/26/81	11:00

Appendix C

STRUCTURAL COMPONENT BEAM 3B-18, ELEV 501'-0", CONC/REINF BY CONTRACT 6426 (SEE SKETCH NO. SK 6)

SHEET 1 OF 2

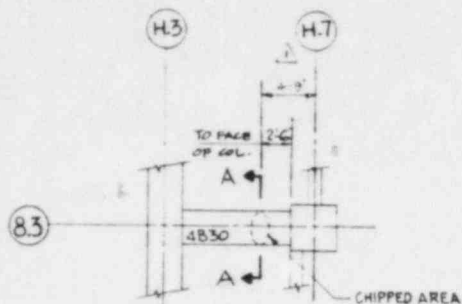
REINFORCEMENT REQUIRED BY ORIGINAL DESIGN AND SHOWN ON DESIGN DRAWINGS	REINFORCEMENT REQUIRED BY ANALYSIS FOR MOST CRITICAL OPERATING/SSE LOAD CONDITION	AS-BUILT CONDITIONS (SEE SKETCH NOTED)			DISCREPANCIES
		LOCATION OF EXCAVATION	BOTTOM BARS EXPOSED	DOWELS EXPOSED	
<u>SECTION A-A</u>	<u>SECTION A-A</u>				<u>ALL EXCAVATIONS</u>
Bottom Bars: 24-#11 in 3 layers	Bottom Bars: 17-#11 in 2 layers	5'-6" West of column line 7.7	8-#11	5-#11 (None required)	1) Rebar spacing deviations. 2) One of 8 dowels was not located. 3) NRC Construction Appraisal Team noted that reinforcement was lapped horizontally, contrary to required vertical lapping.
Bottom Bar Dowels: None required	Bottom Bar Dowels: None required				
Top Bars: 16-#10 in 2 layers	Top Bars: 8-#10				
<u>SECTION B-B</u>	<u>SECTION B-B</u>				
Bottom Bars: 24-#11	Bottom Bars: 17-#11	1'-0" East of column line 7.7	8-#11	7-#11 (None required)	
Bottom Bar Dowels: None required	Bottom Bar Dowels: None required				
Top Bars: 8-#10	Top Bars: 8-#10				
RESOLUTION OF DISCREPANCIES:				COMMENT:	
1) The deviation in spacing would be acceptable if the concrete were adequately consolidated. The concrete is fully consolidated and the concrete is tightly bonded to the rebar. The deviations are acceptable.				1) Beam 3B-18 has been reanalyzed and checked and found to be structurally adequate.	
2) ACI 318-71 requires that only one-fourth of the positive moment reinforcement (bottom bars) extend into the support. The number of dowels observed exceeds the number required by code. Therefore, even if the bar is assumed to be missing the beam would be acceptable.				2) Dimensions and bar sizes shown on as-built sketch SK-6 have been verified.	
				3) Contractor provided extra-long dowels (25'-0") to insure proper development length in both the beam and the bioshield wall. The dowels appear in Section A-A and B-B but are not required.	

Appendix C

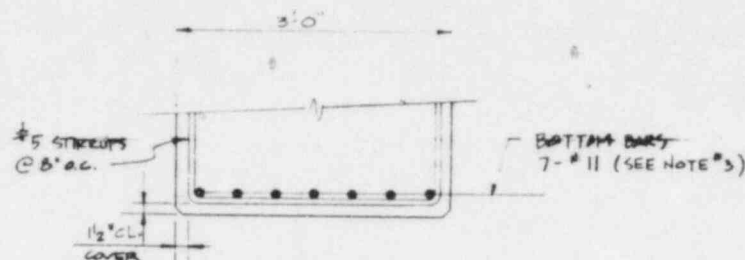
STRUCTURAL COMPONENT BEAM 3B-18, ELEV 501'-0", CONC/REINF BY CONTRACT 6426 (SEE SKETCH NO. SK 6)

SHEET 2 OF 2

REINFORCEMENT REQUIRED BY ORIGINAL DESIGN AND SHOWN ON DESIGN DRAWINGS	REINFORCEMENT REQUIRED BY ANALYSIS FOR MOST CRITICAL OPERATING/SSE LOAD CONDITION	AS-BUILT CONDITIONS (SEE SKETCH NOTED)			DISCREPANCIES
		LOCATION OF EXCAVATION	BOTTOM BARS EXPOSED	DOWELS EXPOSED	
<u>SECTION C-C</u>	<u>SECTION C-C</u>				<u>ALL EXCAVATIONS</u>
Bottom Bars: 24-#11 in 3 layers	Bottom Bars: 17-#11 in 3 layers	5'-0" East of column line 7.7	8-#11	7-#11	
Bottom Bar Dowels: 8-#11 into bioshield walls	Bottom Bar Dowels: 5-#11 into bioshield wall (code minimum)				
Top Bars: 8-#10	Top Bars: 8-#10				
<u>SECTION D-D</u>	<u>SECTION D-D</u>				
Bottom Bars: 8-#11	Bottom Bars: 8-#11	3'-3" East of column line 8.3	8-#11	-	
Bottom Bar Dowels: No dowels required at supporting beam	Bottom Bar Dowels: None required				
Top Bars: 16-#10 in 2 layers	Top Bars: 8-#10				
RESOLUTION OF DISCREPANCIES:				COMMENT:	
3) The orientation of lap splices was not clearly defined on the placement drawings and was left to the contractor. Lap splices can be in either plane. This does not represent a discrepancy.					



LOCATION PLAN



BEAM 4B30 (3'-0" x 3'-0")

SEE NOTE #2 & 3

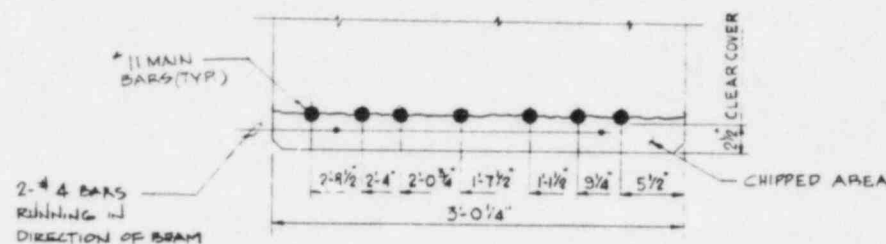
(CONCEPTUAL LAYOUT OF BEAM STEEL)

NOTES:

1. AS-BUILT MEASUREMENT VERIFIED BY P. BONNET (WASTINGHOUSE ELECTRIC CORP.) AND M. FISHER (BECHTEL POWER CORPORATION)
2. FOR DESIGN REQUIREMENTS SEE BIRNKE 5715 & 5719 FOR REBAR DETAILS SEE BETHLEHEM STEEL C-46 B3-RB-84 (BAR FILE # 5305-00-7144)
3. #11 MAIN BOTTOM BARS EXTEND DIRECTLY INTO SUPPORTS AT EACH END. DOWNEELS NOT REQUIRED.

REV	DESCRIPTION	CHK	DATE	BPC	APPROVED
1	ADDED DIMENSION AND NOTE	WNP	10/1/83	N/A	N/A

AS-BUILT



SECTION A-A

BEAM 4B30

AS-BUILT VERIFICATION

BY DRI BPC (W)

ENGR. JMM MMS WVB

DATE 10/1/83 10/1/83

WNP	CHK	APPROVED	WNP-2	SK-7	REV
					1

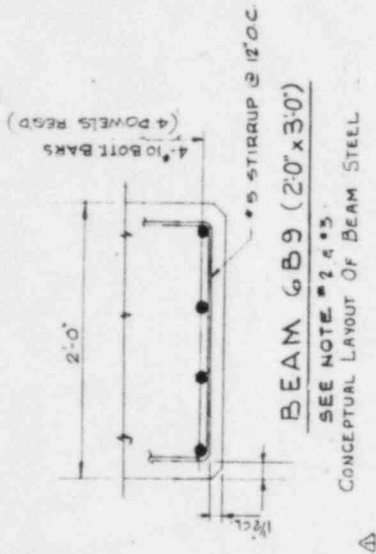
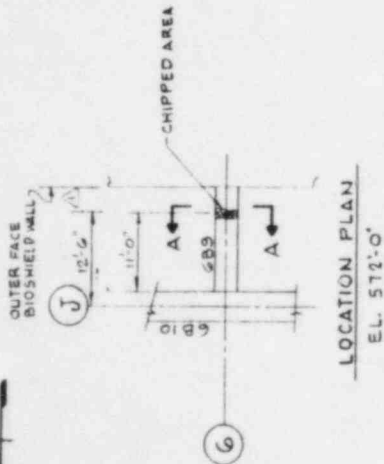
Appendix C

STRUCTURAL COMPONENT BEAM 4B30, ELEV 522'-0", CONC/REINF BY CONTRACT 206A (SEE SKETCH NO. SK 7)

SHEET 1 OF 1

REINFORCEMENT REQUIRED BY ORIGINAL DESIGN AND SHOWN ON DESIGN DRAWINGS	REINFORCEMENT REQUIRED BY ANALYSIS FOR MOST CRITICAL OPERATING/SSE LOAD CONDITION	AS-BUILT CONDITIONS (SEE SKETCH NOTED)			DISCREPANCIES
		LOCATION OF EXCAVATION	BOTTOM BARS EXPOSED	DOWELS EXPOSED	
<u>SECTION A-A</u>	<u>SECTION A-A</u>				<u>ALL EXCAVATIONS</u>
Bottom Bars: 7-#11	Bottom Bars: 2-#11	4'-9" North of column line H.7	7-#11	None - Main bottom bars extend di- rectly into supports.	1) 1 1/2" aggregate concrete was substituted for 3/4" aggregate concrete (required by specifica- tion) without a Request for In- formation.
Top Bars: 5-#11	Top Bars: 3-#11				
RESOLUTION OF DISCREPANCIES:				COMMENT:	
1) Excavation demonstrated that the concrete is fully consolidated, as evidenced by aggregate penetration, especially into the bottom corners of the beam, and that the concrete is tightly bonded to rebars. It is apparent that the use of 1 1/2 inch aggregate did not adversely affect concrete placement.				1) Beam 4B30 has been reanalyzed and checked and found to be structurally adequate. 2) Bar sizes and dimensions shown on as-built sketch SK-7 have been verified.	

N

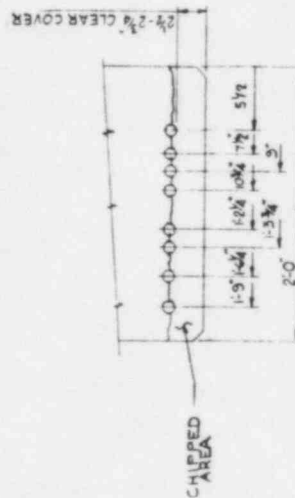


NOTES:

- 1) AS-BUILT MEASUREMENTS - EXISTING BY SONNET/CHICAGO POWER CORP. (SEE ATTACHED PHOTOGRAPH AND W-1 FISHER (SACATEL POWER CORP.))
- 2) FOR DESIGN REQUIREMENT SEE MPD063 5721 5749 & 5750. FOR REBAR DETAILS SEE BETHLEHEM STEEL D403 85-08-15 (BETHLEHEM STEEL D403 85-08-15) (BETHLEHEM STEEL D403 85-08-15) (BETHLEHEM STEEL D403 85-08-15)
- 3) CONCEPTUAL PLACEMENT OF CONCRETE SEE D403 85-08-15

REV	DESCRIPTION	DATE	BY	CHKD	APPROVED
1	ADDED #10 #9 LOC. PLAN	08/01/00	WJ	WJ	WJ
	ADDED NOTE				

AS-BUILT



SECTION A-A

BEAM GB9

AS-BUILT VERIFICATION	
BY	DATE
WJ	08/01/00
CHKD	08/01/00
APPROVED	08/01/00
WJ	08/01/00
CHKD	08/01/00
APPROVED	08/01/00

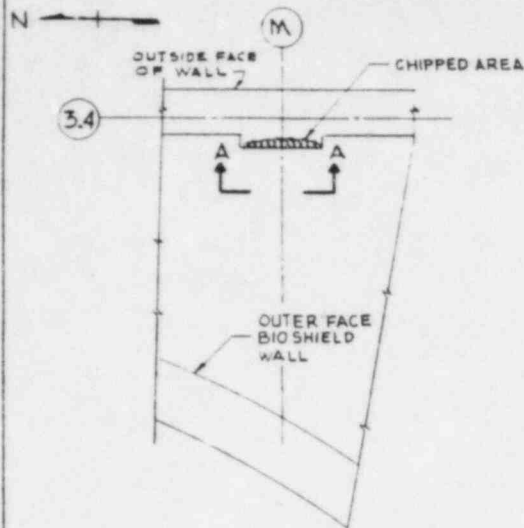
WJ	CHKD	APPROVED	DATE	BY	CHKD	APPROVED
WJ	WJ	WJ	08/01/00	WJ	WJ	WJ
CHKD	CHKD	CHKD	08/01/00	CHKD	CHKD	CHKD
APPROVED	APPROVED	APPROVED	08/01/00	APPROVED	APPROVED	APPROVED

Appendix C

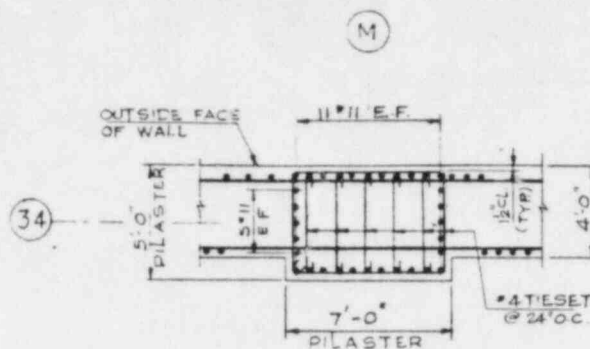
STRUCTURAL COMPONENT BEAM 6B9, ELEV 572'-0", CONC/REINF BY CONTRACT 206A (SEE SKETCH NO. SK 8)

SHEET 1 OF 1

REINFORCEMENT REQUIRED BY ORIGINAL DESIGN AND SHOWN ON DESIGN DRAWINGS	REINFORCEMENT REQUIRED BY ANALYSIS FOR MOST CRITICAL OPERATING/SSE LOAD CONDITION	AS-BUILT CONDITIONS (SEE SKETCH NOTED)			DISCREPANCIES
		LOCATION OF EXCAVATION	BOTTOM BARS EXPOSED	DOWELS EXPOSED	
<u>SECTION A-A</u>	<u>SECTION A-A</u>				<u>ALL EXCAVATIONS</u>
Bottom Bars: 4-#10	Bottom Bars: 2-#10	12'-6" South of column line J	4-#10	4-#10	1) Rebar spacing deviation.
Bottom Bar Dowels: 4-#10 into bioshield wall	Bottom Bar Dowels: 1-#10 (code minimum)				2) 1 1/2" aggregate was substituted for 3/4" aggregate without a Re- quest for Information.
Top Bars: 5-#10	Top Bars: 2-#10				
RESOLUTION OF DISCREPANCIES:				COMMENT:	
1) The deviation in spacing would be acceptable if the concrete were adequately consolidated. The concrete is fully consolidated and the concrete is tightly bonded to the rebar. The deviation is acceptable.				1) Beam 6B9 has been reanalyzed and checked and found to be structurally adequate.	
2) Excavation demonstrated that the concrete is fully consolidated; specifically, that there was good penetration of large aggregate through rebars and that the concrete was tightly bonded to the rebars. It is apparent that the use of 1 1/2 inch aggregate did not adversely affect concrete placement.				2) Dimensions and bar sizes shown on as-built sketch SK-8 have been verified.	

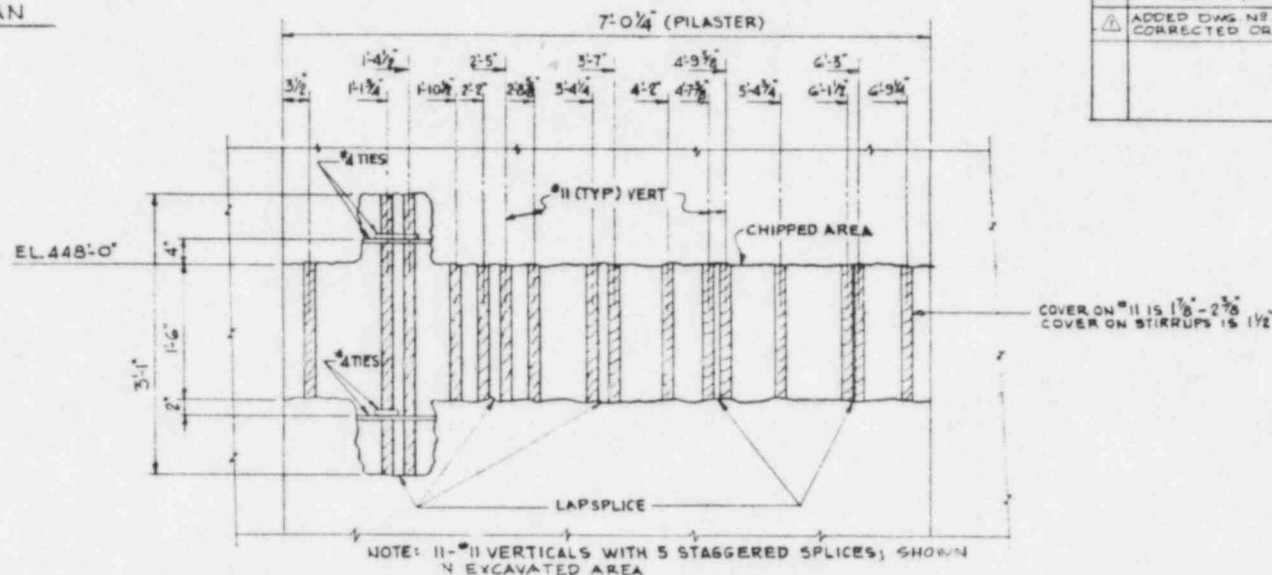


LOCATION PLAN



PILASTER/Col. 34 & M

(SEE NOTE # 2)
(CONCEPTUAL LAYOUT OF PILASTER STEEL)



VIEW A-A
(AS BUILT)

NOTES:

- 1) AS-BUILT MEASUREMENTS VERIFIED BY P. BONNET (WESTINGHOUSE ELECTRIC CORPORATION) AND M. FISHER (BECHTEL POWER CORP.)
- 2) FOR DESIGN REQUIREMENT SEE 54RDW66 ST06, ST08, SECT. 117) & 5743, FOR REBAR DETAIL SEE BETHLEHEM STEEL DWG BS-RE-64/SER FILE # 000-00-2486, AND SLMORE STL CONT'S DWG ST02-#3 (BCH FILE # 205-00-0007)

REV	DESCRIPTION	DATE	BY	CHK	APP	APPROVED
1	ADDED DWG. NO. 5 NOTE CORRECTED ORIENTATION	10/1/83	WNP	SK	WNP	WNP

PILASTER/COLUMN
AT 34 & M

AS-BUILT VERIFICATION

BY BRI RPC (W)

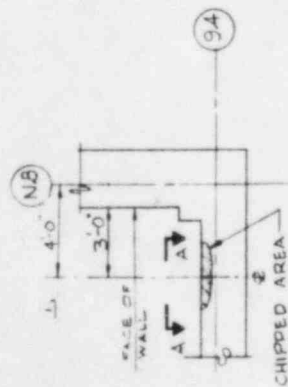
ENGR. / 1/1/83 1/2/83

DWG	CHK	APPROVED	DATE	BY	CHK	APP	REV
WNP-2	SK-9	1/16/83	1/16/83	WNP	SK	WNP	1

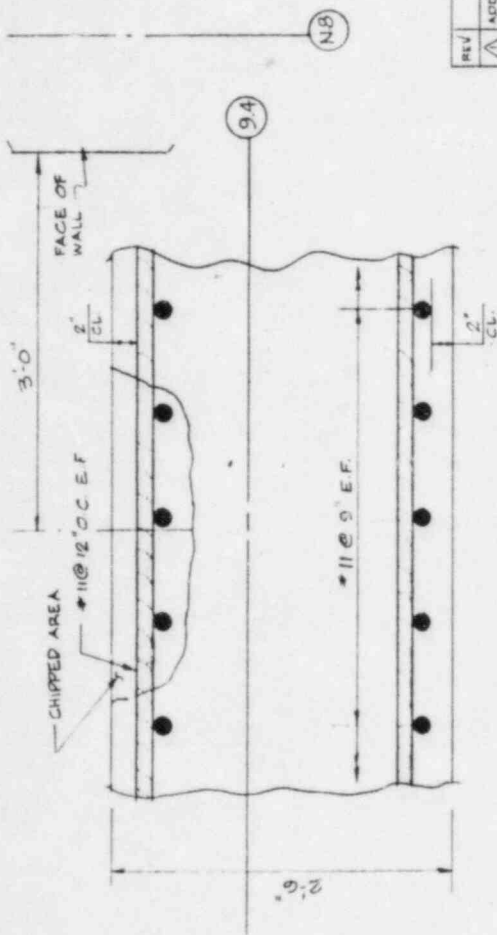
Appendix C

STRUCTURAL COMPONENT PILASTER/COLUMN, EVEL. 448'-0" CONC/REINF BY CONTRACT 206 (SEE SKETCH NO. SK 9) SHEET 1 OF 1

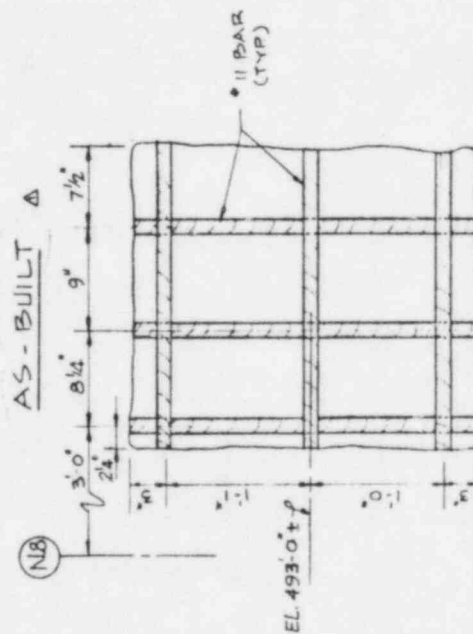
REINFORCEMENT REQUIRED BY ORIGINAL DESIGN AND SHOWN ON DESIGN DRAWINGS	REINFORCEMENT REQUIRED BY ANALYSIS FOR MOST CRITICAL OPERATING/SSE LOAD CONDITION	AS-BUILT CONDITIONS (SEE SKETCH NOTED)			DISCREPANCIES
		LOCATION OF EXCAVATION	BARS EXPOSED	DOWELS EXPOSED	
<u>VIEW A-A</u> Column Bars: 11-#11 in each 7'-0" face Ties: #4 at 24' O.C.	Same as original design	Column M-3.4 at elev. 448'-0"	<u>VIEW A-A</u> 11-#11 with alternate staggered lap splice	N/A	<u>ALL EXCAVATIONS</u> None
RESOLUTION OF DISCREPANCIES:				COMMENT:	
N/A				1) Excavation demonstrated that the concrete is fully consolidated and tightly bonded to the rebar. 2) The dimensions and bar sizes shown on as-built sketch SK-9 have been reverified.	



KEY PLAN @ EL. 492'-6"
STAIRWAY (A-G) REACTOR BLDG.



PART PLAN OF WEST WALL (SOUTH END)
(SEE NOTE #2.)
A CONCEPTUAL LAYOUT OF WALL STEEL.



ELEVATION VIEW A-A
CLEAR COVER VARIES ON HORIZONTAL
BARS FROM $1\frac{1}{2}$ " TO 2 $\frac{3}{4}$ "

NOTES:-
AS-BUILT
VERIFIED BY
INVESTING HO
CORPORATION
W. FISHER (S
CORPORATION

REFER BER DWG.
\$737 5738 (ECT. 535)
\$749 5756 AND
VENDOR'S DWG BS-RB-34
BETH STL DWG WITH BER
FILE # 6809-00-7136)

REV	DESCRIPTION	DATE	BY	APPROVED
1	ADDED DIM 2 NOTE	NO 10/10/10	JA	OK

OWN	CHECK	APPROVED
✓	Jen	J. C. Gower 8/16/12
DATE RECEIVED	SIGNATURE	REMARKS
8/16/12	JEN	WHP-2 SK ID
BY DATE TIME	LOCATION	AS-BUILT VERIFICATION
BY JDR/BPC WJ	CHURCH LANE WFB	
WEST EXT. WALL.		

Appendix C

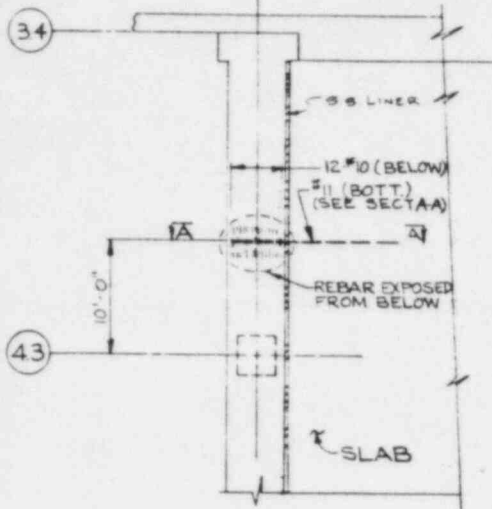
STRUCTURAL COMPONENT WEST EXTERIOR WALL ELEV. 493'-0", CONTRACT 6426 (SEE SKETCH NO. SK. 10)

SHEET 1 OF 1

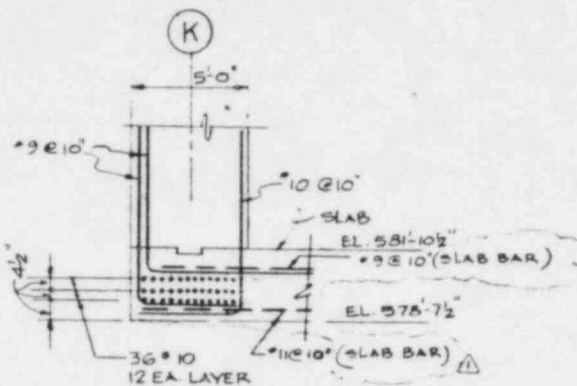
REINFORCEMENT REQUIRED BY ORIGINAL DESIGN AND SHOWN ON DESIGN DRAWINGS	REINFORCEMENT REQUIRED BY ANALYSIS FOR MOST CRITICAL OPERATING/SSE LOAD CONDITION	AS-BUILT CONDITIONS (SEE SKETCH NOTED)			DISCREPANCIES
		LOCATION OF EXCAVATION	BARS EXPOSED	DOWELS EXPOSED	
<u>ELEVATION VIEW A-A</u>			<u>ELEV VIEW A-A</u>		<u>ALL EXCAVATIONS</u>
(Interior face) Vertical Bars: #11 at 9" O.C. each face Horizontal Bars: #11 at 12" O.C. each face	Same as original design	Interior face of wall on column line 9.4, 4'-0" North of column line N.8	(Interior face) Ver- tical Bars: #11 at 9" O.C. Horizontal Bars: #11 at 12" and 13" O.C.	N/A	None
RESOLUTION OF DISCREPANCIES:				COMMENT:	
N/A				1) West exterior wall has been reanalyzed and checked and found to be structurally adequate. 2) Exposed concrete is adequately consolidated with some evidence of very minor air pockets. The concrete is tightly bonded to the rebar. 3) Dimensions and bar sizes shown on as-built sketch SK-10 have been verified.	

N

K

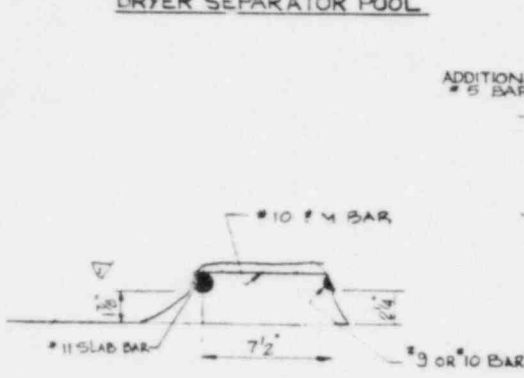


LOCATION PLAN
DRYER SEPARATOR POOL

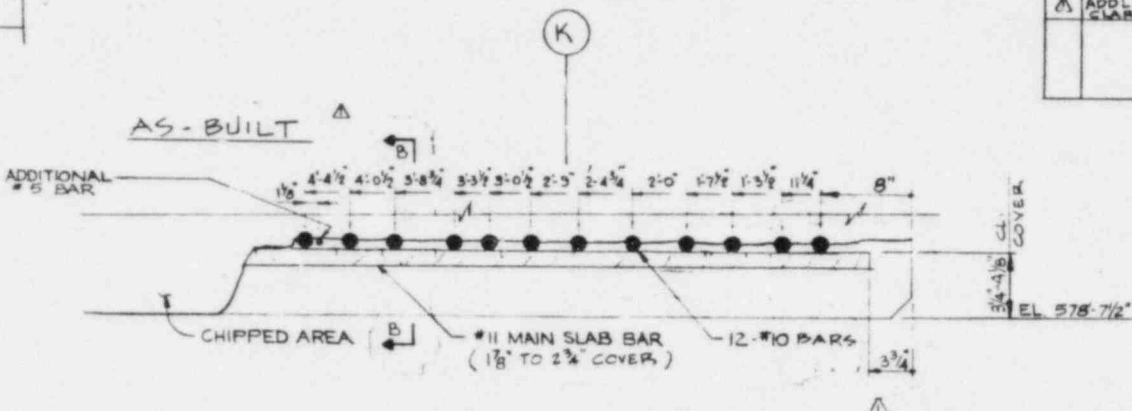


CONCEPTUAL LAYOUT OF WALL/BEAM STEEL
(REF. SECT 567-567 BAR DWG 5724)
(SEE NOTE 2 & 3)

REV	DESCRIPTION	OWN	CHK	DRI	APC	APPROVED
1	ADD CHIPPING & GENERAL SLABIFICATION	NO	1/16	1/16	1/16	1/16



SECT. B-B
(AS BUILT)



SECTION A-A

NOTES:

- 1) AS-BUILT MEASUREMENTS VERIFIED BY P. BONNET (WESTING HOUSE ELECTRIC CORP) AND M. FISHER (BECHTEL POWER CORP)
- 2) FOR DESIGN REQUIREMENT SEE BAR DWG 5724/5725 FOR REBAR DETAILS SEE BETHLEHEM STEEL DWG 88-RE-1150 & 88-AB-115A (ON FILE # 8809-00-017 & 8809-00-016)
- 3) MAIN BARS BOTTOM-EXTEND DIRECTLY INTO SUPPORTS EACH END NO DOWELS REQUIRED

DRYER-SEPARATOR POOL

AS-BUILT VERIFICATION

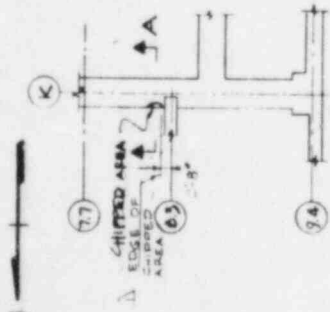
BY	DRI	APC	W
ENG	1/16	1/16	1/16

OWN	CHK	APPROVED	DATE	WNP-2	SK-11	REV
1/16	1/16	1/16	1/16	1/16	1/16	1

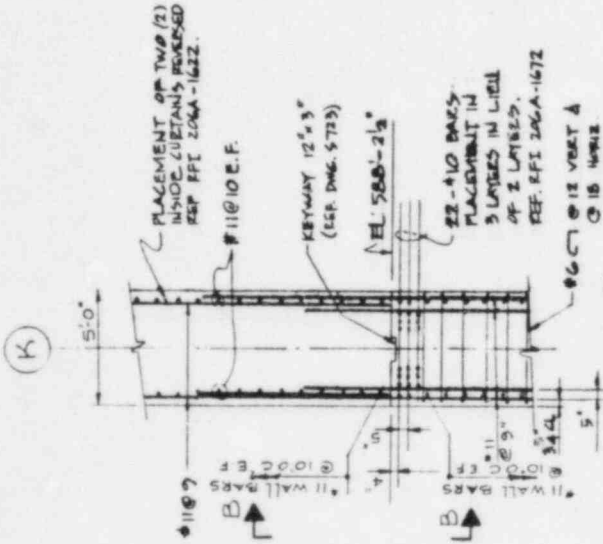
Appendix C

STRUCTURAL COMPONENT DRYER-SEPARATOR POOL WALL, ELEV 578'-7 1/2", CONTRACT 206A (SEE SKETCH NO. SK-11) SHEET 1 OF 1

REINFORCEMENT REQUIRED BY ORIGINAL DESIGN AND SHOWN ON DESIGN DRAWINGS	REINFORCEMENT REQUIRED BY ANALYSIS FOR MOST CRITICAL OPERATING/SSE LOAD CONDITION	AS-BUILT CONDITIONS (SEE SKETCH NOTED)			DISCREPANCIES
		LOCATION OF EXCAVATION	BOTTOM BARS EXPOSED	DOWELS EXPOSED	
<u>SECTION A-A & B-B</u>	<u>SECTION A-A & B-B</u>				<u>ALL EXCAVATIONS</u>
Beam Bottom Bars: 36-#10 in 3 layers	Beam Same as original design	On column line K 10'-0" East of column line 4.3	Beam Bottom Bars: 12-#10 in bottom layer	N/A	None
Slab Bottom Bars: #11 at 10" O.C. each way	Slab Same as original design		Slab 1-#11 and 1-#9 (or #10) bars were ex- posed		
RESOLUTION OF DISCREPANCIES:				COMMENT:	
N/A				1) No discrepancies noted, therefore, no reanalysis is required. The bar spacing is acceptable. 2) Dimensions and bar sizes shown on as-built sketch SK-11 have been verified. 3) Excavation demonstrated that exposed concrete is adequately consolidated and tightly bonded to the rebar.	

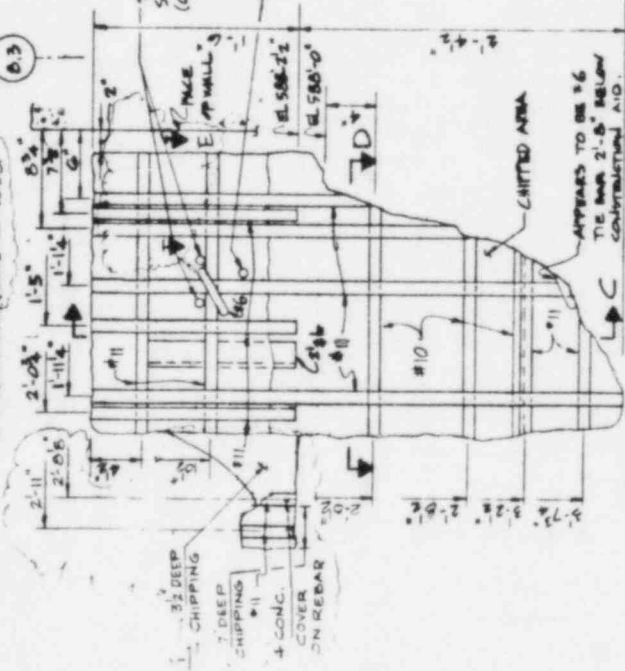


LOCATION PLAN
(REF. DWG 5723)

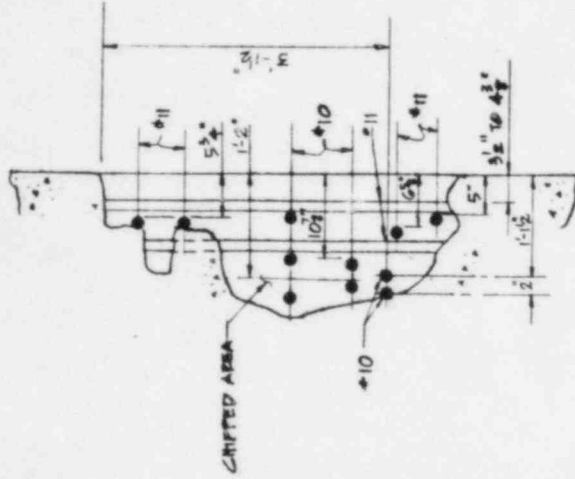


CONCEPTUAL LAYOUT OF WALL STEEL

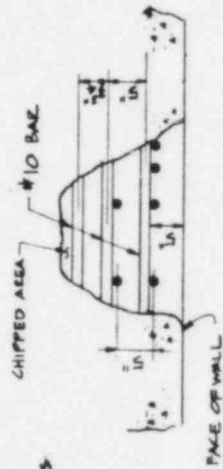
SECTION A-A
PVC 03-18-14 D (6809-00-2095)



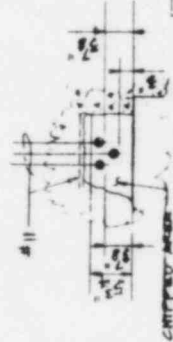
SECTION B-B (AS BUILT)



SECTION C-C



SECTION D-D



SECTION E-E

NOTE:

1. AS BUILT MEASUREMENT
VERIFIED BY R. ROBERT
(MONTGOMERY ELECTRIC
CORPORATION) AND
M. FISHER (BOCATTEL
PAVING CORPORATION)
2. FOR DESIGN REQUIREMENT
SEE PER DWG. 5723
AND REBAR DETAIL
DWG. SEE DETN. STD. DWG.
25 PER 114D (B.C. 212)
*4809-00-0095

[illegible]

Appendix C

STRUCTURAL COMPONENT FUEL POOL WALL ELEV. 588'-2 1/2", CONC/REINF BY CONTRACT 206A (SEE SKETCH NO. SK-12) SHEET 1 OF 2

REINFORCEMENT REQUIRED BY ORIGINAL DESIGN AND SHOWN ON DESIGN DRAWINGS	REINFORCEMENT REQUIRED BY ANALYSIS FOR MOST CRITICAL OPERATING/SSE LOAD CONDITION	AS-BUILT CONDITIONS (SEE SKETCH NOTED)			DISCREPANCIES
		LOCATION OF EXCAVATION	BARS EXPOSED	DOWELS EXPOSED	
<u>SECTION A-A</u>	<u>SECTION A-A</u>				<u>ALL EXCAVATIONS</u>
Vertical: Outer layer: #11 at 9" O.C., lap splices start at Elev 588'- 2 1/2" Inner Layer: #11 at 9" O.C., up to Elev 599'-10 1/2" +/-	Same as original design	On column line K 2'-8" East of column line 8.3	Vertical: #11 2 layers see SK-12		1) The 22-#10 bars were not placed in accordance with RFI 206A-1672.
Horizontal Bars: #11 at 10" O.C. each face	Same as original design		Horizontal: #11-1 layer see SK-12		2) Bar spacing in Section E-E, (SK-12).
Additional Bars: 22-#10 as a con- struction aid during placing of concrete in the upper wall above Elev 588'- 2 1/2"	Additional Bars: At construction joint: Not required		Additional Bars: 7-#10 exposed		3) NRC CAT Representative noted that third layer of relocated 22-#10 bars was not visible as directed in answer to contractors Request for Information 206A-1672.
RESOLUTION OF DISCREPANCIES:				COMMENT:	
1) RFI 206A-1672 permitted contractor to revise placement of the 22-#10 bars from 2 layers to 3 layers (of 8, 8 and 6 bars) in order to provide access through the middle of the wall for tremie and vibrator use. The depth of the excavation for the #10 bars is approximately one-fourth the width of the wall (60 inches). Ex- trapolation of this quantity would provide reasonable assurance that 22-#10 bars were placed.				1) The fuel pool wall has been reanalyzed and checked and is structurally adequate.	
2) The spacing deviation would be acceptable provided that concrete was adequately consolidated around the bars. Excavation demon- strated that the exposed concrete is fully consolidated and is tightly bonded to the rebar.				2) Subsequent to the NRC Representative's visit, placement procedures were discussed with the Foreman of reinforcing during concrete placement. He indicated that the bars were relocated to provide access for a tremie in order to properly place the concrete in the wall below the bars.	

Appendix C

STRUCTURAL COMPONENT FUEL POOL WALL ELEV. 588'-2 1/2", CONC/REINF BY CONTRACT 206A (SEE SKETCH NO. SK-12) SHEET 2 OF 2

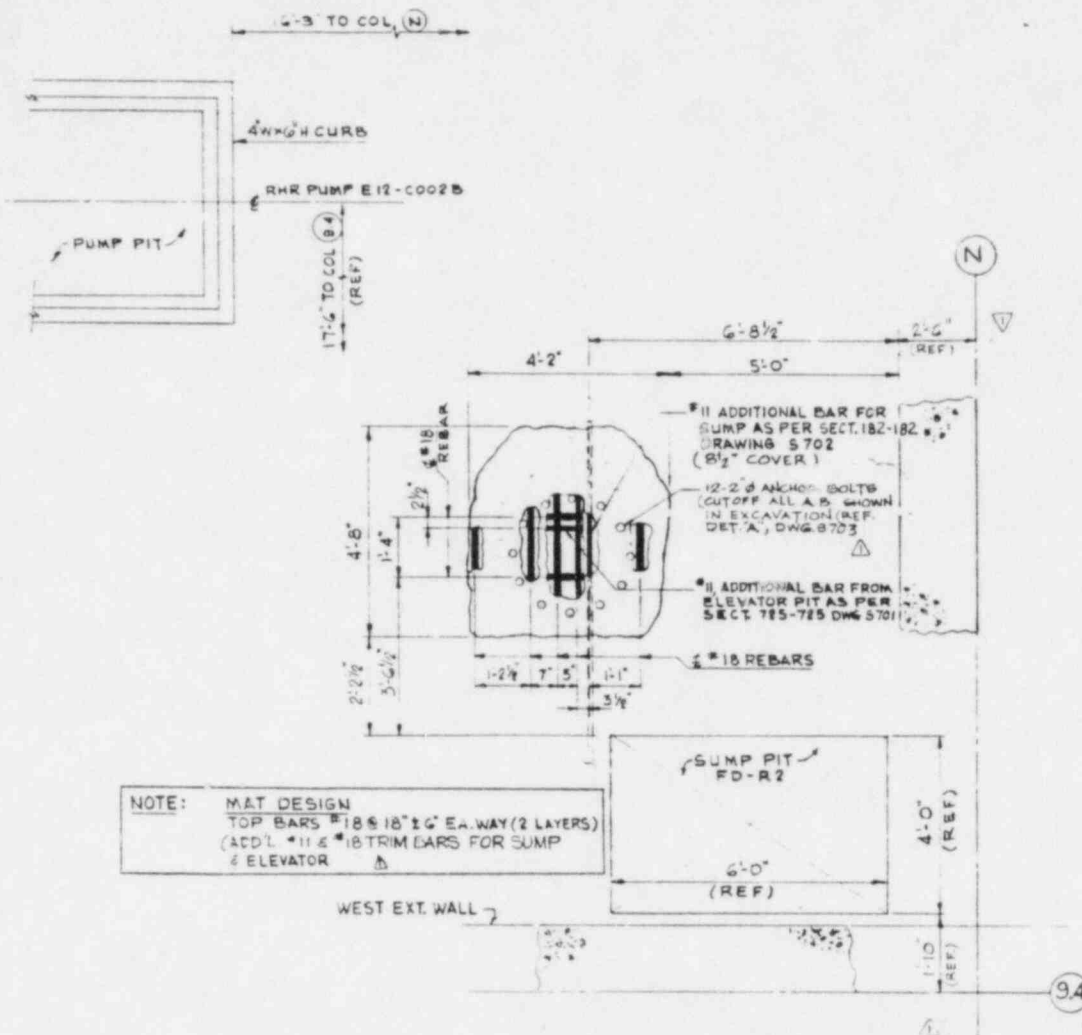
REINFORCEMENT REQUIRED BY ORIGINAL DESIGN AND SHOWN ON DESIGN DRAWINGS	REINFORCEMENT REQUIRED BY ANALYSIS FOR MOST CRITICAL OPERATING/SSE LOAD CONDITION	AS-BUILT CONDITIONS (SEE SKETCH NOTED)			DISCREPANCIES
		LOCATION OF EXCAVATION	BARS EXPOSED	DOWELS EXPOSED	
RESOLUTION OF DISCREPANCIES:				COMMENT:	
3) Excavation subsequent to the NRC CAT Representative visit exposed the third layer of #10 bars as shown on as-built sketch SK-12.				3) Excavation demonstrated that the exposed concrete is adequately consolidated and is tightly bonded to the rebars.	
				4) Dimensions and bar sizes shown on as-built sketch SK-12 have been verified.	

NOTES:

AS-BUILT MEASUREMENTS
VERIFIED BY R. BONNET
ESTINGHOUSE ELECTRIC
CORPORATION) AND M. FISHER
SCHETEL POWER (CORP.)

FOR DESIGN REQUIREMENT:
SEE BWP DWG. 8701-#701-#703
FOR REBAR DETAIL SEE
SLMORE STL CONT. DWG
8702-#6 (BLC FILE #
25-00-0010) & 8702-#7
BLC FILE # 205-00-0011.

N



AS-BUILT NOTE

COVER FOR W-S#8 BARS IS 3 3/8"
COVER FOR E-W#8 BARS IS 7 3/8"-7 1/4"

REV	DESCRIPTION	DATE	CHK	BY	APP	APPROVED
1	ADDED A.B. #8 BARS CLARIFIED #11 BAR PICTORIALLY	10/15/15	WNP	SK	13	REV 1

NOTE: MAT DESIGN
TOP BARS #18 @ 18" EA. WAY (2 LAYERS)
(ADDL. #11 & #18 TRIM BARS FOR SUMP
& ELEVATOR)

PART PLAN @ EL. 422'-3"

(FOUNDATION MAT)

AS-BUILT

FOUNDATION MAT
EL. 422'-3"

AS-BUILT VERIFICATION

BY BAI BPC (W)

ENGR. 10/15/15

DATE 10/15/15

DWN. CHK. APPROVED

RAK 10/15/15

WNP-2 SK-13

REV 1

Appendix C

STRUCTURAL COMPONENT FOUNDATION MAT, ELEV. 422'-3", CONC/REINF BY CONTRACT 205 (SEE SKETCH NO. SK-13)

SHEET 1 OF 1

REINFORCEMENT REQUIRED BY ORIGINAL DESIGN AND SHOWN ON DESIGN DRAWINGS	REINFORCEMENT REQUIRED BY ANALYSIS FOR MOST CRITICAL OPERATING/SSE LOAD CONDITION	AS-BUILT CONDITIONS (SEE SKETCH NOTED)			DISCREPANCIES
		LOCATION OF EXCAVATION	BOTTOM BARS EXPOSED	DOWELS EXPOSED	
PART PLAN AT ELEV. 422'-3" Top bars: #18 at 18" +/- 6" O.C. each way Additional #11 and #18 bars around openings and at faces of sump and elevator pit.	Same as original design	5'-0" North of north face of wall on column line N and 8'-0 1/2" East of column line 9.4	Top bars: E-W: #18 at 14 1/2", 7", 5" and 16 1/2" O.C. N-S: #18 at 16" O.C. Additional #11 E-W bar from North face of sump and #11 N-S bar from elevator pit.	N/A	<u>ALL EXCAVATIONS</u> 1) Spacing deviation between E-W bars partly due to need to avoid inter- ference with 12-2 inch diameter anchor bolts in a 30 inch diameter bolt circle. 2) NRC Construction Appraisal Team identified one #11 sump face re- bar as not located in accordance with concrete shop drawing.
RESOLUTION OF DISCREPANCIES:				COMMENT:	
1) The spacing deviation would be acceptable provided that concrete was adequately consolidated around the bars. Excavation demon- strated that the exposed concrete is fully consolidated and is tightly bonded to the rebar. 2) Both the design drawing and the shop drawing called for a vertical configuration of #11 sump face bars but neither dimensioned their location. The location of the top #11 is acceptable for design, therefore, the discrepancy is resolved.				1) The dimensions and bar sizes shown on as-built sketch SK-13 have been verified.	

Appendix C

STRUCTURAL COMPONENT FOUNDATION MAT, ELEV 422'-3", CONC/REINF BY CONTRACT 205 (SEE SKETCH NO. SK 14)

SHEET 1 OF 1

REINFORCEMENT REQUIRED BY ORIGINAL DESIGN AND SHOWN ON DESIGN DRAWINGS	REINFORCEMENT REQUIRED BY ANALYSIS FOR MOST CRITICAL OPERATING/SSE LOAD CONDITION	AS-BUILT CONDITIONS (SEE SKETCH NOTED)			DISCREPANCIES
		LOCATION OF EXCAVATION	BARS EXPOSED	DOWELS EXPOSED	
PART PLAN AT ELEV. 422'-3" Top bars: #18 at 18" +/- 6" O.C. each way	Same as original design	5'-3" East of column line 7 and 3'-9" South of south face of wall on column line N	Top bars E-W" #18 at 1'-8" O.C. N-S: #18 at 1'-7" O.C.	N/A	None
RESOLUTION OF DISCREPANCIES:					ALL EXCAVATIONS
N/A					COMMENT:
					1) The exposed concrete is fully consolidated and is tightly bonded to the rebar.
					2) The dimensions and bar sizes shown on as-built sketch SK-14 have been verified.

FOUNDATION MAT EL. 422.3'	AS-BUILT VERIFICATION	
BY	ERT	ERC (W)
CHECK	WMM	WMS
DATE	10/16/19	10/16/19
APPROVED	WMP-2	SK-15
DATE	10/16/19	
BY	for	REV

Appendix C

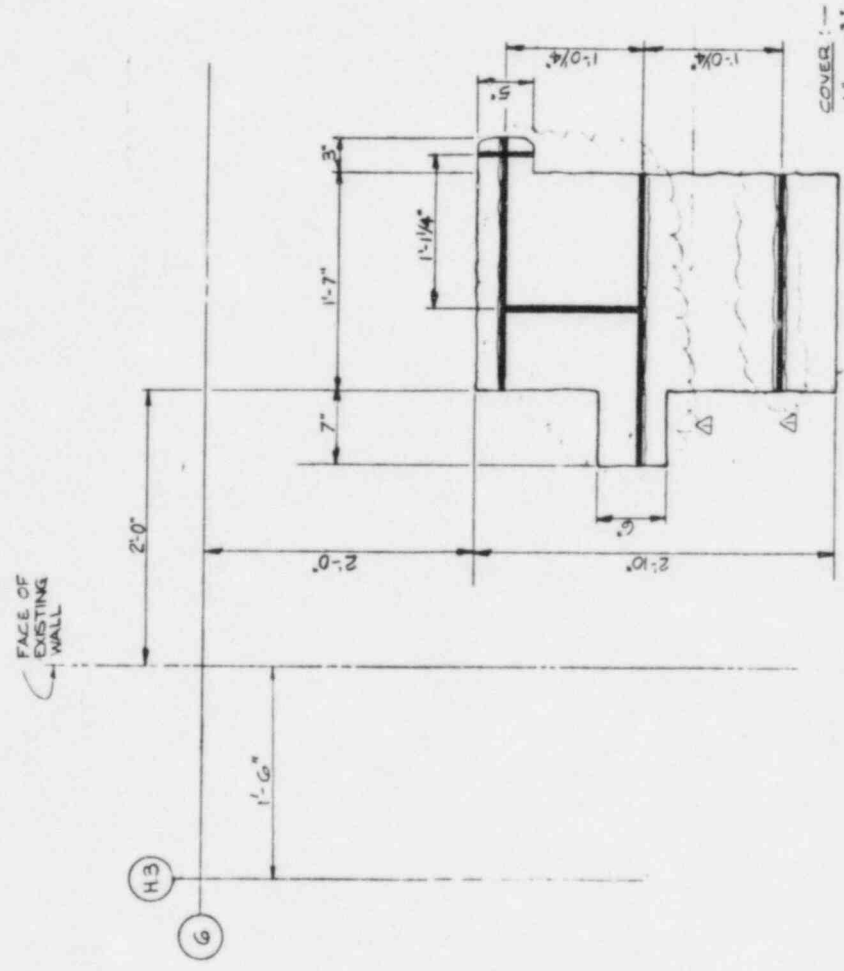
STRUCTURAL COMPONENT FOUNDATION MAT, ELEV 422'-3" CONC/REINF BY CONTRACT 205 (SEE SKETCH NO. SK 15)

SHEET 1 OF 1

REINFORCEMENT REQUIRED BY ORIGINAL DESIGN AND SHOWN ON DESIGN DRAWINGS	REINFORCEMENT REQUIRED BY ANALYSIS FOR MOST CRITICAL OPERATING/SSE LOAD CONDITION	AS-BUILT CONDITIONS (SEE SKETCH NOTED)			DISCREPANCIES
		LOCATION OF EXCAVATION	BARS EXPOSED	DOWELS EXPOSED	
PART PLAN AT ELEV. 422'-3"	Same as original design	7'-6" South of column line K and 4'-6" East of east face of ex- terior wall on column line 9-4	Top bars N-S: #18 at 1'-5" O.C E-W and Additional bars at pump pit face: #18 at 5", 8" and 4 1/2"	N/A	<u>ALL EXCAVATIONS</u>
Top bars: #18 at 18" +/- 6" O.C. each way					1) Spacing deviation between #18 bars.
Additional Bars: #18 at faces of pump pit					
RESOLUTION OF DISCREPANCIES:				COMMENT:	
1) The spacing deviation would be acceptable provided that the concrete was adequately consolidated around the bars. Excavation demonstrated that the exposed concrete is fully consolidated and is tightly bonded to the rebar. Upon completion of patching, the discrepancy will have been resolved.				1) The dimensions and bar sizes shown on as-built sketch SK-15 have been verified.	



- NOTES:
- 1) AS-BUILT MEASURE - DIMENSIONS VERIFIED BY PERMANENTLY PLACED DIMENSIONING POINTS (KOLSE ELECTRIC CORP. AND M. FISHER (BECHTEL POWER CORP.))
 - 2) REFER BAR DWG. S TO S AND VENDOR'S DETAIL DWG. (S-201-3) (BETH. STL DWG. WITH S&B FILE # 206-00-3088)



SLAB DESIGN
5/8 @ 12 EA WAY (TOP)
(SEE NOTE - 2)

REV	DESCRIPTION	DATE	BY	CHK	APP	APPROVED
1	GEN. CLARIFICATION	10/1/80	NA	NA	NA	NA

SLAB AT EL 471'-0"

AS-BUILT VERIFICATION					
BY	DATE	CHK	APP	APPROVED	REMARKS
BY	DATE	CHK	APP	APPROVED	REMARKS
WNP-2	SK-16				

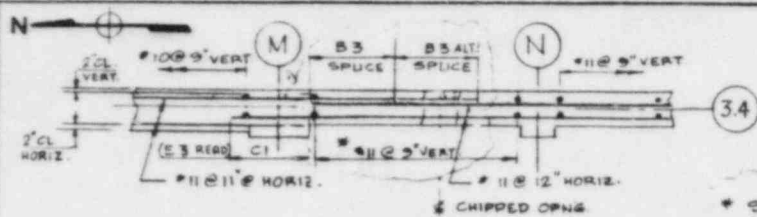
PLAN @ EL 471'-0"

Appendix C

STRUCTURAL COMPONENT FLOOR SLAB ELEV 471'-0", CONC/REINF BY CONTRACT 6426 (SEE SKETCH NO. SK-16)

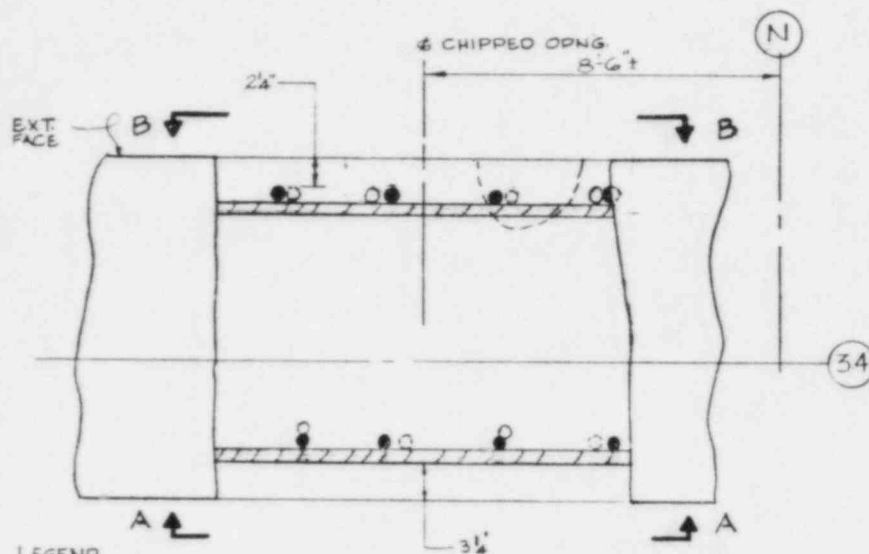
SHEET 1 OF 1

REINFORCEMENT REQUIRED BY ORIGINAL DESIGN AND SHOWN ON DESIGN DRAWINGS	REINFORCEMENT REQUIRED BY ANALYSIS FOR MOST CRITICAL OPERATING/SSE LOAD CONDITION	AS-BUILT CONDITIONS (SEE SKETCH NOTED)			DISCREPANCIES
		LOCATION OF EXCAVATION	BARS EXPOSED	DOWELS EXPOSED	
PLAN AT ELEV 471'-0" Top BARS: #6 at 12" O.C. each way	Same as original design	3'-6" South of column line H.3 and 2'-0" West of column line 6	Bottom bars: Not exposed Top bars: E-W: #6 at 1'-1 1/4" N-S: #6 at 1'-0 1/4" and 1'- 0 1/4"	N/A	None <u>ALL EXCAVATIONS</u>
RESOLUTION OF DISCREPANCIES:				COMMENT:	
N/A				1) Excavation demonstrated that exposed concrete is fully consolidated and is tightly bonded to the rebar. 2) Dimensions and bar sizes shown on as-built sketch SK-16 have been verified.	

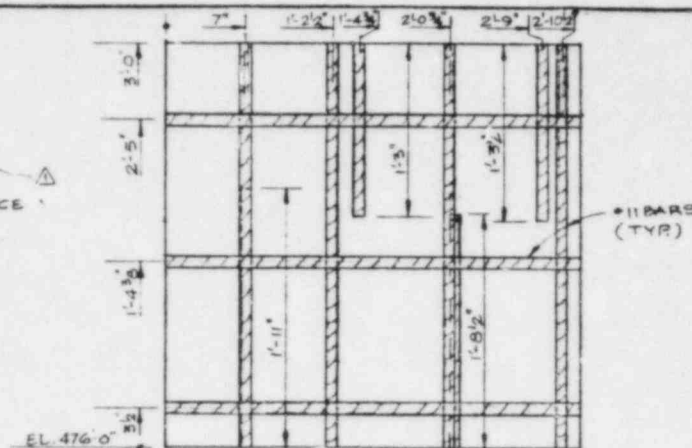


REF. BSR DWGS & APPD. DOC. 6704, 6737, 9738, 9749, 9756 AND RFI*6426-329

REF. TO REBAR DETAIL DWGS. BS-RB-6A (BSR FILE# 206-00-2696)
 BS-RB-33 (BSR FILE# 206-00-3153)



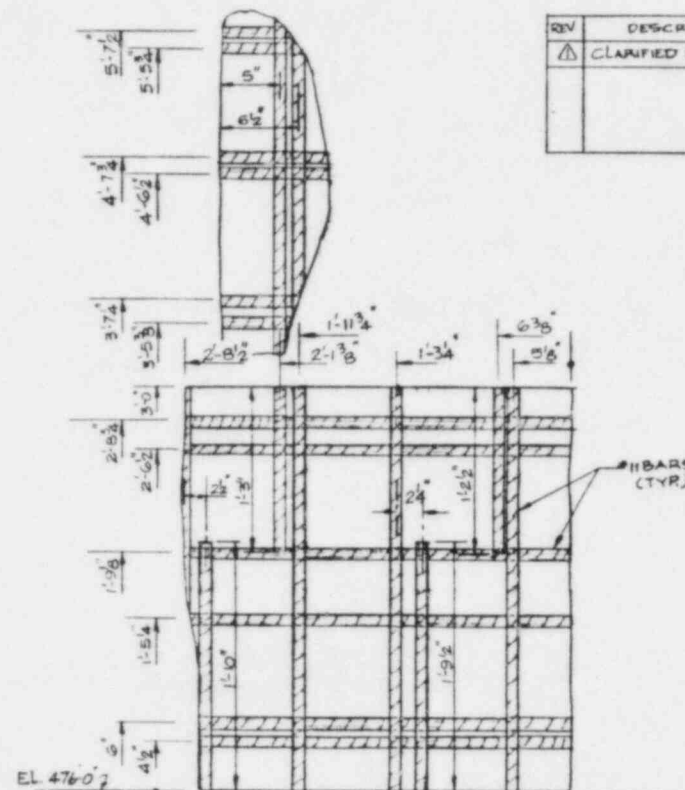
- LEGEND
- CONTINUE BAR
 - DOWEL FROM BELOW
 - DOWEL FROM TOP



NOTE:-

AS-BUILT MEASUREMENTS
 VERIFIED BY R. BONNET
 WESTINGHOUSE ELECTRIC
 CORPORATION AND
 M. FISHER (BECHTEL POWER
 CORPORATION)

REV	DESCRIPTION	CHG	CD	DATE	BY	APP	APPROVED
1	CLARIFIED KEY PLAN	1	1	1/16	1/16	1/16	1/16



EAST WALL

AS-BUILT VERIFICATION

BY	DATE	DATE	DATE	DATE	DATE	DATE	DATE
1/16	1/16	1/16	1/16	1/16	1/16	1/16	1/16

CHG: 1/16
 CD: 1/16
 DATE: 1/16
 BY: 1/16
 APP: 1/16

WAP-2 SK-17 REV 1

Appendix C

STRUCTURAL COMPONENT EAST EXTERIOR WALL ELEV 476'-0", CONC/REINF BY CONTRACT 6426 (SEE SKETCH NO. SK-17) SHEET 1 OF 1

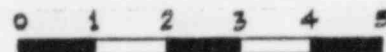
REINFORCEMENT REQUIRED BY ORIGINAL DESIGN AND SHOWN ON DESIGN DRAWINGS	REINFORCEMENT REQUIRED BY ANALYSIS FOR MOST CRITICAL OPERATING/SSE LOAD CONDITION	AS-BUILT CONDITIONS (SEE SKETCH NOTED)			DISCREPANCIES
		LOCATION OF EXCAVATION	BARS EXPOSED	DOWELS EXPOSED	
ELEVATION A-A & B-B Vertical bars: #11 at 9" O.C., each face Horizontal bars: #11 at 12" O.C. each face, south of column line M #11 at 11" O.C., North of column line M	Same as original design	On column line 3.4 and 8'-6" North of column line N (South of column line M)	INTERIOR FACE Vertical: #11 at 7 1/2" to 10 1/4" OC Horizontal: #11 at 1'- 0 5/8" to 1'-0 7/8" O.C. EXTERIOR FACE Vertical: #11 @ 1'- 0 5/8" to 1'-0 7/8" O.C. Horizontal: #11 varies from 9" to 12"	N/A	ALL EXCAVATIONS 1) During NRC CAT visit on July 25 and 26, 1983, the CAT Representa- tive postulated that every hori- zontal rebar is spliced on the exterior face. 2) "C1" splice length call-out noted at interior face is in error.
RESOLUTION OF DISCREPANCIES:				COMMENT:	
1) Vendor Drawing BS-RB-33 shows staggered laps of #11 bars spaced at 11" O.C. to #11 bars spaced at 12" O.C. As shown on sketch SK-17A (detailed layout of bars), the spacing of bars is such that some bars will not be contact or non-contact spliced. Request for Information 6426-329 was submitted by the contractor requesting technical direction to resolve the problem. In response, the engineer directed the contractor to add 2XB3 splices at such locations. The additional bars are shown on sketch SK-17B, and are the additional horizontal bars found in the excavation. These additional bars satisfy the original design intent.				1) Excavation demonstrated that the exposed concrete is fully consolidated and tightly bonded to the rebar.	
2) The use of "C1" splice (11'-9") instead of an embedment "E3" (5'-6") is conservative and does not represent a deficiency in this case.				2) Dimensions and bar sizes shown on as-built sketch SK-17 have been verified.	

LEGEND:-

CHIPPED AREA

REBARS @ 11" O.C.

REBARS @ 12" O.C.



VERT. SCALE



HORIZ. SCALE



EL. 500'-0"



156

144

132

120

108

96

84

72

60

48

36

24

12

0

EL. 471'-0" 9

PART ELEVATION OF EAST WALL

LOOKING WEST

REBARS SHOWN PER BETH. STEEL DRAWING.

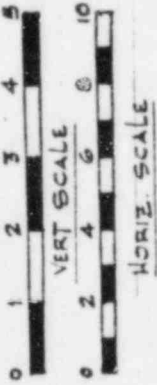
SK-

UNITED STATES

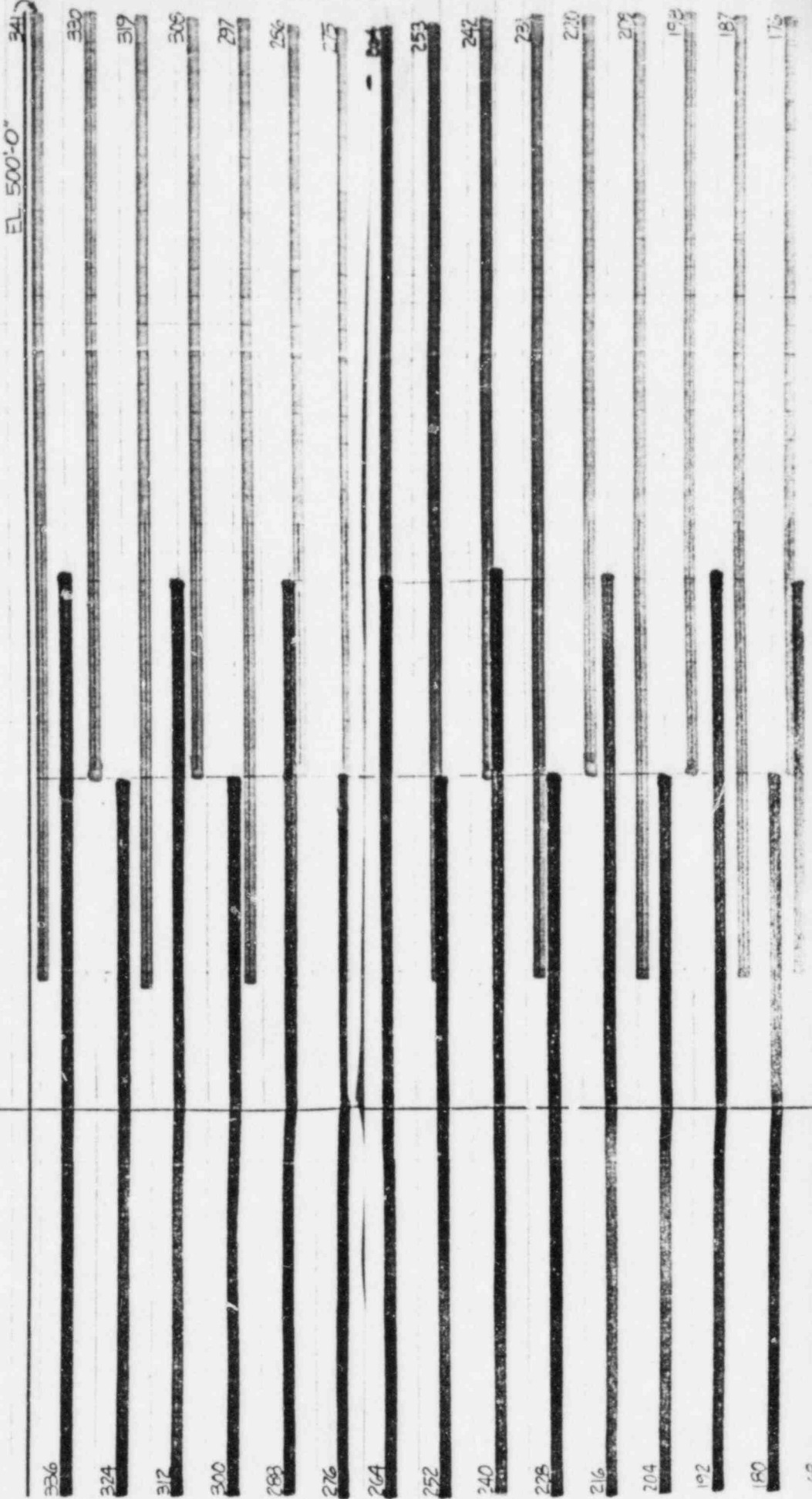
BARS @ 12" O.C.

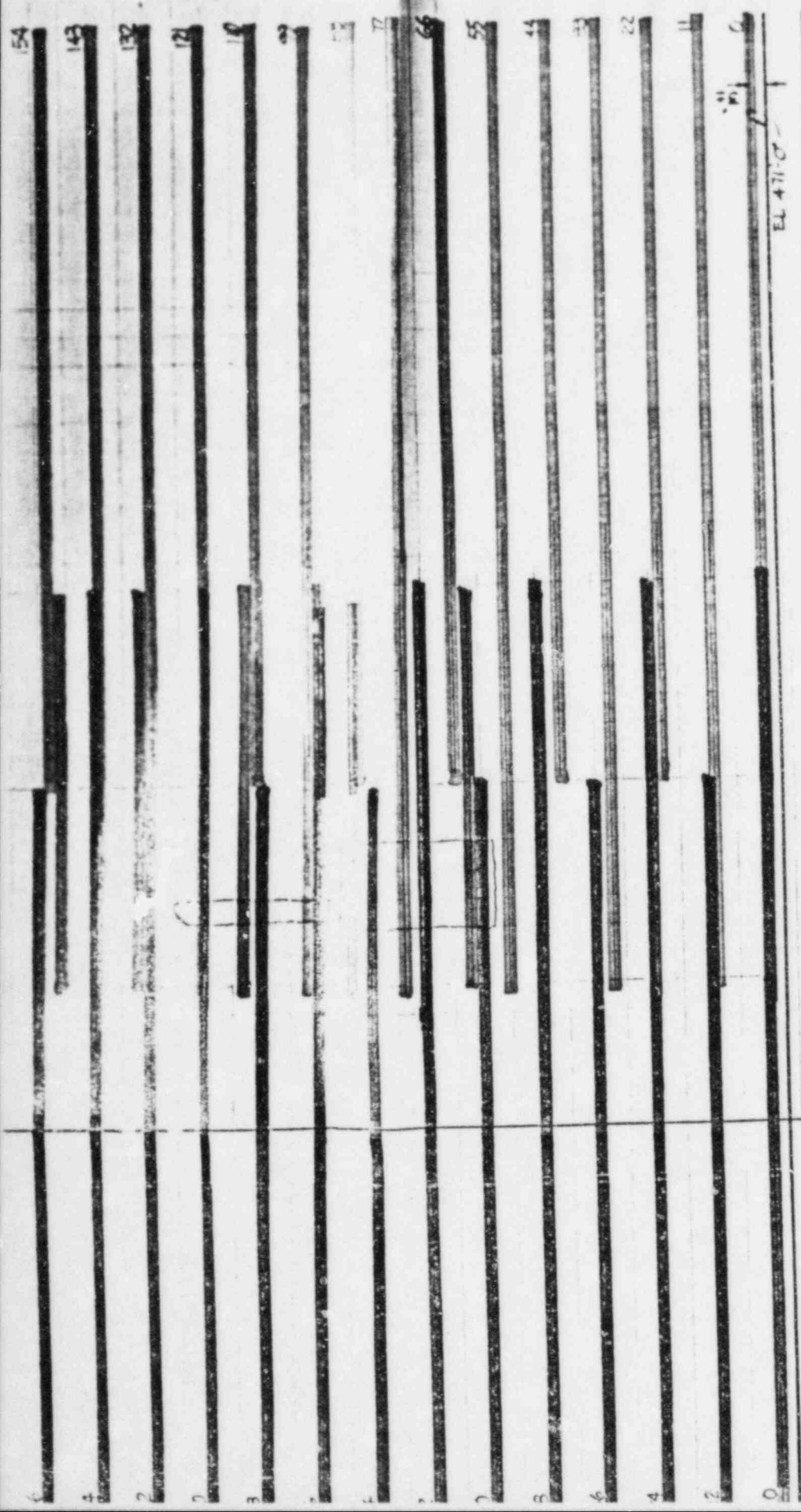
BARS @ 11" O.C.

ADD'L BARS PER RFI 6426-396



N





PART ELEVATION OF EAST WALL

LOOKING WEST
REBARS SHOWN PER BETH-STL DNG (APPD) AND PER RFI.

SK-17B



Westinghouse
Electric Corporation

Water Reactor
Divisions

Richland Program Office

Box 606
Richland Washington 99352
509-375 5223

September 15, 1983

Mr. H.A. Crisp, WNP-2 Construction Manager
Washington Public Power Supply System
3000 George Washington Way
Richland, Washington 99352

Subject: EVALUATION OF REINFORCED CONCRETE STRUCTURAL MEMBERS IN WNP-2
REACTOR BUILDING

The Westinghouse Construction Quality Assessment Team have completed review of the Supply System evaluation of concrete structures as described in the Supply System Report "Evaluation of Concrete and Reinforcing Steel for Washington Public Power Supply System Unit #2". We have reviewed the excavations as well as all documentation related thereto and concur with the conclusion of the report that the as-built structures are structurally adequate for all specified loads. The Westinghouse review was performed by Mr. H.P. Bonnet and Mr. R.S. Orr.

Mr. H.P. Bonnet has thirty-four (34) years of experience in Structural Engineering. His specific experience related to concrete structures includes four (4) years field engineering for concrete bridges and foundations, complete supervision of design, drafting and review of shop drawings for some very heavily reinforced concrete structures including Titan 1 underground missile bases, heavy machinery foundations for the steel industry, paper machine structures, turbine generator foundations, an extremely large prestressed concrete building and many very large reinforced concrete chimneys, silos and their foundations. Mr. Bonnet has been a member of ACI Committee 307 (Reinforced Concrete Chimneys) for the past ten (10) years.

Mr. R.S. Orr has twenty-one (21) years experience in all structural aspects of nuclear power plants. His specific experience related to concrete structures includes design and construction inspection for fossil power plants, design evaluation of prestressed concrete reactor vessels and prestressed and reinforced concrete containment, and technical supervision of all concrete structures design and licensing for the Floating Nuclear Plant. Mr. Orr has participated on concrete code committees since 1968 and was Chairman of ACI Committee 349, Concrete Nuclear Structures from 1977 to 1982.

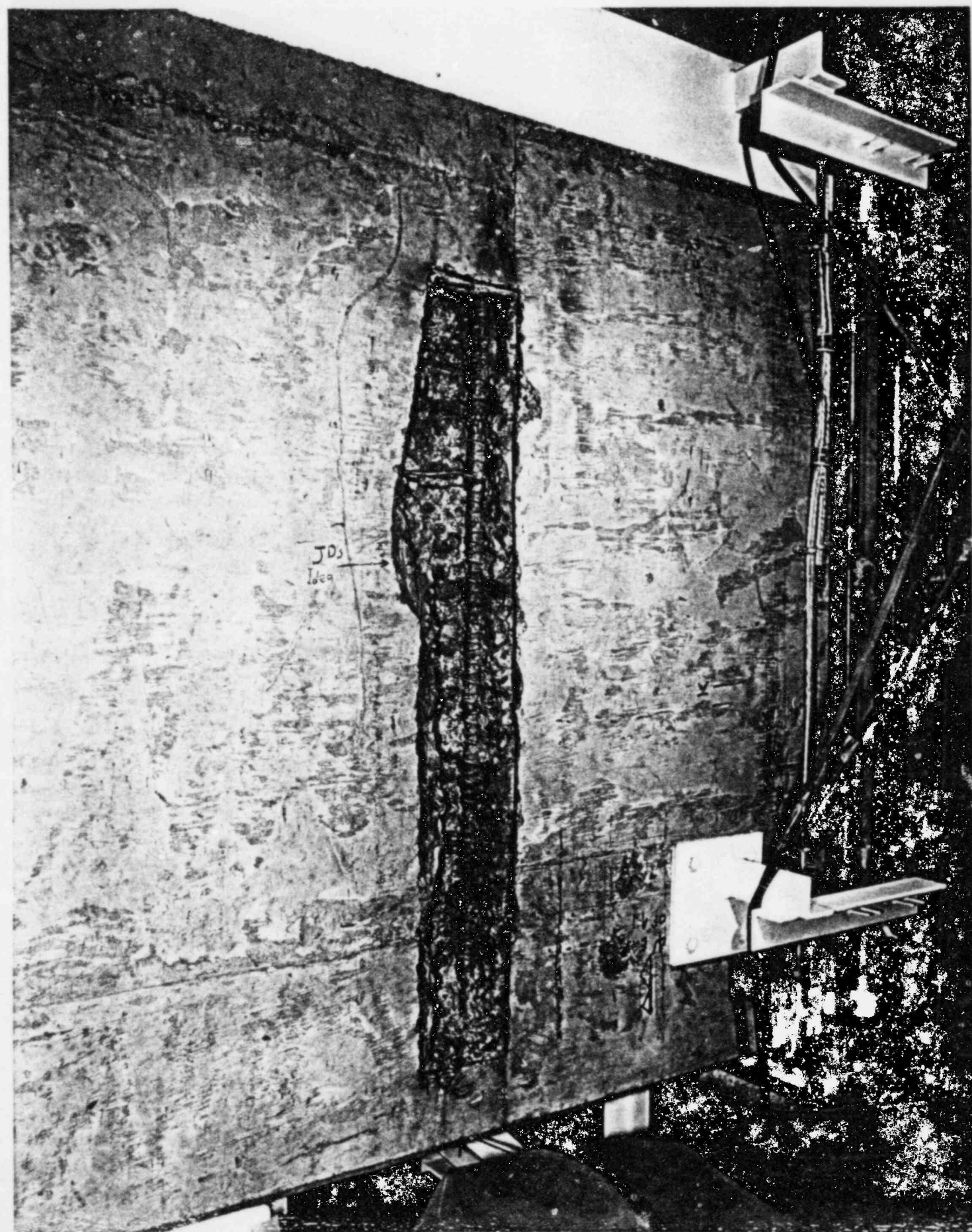
The Westinghouse review covered the following items significant to the evaluation of the seventeen (17) structural members investigated in the Supply System Program.

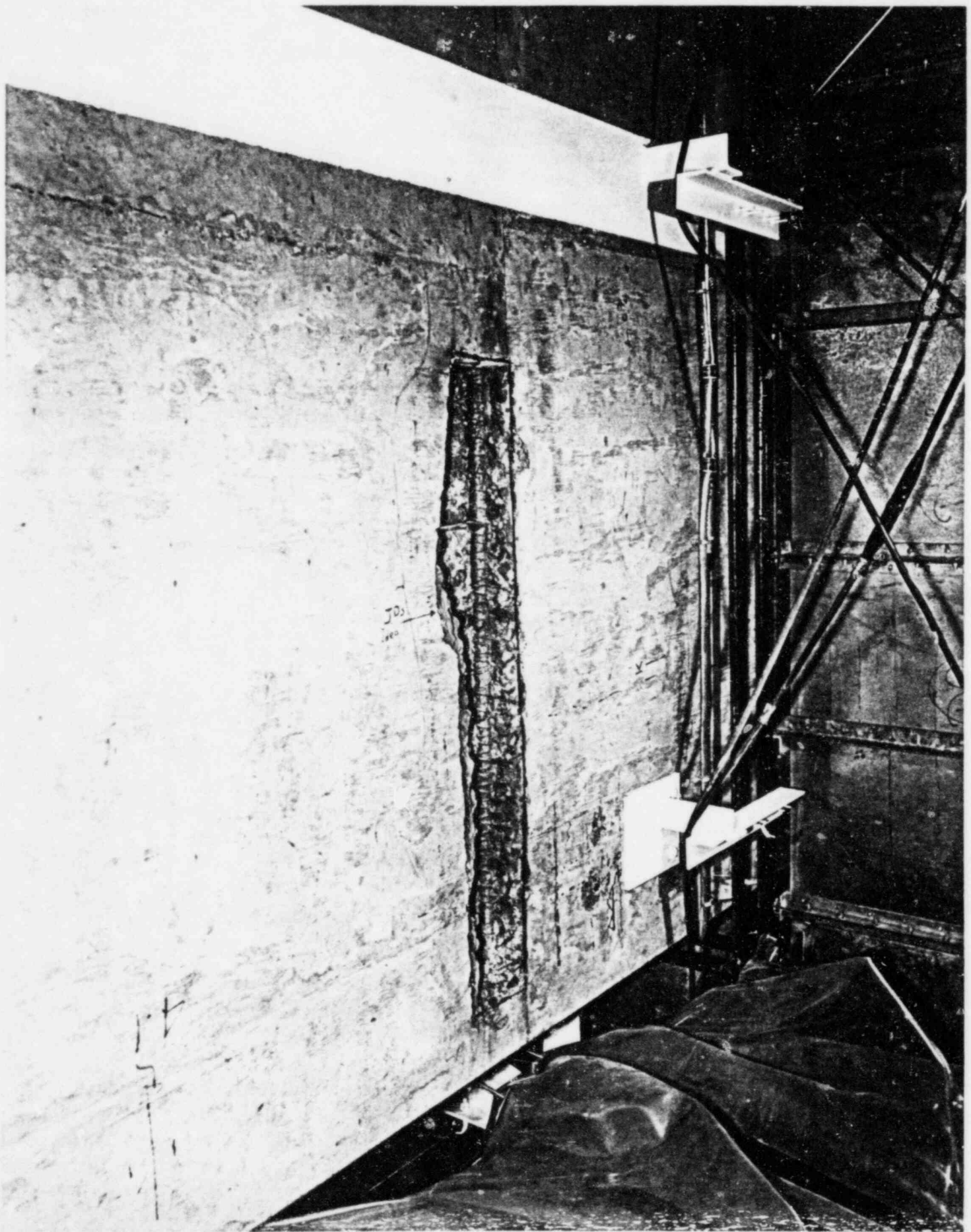
1. Westinghouse reviewed the Inspection Reports and Notices of Violations issued by the NRC as well as participating in the site meetings with NRC between July 25-27.
2. Westinghouse made a detailed survey of all the concrete excavations (23). This survey included a location check of the excavation, a complete dimensional check for each rebar exposed, and a size check for rebar (where possible).
3. In addition a complete survey was made at every excavation to check for concrete consolidation and bond to rebar.
4. All as-built drawings made by Burns and Roe were verified for dimensions and size of rebar.
5. All as-built drawings were reviewed against the design drawings, shop drawings and any Requests for Information which affected the reinforcing steel placement.
6. The design criteria being used by Burns and Roe in their re-analysis of the structural beams was reviewed against the commitments of the FSAR.
7. Design philosophy and methodology used by Burns and Roe for re-analysis of the beams was reviewed.
8. The Burns and Roe calculations for three beams 2B5, 2B11 and 2B25 were verified in detail. (Design loads were taken from previously verified Burns and Roe calculations and were not verified in the Westinghouse review.) Other calculations were reviewed for methodology.
9. Burns and Roe evaluations of the impact of differences between design, shop and as-built drawings were reviewed for concurrence and completeness.
10. Procedures for patching of all excavated areas except 2B11 and 2B25 have been reviewed. The procedure for patching 2B11 and 2B25 will be reviewed as soon as it is finalized by the Supply System.

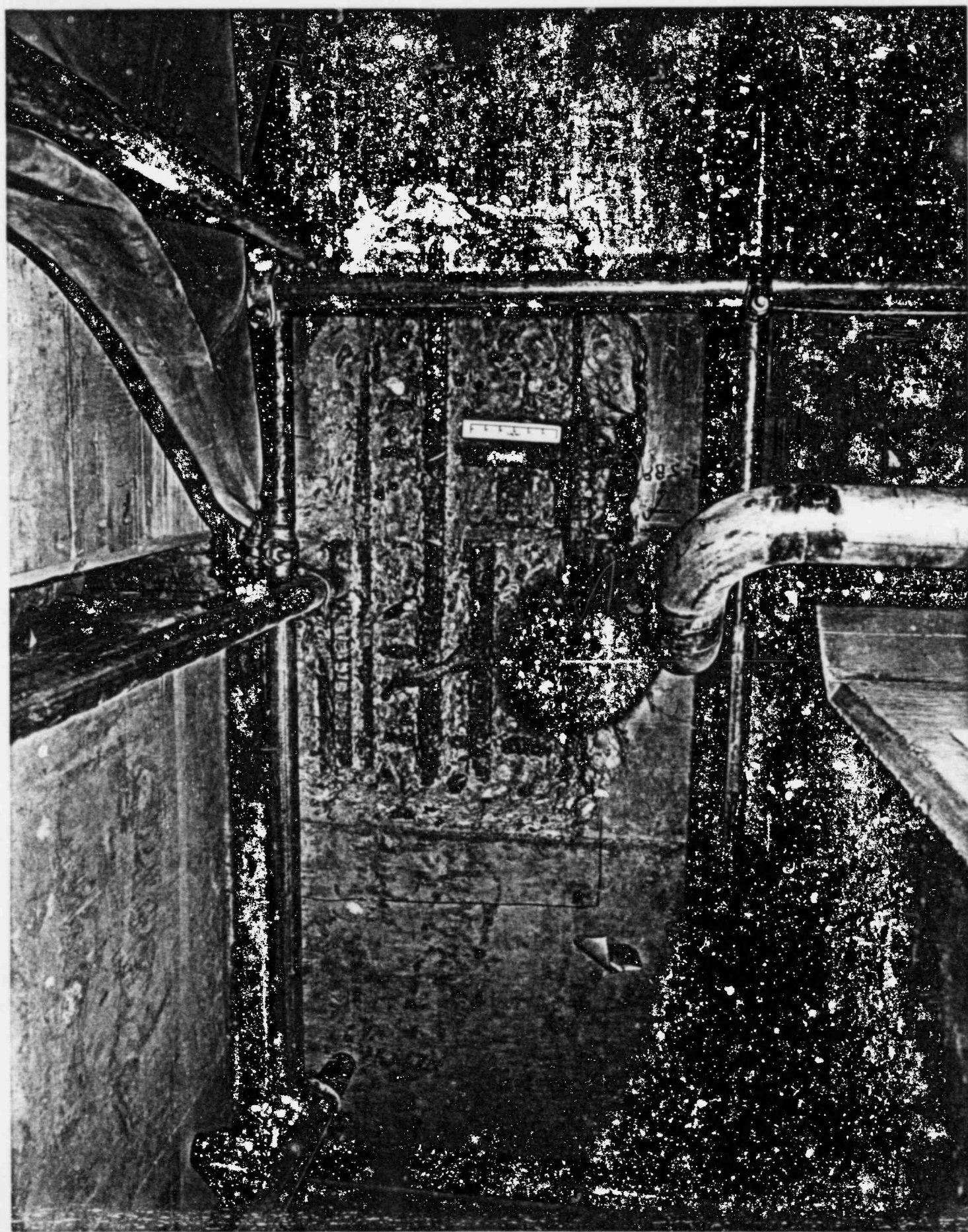
The above review was commenced at the beginning of July and was performed in parallel with the Burns and Roe evaluation. Westinghouse provided comments on the program during the course of the review and all comments have been adequately addressed in the final report.

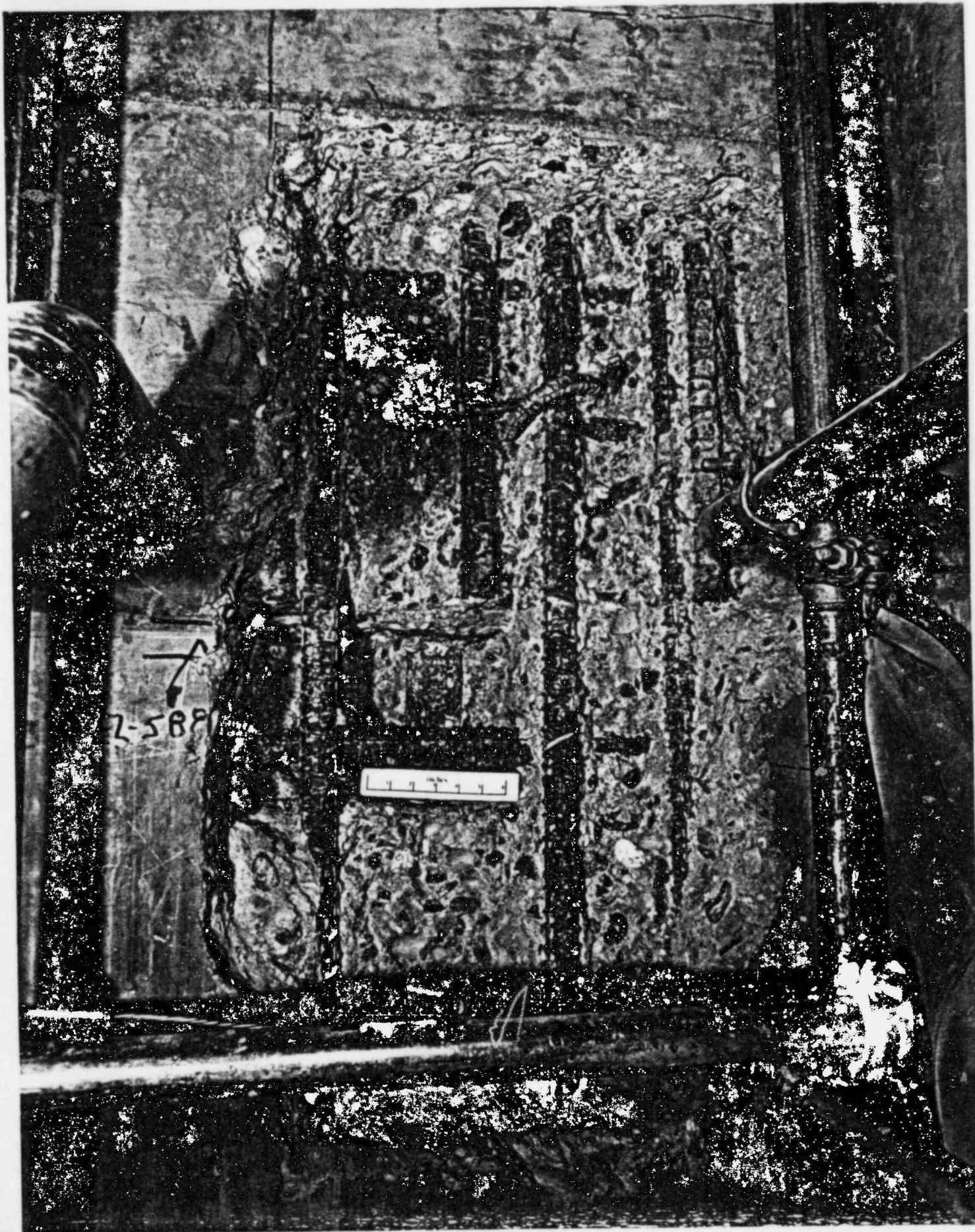
Henry P. Bonnet
H.P. Bonnet

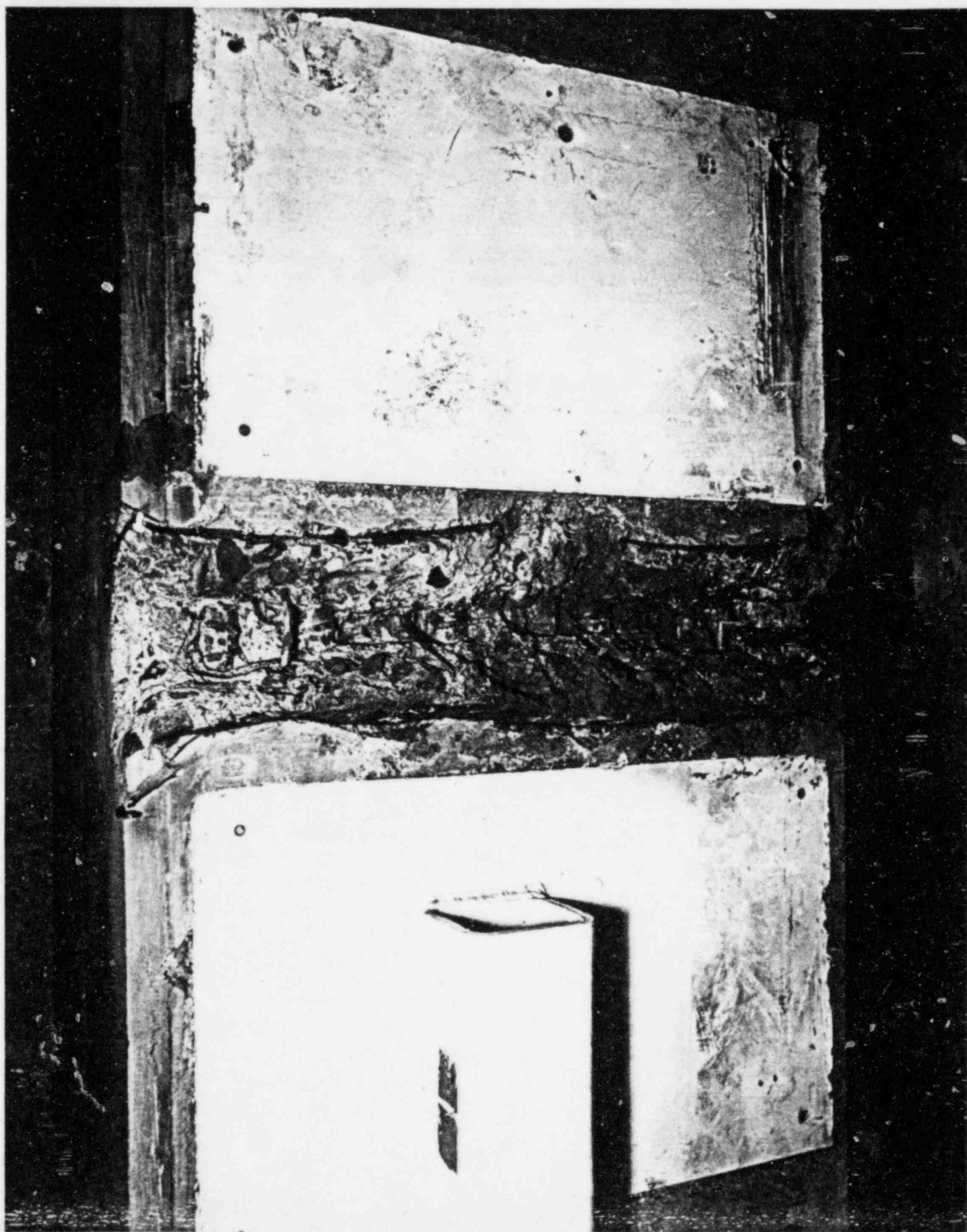
Richard Q. Orr
R.S. Orr
Manager, Construction
Quality Assessment
Program

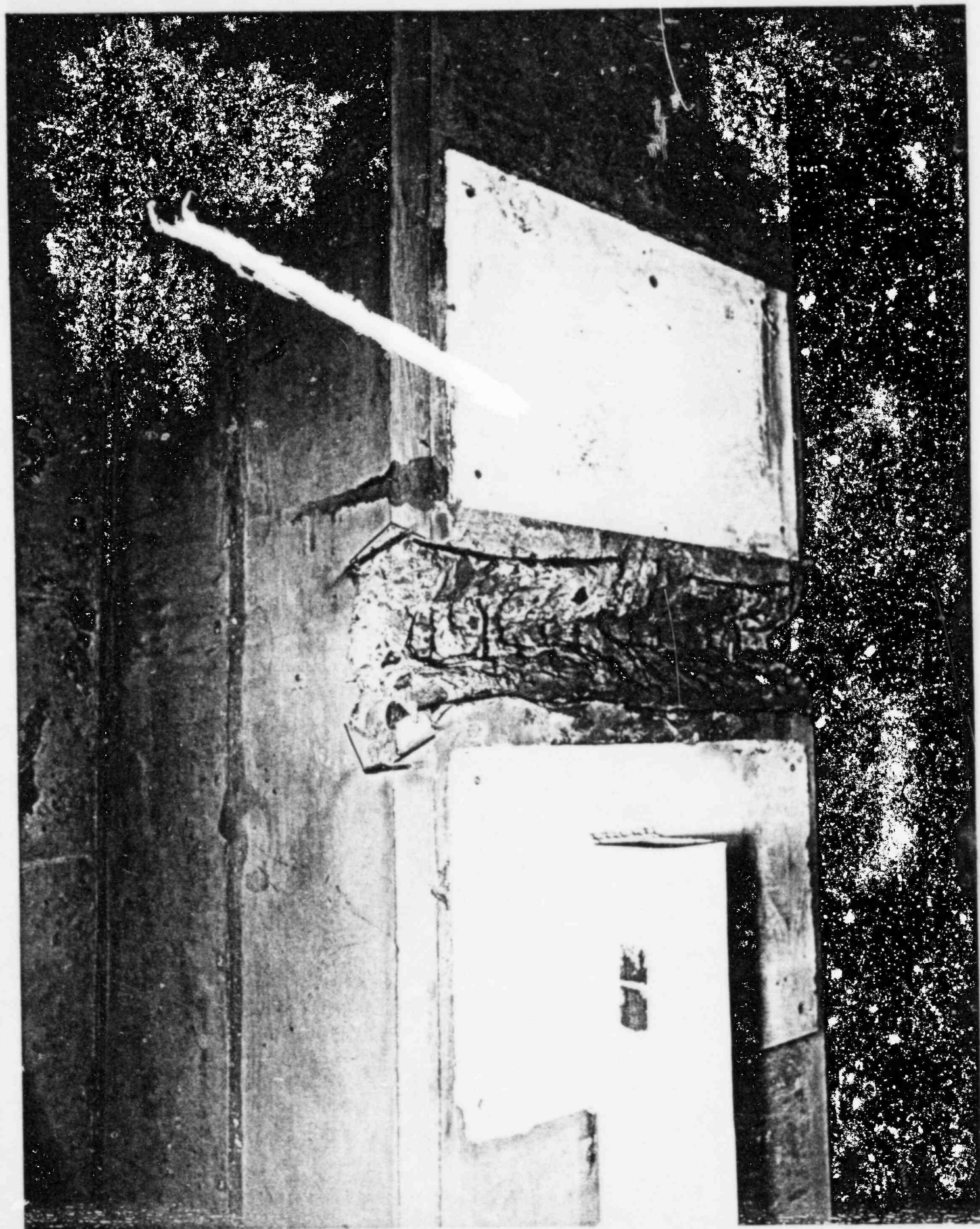




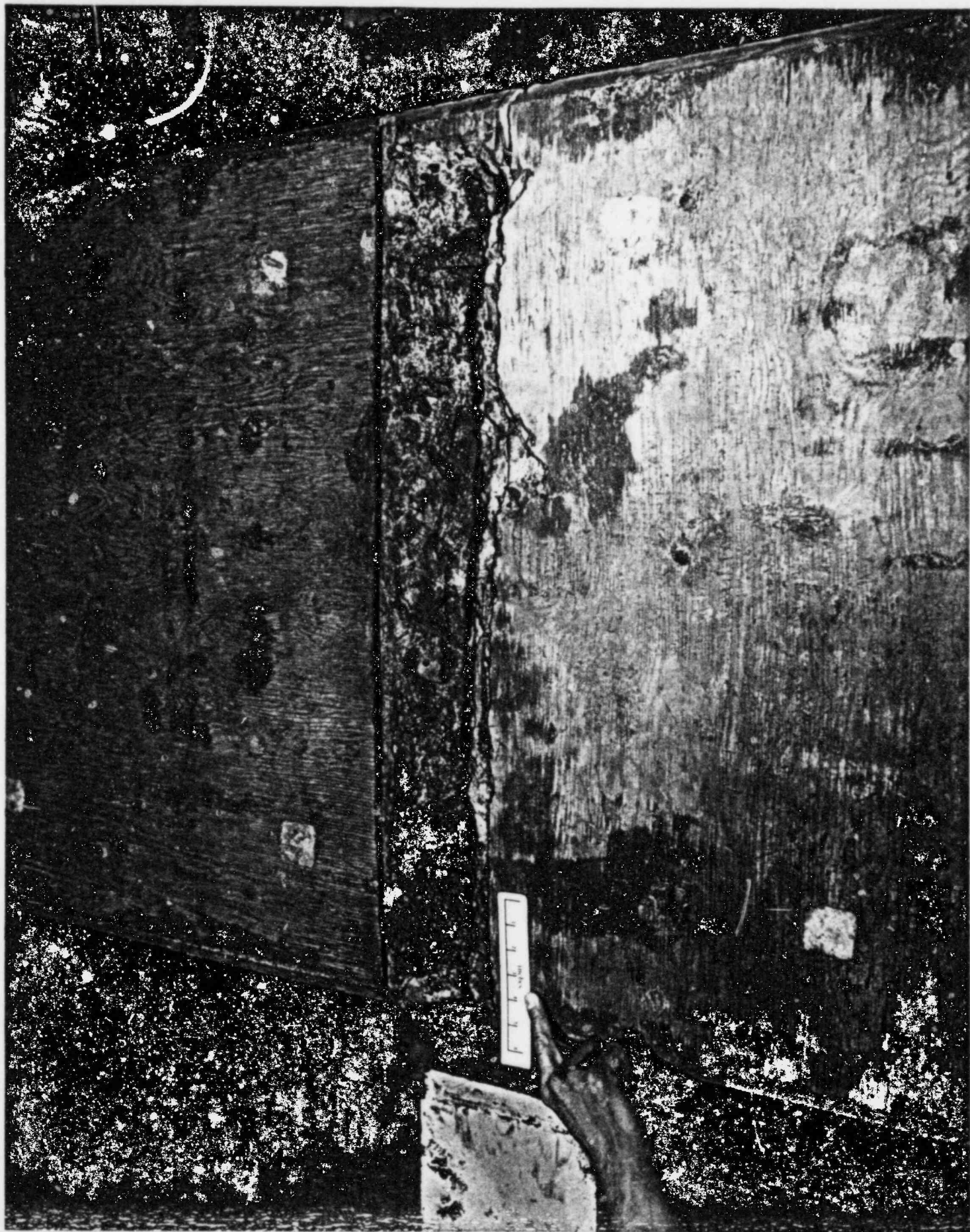


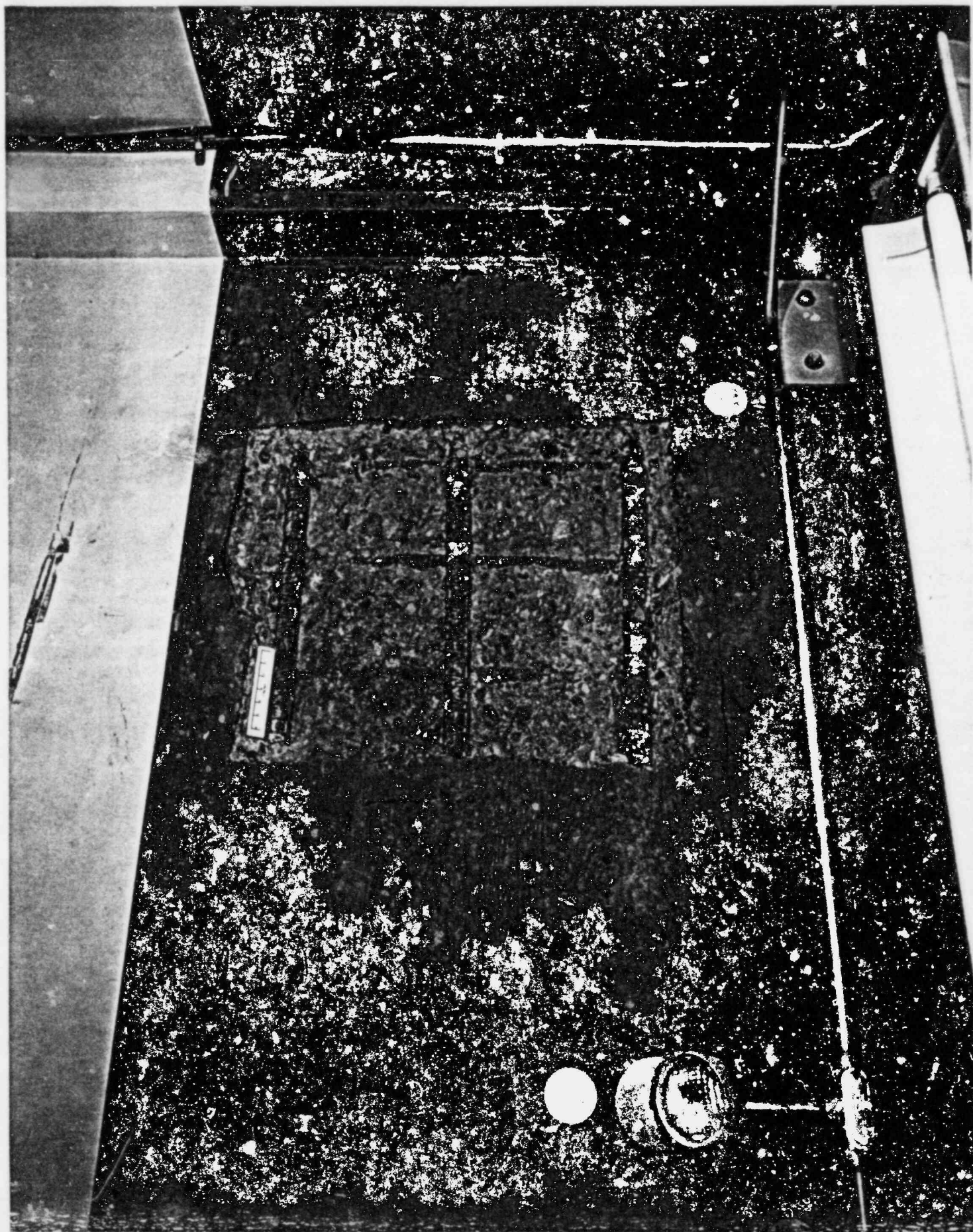


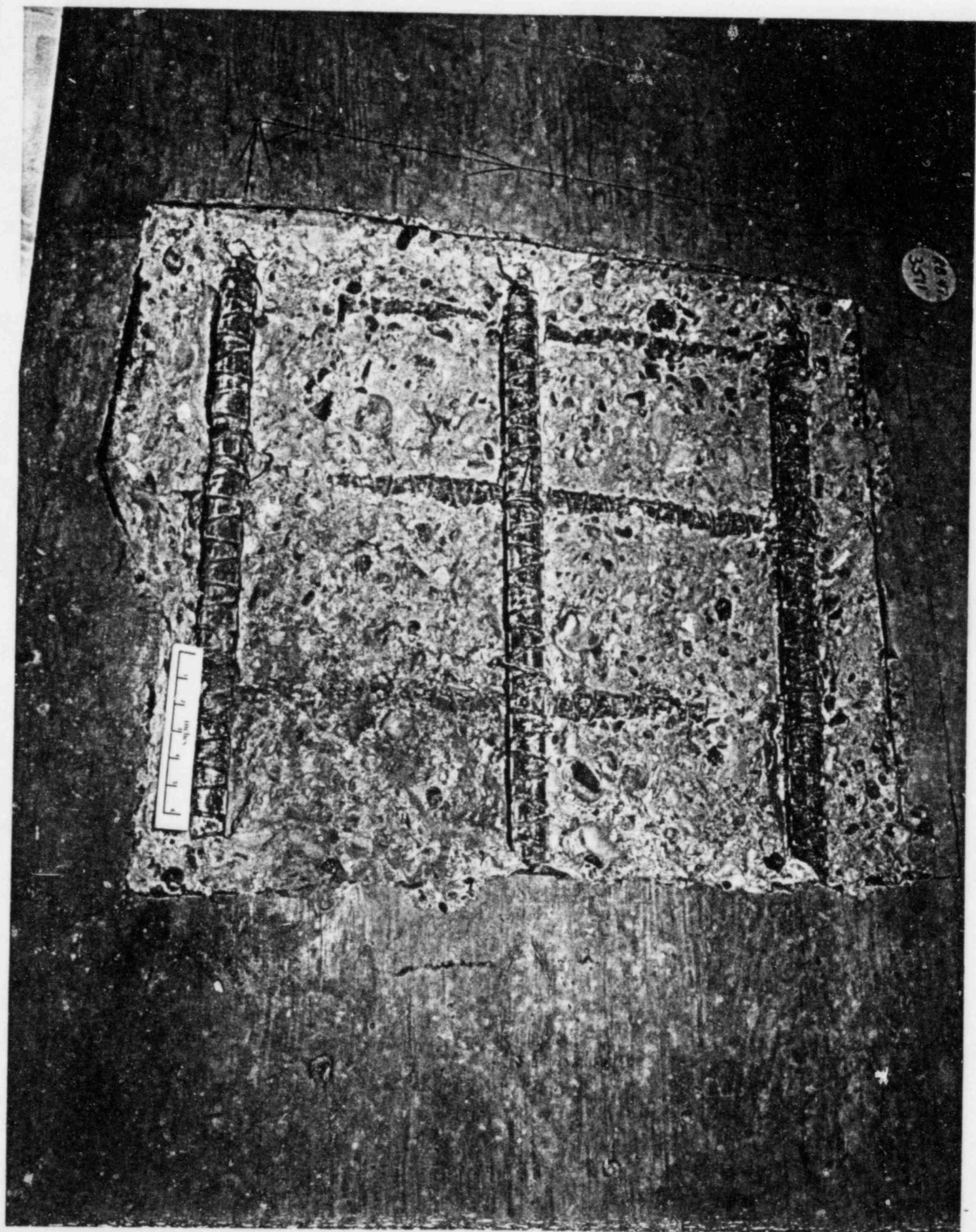








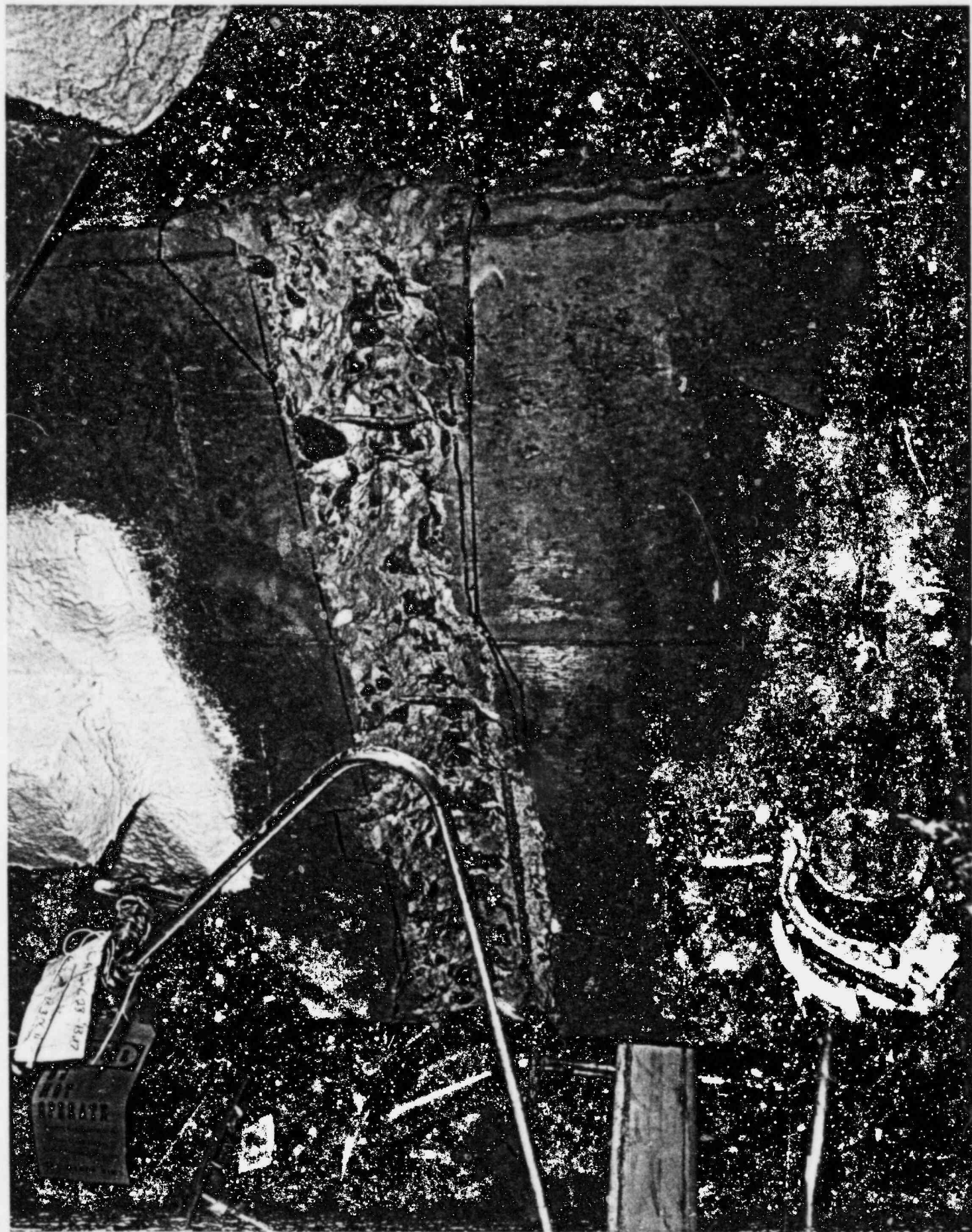


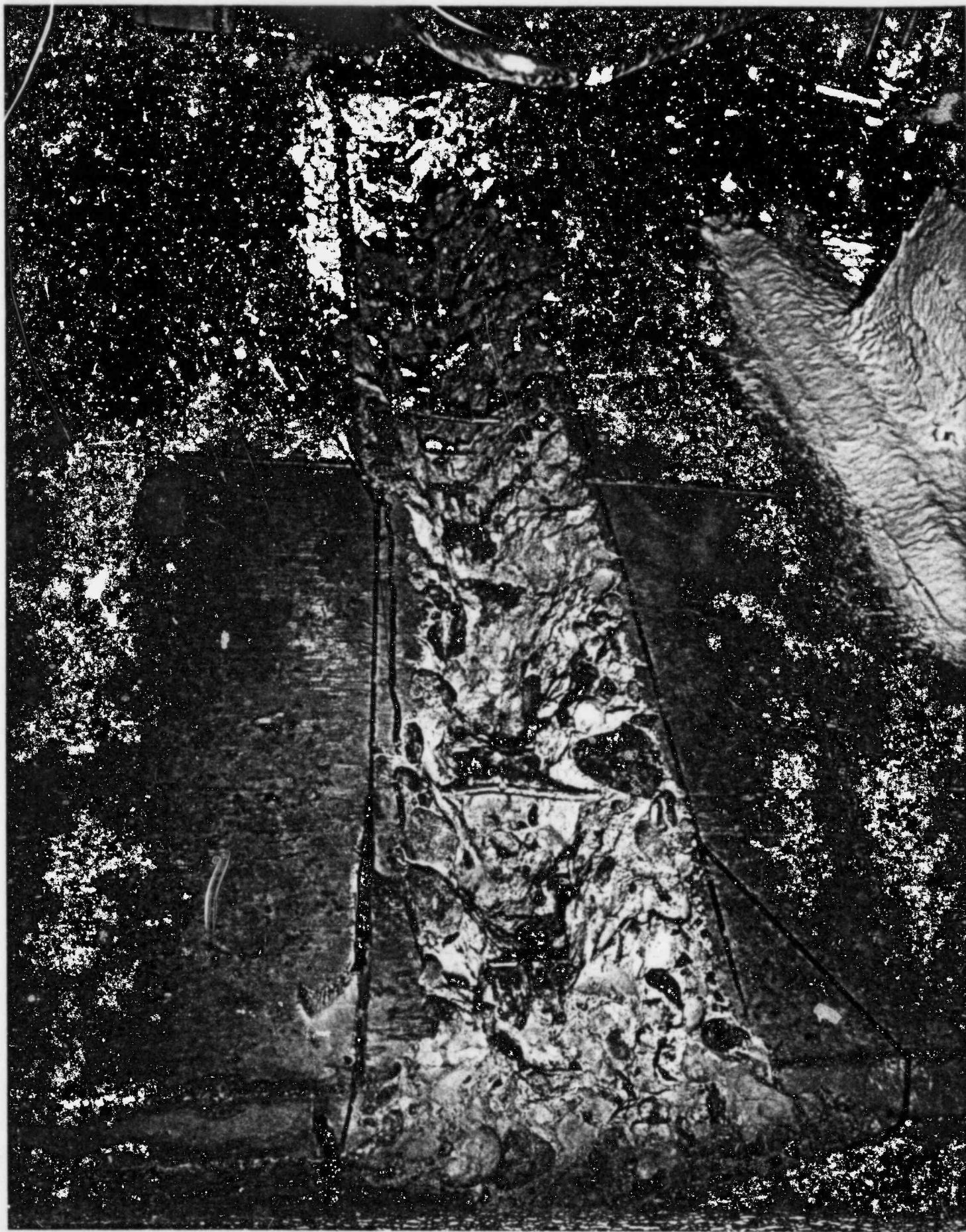






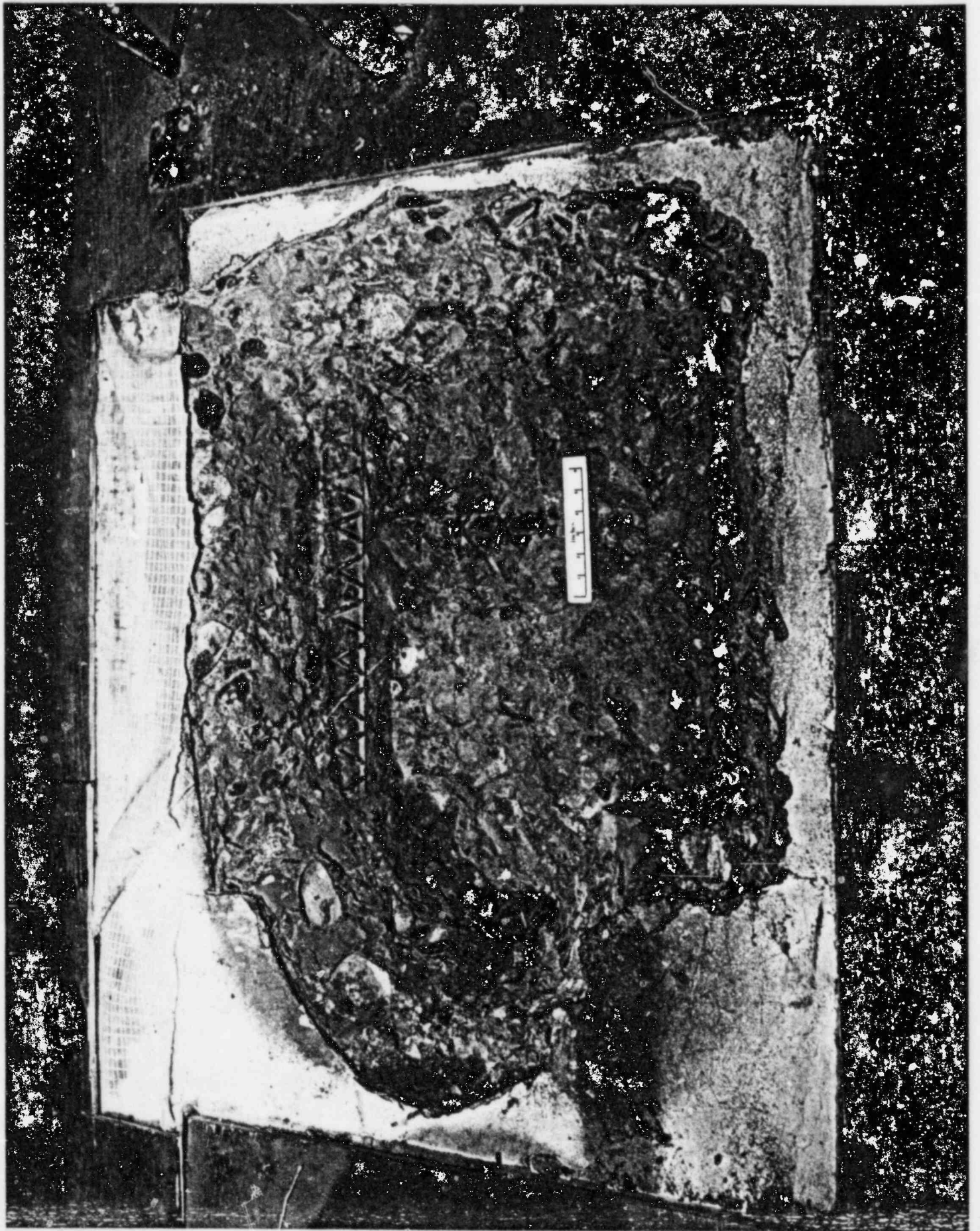


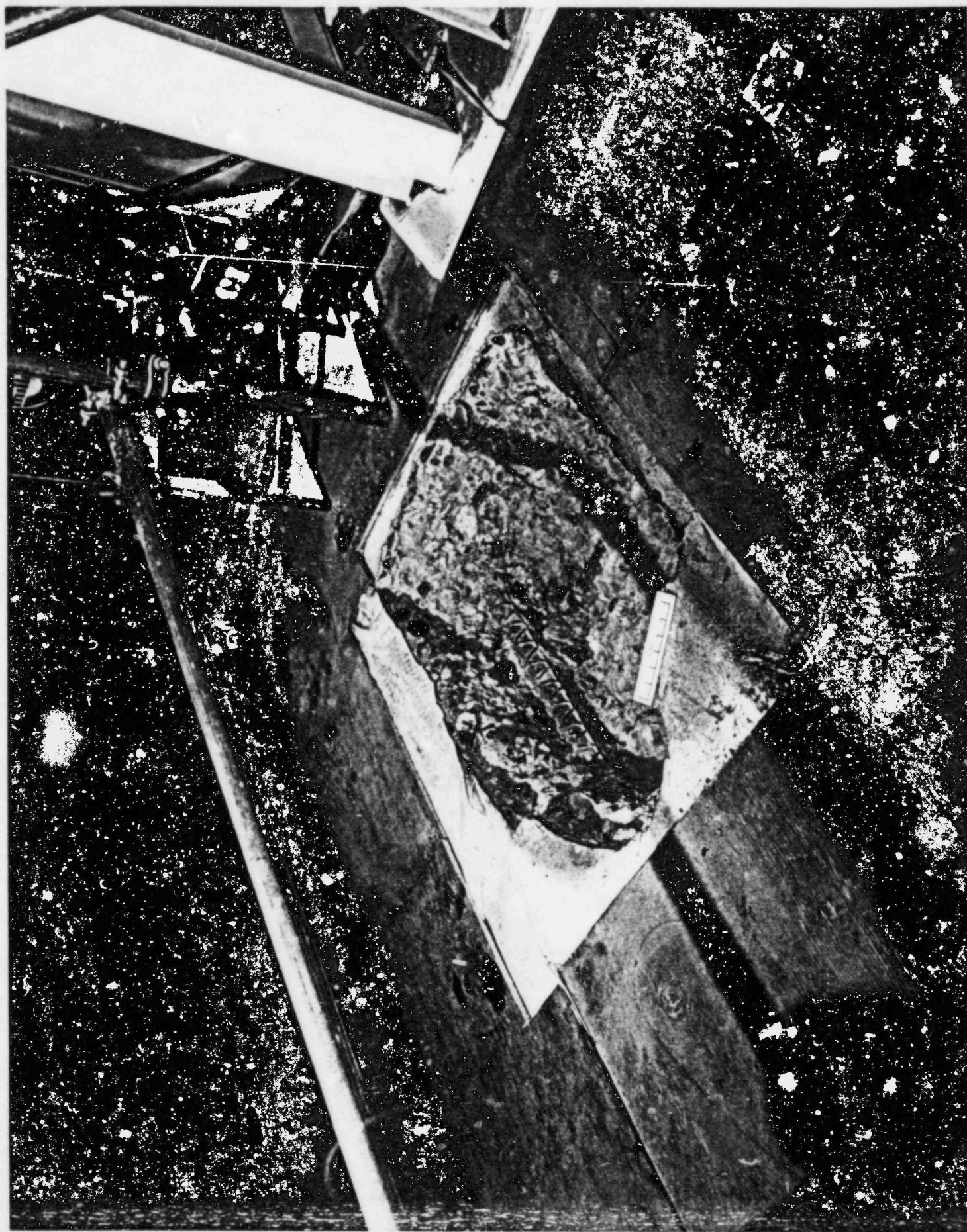


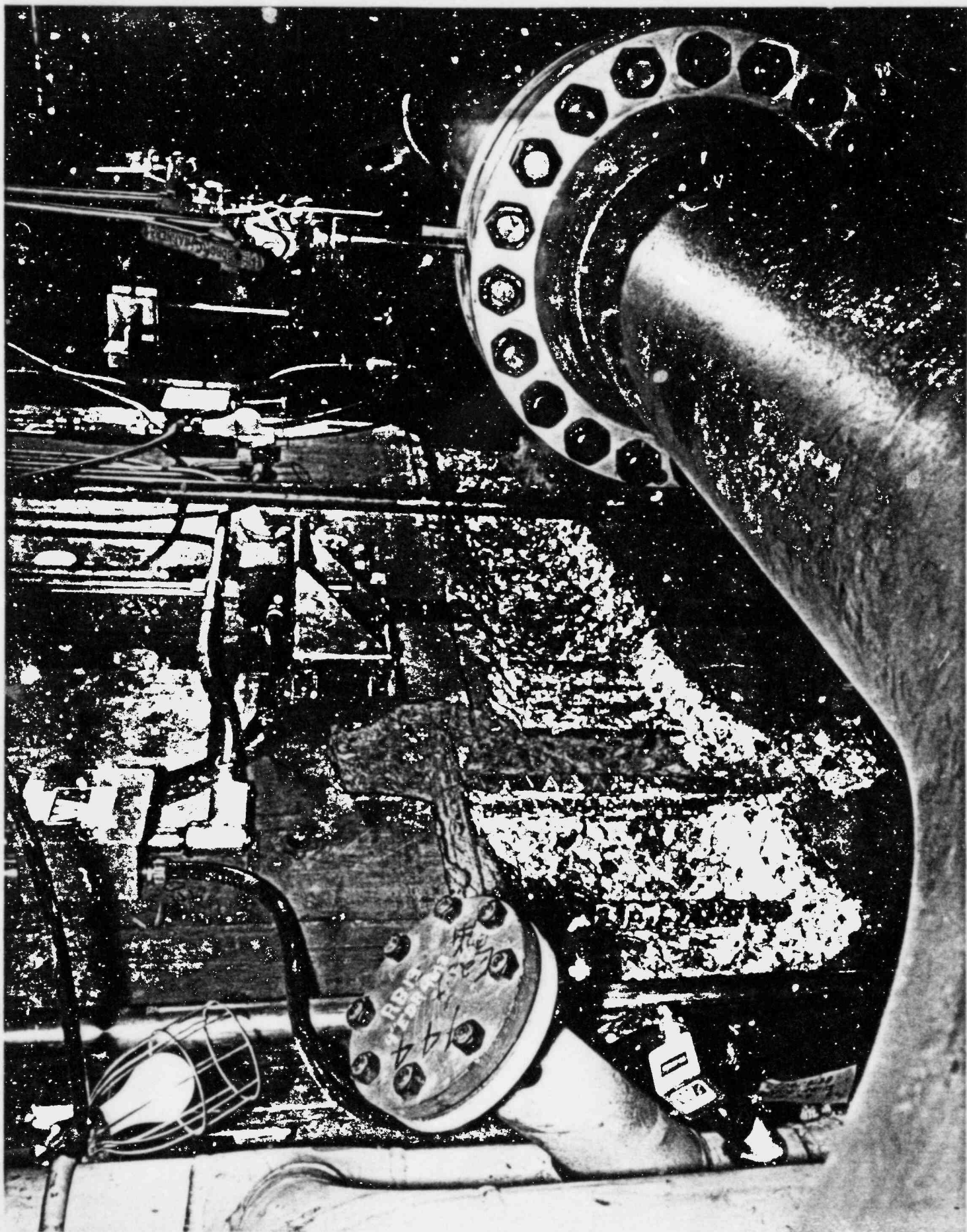


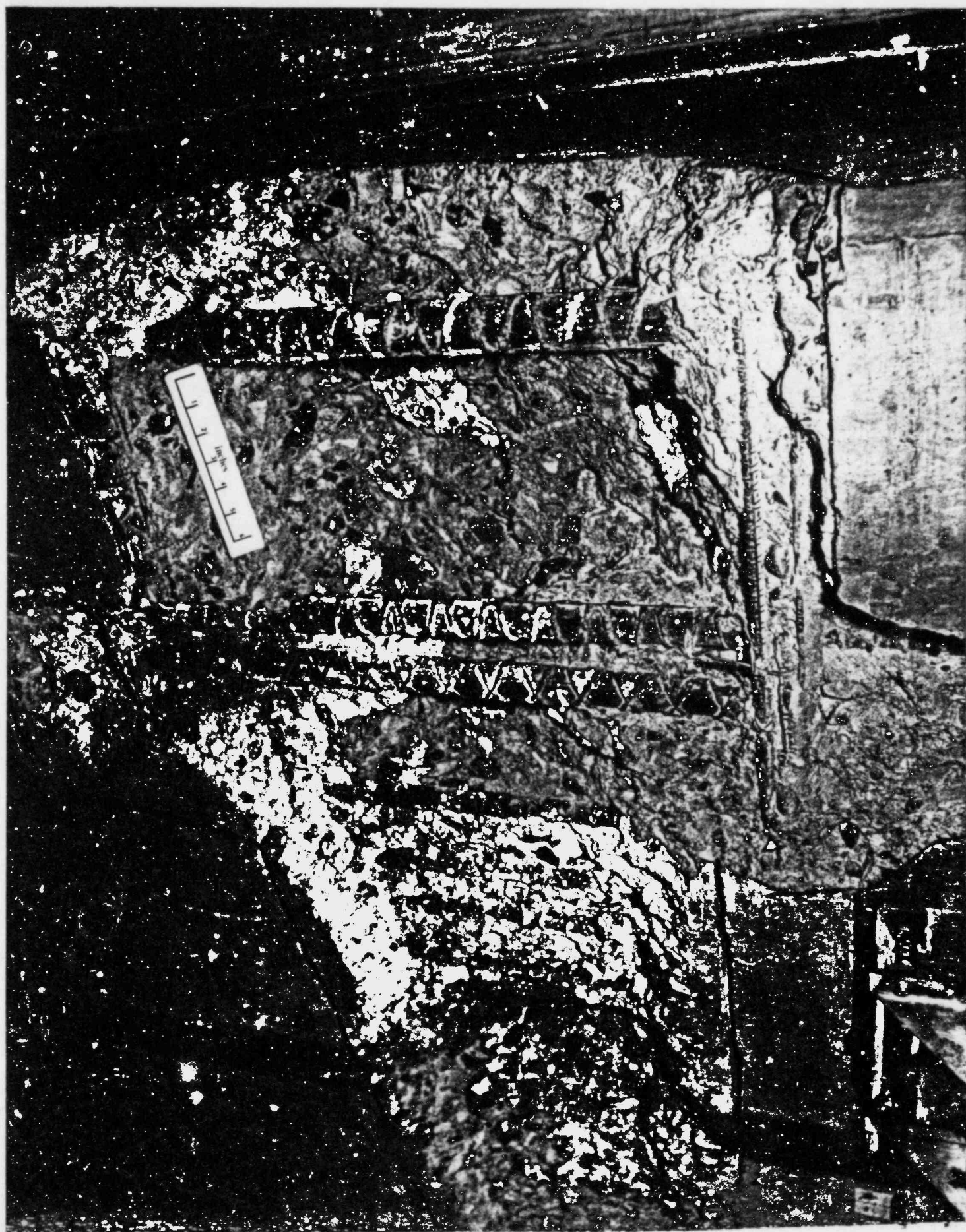




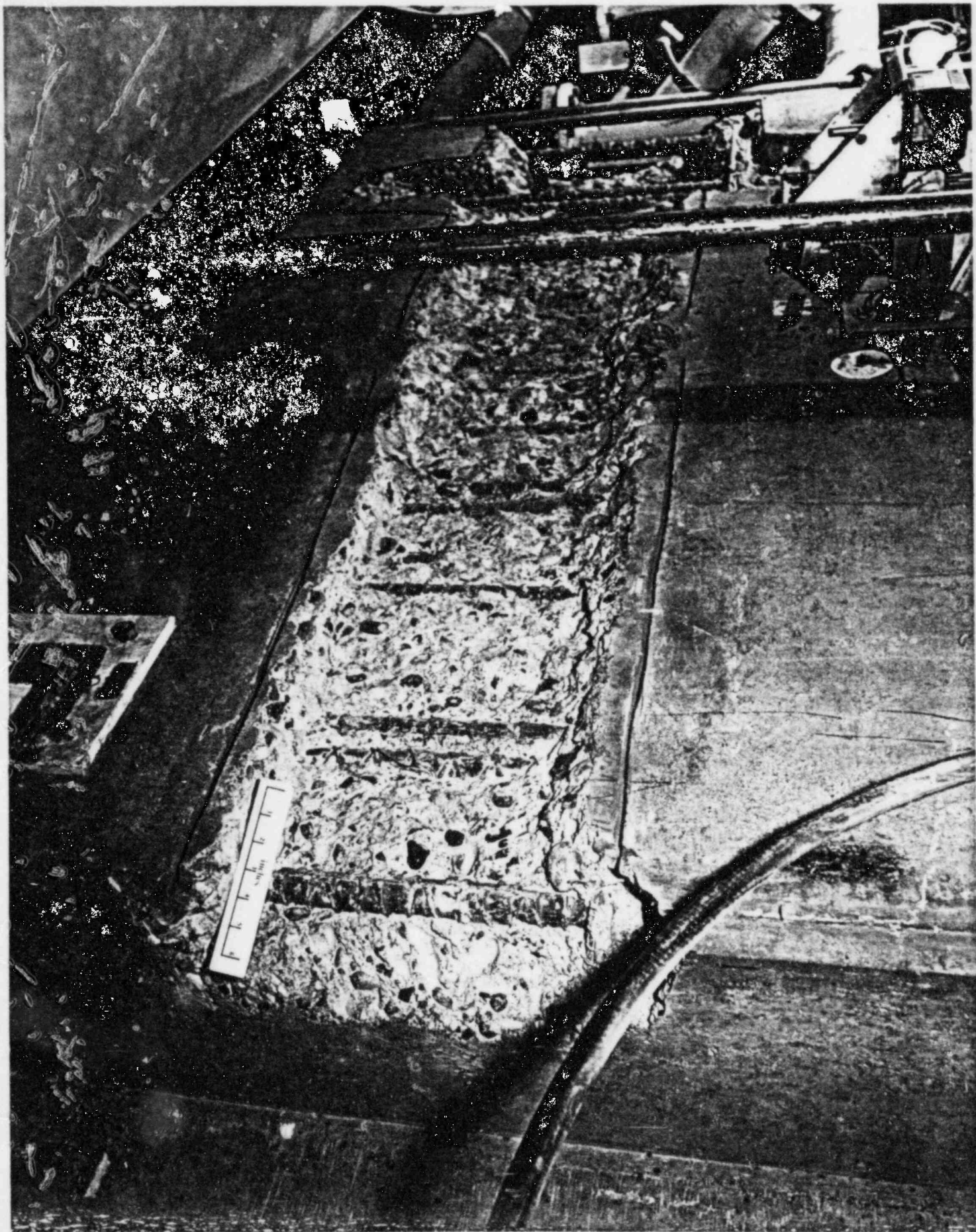


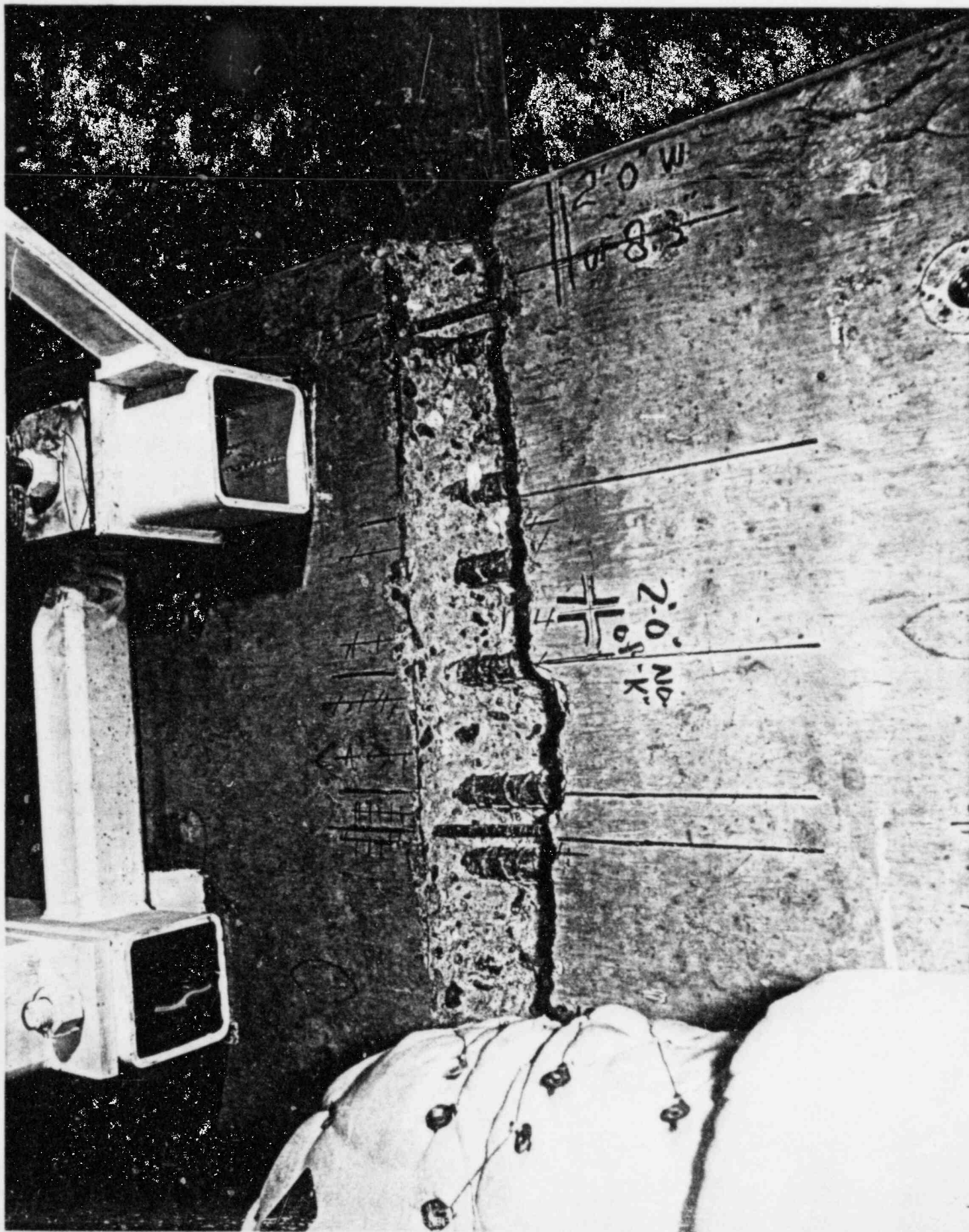




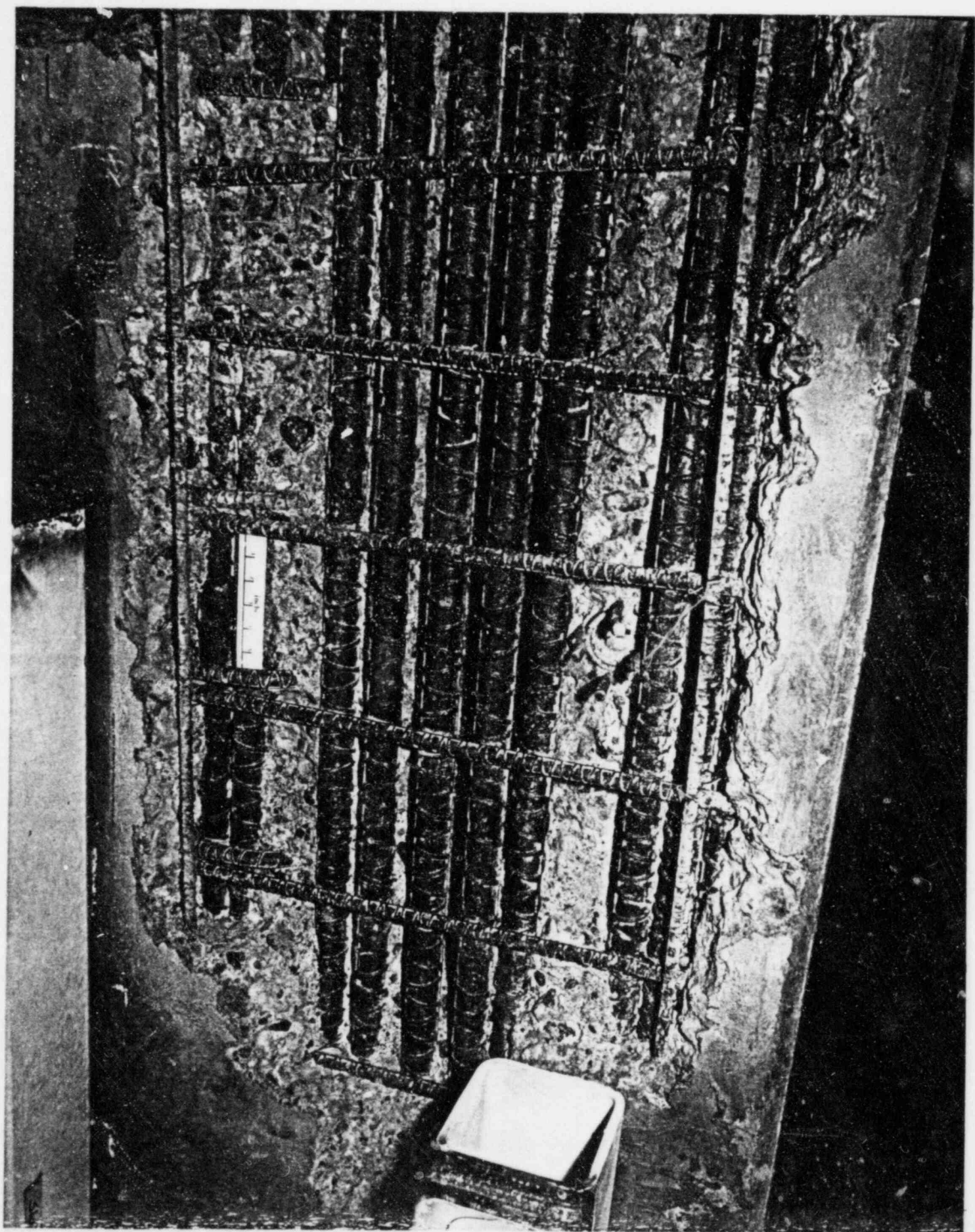


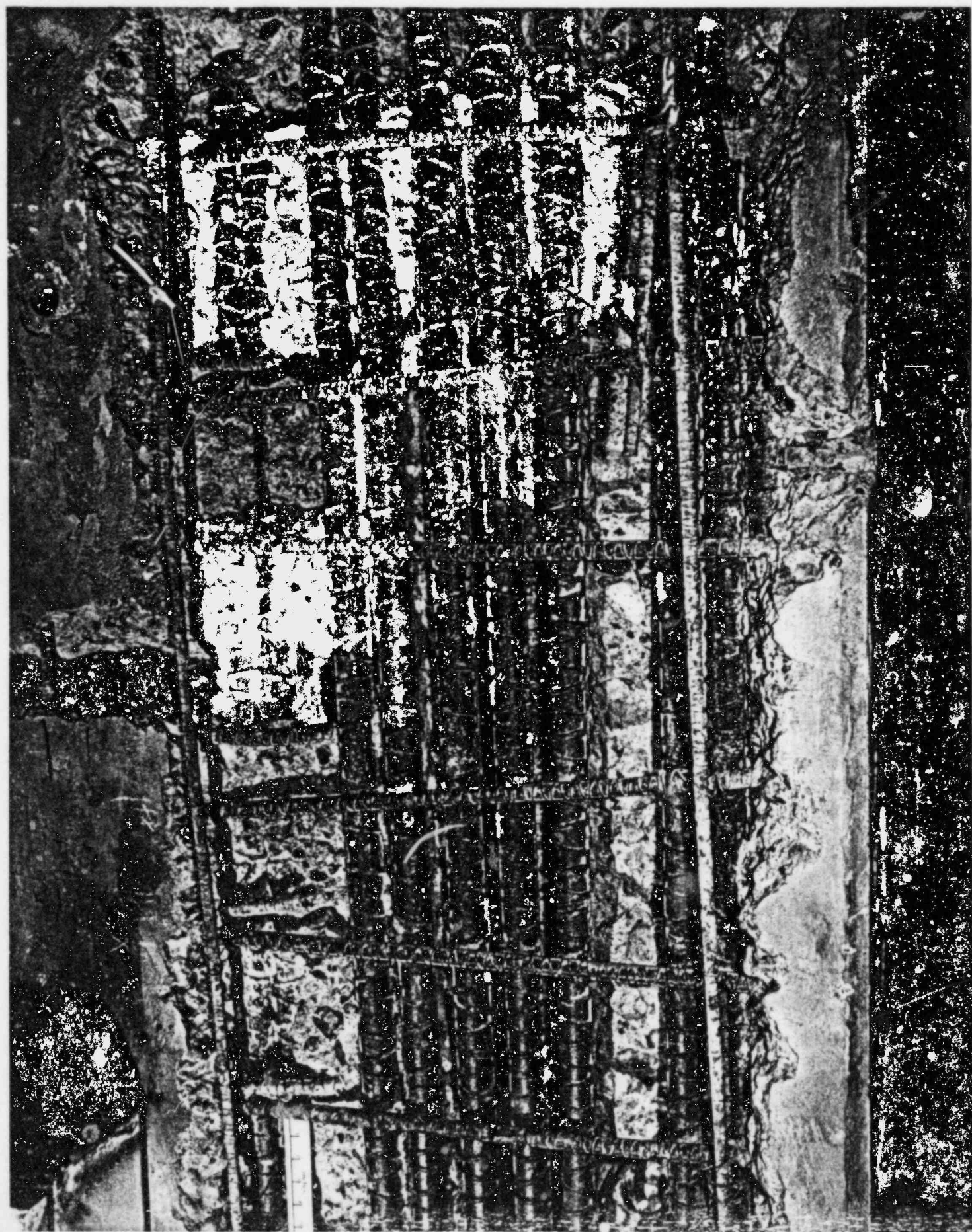






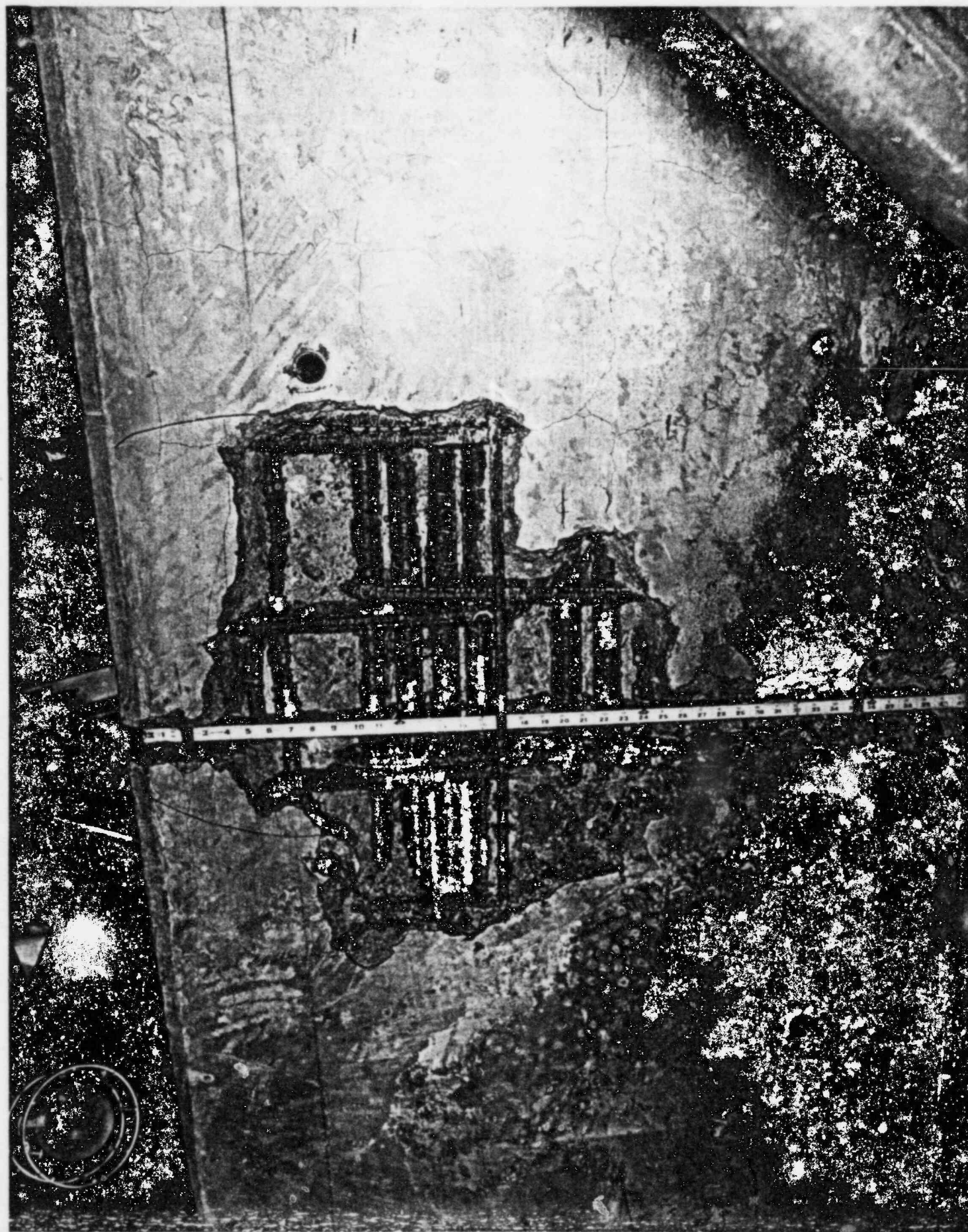




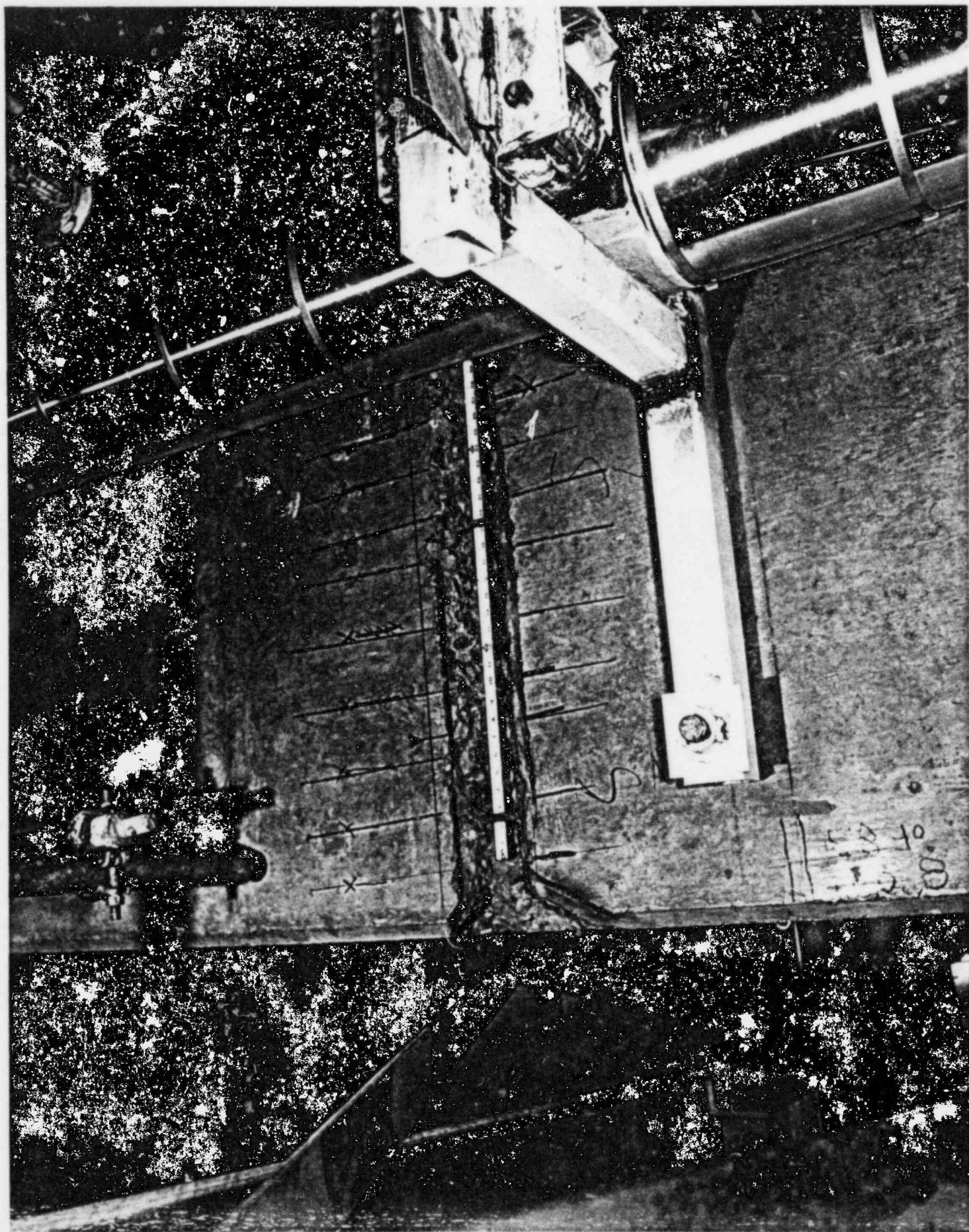




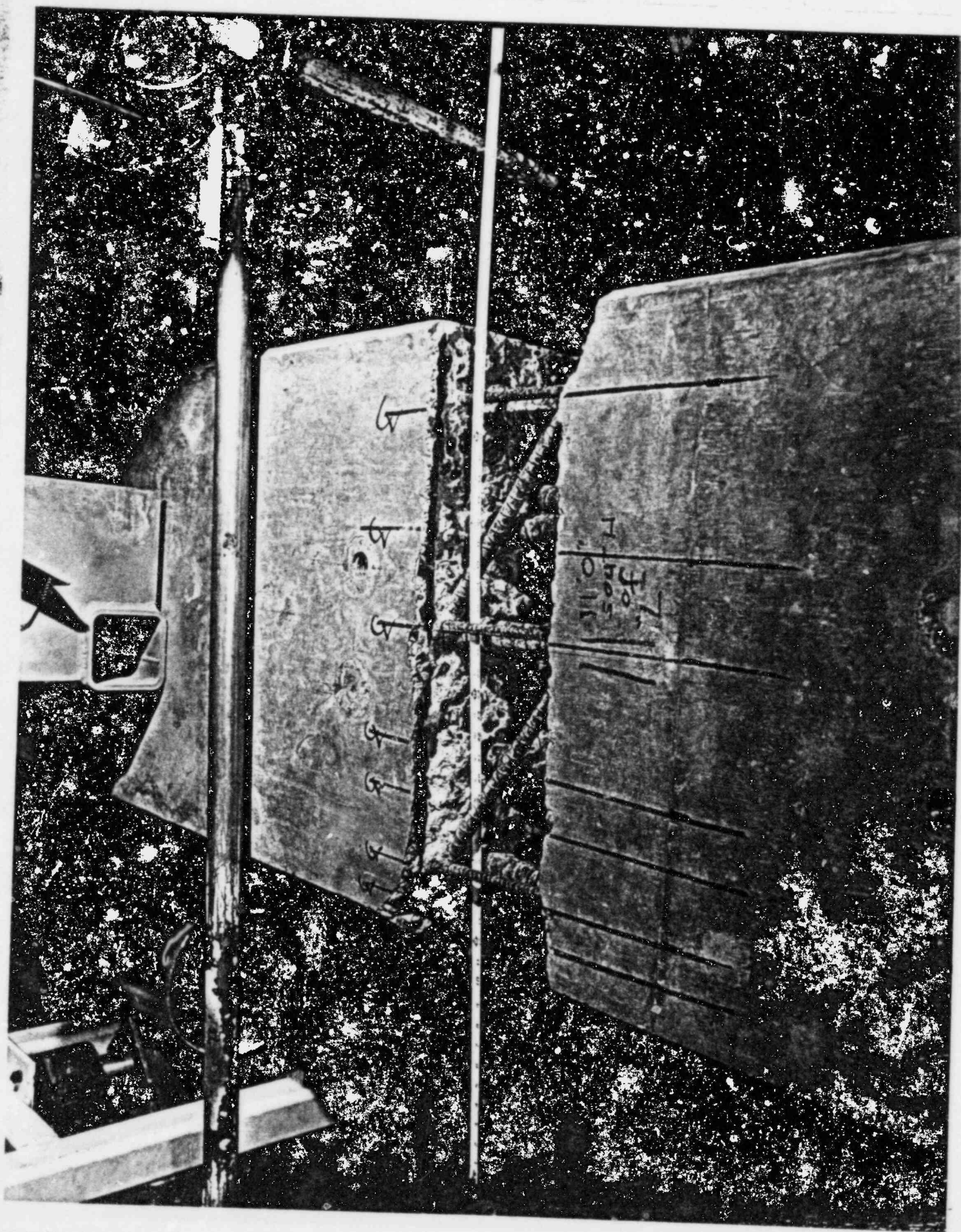


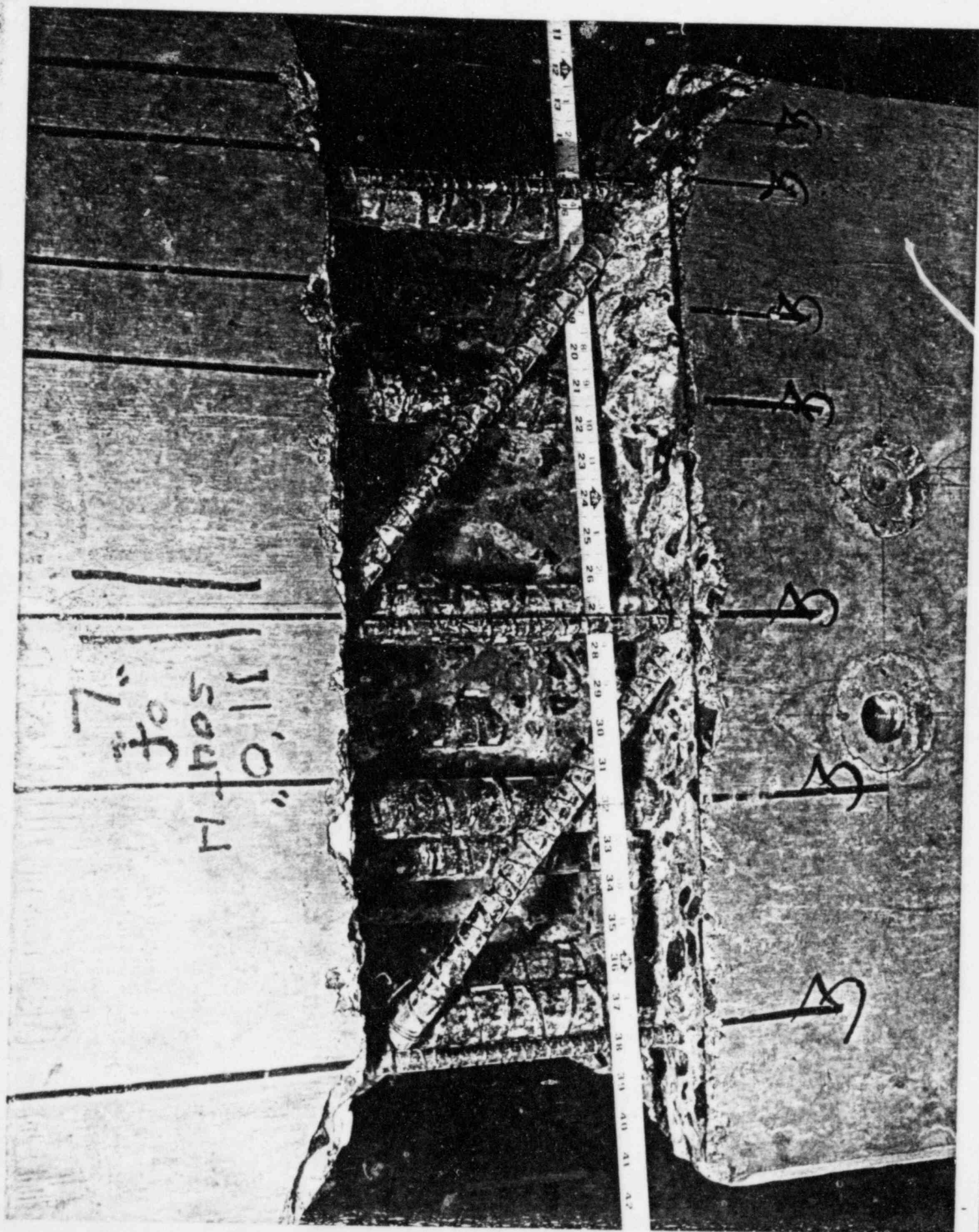


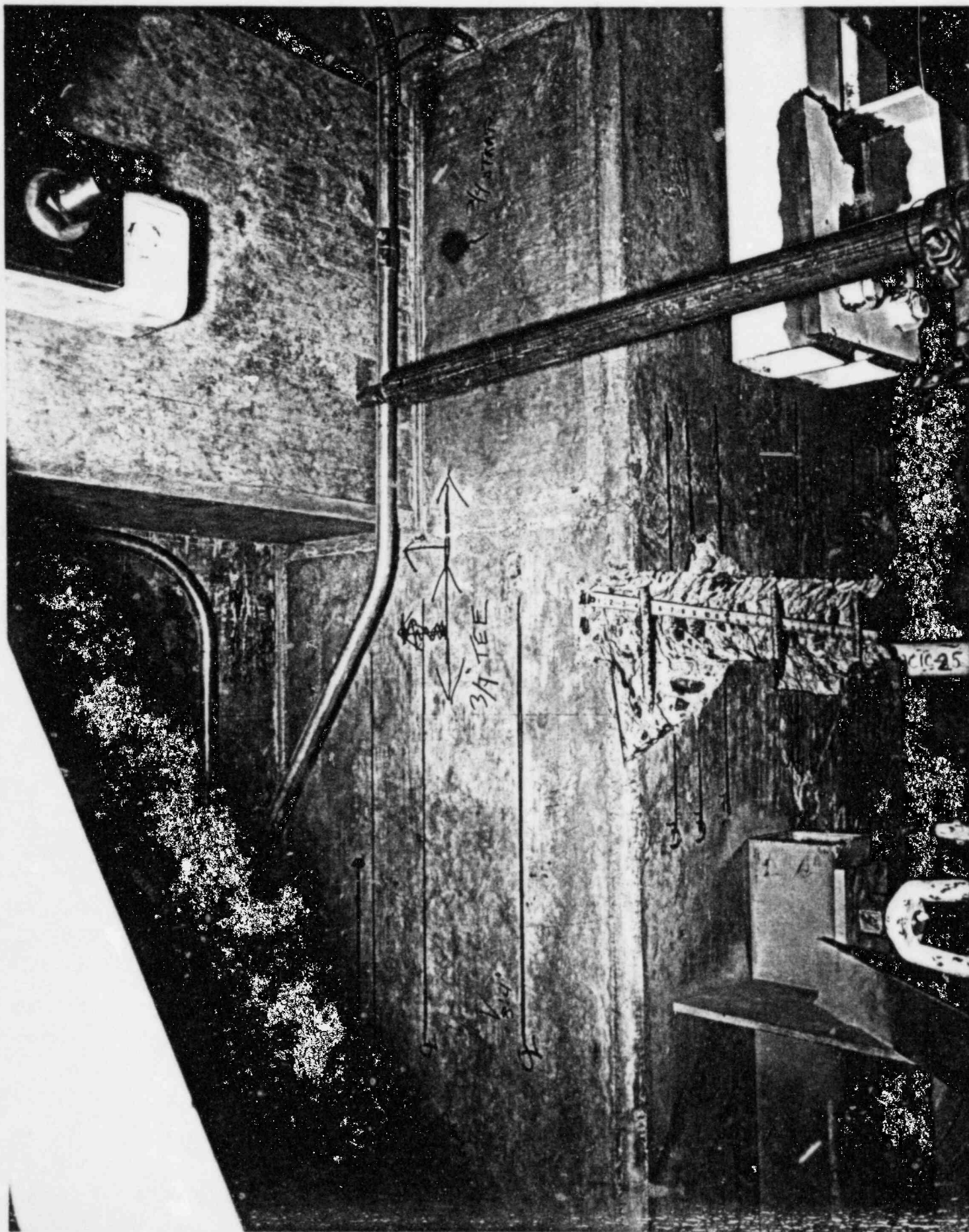


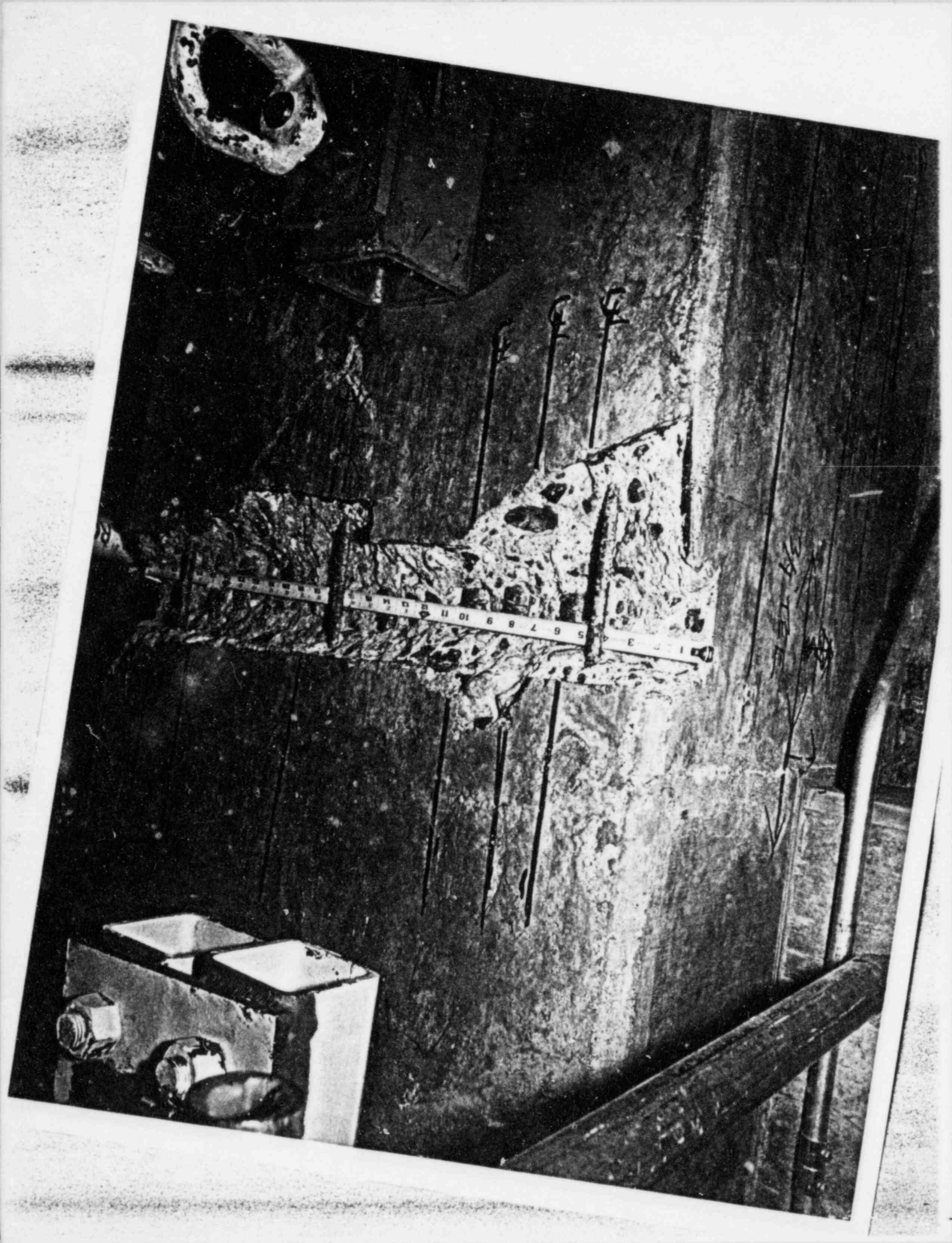


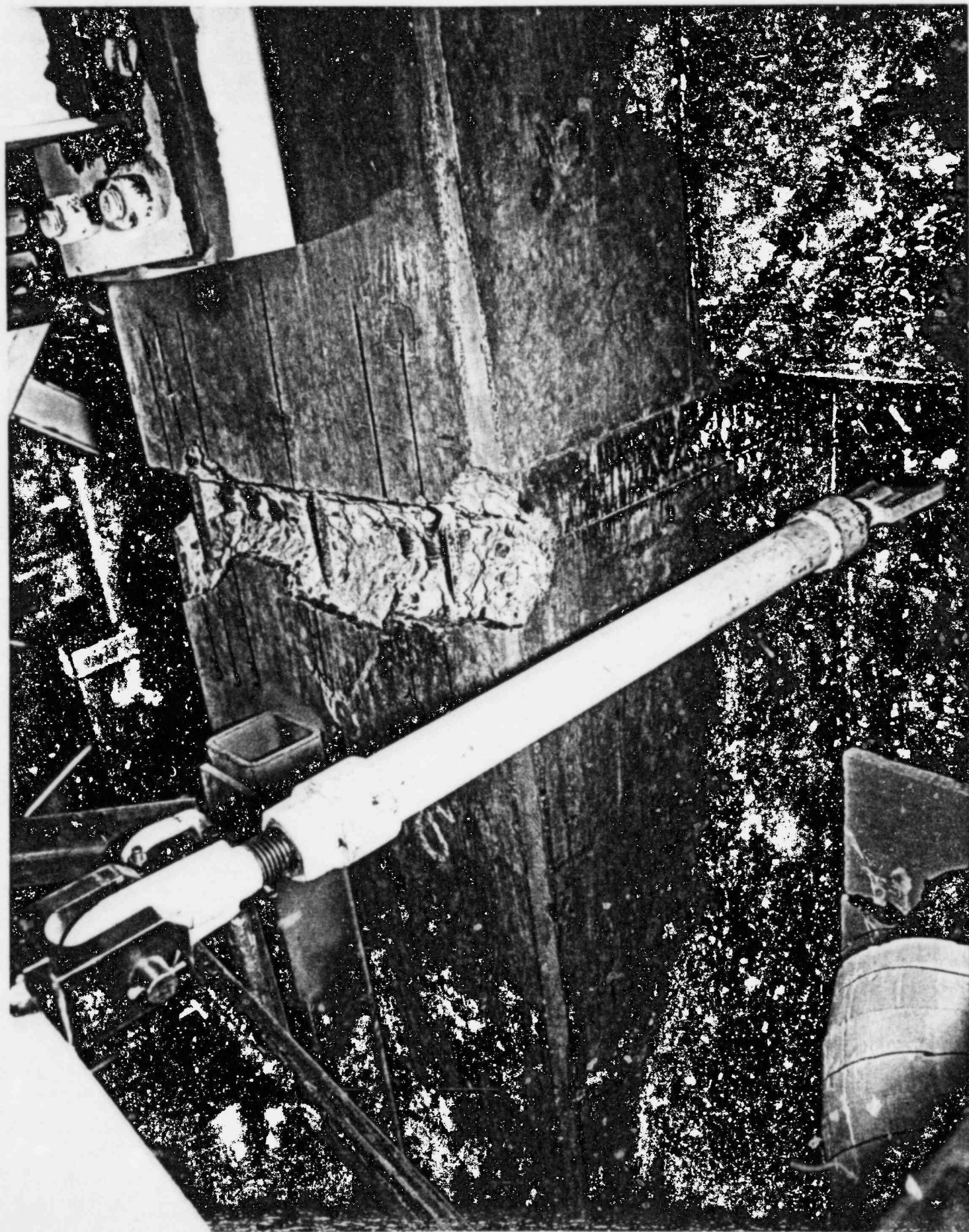


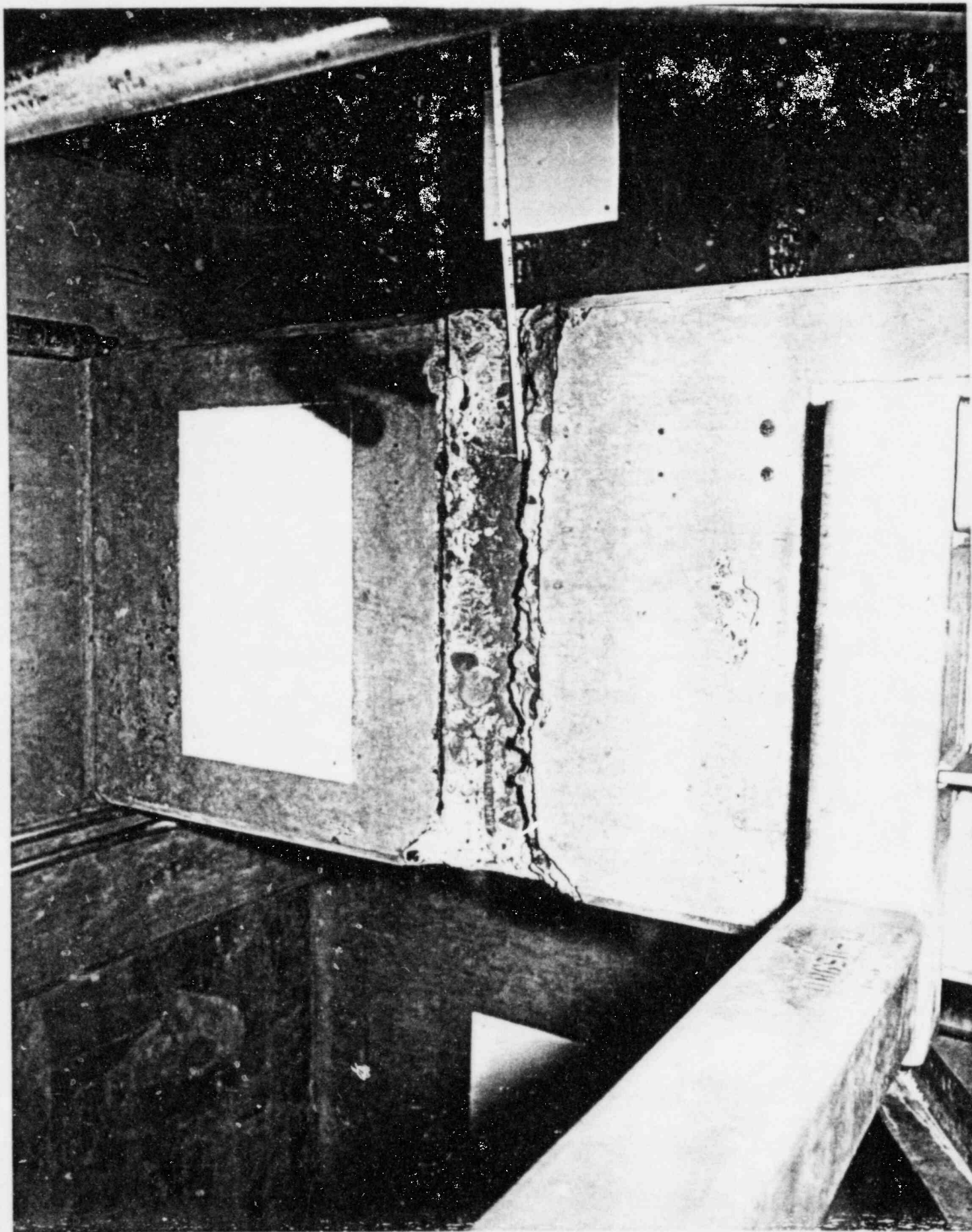


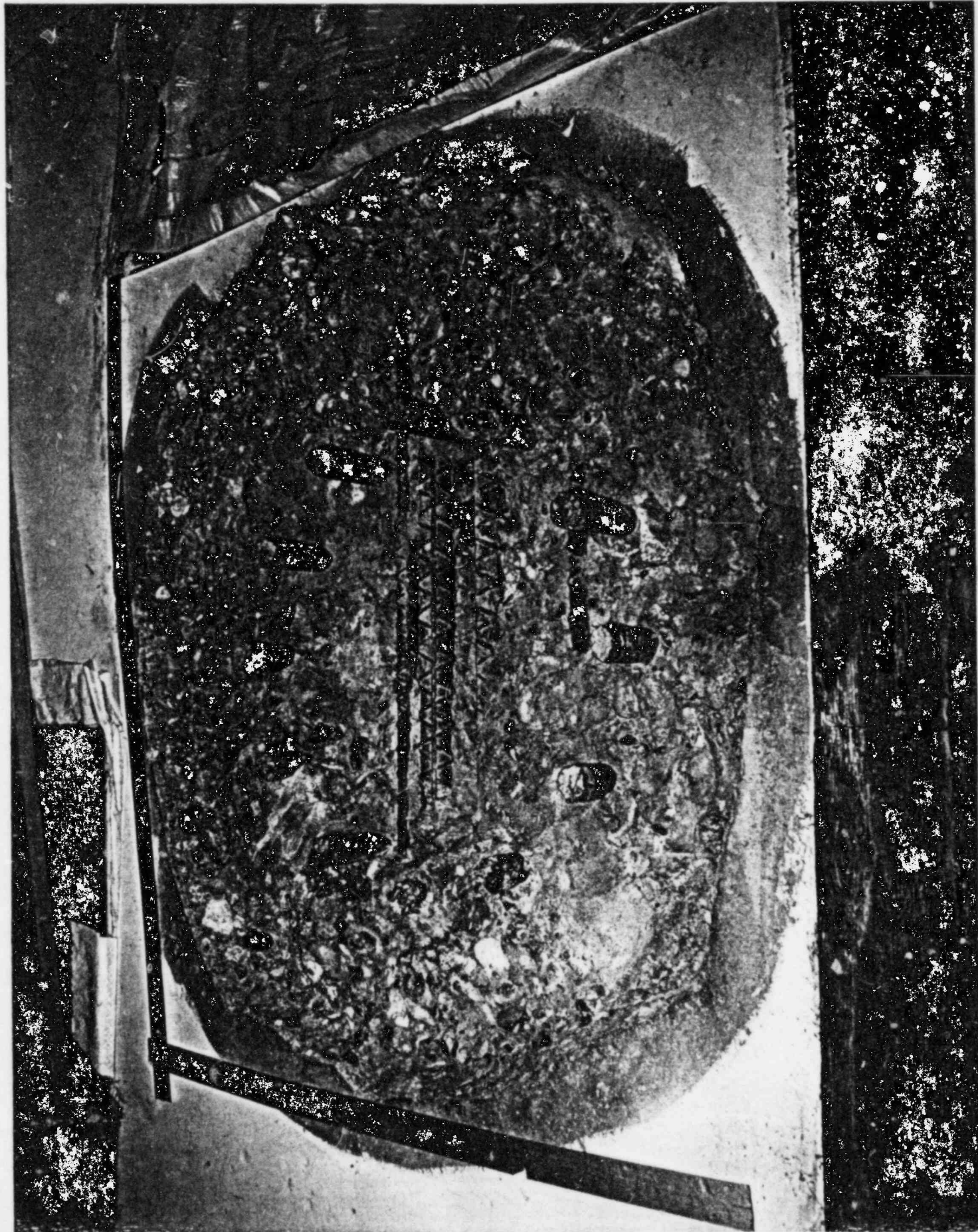


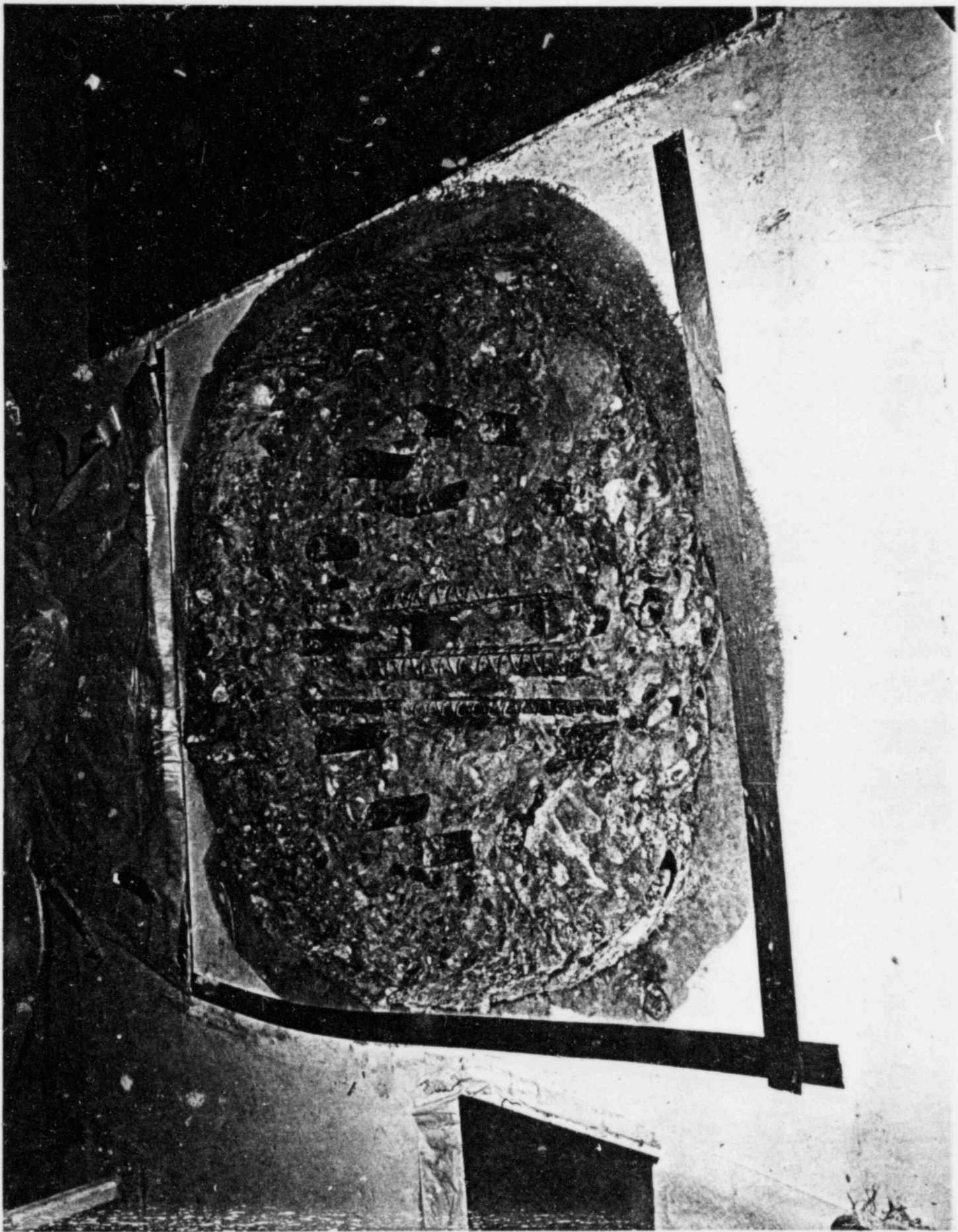


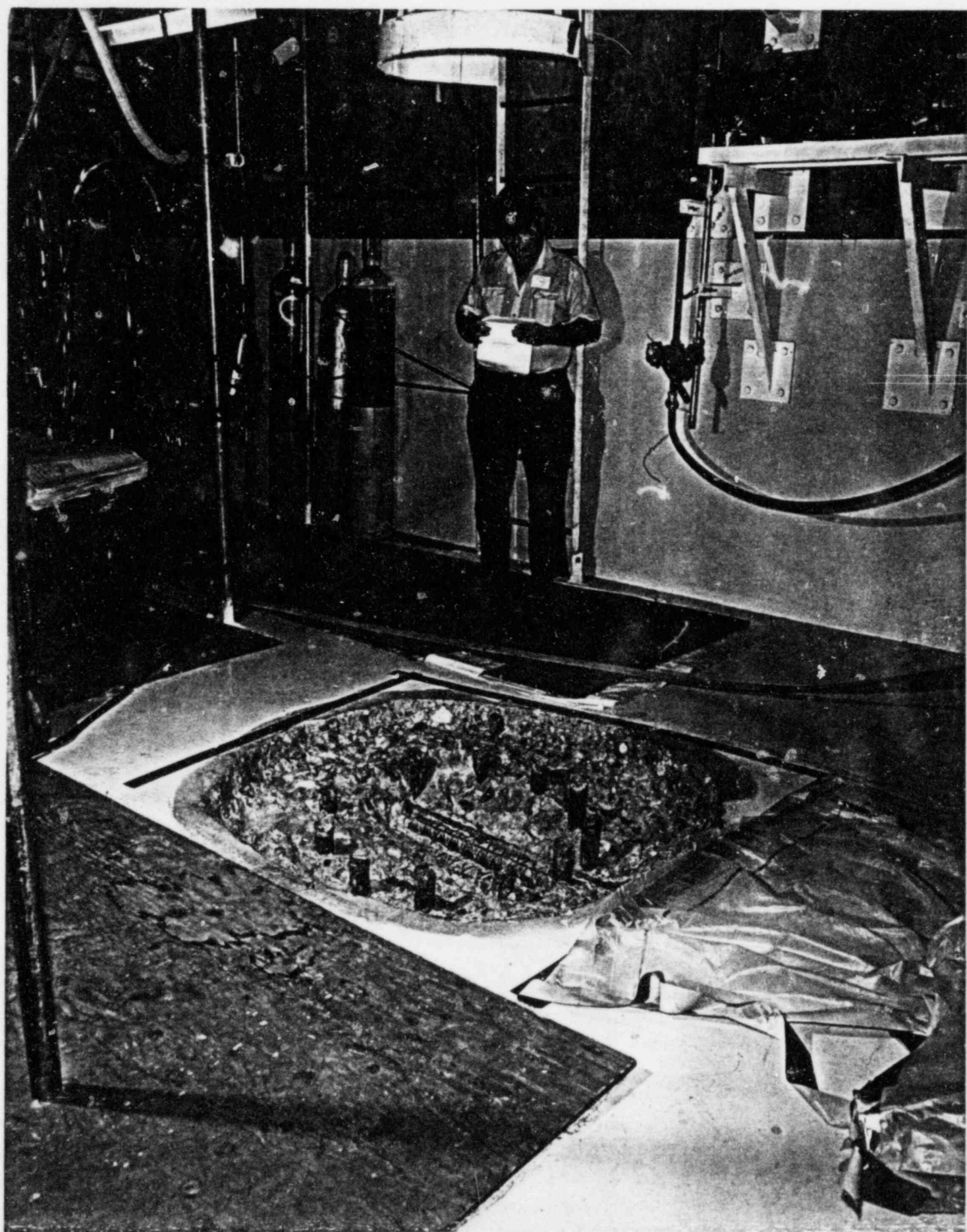




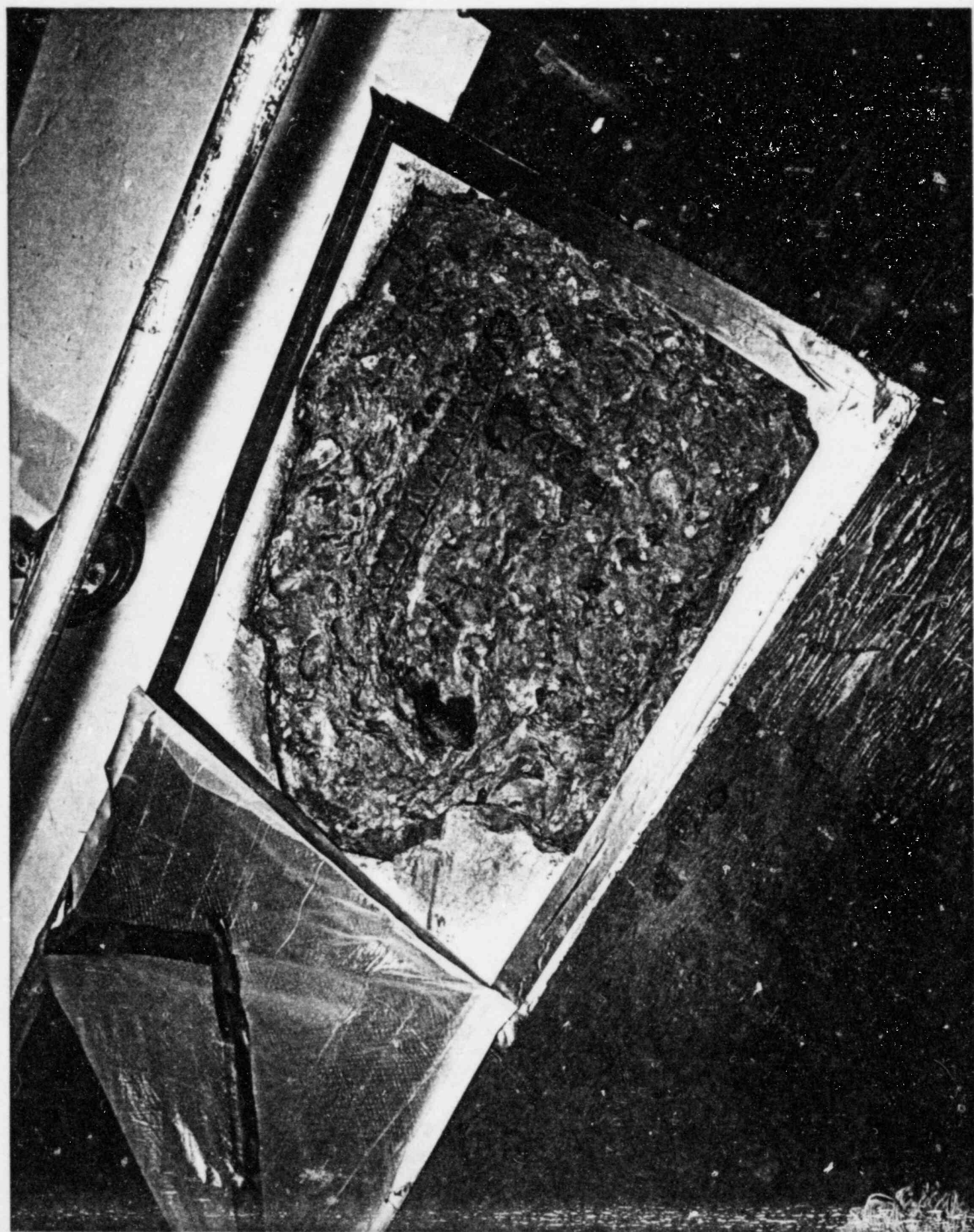




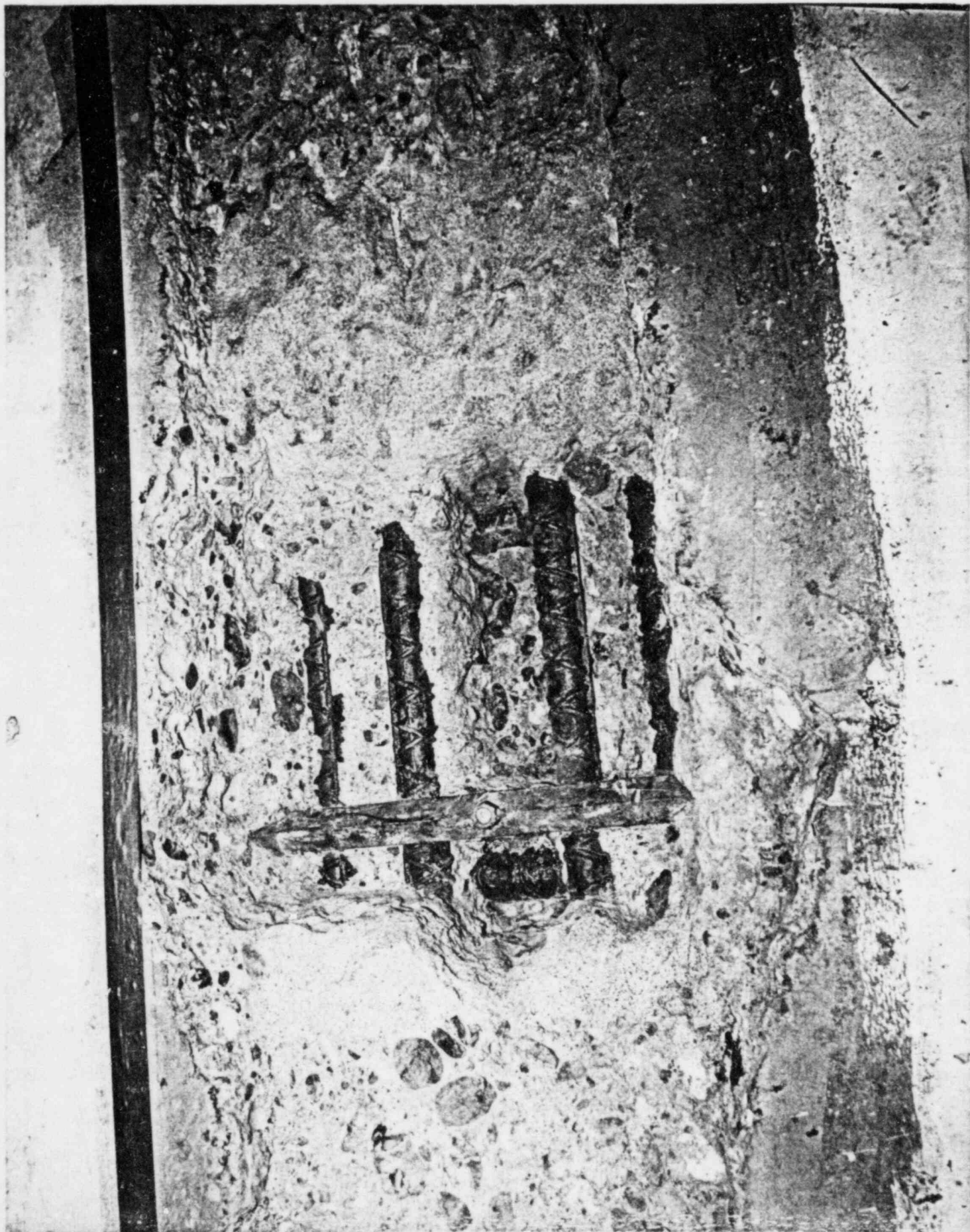






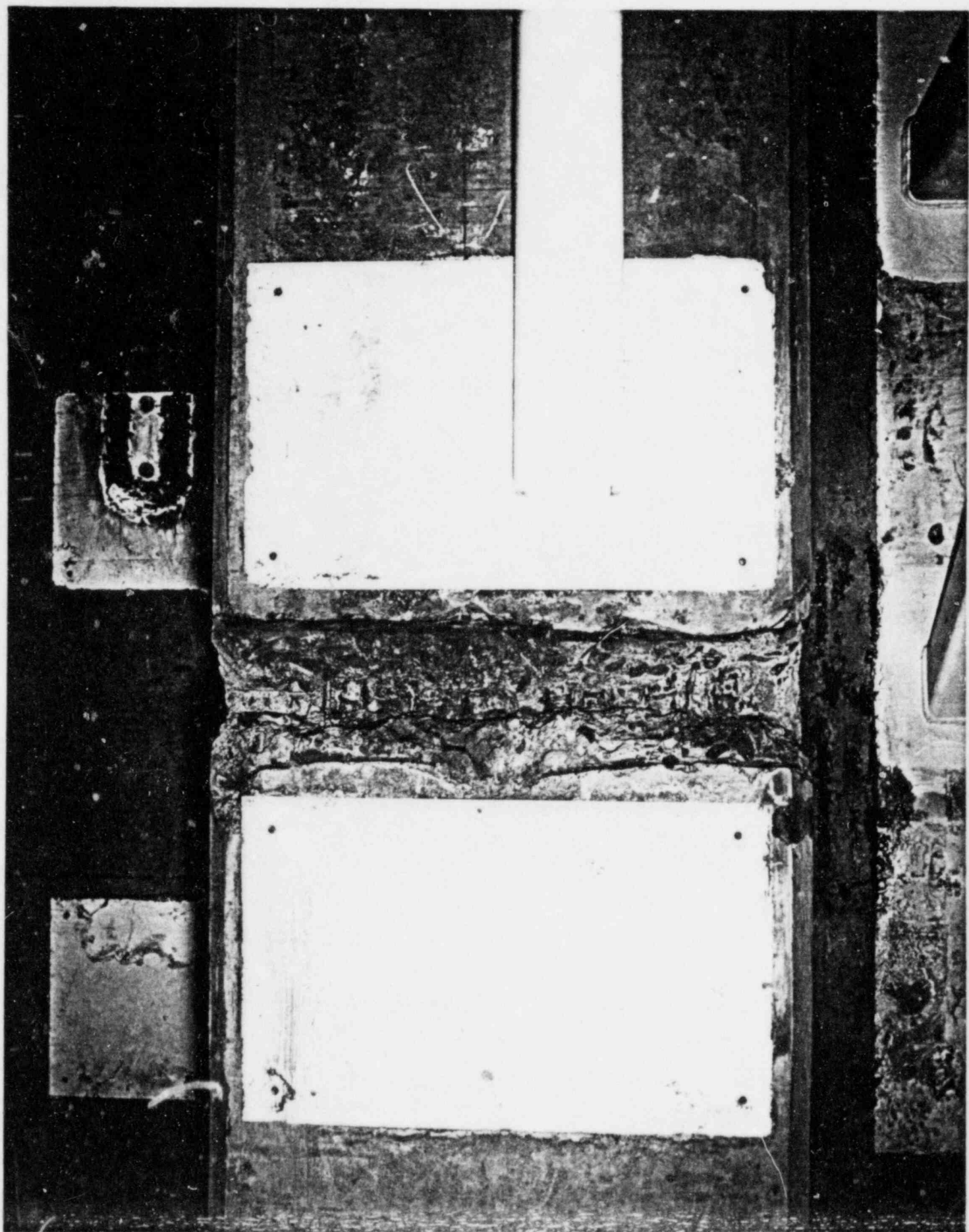


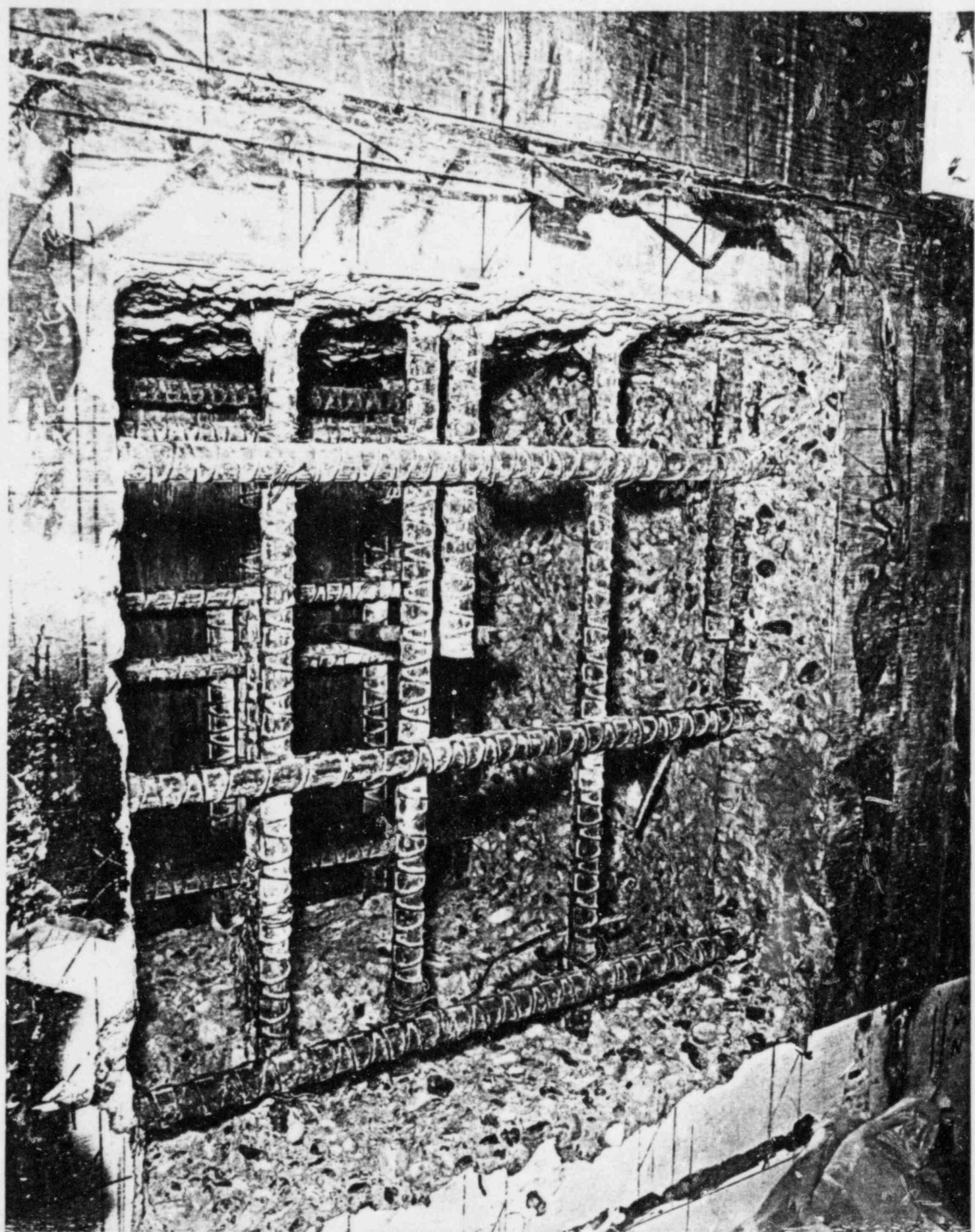


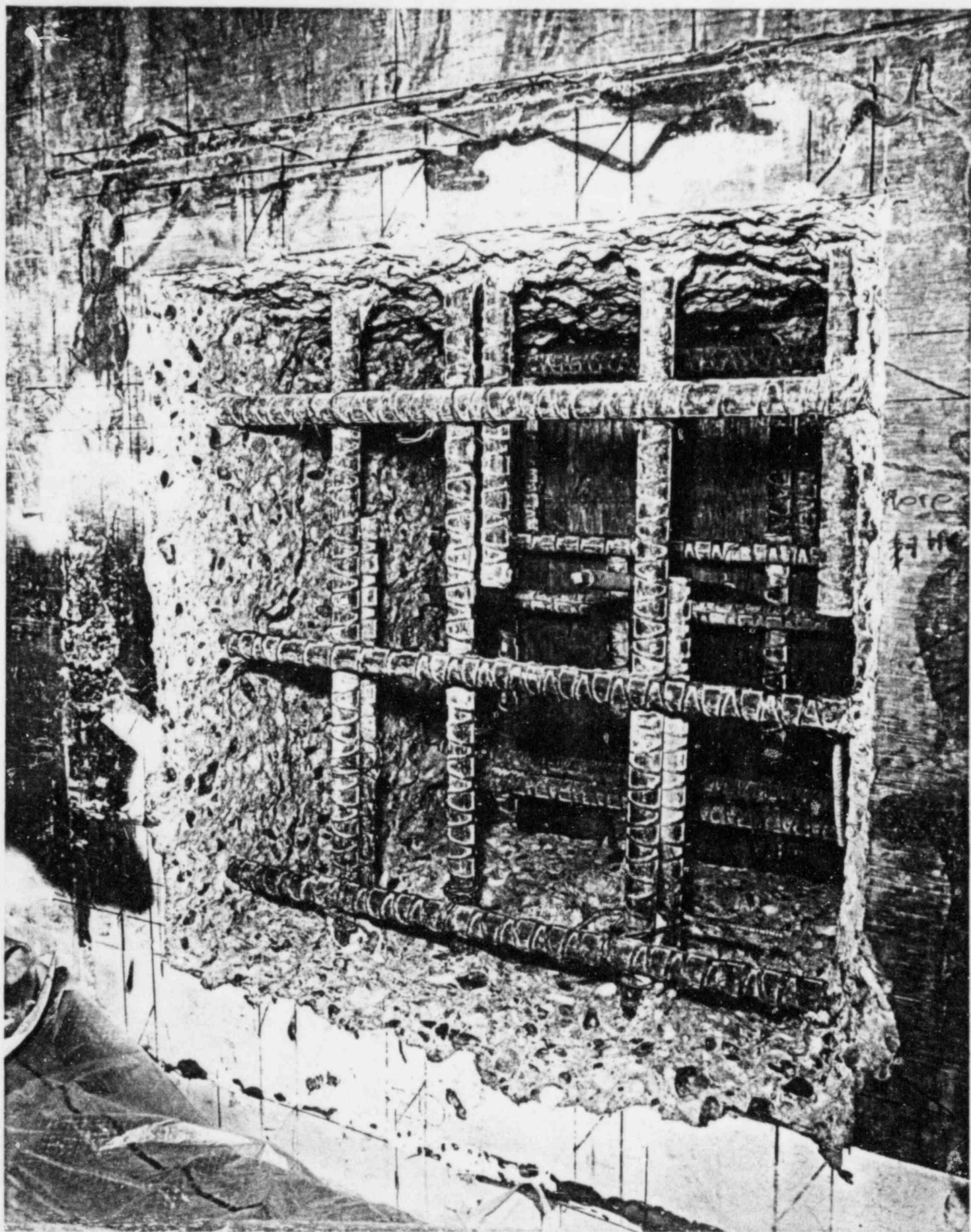


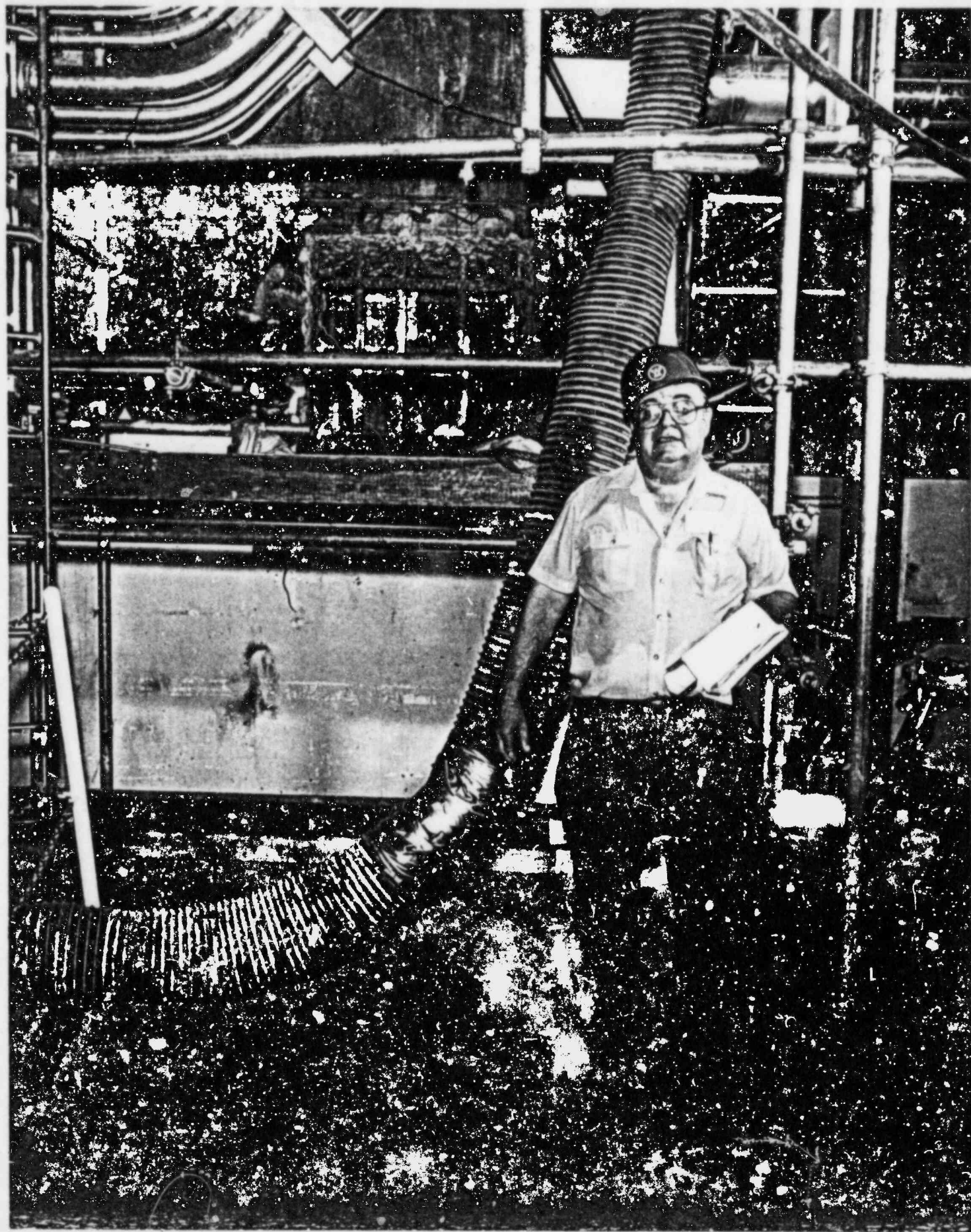


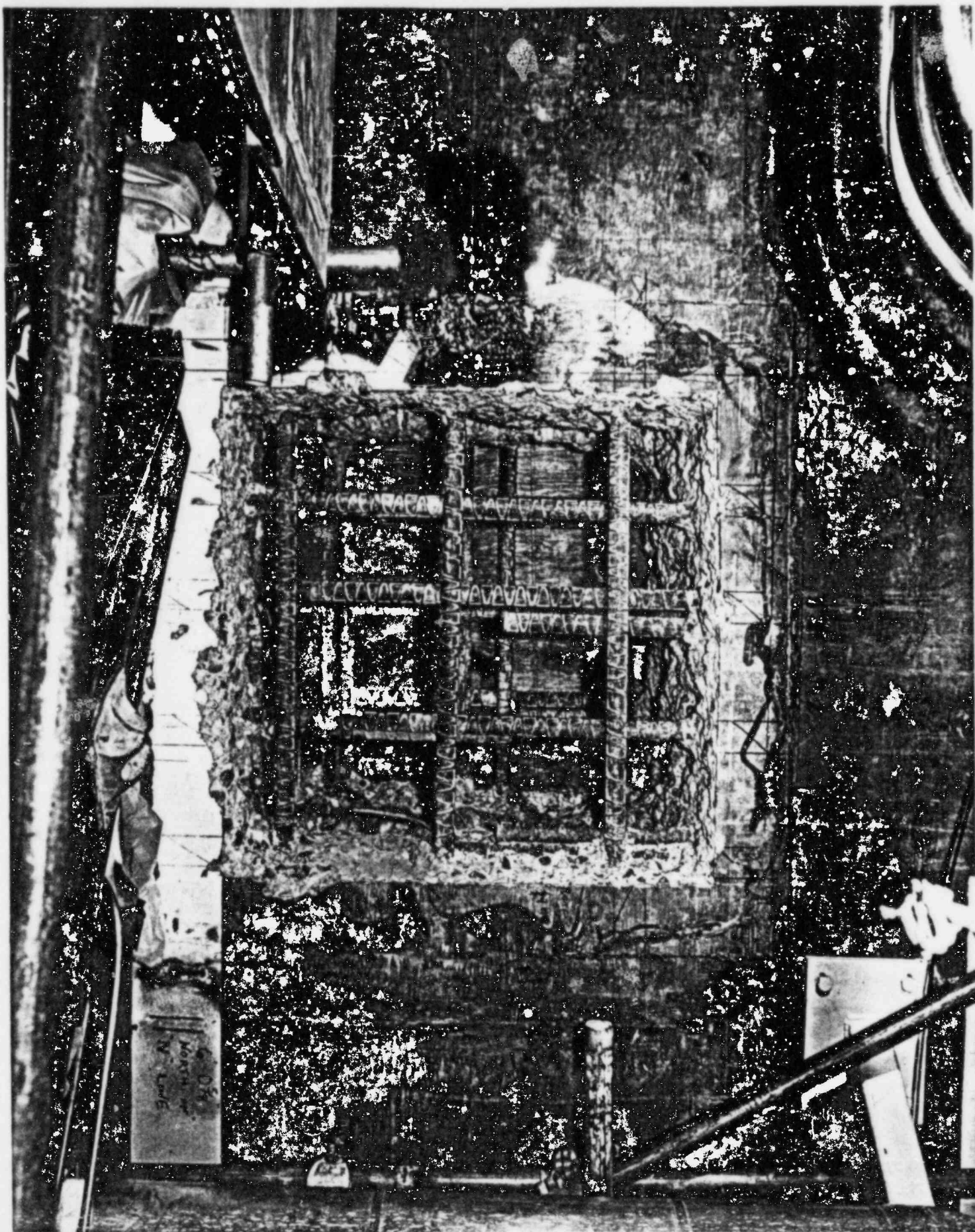


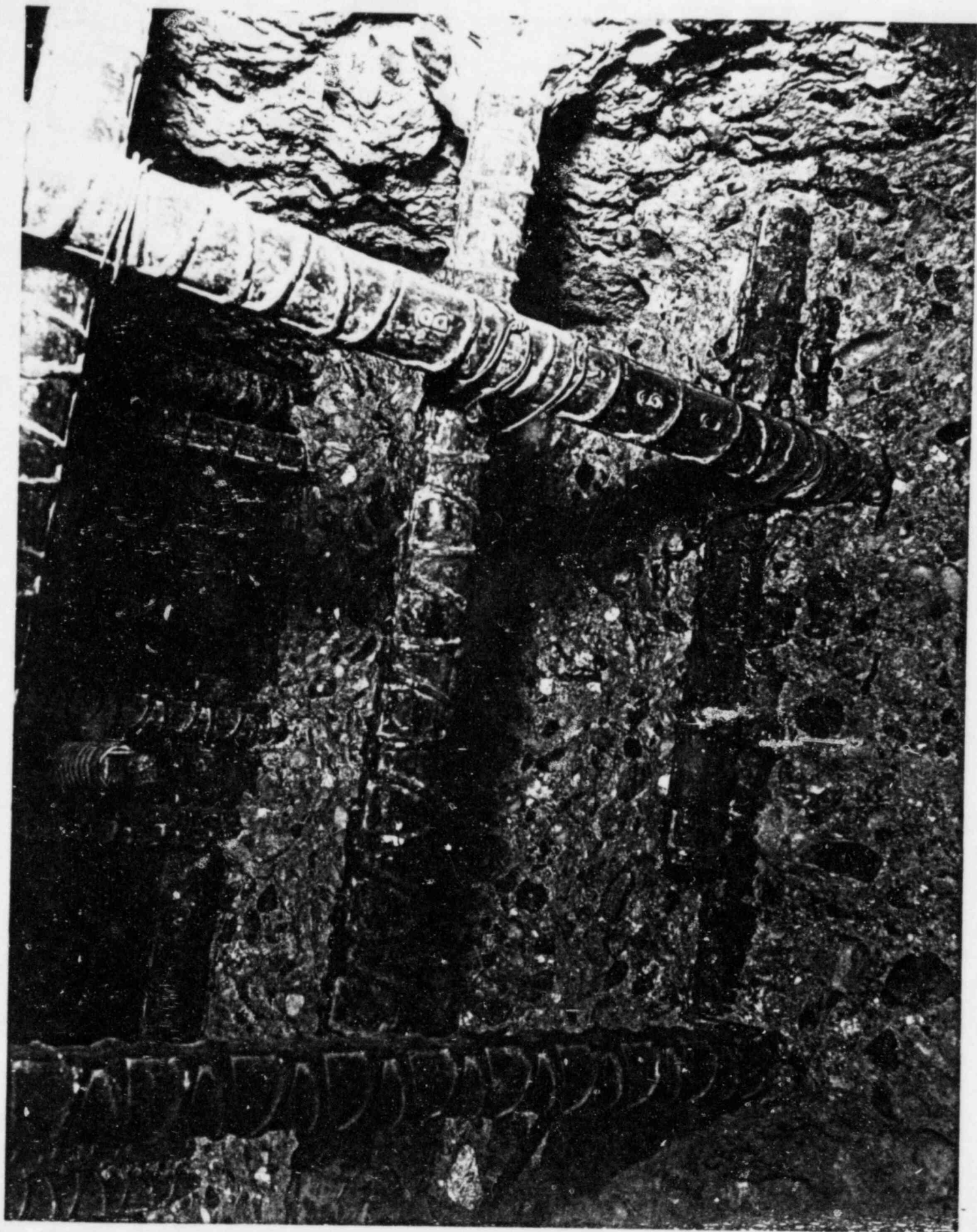


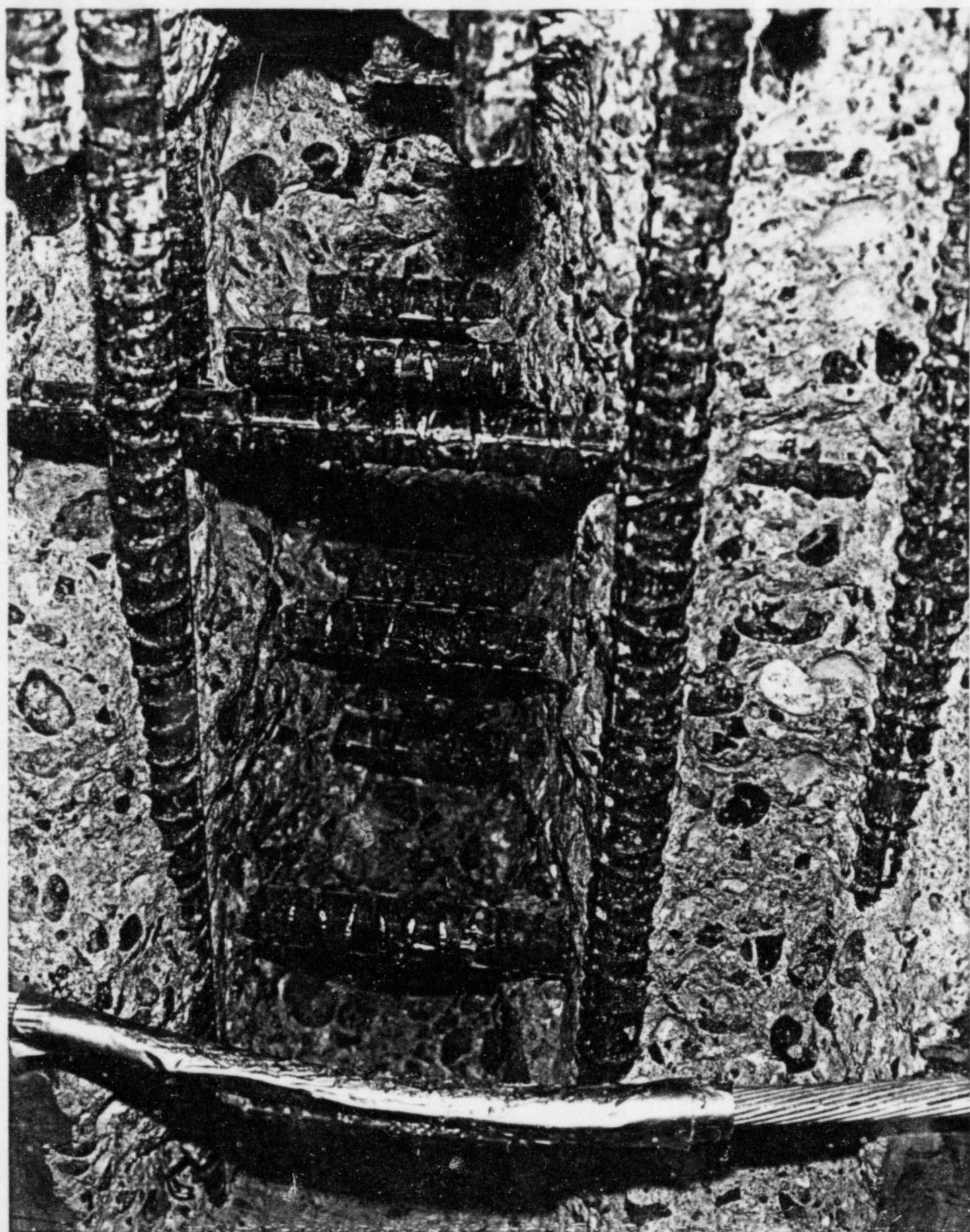


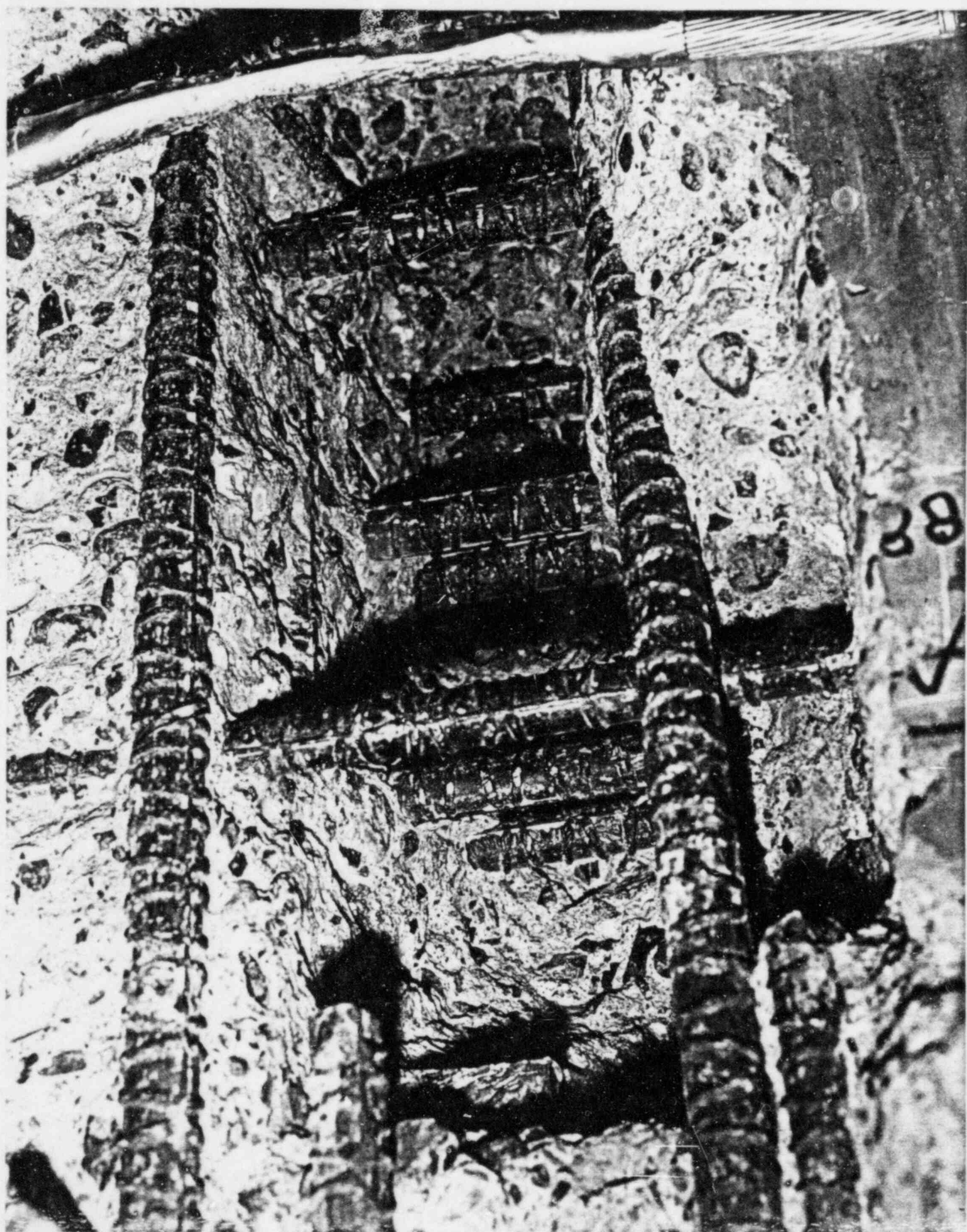


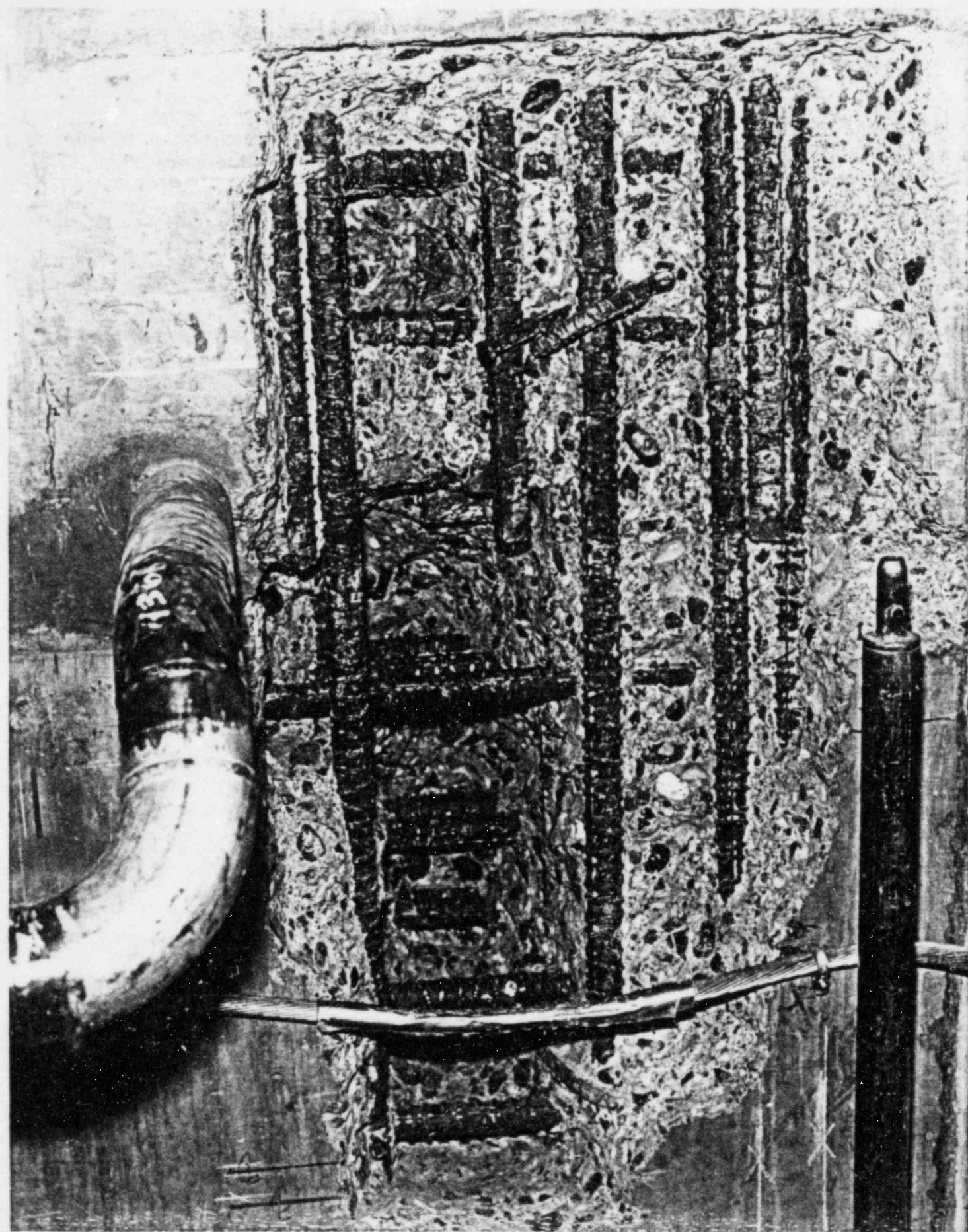


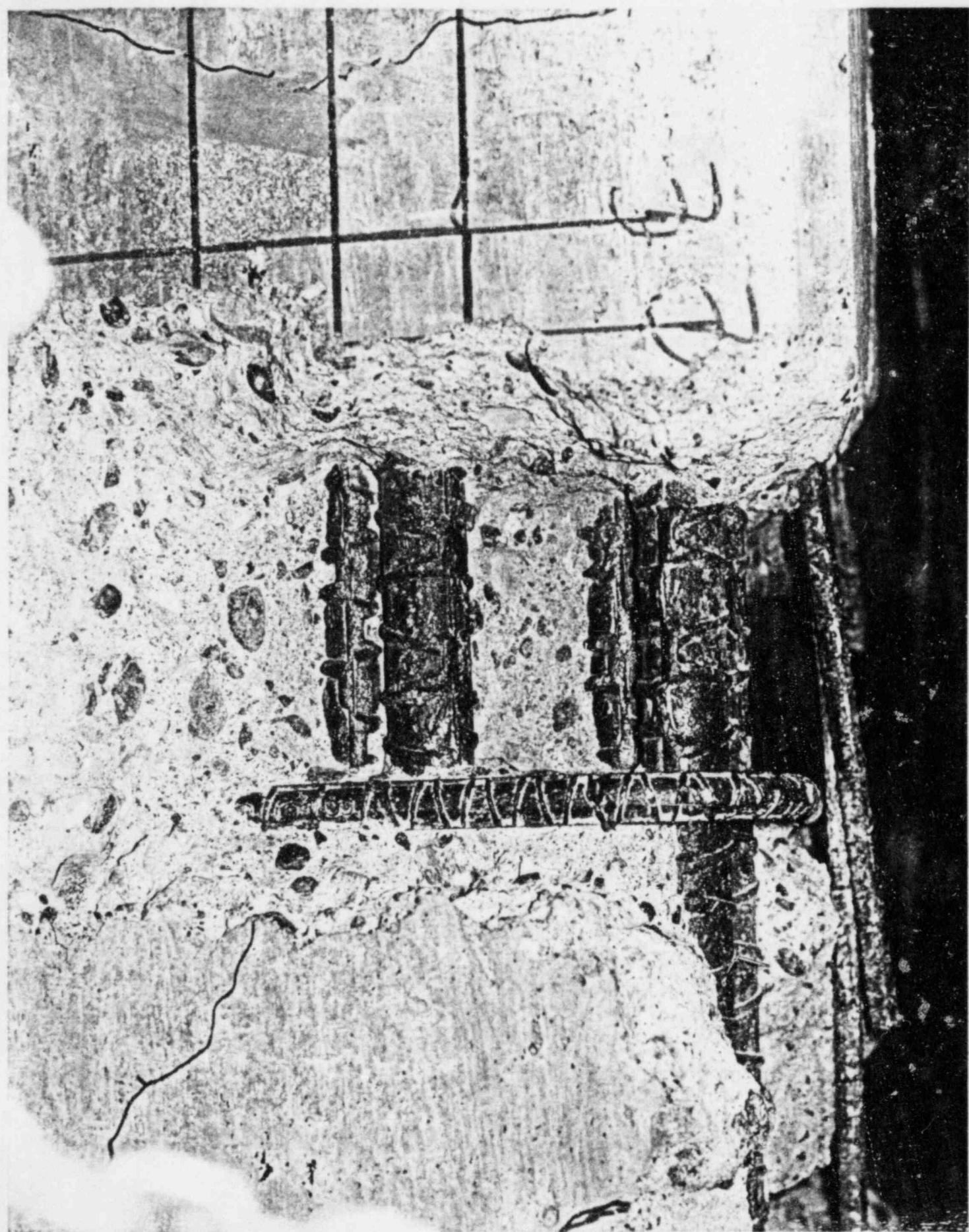


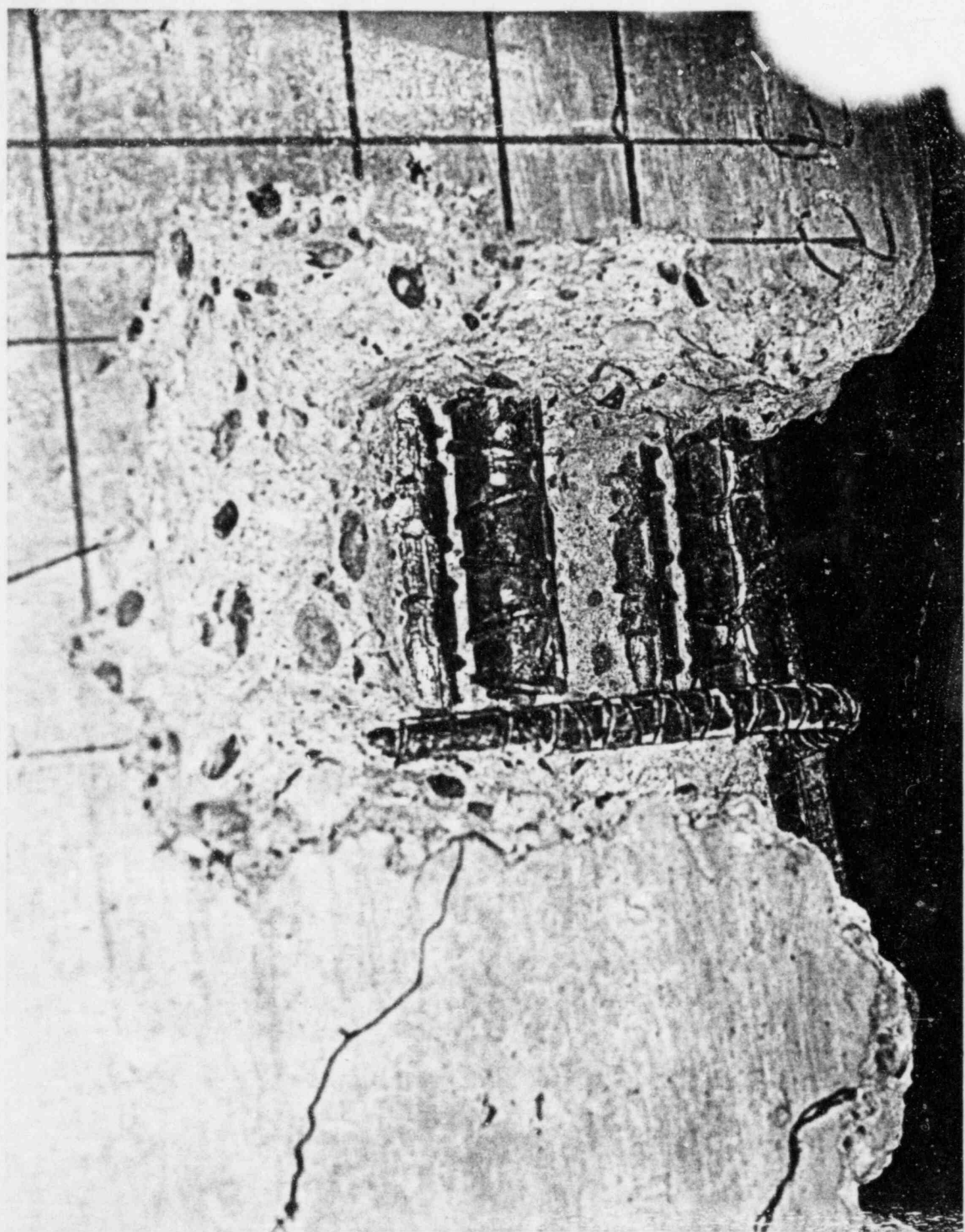








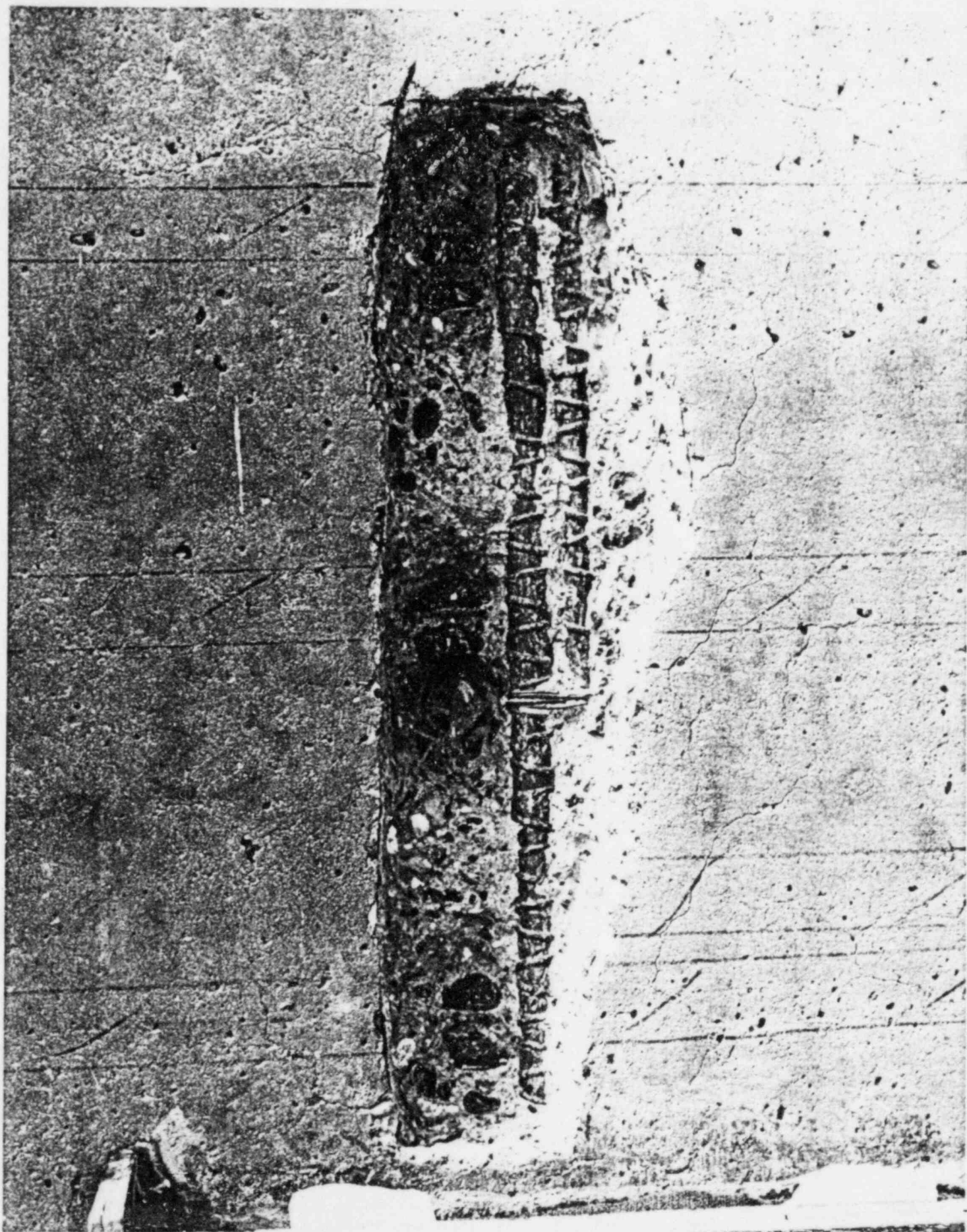


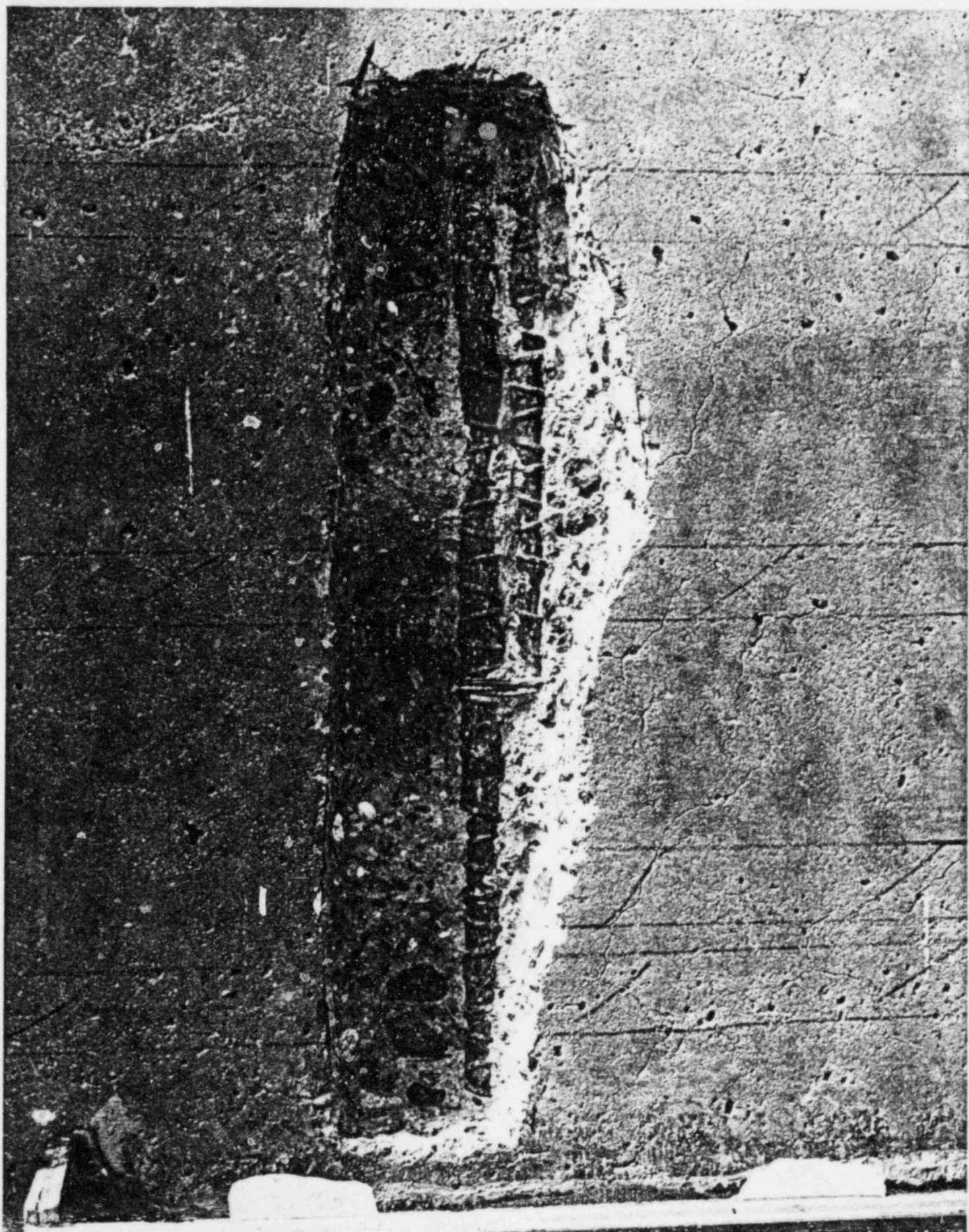


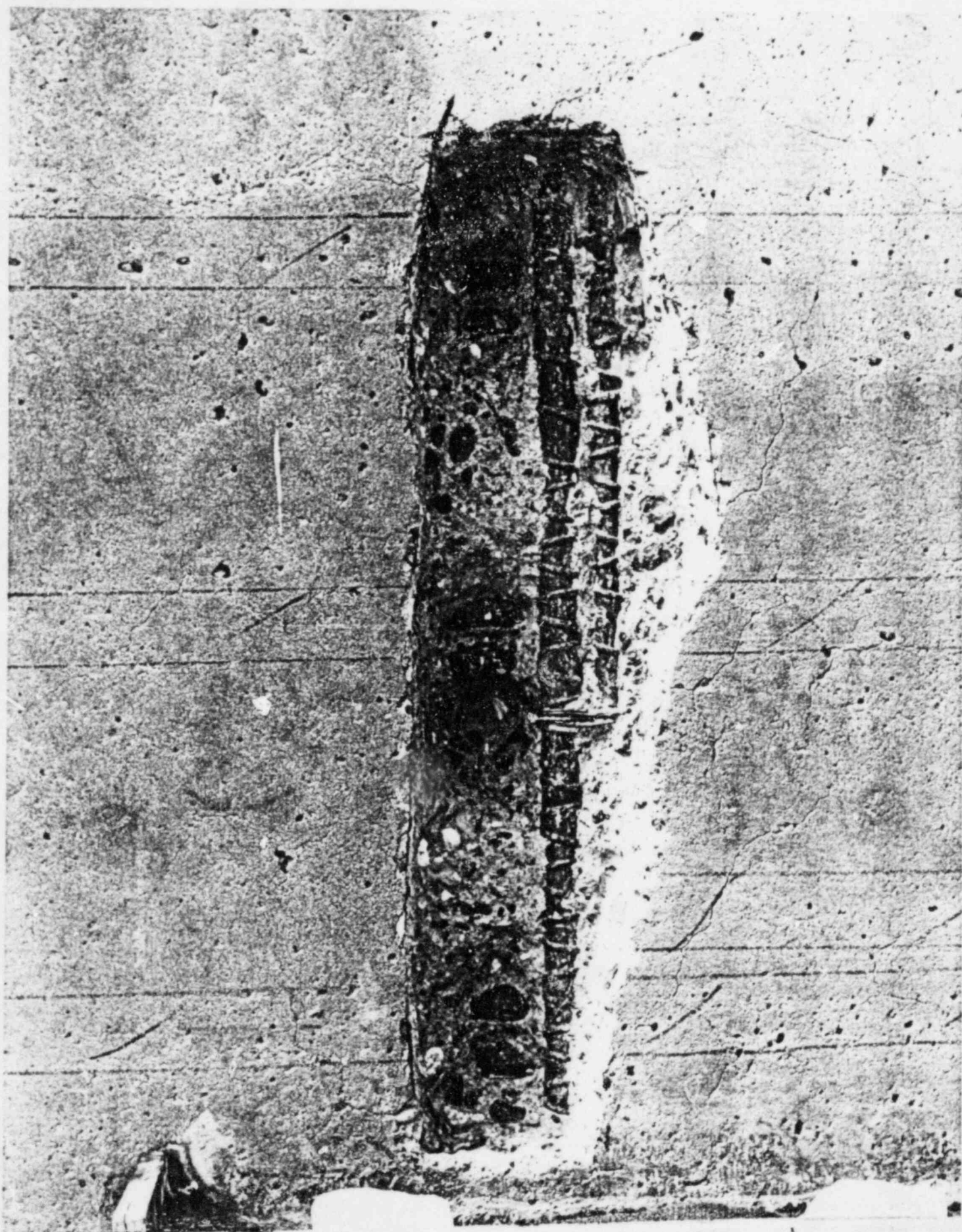
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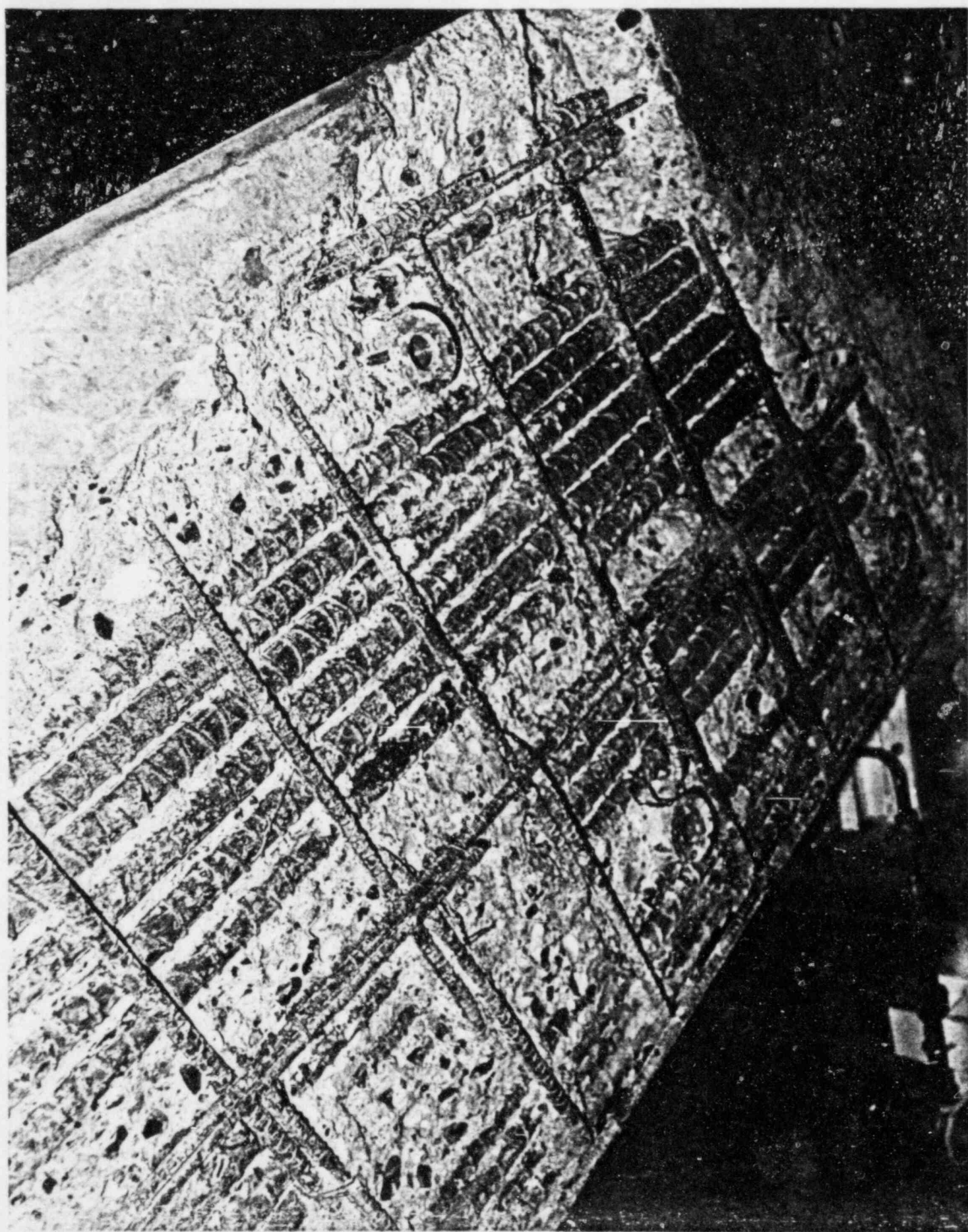












Page 2
WNP-2 Concrete Excavation
Photographs

<u>Sketch No.</u>	<u>Negative Number</u>	<u>Description</u>
4	40	E1. 471' beam 2B25 (looking up), 8' east of line 8.3
4	41	E1. 471' beam 2B25 (looking up), 7' west of line 8.3
4	42	same as neg. no. 41
2	44	E1. 471' beam 2B5 (looking up), 7' west of line 8.3
2	45	same as neg. no. 44
1	46	E1. 471' beam 2B3 (looking up), 2' east of line 7.7
1	47	same as neg. no. 46
1	48	same as neg. no. 46
5	49	E1. 501' beam (looking up), 4'-9" west of line 8.3
13	54	SK 13 looking south
13	55	SK 13 looking west
13	56	SK 13 looking southeast
14	57	SK 14 looking southwest
14	58	SK 14 looking southeast
15	59	SK 15 looking east
15	60	SK 15 looking south
15	61	SK 15 looking north
8	62	SK 8 looking up face west
8	63	SK 8 looking up face north
17	64	SK 17 looking southeast from inside
17	65	SK 17 looking northeast from inside
17	66	SK 17 overall from 20 feet
17	67	SK 17 overall from 5 feet
17	68	SK 17 close up
12	86	Fuel pool wall looking south
12	87	same as neg. no. 86
12	88	same as neg. no. 86
3	89	2B11 looking north
3	90	same as neg. no. 89
3	91	2B11 looking south
17	92	East exterior wall looking west (approx. to the center line 480'-6", just above opening)
17	93	same as neg. no. 92
17	94	same as neg. no. 92
4	95	2B25 looking up (patch removed)
4	96	same as neg. no. 95

Washington Public Power Supply System

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WNP-2 CONCRETE EXCAVATION REACTOR BUILDING

PHOTOGRAPHS

<u>Sketch No.</u>	<u>Negative Number</u>	<u>Description</u>
11	4	North wall/beam dryer separator pool el. 578'-7½" (looking up)
11	5	same as neg. no. 4
12	6	North wall/beam fuel storage pool el. 588' (looking south)
12	7	same as neg. no. 6
8	8	El. 572' beam 6B9 (looking up), 2' north bioshield wall face
8	9	same as neg. no. 8
7	10	El. 522' beam 4B30 (looking up), 4'-9" north of column line
7	11	same as neg. no. 10
10	12	West ext. wall (east face) in stairwell el. 492'-6" (looking west)
10	13	same as neg. no. 12
6	14	El. 501' beam 3B18 (looking up), 5' east of column line 7.7
6	15	El. 501' beam 3B18 (looking up), 1' east of column line 7.7
6	16	same as neg. no. 15
6	17	El. 501' beam 3B18 (looking up), 5'-6" west column line 7.7
6	18	same as neg. no. 17
6	19	El. 501' beam 3B18 (looking up), 3'-3" east column line 8.3
6	20	same as neg. no. 19
14	23	Mat el. 422'-3" crane bay (looking down), 6' south of column line N; 6'-9" east of column line 7
14	24	same as neg. no. 23
9	25	Pilaster/column at 3.4 and M (looking southeast)
9	26	same as neg. no. 25
9	27	same as neg. no. 25 (looking northeast)
9	28	same as neg. no. 27
3	31	El. 471' beam 2B11 (looking up), 2' west of column line 8.3
3	32	same as neg. no. 31
3	33	El. 471' beam 2B11 (looking up)
3	34	same as neg. no. 33
3	35	same as neg. no. 33
3	36	same as neg. no. 33
4	39	El. 471' beam 2B25 (looking up), 8' east of line 8.3