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SACRAMENTO MUNICIPAL UTILITY DISTRICT ☐ 6201 S Street, Box 15830, Sacramento, California 95813; (916) 452-3211

January 19, 1981

Mr. R. H. Engelken, Director
Region V, Office of Inspection
and Enforcement
U.S. Nuclear Regulatory Commission
Suite 202, Walnut Creek Plaza
1990 North California Boulevard
Walnut Creek, CA 94596

Docket 50-312
Rancho Seco Nuclear Generating
Station, Unit No. 1
IE Bulletin 80-11

Dear Mr. Engelken:

The subject bulletin dated May 8, 1980, requested information on masonry walls that could effect safety related systems. The District responded on July 16, 1980 with information requested in items 1, 2a, and 3. The attached report represents a final response to all items in the bulletin. This report shows that the concrete masonry walls at Rancho Seco will withstand site related extreme environmental effects with no failure.

Sincerely,

John J. Mattimoe

John J. Mattimoe
Assistant General Manager
and Chief Engineer

Sworn to me and subscribed before
me this 21st day of January, 1981.

Patricia K. Geisler
Notary Public

OFFICIAL SEAL
PATRICIA K. GEISLER
My Commission Expires November 22, 1983

Enclosure

cc: NRC Office of Inspection
and Enforcement
Division of Reactor Operations
Inspection
Washington, D.C. 20555

REPORT ON THE RE-EVALUATION

OF

CONCRETE MASONRY WALLS

IN RESPONSE TO NRC I&E BULLETIN 80-11

FOR THE

RANCHO SECO NUCLEAR GENERATING STATION

UNIT 1

1.0 GENERAL

This report contains the results of the re-evaluation of concrete masonry walls for the Rancho Seco Plant and serves as a complete response to NRC I&E Bulletin 80-11 dated May 8, 1980.

2.0 DESCRIPTION OF MASONRY WALLS

2.1 Identification and Function of Walls

There are two areas of the Rancho Seco Plant that have masonry walls and they are as follows:

A. At the 40 foot elevation of the Auxiliary Building at the west end a three sided masonry wall enclosure around the Nuclear Service Station Transformer Train "A". See Plan in Attachment "D".

B. At grade on the north side of the Turbine Building and Reactor Building a masonry wall enclosure surrounding the tank farm. See Plan in Attachment "D".

Both of the masonry wall areas have security masonry walls, to prevent intrusion into these areas, that enclose safety related equipment. The failure of these walls could possibly damage this equipment and on this basis these walls were selected for the survey and analysis. These are the only masonry walls in the plant that are in the vicinity of safety related items. The Field Survey Procedure identifies the wall numbering system, the results of the survey which indicates wall height and thickness and single wythe masonry construction is incorporated in this report as Attachment "C". These walls are classified as security walls.

2.2 Wall Configurations and Details

The nuclear service station transformer enclosure, located at the forty foot elevation of the Auxiliary Building is constructed from normal weight 12 inch concrete masonry with all cells grouted. At the top of the wall there is a 12 inch deep by 21 inch wide reinforced concrete bond beam. The reinforcement in the bond beam consists of six #6 reinforcing steel and #4 reinforcing steel closed stirrups at a maximum spacing of two feet on centers. The bond beam is attached to the existing west reinforced concrete wall using shell concrete anchors installed in the existing concrete and reinforcing steel dowels threaded at one end to engage the concrete anchors. The dowels are located to lap the bond beam horizontal reinforcement. The north masonry wall is constructed on top of a existing twelve inch thick reinforced concrete wall. The vertical reinforcing steel is #4 bars at 16 inches on center on each face in the grouted cells. The vertical reinforcing steel extends into the bond beam and is attached to the existing concrete wall with concrete shell anchors and threaded reinforcing steel dowels. The west and south masonry walls have vertical reinforcing steel of #4 bars @ 16 inches on center staggered in each face of grouted cells extending into the bond beam and secured into existing concrete with concrete shell anchors and threaded reinforcing steel dowels. The exception to this vertical reinforcing steel spacing is around the structural steel louver in the west wall. The vertical steel in this area are #4 bars at eight inches on center each face. Additional vertical steel was placed because one end of the structural steel beams are attached to the south masonry walls with anchor bolts embedded in the grouted cells.

The horizontal reinforcing steel is two #4 bars at 32 inches on center. The bars have a lap splice with dowels that are threaded on one end and screwed into concrete shell anchors installed in the existing reinforced concrete walls. Refer to the drawings in Attachment "D" for sheets 1, 2 and 3 for Plans, Sections and Details of the Nuclear Service Transformer Enclosure for more specific details of construction.

The security fence, located on the north side of the Reactor Building and Turbine Building, is constructed using 8" wide normal weight concrete block with all cells grouted with concrete. The masonry wall is constructed on a continuous reinforced concrete spread footing. The masonry wall is 8 feet high and is topped by a 6 foot chain link fence. The vertical reinforcement consists of two #5 in alternate cells with one bar cut-off 5 feet above the foundation and one bar continuing to the top of the wall. The horizontal reinforcing steel consists of five #5 bars spaced over the height of the wall as follows: one in the first course, one in the fourth course, one in the seventh course, one in the tenth course, and one in the top course. One additional #5 bar is placed over the man door opening. The horizontal bars have been lap spliced at the corners.

At each side of the openings for the 14 foot high gates a pilaster has been constructed from concrete masonry utilizing two blocks. Each grouted cell has a #5 reinforcing bar full height of the pilaster. The horizontal wall reinforcing extend into the pilaster block and the blocks are tied together with #5 hooked reinforcing bars. The spacing of the ties, up to 8 feet, match the wall horizontal reinforcing. Above 8 feet to 14 feet the ties are placed in every third course. Each gate hinge is secured by a anchor bolt hooked around the second pilaster cell vertical reinforcing bar from the opening. For more definitive information on the plant location and construction details see Attachment "D" see Tank Farm Fence Plot Plan, Sections and Details.

2.3 Materials of Construction

A. Concrete Masonry Block

Conforms to ASTM C-90 Specification for Hollow Load Bearing Concrete Masonry Units. Grade "N" Normal Weight Units were used.

B. Concrete

f'_c = 3000 psi at 28 days.

C. Tank Farm Fence Cell Grout

f'_c = 3000 psi at 28 days

D. Transformer Enclosure Cell Grout

f'_c = 2000 psi at 28 days

E. Mortar

Type "S" or "M"
Type "S" f'_c = 1800 psi at 28 days
Type "M" f'_c = 2500 psi at 28 days

F. Reinforcing Steel

ASTM A615 Grade 60 "Specification for Deformed Billet-Steel Bars for Concrete Reinforcement."

G. Bolts

Anchor bolts conform to ASTM A 307.

The material properties that were used in the analysis did not deviate from the standards listed above. Testing of concrete and cell grout was accomplished by an independent testing laboratory. The method used for compressive test conformed to ASTM C-39 "Tests for Compressive Strength Cylindrical Concrete Cylinders." The following is the results of the 28 day tests:

1. Concrete f'_c = 3060 psi

2. Tank Farm Fence Cell Grout f'_c = 3360 psi

3. Transformer Enclosure Cell Grout f'_c = 2280 psi

3.0 CONSTRUCTION PRACTICES

The tank farm security fence construction sequence is as follows:

A. Drill pilaster caissons, set rebar cage and place concrete to the bottom of footing elevation.

B. Construct spread footing including footing and wall reinforcing steel.

C. Lay up concrete masonry units, installing horizontal reinforcing steel and embedded anchor bolts at the designated locations.

D. Grout wall cells, and place chain link fence sockets.

E. Complete pilasters and grout.

F. Set manually door frame and install door.

G. Surface mount security system conduit and junction boxes.

H. Install chain link fence and install 14 foot high gates.

The transformer enclosure construction sequence is as follows:

A. Roughen concrete curb surfaces, drill and set concrete expansion anchors. Place vertical reinforcing steel dowels and horizontal curb reinforcing steel and place concrete to widen the curb to 12 inches.

B. Roughen horizontal and vertical surfaces of existing concrete walls. Drill and set concrete expansion anchors for vertical and horizontal masonry wall dowels.

C. Install ventilation louver sill plate.

D. Lay up masonry units installing dowels and horizontal reinforcing steel, ventilation louver jamb plates.

E. When masonry units are layed up to 8 feet set vertical reinforcing steel full height and grout all cells.

F. Lay up masonry units to bottom elevation of bond beam, place horizontal reinforcing steel, ventilation head plate, lintel stirrups in the west wall, and grout all cells.

G. Form, place bond beam reinforcing steel and stirrups and pour bond beam.

H. Set structural steel, install connection bolts, place grating, install ventilation louvers set man door frame and install door. Surface mount conduit and junction boxes for security system.

Tests conducted were identified in Paragraph 2.3 Materials of Construction. Inspections were conducted under the Sacramento Municipal Utility Districts QA/QC program for Rancho Seco.

The results of the tests and inspections are filed at the Rancho Seco Plant Site.

4.0 RE-EVALUATION CRITERIA AND COMMENTARY

4.1 Criteria

Attachment A contains the criteria used for the re-evaluation of the safety-related concrete masonry walls for this plant.

Licensing commitments contained in the Final Safety Analysis Report (FSAR) as related to loads and load combinations are incorporated in the criteria. In addition, the criteria considers present day state-of-the-art analysis and design techniques as follows:

a) No stress increase factors for normal operating loads

b) Stress increase factors for abnormal and extreme environmental loads

c) Realistic damping values

d) Interstory drift

e) Frequency variations due to uncertainties in material properties and effective mass

4.2 Commentary on the Criteria

Attachment B is the commentary on the criteria and contains detailed justification of the criteria by reference to existing codes, test data and standards of practice.

5.0 RESULTS OF THE EVALUATION

The results of the evaluation for the Nuclear Service Station Transformer is shown in Table 1 and the results for the Tank Farm Fence is shown in Table 2.

The flexure capacity for the Nuclear Service Station Transformer Enclosure is controlled by the reinforcing steel and analyzed as a one-way slab between the concrete floor slab and the bond beam. The shear capacity was calculated without utilizing the reinforcing steel.

The flexure capacity of the Tank Farm Fence is controlled by the masonry and was analyzed as a cantilever from the spread footing. Seismic forces controlled the design and the factor of safety for overturning is 3.2 for O.B.E. and 1.6 for S.S.E. conditions. The shear capacity was calculated without utilizing the reinforcing steel.

The results indicate that the walls in both cases will not fail under adverse environmental conditions.

TABLE 1

NUCLEAR SERVICE STATION
TRANSFORMER ENCLOSURE

SUMMARY (Units: Kips/Ft. and Ft. Kips/Ft.)

Wall No.	Type of Stress	Load due to:				Capacity OBE	Load due to:		Capacity SSE	Remarks
		D	L	Eo	D+L+Eo		Es	D+L+Es		
528.IN										See wall no. 528.3S
528.2W	Axial	3.0	1.6	0.8	5.4	45.0	1.7	6.3	76.0	Compression
	Flexure	0.2	—	1.4	1.6	2.6	2.7	2.9	5.7	
	Shear (Off-Plane)	—	—	0.4	0.4	4.4	0.8	0.8	7.3	
	Shear In-Plane	—	—	2.1	2.1	5.5	4.1	4.1	9.2	
Lintel	Flexure	11.2	11.7	4.3	27.2	28.0	8.7	31.6	46.5	
	Shear	3.5	2.5	1.4	7.4	9.7	2.8	8.8	16.2	
528.3S	Axial	2.1	0.3	0.8	3.2	45.0	1.8	4.2	76.0	Compression
	Flexure	0.2	—	1.4	1.6	2.6	2.7	2.9	5.7	
	Shear (Off-Plane)	—	—	0.4	0.4	4.4	0.8	0.8	7.3	

TABLE 2

TANK FARM FENCE

SUMMARY (Units: Kips/Ft. and Ft. Kips/Ft.)										
Wall No.	Type of Stress	Load due to: D	L	Eo	D+L+E	Capacity OBE	Load due to: Es	D+L+E	Capacity SSE	Remarks
181.IW&N thru 181.8E	Axial	0.75	—	0.11	0.86	30.4	0.22	0.97	50.8	Compression
	Flexural	—	—	0.69	0.69	1.31	1.4	1.4	2.2	
	Shear (Off-Plane)	—	—	0.18	0.18	1.8	0.34	0.34	3.0	
Pilasters	Axial	4.47	—	0.7	5.2	91.6	1.34	5.8	152.9	Compression
	Flexural	4.02	—	5.6	9.62	11.9	10.9	15.5	19.8	

ATTACHMENT A

CRITERIA FOR THE RE-EVALUATION OF CONCRETE MASONRY WALLS

CONTENTS

CRITERIA FOR THE RE-EVALUATION

OF CONCRETE MASONRY WALLS

1.0 General

1.1 Purpose

This criteria is provided for use in re-evaluating the structural adequacy of concrete masonry walls as required by NRC I&E Bulletin 80-11, Masonry Wall Design, dated May 8, 1980.

1.2 Scope

The re-evaluation shall determine whether the concrete masonry walls and/or the safety related equipment and systems associated with the walls will perform their intended function under the loads and load combinations prescribed herein. Verification of wall adequacy shall include a review of local transfer of load from block into wall, global response of wall, and transfer of wall reactions into supports. Anchor bolts and embedments for attachments to the walls are not considered to be within the scope of the evaluation.

2.0 Governing Code

The governing code is ACI 531-79 "Building Code Requirements for Concrete Masonry Structures." Supplemental allowables, as specified herein, shall be used for cases not directly covered by the governing code.

3.0 Loads and Load Combinations

Load Combinations

a) $D + L$

b) $D + L + E_o$

c) $D + L + W$

d) $D + L + E_s$

D = Structure Dead Load

L = Live Load (100 psf)

E_o = Operating Base Earthquake

W = Wind (101 mph)

E_s = Design Basis Earthquake (S.S.E.)

4.0 Materials

a) Concrete F'_c = 3000 psi at 28 days

b) Concrete Masonry Block - ASTM C-90 Type "N"

c) Mortar - Type "S" or "M"

d) Tank Farm Fence Core grout f'_c = 3000 psi at 28 days

e) Transformer Enclosure Core grout f'_c = 2000 psi at 28 days

f) Reinforcing steel - ASTM A615 Grade 60

g) Structural steel - ASTM A36

h) Bolts - ASTM A-307

5.0 Design Allowables

5.1 Design allowables for load combinations listed in Paragraph 3.0.

5.1.1 Masonry

The allowable tension, compression, shear, bond and bearing stresses shall be as given in the governing code.

5.1.2 Core Concrete or Cell Grout

The allowable tension stresses shall be $2.5\sqrt{f'_c}$ or 0.33 times the modulus of rupture as determined by test.

5.1.3 Reinforcing Steel and Ties

The allowable tension and compression stresses shall be as given in the governing code.

5.1.4 Seismic and Wind Loading

The allowable stresses will not be increased for load combinations that include the operating base earthquake or wind. For stress increases for load combinations for design basis earthquake (S.S.E.) see Paragraph 5.2.

5.2 Design allowables for load combinations which contain safe shutdown (design basis) earthquake loads shall be as follows:

5.2.1 Masonry

The allowable masonry stresses given in Paragraph 5.1.1 through 5.1.2 shall be increased as follows:

STRESS	INCREASE FACTOR
Compression	
axial:	2.0
flexural:	2.5

STRESS	INCREASE FACTOR
Bearing:	2.5
Shear and Bond:	1.67
Tension	
No tension rebar	
tension normal to bed joints:	1.67
tension parallel to the bed joints; in running bond:	1.67

5.2.2 Reinforcing Steel and Ties

The allowable steel stresses shall be 90 prcent of minimum ASTM specified yield strength provided lap splice lengths and embedment (anchorage) can develop this stress level. Allowable bond stresses may be increased by a factor of 1.67 in determining splice and anchorage lengths.

5.3 Damping

5.3.1 The damping values to be used shall be as follows:

a) For uncracked sections, use 2 percent damping for OBE and SSE.

b) For cracked reinforced sections, use 4 percent damping for OBE and 7 percent damping for SSE.

5.4 Modulus of Rupture

5.4.1 The extreme tensile fiber stress for use in determining the lower bound uncracked moment capacity is $6\sqrt{f'_c}$ or 0.8 times the modulus of rupture as determined by test for the core concrete or cell grout and 2.4 times the code allowable flexural tensile stress for masonry.

5.5 Non-Category I Masonry Walls

5.5.1 Concrete masonry walls not supporting safety systems but whose collapse could result in the loss of required function of safety related equipment or systems shall be evaluated the same as walls that support safety systems. Alternatively, the walls may be analytically checked to verify that they will not collapse when subjected to accident, or safe shutdown (design basis) earthquake loads.

6.0 Analysis and Design

6.1 Structural Response of Masonry Walls

6.1.1 Equivalent Moment of Inertia (I_e)

To determine the out-of-plane frequencies of masonry walls, the uncracked behavior and capacities of the walls (Step 1) and, if applicable, the cracked behavior and capacities of the walls (Step 2) shall be considered.

Step 1 - Uncracked Condition

The equivalent moment of inertia of an uncracked wall (I_t) shall be obtained from a transformed section consisting of the block, mortar, cell grout and core concrete. Alternatively, the cell grout and core concrete, neglecting block and mortar on the tension side, may be used.

Step 2 - Cracked Condition

If the applied moment (M_a) due to all loads in a load combination exceeds the uncracked moment capacity (M_{cr}), the wall shall be considered to be cracked. In this event, the equivalent moment of inertia (I_e) shall be computed as follows:

$$I_e = \left(\frac{M_{cr}}{M_a} \right)^3 I_t + \left[1 - \left(\frac{M_{cr}}{M_a} \right)^3 \right] I_{cr}$$

$$M_{cr} = f_r \left(\frac{I_t}{y} \right)$$

where,

M_{cr} = Uncracked moment capacity

M_a = Applied maximum moment on the wall

I_t = Moment of inertia of the transformed section

I_{cr} = Moment of inertia of the cracked section

f_r = Modulus of rupture (as defined in Paragraph 5.4.1)

y = Distance of neutral plane from tension face

If the use of I_e results in an applied moment, M_a, which is less than M_{cr}, then the wall shall be verified for M_{cr}.

6.1.2 Frequency Variations

Uncertainties in structural frequencies of the masonry wall due to variations in structural properties and mass shall be taken into account. Significant variables include mass, boundary conditions, modulus of elasticity, extent of cracking, vertical load, in-plane and out-of-plane loads, two-way action, and composite action of multi-wythe walls. To account for the effect of frequency variations, it is considered conservative to use the lower bound frequency if it is on the higher frequency side of the peak response spectrum. If the lower bound frequency is on the lower frequency side of the peak, the peak acceleration shall be used unless a more detailed analysis is performed.

6.2 Structural Strength of Masonry Walls

6.2.1 Boundary Conditions

Boundary conditions may be determined considering one-way or two-way spans with hinged, fixed or free edges as appropriate. Conservative assumptions may be used to simplify the analysis as long as due consideration is given to frequency variations.

6.2.2 Distribution of Concentrated Out-of-Plane Loads

- Two-Way Action

  Where two-way bending is present in the wall the localized moments per unit width under a concentrated load can be determined using appropriate analytical procedures for plates. Standard solutions and tabular values based on elastic theory contained in textbooks or other published documents can be used if applicable for the case under investigation (considering load location and boundary conditions).

- One-Way Action

  For dominantly one-way bending, local moments can be determined using beam theory and an effective width of six times the wall thickness. However, such moments shall not be taken as less than that for two-way plate action.

6.2.3 Interstory Drift Effects

Interstory drift effects shall be derived from the original dynamic analysis.

6.2.4 Stress Calculations

All stress calculations shall be performed by conventional methods prescribed by the Working Stress Design or other accepted principles of engineering mechanics.

6.2.5 Analytical Techniques

In general, classical design techniques shall be used in the evaluation. Simplified analytical assumptions may be used. However, more refined methods utilizing computer analyses of dynamic analyses may be used on a case-by-case basis.

ATTACHMENT B

COMMENTARY ON CRITERIA FOR THE RE-EVALUATION OF CONCRETE MASONRY WALLS

CONTENTS

COMMENTARY ON CRITERIA FOR THE RE-EVALUATION

OF CONCRETE MASONRY WALLS

1.0 GENERAL

1.1 Purpose

On May 8, 1980, the NRC issued I&E Bulletin 80-11 entitled, "Masonry Wall Design", to certain Owners of operating reactor facilities. One of the tasks required by the bulletin was to establish appropriate re-evaluation criteria. A detailed justification of the criteria along with qualified safety margins are also to be provided by the Owner. This commentary serves as justification of the criteria used and provides a discussion of the margins of safety.

1.2 Scope

The concrete masonry walls are evaluated for all applicable loads and load combinations. Calculated wall stresses are first compared against an allowable stress criteria. In general, wall stresses are maintained within the elastic range of the load carrying components.

Anchor bolts, embeds and bearing plates provided for support of systems attached to the walls are subject to another NRC bulletin and are not considered to be within the scope of this evaluation.

2.0 GOVERNING CODE

The governing code is ACI 531-79 "Building Code Requirements fo Concrete Masonry Structures." These codes do not address the ab ormal loads typically applied to nuclear power plant design. Th efore, supplemental allowables and alternative design technique are specified in the criteria for cases not directly covered by the code.

3.0 LOADS AND LOAD COMBINATIONS

The loads identified and defined in the SAR for safety related structures form the basis for licensing of the plant and were used in the evaluation of the masonry walls. The load combinations listed in the SAR for safety related concrete structures were used except if licensing commitments related to load combinations were not identified in the SAR or other project documents, then applicable loads with a load factor of unity were combined and form the basis for the evaluation.

4.0 MATERIALS

Material strengths were largely determined by review of project specifications, drawings and field documentation. It may also be necessary, in some cases, to perform in-situ tests or to test samples taken from the as-built structure to supplement data obtained from project documents.

5.0 DESIGN ALLOWABLES

5.1 Allowables in this section apply to loads and combinations of loads which are normally encountered during plant operation or shutdown, and include dead loads and live loads. In addition, this section covers allowables for loads infrequently encountered, such as operating basis earthquake and wind loads. The loads in the various load combinations have no increase factors and stresses are maintained well within the elastic range.

In general, the governing code allowables are applied. However, for cases not covered by the code, such as grout tension, allowables are based on a factor of safety of 3 against failure.

5.2 This section deals with other abnormal loads which are credible but highly improbable such as the safe shutdown earthquake.

Code allowable stresses for masonry in tension, shear and bond are increased by a factor of 1.67. In general, this provides a factor of safety against failure of 1.8 (3 ÷ 1.67). Masonry compression stresses are increased by factors ranging from 2.0 to 2.5 with a minimum safety factor of 1.2 (3 ÷ 2.5).

Reinforcing steel is allowed to approach 0.9 times the yield strength which is typical for reinforcing steel which is required to resist abnormal loads.

5.3 Damping for reinforced walls which are expected to crack due to out-of-plane seismic inertia for conservatively set at 4% for OBE and 7% for SSE. These values are typically recognized as being realistic for reinforced concrete, yet conservative for reinforced masonry.

5.4 The modulus of rupture of concrete, grout and mortar was assumed to vary by 20%, therefore, a lower bound modulus of rupture is determined by applying a reduction factor of 0.8 to the theoretical concrete modulus of rupture of $7.5\sqrt{f'c}$ or to the modulus of rupture determined by testing samples taken from the as-built structure. For masonry, the modulus of rupture is approximated by increasing the code allowable flexural tensile stress by the factor of safety of 3 and then applying the 20% reduction to arrive at a lower bound value. (0.8 x 3 Ft = 2.4 Ft, where Ft is the code allowable tensile stress.)

6.0 ANALYSIS AND DESIGN

6.1 The structural response of the masonry walls subjected to out-of-plane seismic inertia loads is based on a constant value of gross moment of enertia along the span of the wall for the elastic (uncracked) conditions. If the wall is cracked, a better estimate of the moment of inertia is obtained by use of the ACI-318 formula for effective moment of inertia used in calculating immediate deflections. (Reference 15)

6.2 The determination of the out-of-plane structural strength of masonry walls is highly sensitive to the boundary conditions assumed for the analysis. Fixed end conditions are justified for walls (a) built into thicker walls or continuous across walls and slabs, (b) that have the strength to resist the fixed end moment, and (c) that have sufficient support rigidity to prevent rotation. Otherwise, the wall edge is simply supported or free depending on the shear carrying capability of the wall and support.

Distribution of concentrated loads are affected by the bearing area under the load, horizontal and vertical wall stiffness, boundary conditions and proximity of load to wall supports. Analytical procedures applied to plates based on elastic theory are used to determine the appropriate distribution of concentrated loads. A conservative estimate of the localized moment per unit length for plates supported on all edges can be taken as:

$$M_L = 0.4P$$

where: M_L = Localized moment per unit length (in-lbs/in)

P = Concentrated load perpendicular to wall (lbs)

For loads close to an unsupported edge, the upper limit moment per unit length can be taken as:

$$M_L = 1.2P$$

For predominately one-way action, an effective beam width of 6 times the wall thickness for distribution of concentrated loads is conservative for the following conditions:

a) Concentrated load at midspan; simple supports: $L > 9.6T$

b) Concentrated load at midspan; fixed supports: $L > 19.2T$

c) Concentrated load on a cantilever: $h > 2.4T$

d) Couple at midspan; simple supports: $a > 4.8T$

e) Couple near a support; simple supports: a >2.4T

Where: L is the beam length

h is the distance from the fixed end to the point of load application

a is the distance between the concentrated loads producing a couple

T is the thickness of the wall

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ATTACHMENT C

SURVEY PROCEDURE
FOR CONCRETE MASONRY WALLS

I & E BULLETIN 80-11

SURVEY PROCEDURE

FOR

CONCRETE MASONRY WALLS

SACRAMENTO MUNICIPAL UTILITY DISTRICT

RANCHO SECO NUCLEAR GENERATING STATION

By ______________________

Approved ______________________
Project Engineer

BECHTEL POWER CORPORATION

TABLE OF CONTENTS

APPENDICES

1.0 PURPOSE

This procedure specifies the items to be performed and the data to be accumulated to aid in the response to NRC I&E Bulletin 80-11, Masonry Wall Design, dated May 8, 1980, (Appendix A).

2.0 SCOPE

2.1 This survey shall be conducted and the data accumulated for all Concrete Masonry Walls which are in proximity to or have attachments from safety related systems such that failure of the wall could affect the safety related system.

2.2 Sufficient data is to be recorded to determine the characteristics of the wall construction, geometry, location and magnitudes of applied loads and corresponding connection details for safety and non-safety systems supported by the wall.

3.0 SURVEY REQUIREMENTS

3.1 Each survey team is to consist of members representing pertinent disciplines. One member shall be designated as Chief of Party.

3.2 Background sketches of each side of each wall prepared in advance in the office are to be used to record data (see Appendix B). Additional sheets are to be used, as required, to record plan views and attachment details. These shall be numbered as sheet 2, 3, etc. to the original wall number.

3.3 In the safety related areas the survey team is to make a systematic search to identify the location of any concrete masonry walls not shown on the design drawings and is to survey those walls in accordance with this procedure. Areas inspected or not inspected shall be identified and documented.

3.4 Photographs are to be taken of each side of the masonry walls surveyed except where determined infeasible by the survey team. Photographs shall be numbered to correspond with the masonry wall numbering system.

3.5 The survey will cover the following items:

3.5.1 The dimensional location and identification of all Category I items attached to the wall. Hanger mark numbers are to be recorded.

3.5.2 The location and identification of all non-Category I items greater than one inch in diameter or groups of items adding equivalent loads, e.g., multiple conduit runs.

3.5.3 The survey team shall identify the significant attachments to be documented e.g., attachments estimated to weigh at least 25 lbs. (Note: project may establish a higher cut-off weight consistent with wall size if appropriate.)

3.5.4 Record sufficient data for attachments so that tributary gravity loads and seismic loads can be estimated. This will consist of at least locating the next support on each side of the wall, not on the wall under consideration, for all items and the next seismic restraint or anchor for seismic Category I systems.

3.5.5 Dimensions shall be recorded to the nearest one inch. Where limited access prevents physical measurement, locations shall be estimated to the nearest 6 inches and noted that this is an estimate.

4.0 SURVEY PROCEDURE

4.1 The survey team shall complete the sketch of the wall showing:

4.1.1 All openings and penetrations associated with each discipline's components. Record locations and sizes.

4.1.2 Details of wall boundary conditions, i.e., whether top or sides are visible free or attached to walls, ceiling or steel beams.

4.1.3 Support attachments including the manner of attachment to the wall, e.g., through bolted with backing plates, or concrete expansion anchors. (Record type, if can be identified, and size.) Record relationship between anchors and mortar joints for all supports. This requirement does not apply to non-safety related items which can positively be identified"and the failure of which cannot hazard any safety related items.

4.1.4 Type of wall construction and thickness, if visual determination is possible.

D1 Single Wythe
D2 Multiple Wythe with Mortar
D3 Composite - Two Wythe with Grout Core

4.1.5 Show the location and size of structurally significant cracking as determined by the survey team. Survey the general condition of the masonry wall and attachments to the masonry wall.

4.1.6 Whether or not wall supports or restrains safety related systems or equipment which may be safety related. (Initial estimate to be made from drawings and confirmed by survey.) The systems and equipment shall be identified.

4.1.7 Specify whether or not wall is in proximity to a system which may be safety related. (Proximity is defined as within an arc length equal to the masonry wall height from the base of each face of the masonry wall extending to the floor. Proximity does not extend beyond compartments.) Systems and items falling in this category shall be identified and the approximate location with respect to the wall shall be described. (Use additional sheets as required.)

4.2 A composite sketch shall be prepared for each wall. This sketch shall show all the information recorded and verified by the survey team. A visual inspection shall then be made in the field to verify all the information shown on the composite sketch. After the inspection is completed for a wall, the composite sketch shall be signed as "checked."

4.3 The form shown in Appendix C shall be filled in by the Chief of Party as each wall is surveyed and as each wall is checked.

5.0 SKETCH PREPARATION (IN OFFICE)

5.1 The sketch number should contain the wall number, and should also reference the drawing number where the wall is located, e.g., 181.2N indicates drawing C-181, wall 181.2.

5.2 The side of the wall shown should be labeled as such: North, South, East or West, e.g., 181.2N. If more than one sketch is required for a side, A, B, C, etc. will be added to wall number, e.g., 131.2N(A).

5.3 Column lines and reference elevation should be shown for orientation.

6.0 INSTRUCTIONS FOR COMPLETING SKETCH

Item (See Appendix B)

(1) To be completed by Home Office

(2) Indicate discipline - Civil
- Electrical
- Mechanical
- Plant Design

(3) Indicate type of construction

(4) Name of person making survey

(5) Checker (to be used only for <u>composite</u> sketch of each wall.)

(6) Additional sheets as required

(7) Date of survey

(8) Circle Yes or No, if conclusive

APPENDIX "A"

SSINS No.: 6820
Accession No.:
7912190695

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
WASHINGTON, D.C. 20555

May 8, 1980

IE Bulletin No. 80-11

MASONRY WALL DESIGN

Description of Circumstances:

In the course of conducting inspections pursuant to IE Bulletin Nos. 79-02 and 79-14 at the Trojan Nuclear Plant, Portland General Electric Co. (PGE) identified a problem with the structural integrity of concrete masonry walls with Seismic Category I piping attached to them. This problem was briefly addressed in IE Information Notice No. 79-28, which was sent to all Construction Permit and Operating License holders on November 16, 1979 (Attachment 1).

The problem was that some walls were found which did not have adequate structural strength to sustain the required piping system support reactions. These structural deficiencies were at that time reported to be attributable to two deficiencies:

1) Apparent lack of a final check of certain pipe support locations and reactions to ensure that the supporting elements possessed adequate structural integrity to sustain the required loads.

2) Non-conservative design criteria for the reactions from supports anchored into the face of concrete masonry walls; e.g., relying on the combined strength of double block walls without substantial positive connection between the two walls by means other than the bond provided by a layer of mortar, grout or concrete between them.

Continued investigations into the deficiencies identified at the Trojan Nuclear Plant, engineered by Bechtel, confirmed the deficiencies to be attributable to error in engineering judgment, lack of procedures and procedural detail, and inadequate design criteria (details are in Trojan Nuclear Plant's LER No. 79-15, and supplements). Because of this and the generic implications of similar deficiencies with other operating facilities, we have concerns with regard to the adequacy of design criteria used for the design of masonry walls and an apparent lack of design coordination between the structural and piping/equipment design groups.

IE Bulletin 79-02, Revision 2 issued on November 8, 1979 required a review of pipe supports attached to masonry walls using expansion anchor bolts. For most pipe supports in this category, the expansion anchor bolts were replaced by bolting through the wall or the support was relocated to another structure. Supports that are bolted through masonry walls are also to be considered in the review for this Bulletin.

Action to be taken by all power reactor facilities with an Operating License (except Trojan, Sequoyah Unit 1, North Anna Unit 2, and Salem Unit 2):

1. Identify all masonry walls in your facility which are in proximity to or have attachments from safety-related piping or equipment such that wall failure could affect a safety-related system. Describe the systems and equipment, both safety and non-safety-related, associated with these masonry walls. Include in your review, masonry walls that are intended to resist impact or pressurization loads, such as missiles, pipe whip, pipe break, jet impingement, or tornado, and fire or water barriers, or shield walls. Equipment to be considered as attachments or in proximity to the walls shall include, but is not limited to, pumps, valves, motors, heat exchangers, cable trays, cable/conduit, HVAC ductwork, and electrical cabinets, instrumentation and controls. Plant surveys, if necessary, for areas inaccessible during normal plant operation shall be performed at the earliest opportunity.

2. Provide a re-evaluation of the design adequacy of the walls identified in Item 1 above to determine whether the masonry walls will perform their intended function under all postulated loads and load combinations. In this regard, the NRC encourages the formation of an owners' group to establish both appropriate re-evaluation criteria and where necessary, a later confirmatory masonry test program to quantify the safety margins established by the re-evaluation criteria (this is discussed further in Item 3 below).

   a. Establish a prioritized program for the re-evaluation of the masonry walls. Provide a description of the program and a detailed schedule for completion of the re-evaluation for the categories in the program. The completion date of all re-evaluations should not be more than 180 days from the date of this Bulletin. A higher priority should be placed on the wall re-evaluations considering safety-related piping 2-1/2 inches or greater in diameter, piping with support loads due to thermal expansion greater than 100 pounds, safety-related equipment weighing 100 pounds or greater, the safety significance of the potentially affected systems, the overall loads on the wall, and the opportunity for performing plant surveys and, if necessary, modifications in areas otherwise inaccessible. The factors described above are meant to provide guidance in determining what loads may significantly affect the masonry wall analyses.

   b. Submit a written report upon completion of the re-evaluation program. The report shall include the following information.

      (i) Describe, in detail, the function of the masonry walls, the configurations of these walls, the type and strengths of the materials of which they are constructed (mortar, grout, concrete and steel), and the reinforcement details (horizontal steel, vertical steel, and masonry ties for multiple wythe construction). A wythe is considered to be (as defined by ACI Standard 531-1979) "each continuous vertical section of a wall, one masonry unit or grouted space in thickness and 2 in. minimum in thickness."

(ii) Describe the construction practices employed in the construction of these walls and, in particular, their adequacy in preventing significant voids or other weaknesses in any mortar, grout, or concrete fill.

(iii) The re-evaluation report should include detailed justification for the criteria used. References to existing codes or test data may be used if applicable for the plant conditions. The re-evaluation should specifically address the following:

(a) All postulated loads and load combinations should be evaluated against the corresponding re-evaluation acceptance criteria. The re-evaluation should consider the loads from safety and non-safety-related attachments, differential floor displacement and thermal effects (or detailed justification that these can be considered self limiting and cannot induce brittle failures), and the effects of any potential cracking under dynamic loads. Describe in detail the methods used to account for these factors in the re-evaluation and the adequacy of the acceptance criteria for both in-plane and out-of-plane loads.

(b) The mechanism for load transfer into the masonry walls and postulated failure modes should be reviewed. For multiple wythe walls in which composite behavior is relied upon, describe the methods and acceptance criteria used to assure that these walls will behave as composite walls, especially with regard to shear and tension transfer at the wythe interfaces. With regard to local loadings such as piping and equipment support reactions, the acceptance criteria should assure that the loads are adequately transferred into the wall, such that any assumptions regarding the behavior of the walls are appropriate. Include the potential for block pullout and the necessity for tensile stress transfer through bond at the wythe interfaces.

3. Existing test data or conservative assumptions may be used to justify the re-evaluation acceptance criteria if the criteria are shown to be conservative and applicable for the actual plant conditions. In the absence of appropriate acceptance criteria a confirmatory masonry wall test program is required by the NRC in order to quantify the safety margins inherent in the re-evaluation criteria. Describe in detail the actions planned and their schedule to justify the re-evaluation criteria used in Item 2. If a test program is necessary, provide your commitment for such a program and a schedule for submittal of a description of the test program and a schedule for completion of the program. This test program should address all

appropriate loads (seismic, tornado, missile, etc.). It is expected that the test program will extend beyond the 180 day period allowed for the other Bulletin actions. Submit the results of the test program upon its completion.

4. Submit the information requested in Items 1, 2a, and 3 within 60 days of the date of this Bulletin. Within 180 days of the date of this Bulletin submit the information requested in Item 2b.

If in the course of the re-evaluation, the operability of any safety related system is in jeopardy, the licensee is expected to meet the applicable technical specifications action statement.

This information is requested under the provisions of 10 CFR 50.54(f). Accordingly, you are requested to provide within the time period specified in Item 4, written statements of the above information, signed under oath or affirmation.

Reports should be submitted to the Director of the appropriate NRC Regional Office and a copy should be forwarded to the NRC Office of Inspection and Enforcement, Division of Reactor Operations Inspection, Washington, D.C. 20555.

The reporting requirements of this Bulletin do not preclude nor substitute for the applicable requirements to report as set forth in the regulations and license.

If you require additional information regarding this matter, please contact the Director of the appropriate NRC Regional Office.

Approved by GAO, B180255 (R0072); clearance expires 7/31/80. Approval was given under a blanket clearance specifically for identified generic problems.

Attachment:
IE Information Notice No. 79-28

IE Bulletin No. 80-11
May 8, 1980

Enclosure

RECENTLY ISSUED
IE BULLETINS

Bulletin No.	Subject	Date Issued	Issued To
80-10	Contamination of Nonradioactive System and Resulting Potential for Unmonitored, Uncontrolled Release to Environment	5/6/80	All power reactor facilities with an OL or CP
80-09	Hydramotor Actuator Deficiencies	4/17/80	All power reactor operating facilities and holders of power reactor construction permits
80-08	Examination of Containment Liner Penetration Welds	4/7/80	All power reactors with a CP and/or OL no later than April 7, 1980
80-07	BWR Jet Pump Assembly Failure	4/4/80	All GE BWR-3 and BWR-4 facilities with an OL
80-06	Engineered Safety Feature (ESF) Reset Controls	3/13/80	All power reactor facilities with an OL
80-05	Vacuum Condition Resulting In Damage To Chemical Volume Control System (CVCS) Holdup Tanks	3/10/80	All PWR power reactor facilities holding OLs and to those with a CP
79-01B	Environmental Qualification of Class IE Equipment	2/29/80	All power reactor facilities with an OL
80-04	Analysis of a PWR Main Steam Line Break With Continued Feedwater Addition	2/8/80	All PWR reactor facilities holding OLs and to those nearing licensing
80-03	Loss of Charcoal From Standard Type II, 2 Inch, Tray Adsorber Cells	2/6/80	All holders of Power Reactor OLs and CPs
80-02	Inadequate Quality Assurance for Nuclear	1/21/80	All BWR licenses with a CP or OL
80-01	Operability of ADS Valve Pneumatic Supply	1/11/80	All BWR power reactor facilities with and OL

Attachment to IE Bulletin 80-11

Attachment 1
SSINS No.: 6870
Accession No.:
7910250475

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
WASHINGTON, D.C. 20555

November 16, 1979

IE Information Notice No. 79-28

OVERLOADING OF STRUCTURAL ELEMENTS DUE TO PIPE SUPPORT LOADS

Description of Circumstances:

Recently, the NRC was informed that, in the course of the inspections pursuant to IE Bulletin No. 79-02 and 79-14 by the Portland General Electric Co. (PGE) at the Trojan Nuclear Plant, some walls were found which did not have adequate structural strength to sustain the required support reactions. Bechtel Corporation was the Architect Engineer for the plant. These structural inadequacies were reported to be attributable to two deficiencies:

1) Apparent lack of a final check of certain pipe support locations and reactions to ensure that the supporting structural elements possessed adequate structural integrity to sustain the required loads.

2) Inadequate design criteria for the reactions from supports anchored into the face of concrete block walls; e.g., relying on the combined strength of double concrete block walls without positive connection between the two walls by means other than the bond provided by layer of grout between them.

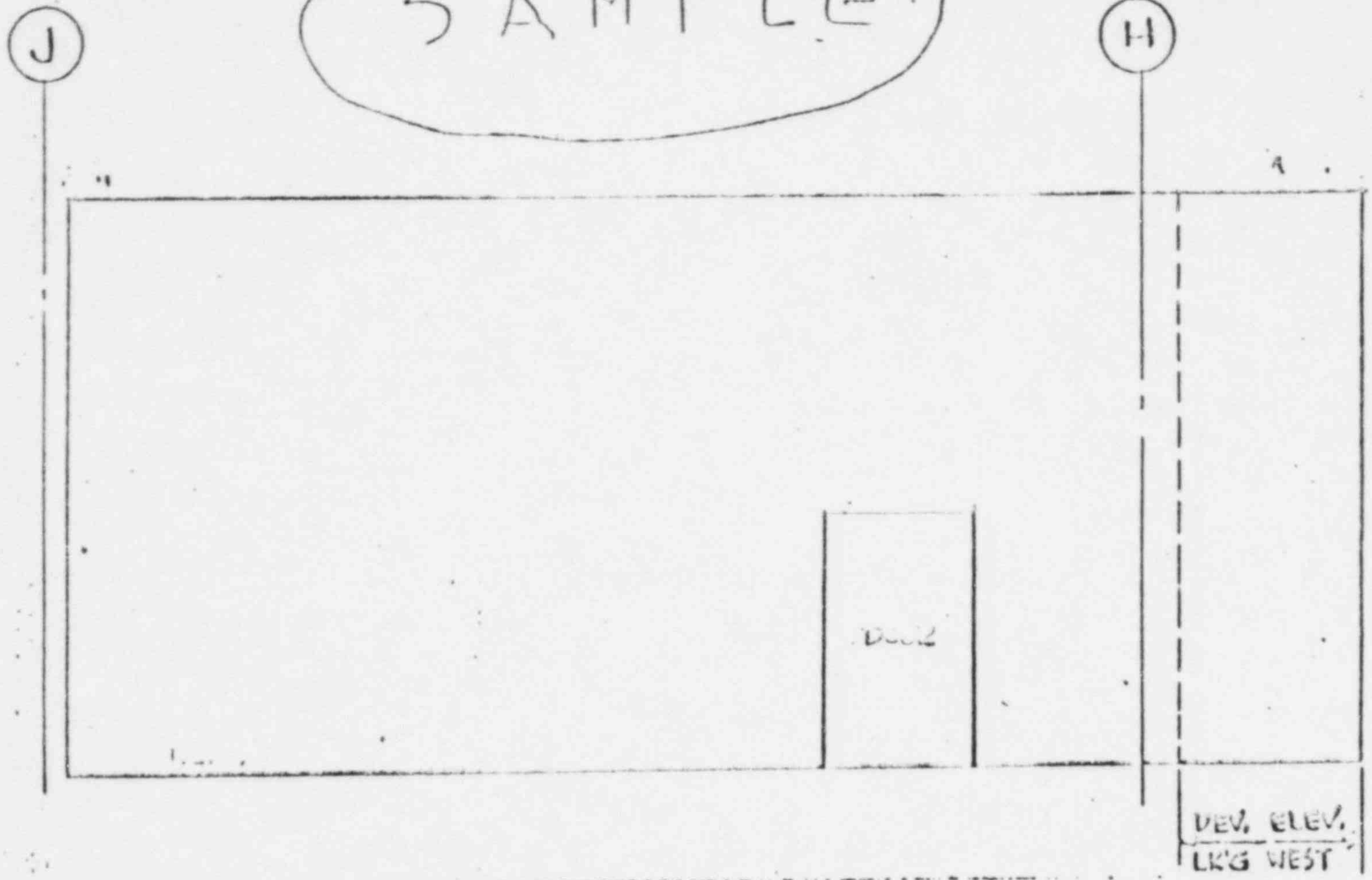
The NRC is currently pursuing these issues in detail for the Trojan Nuclear Plant to determine the extnet of these deficiencies and the generic implications for other Bechtel facilities.

This Information Notice is provided as an early notification of a possible significant matter. It is expected that recipients will review the information for possible applicability to their facilities and the actins being performed under IE Bulletin No. 79-02. Specific action is being requested relating to the adequacy of attachments to concrete block walls under IE Bulletin No. 79-02, Revision 2, item 5.c. No specific actions are requested in response to this Information Notice. If NRC evaluations so indicate, further licensee actions may be requested or required. If you have any questions regarding this matter, please contact the Director of the appropriate NRC Regional Office.

No written response to this IE Information Notice is required.

A'PENDIX "B"
pg 1 of 1
No. 3011-01

SAMPLE



ELEV. LOOKING NORTH

WALL CARRIES SAFETY RELATED ITEMS - YES NO (8)		
BUILDING REACTOR (1)	DISCIPLINE (2)	BECHTEL SAN FRANCISCO - PILGRIM UNIT 1 JOB NO. 10394-075
FLOOR ELEV. 51-0	TYPE OF CONSTRUCTION D1 (3) D2 D3	MASONRY WALL SURVEY
SCALE 1/4"=1'-0 BY DG	FIELD REVIEW. BY (4)	WALL NO. 65.4.5 (1) SH. 1(1) OF (6)
DATE 3.20.80 CHK PK	DATE (7) CH'K. (5)	

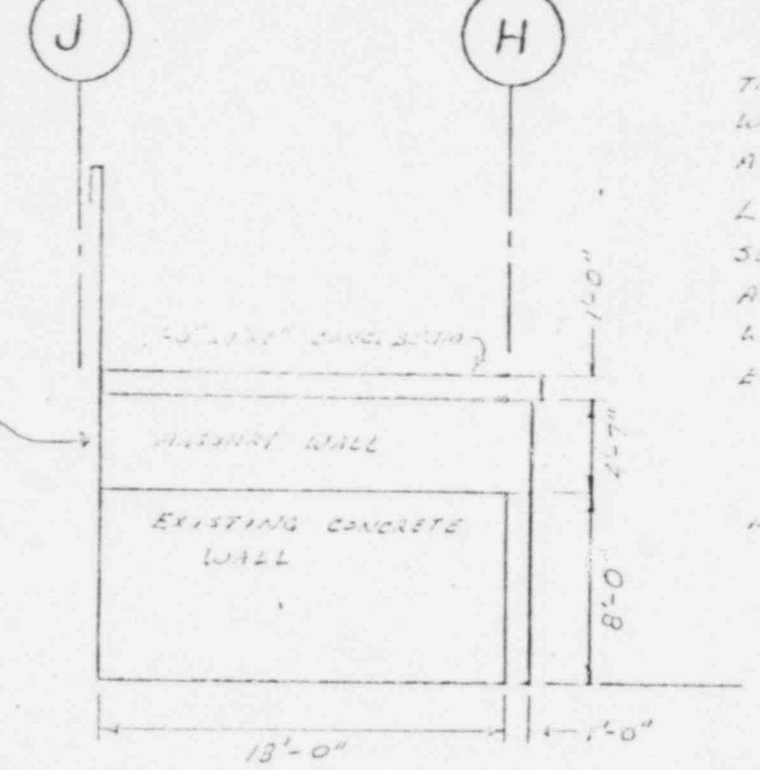
APPENDIX "C"

SHEET 1 OF 1
DATE 6-24-80
REV. 0

CONSECUTIVE NO.	WALL NO.	SURVEY COMPL. (DATE)	COMPOSITE SKETCH CHECKED		REMARKS
			BY	DATE	
1	528.1N	7/3/80	GKG	7/3/80	
2	528.2W	7/3/80	GKG	7/3/80	
3	528.3S	7/3/80	GKG	7/3/80	
4	528.4	7/3/80	GKG	7/3/80	PLAN VIEW
1	131.1 W&N	7/11/80	GKG	7/14/80	
2	131.2W	7/11/80	GKG	7/14/80	
3	131.3S&W	7/11/80	GKG	7/14/80	
4	131.4S	7/11/80	GKG	7/14/80	
5	131.5S&E	7/11/80	GKG	7/14/80	
6	131.6E&N	7/11/80	GKG	7/14/80	
7	131.7E	7/11/80	GKG	7/14/80	
8	131.8E	7/11/80	GKG	7/14/80	
9	131.9	7/11/80	GKG	7/14/80	PLAN VIEW
10	131.10	7/11/80	GKG	7/14/80	PLAN VIEW
11	131.11	7/11/80	GKG	7/14/80	PLAN VIEW

APPENDIX D

CONCRETE MASONRY WALL SKETCHES



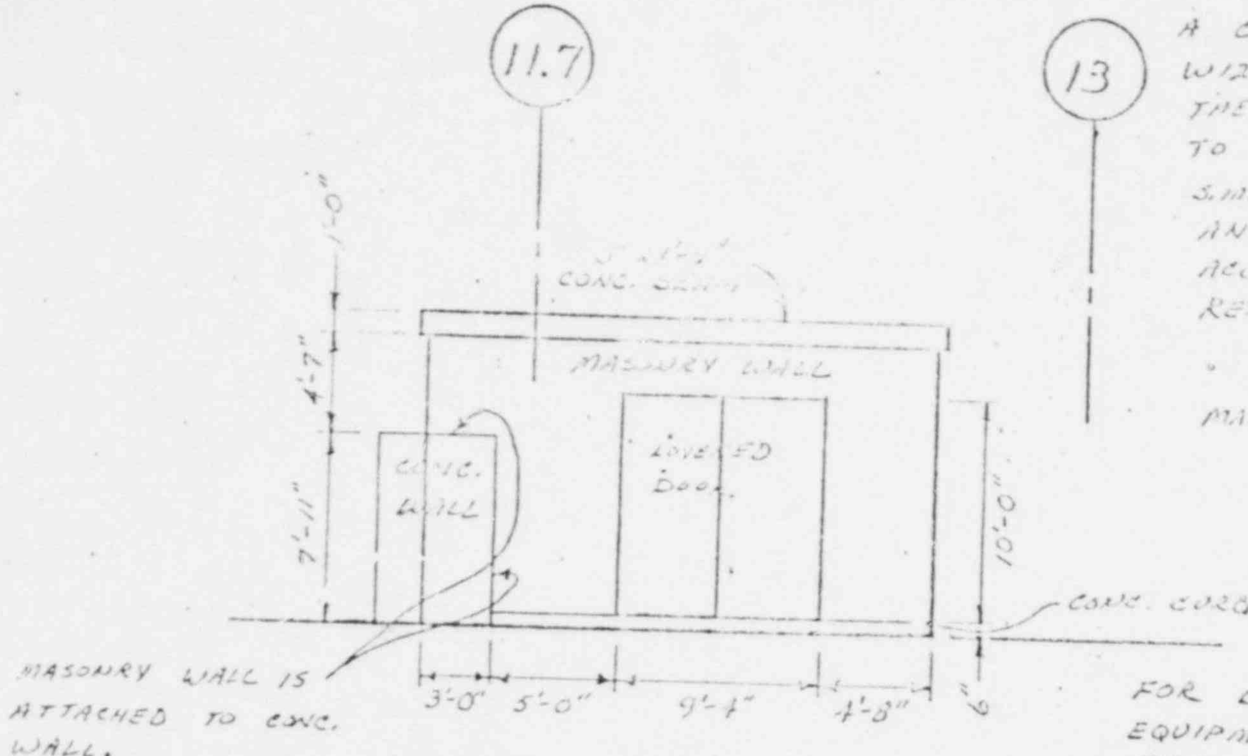
CONC. BEAM AND MASONRY WALL ARE ATTACHED TO CONC. WALL ALONG COL. LINE (J).

THE ONLY ITEM ATTACHED TO THE WALL WHOSE FAILURE COULD AFFECT A CATEGORY I SYSTEM IS THE L3x3x5/16 LEDGER ANGLE THAT SUPPORTS GRATING. THE ANGLE AND ITS ATTACHMENT TO THE WALL ARE AS SHOWN ON S.M.U.D. ECN # A2055/C DWG. C-747.

MASONRY WALL THICKNESS = 1'-0".

NORTH ELEV
LOOKING SOUTH

WALL CARRIES SAFEY RELATED ITEMS - YES (KS)		BECHTEL - RANCHO SECO
BUILDING AUXILIARY	DISCIPLINE CIVIL	LOS ANGELES JOB NO. 12333-G16
FLOOR ELEV. 40'-0"	TYPE OF CONSTRUCTION (D1) D2 D3	MASONRY WALL SURVEY 4
SCALE 1/8"=1'-0" BY EEK	FIELD REVIEW BY [illegible]	
DATE 6-11-80 CH'K [illegible]	DATE 7/3/80 CH'K [illegible]	WALL NO 528.1N SHT 1 OF 3



THE ONLY ITEMS ATTACHED TO THE WALL WHOSE FAILURE COULD AFFECT A CATEGORY I SYSEM ARE THE W12 x 16.5 BEAMS THAT SUPPORT GRATING. THE BEAMS AND THEIR ATTACHMENT TO THE WALL ARE AS SHOWN ON S.M.U.D. ECN # A2055/C DWG. C-747 AND AS DESCRIBED IN THE ACCOMPANYING NONCONFORMING REPORT.

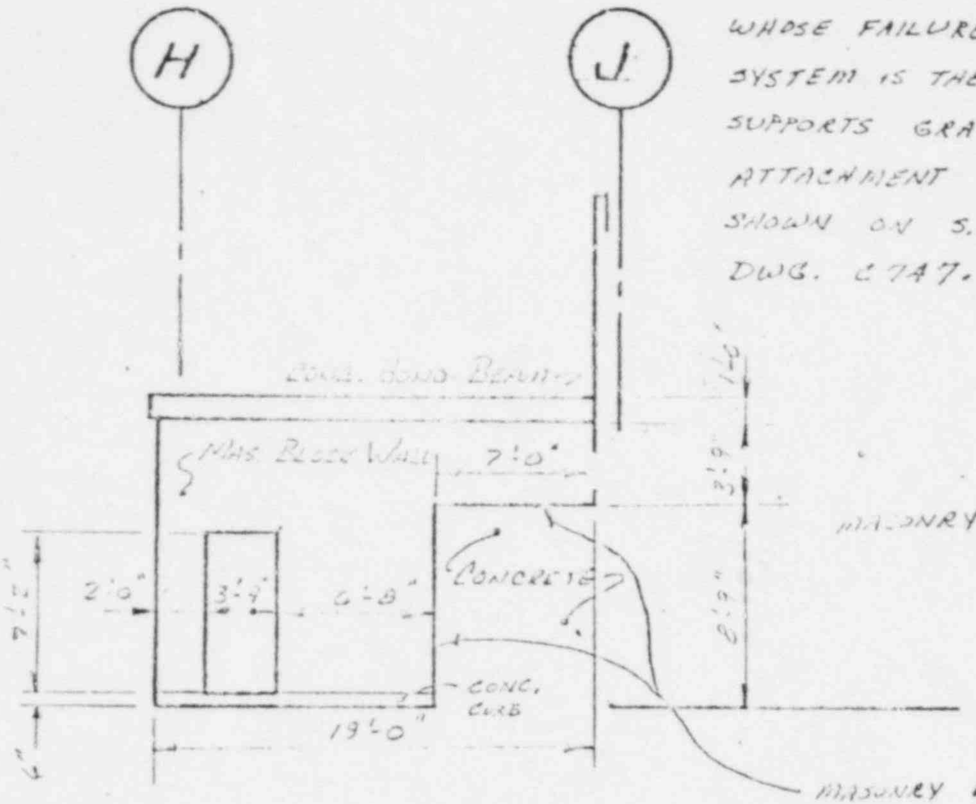
MASONRY WALL THICKNESS = 1'-0'

FOR LOCATION OF CATEGORY I EQUIPMENT IN PROXIMITY OF THIS WALL SEE SKETCH 528.4.

WEST ELEV
LOOKING EAST

WALL CARRIES SAFETY RELATED ITEMS - YES (NO)		
BUILDING AUXILIARY	DISCIPLINE CIVIL	BECHTEL - RANCHO SECO LOS ANGELES JOB NO. 12333-016
FLOOR ELEV. 40'-0"	TYPE OF CONSTRUCTION (01) 02 03	MASONRY WALL SURVEY
SCALE 1/8" = 1'-0" BY BEB	FIELD REVIEW BY J.P. [illegible]	
DATE 6-24-80 CH'K [illegible]	DATE 7/3/80 CH'K [illegible]	WALL NO. 528.4

THE ONLY ITEM ATTACHED TO THE WALL WHOSE FAILURE COULD AFFECT A CATEGORY I SYSTEM IS THE L3x3x5/16 LEDGER ANGLE THAT SUPPORTS GRATING. THE ANGLE AND ITS ATTACHMENT TO THE WALL ARE AS SHOWN ON S.M.U.D ECN # A2055/C DWG. C747.

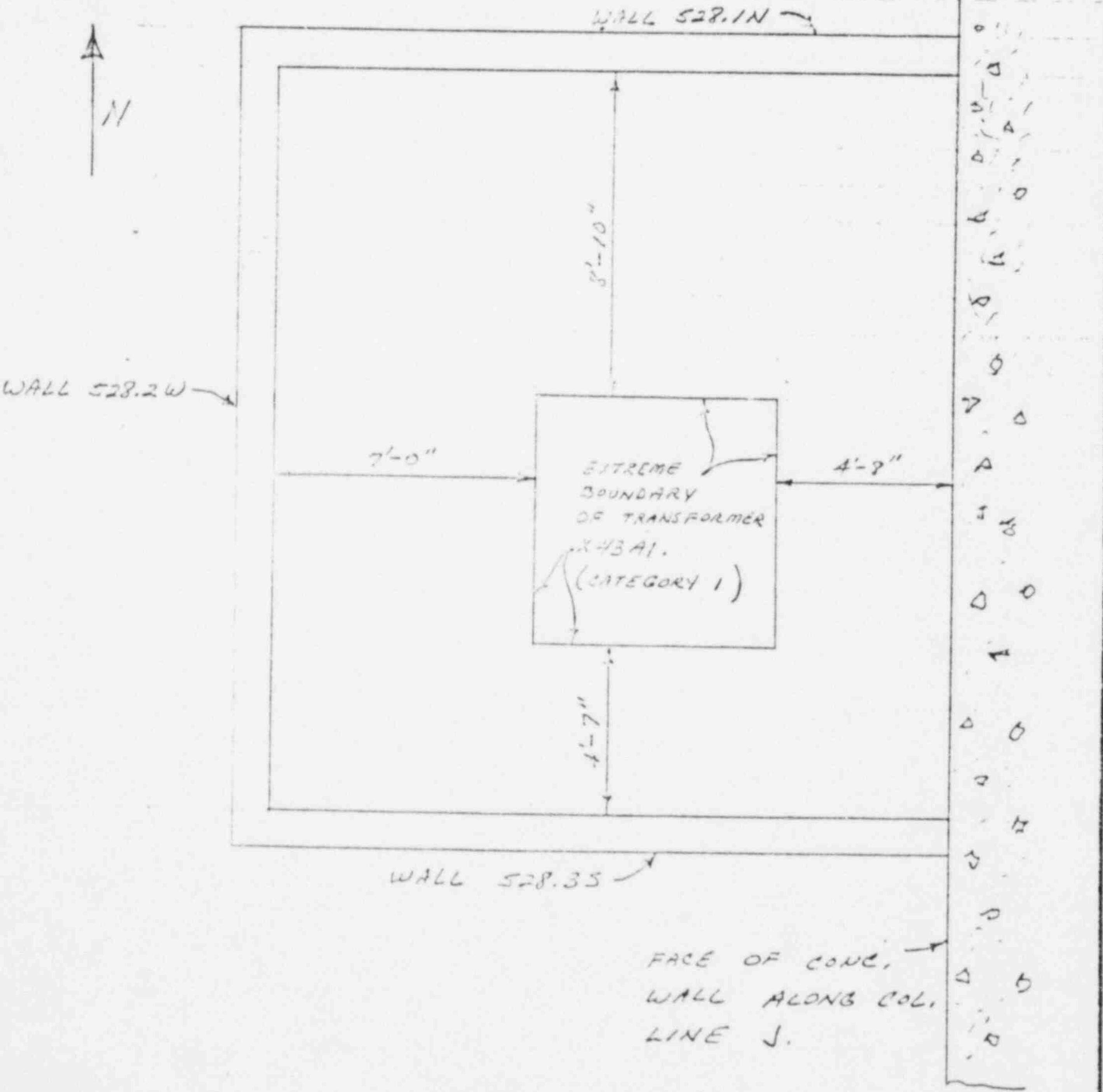


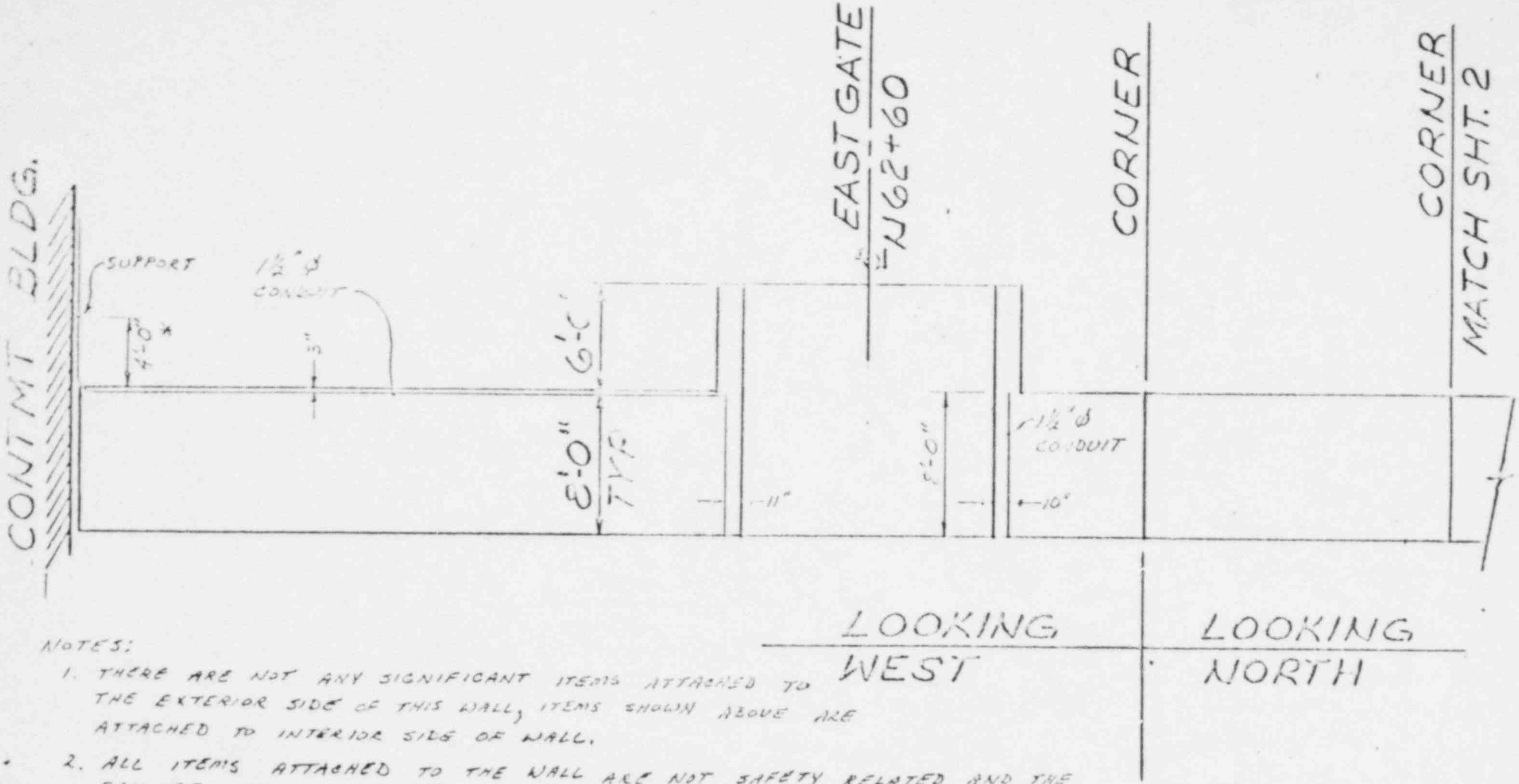
SOUTH ELEV
LOOKING NORTH

FOR LOCATION OF CATEGORY I EQUIPMENT IN PROXIMITY OF THIS WALL SEE SKETCH 528.4.

WALL CARRIES SAFETY - RELATED ITEMS - YES (AS)		
BUILDING AUXILIARY FLOOR ELEV. 40'-0" SCALE 1/8" = 1'-0" BY [illegible] DATE 6-24-80 CH'K [illegible]	DISCIPLINE CIVIL TYPE OF CONSTRUCTION [illegible] FIELD REVIEW BY J.K. Andrews DATE 7/3/80 CH'K [illegible]	BECHTEL [illegible] LOS ANGELES [illegible] MASONRY WALL SURVEY WALL NO 528.3S SHT 3 OF 5

SKETCH 528.A – LOCATION OF TRANSFORMER X43A1
ONLY CATEGORY I EQUIPMENT IN PROXIMITY OF
WALLS 528.2W AND 528.3S.

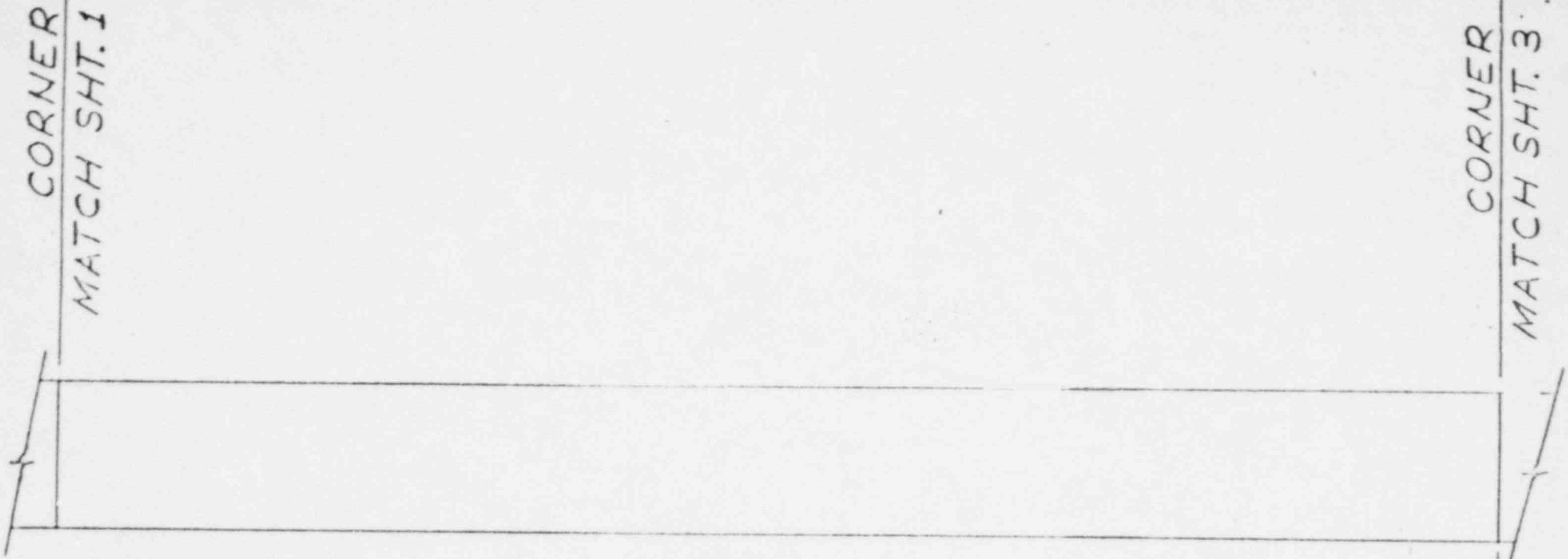




NOTES:

1. THERE ARE NOT ANY SIGNIFICANT ITEMS ATTACHED TO THE EXTERIOR SIDE OF THIS WALL; ITEMS SHOWN ABOVE ARE ATTACHED TO INTERIOR SIDE OF WALL.
2. ALL ITEMS ATTACHED TO THE WALL ARE NOT SAFETY RELATED AND THE FAILURE OF WHICH WILL NOT HAZARD ANY SAFETY RELATED ITEMS.
3. THE MASONRY WALL IS CONNECTED BY MORTAR TO THE CONTAINMENT BLDG.
4. * DENOTES ESTIMATED DIMENSION.
5. FOR LOCATION OF SAFETY RELATED ITEMS IN PROXIMITY OF THIS WALL SEE SKETCH NO.'S 181.9 AND 181.10.
6. C.H. CHAIN LINK FENCE IS INSTALLED ON TOP OF WALL AS SHOWN ON ENG. DWG.'S.
7. WALL THICKNESS = 8"

WALL CARRIES SAFETY RELATED ITEMS - YES (NO)		BECHTEL - RANCHO SECO
BUILDING TANK SECURITY FENCE	DISCIPLINE CIVIL	LOS ANGELES JOB NO. 12334-613
FLOOR ELEV. GRADE	TYPE OF CONSTRUCTION (D) D2 D3	MASONRY WALL SURVEY
SCALE 1/8"=1'-0" BY EEB	FIELD REVIEW BY [illegible]	
DATE 6-24-80 CH'K [illegible]	DATE 7/11/80 . CH'K [illegible]	WALL NO 181.1W&N SHT 1 OF 2



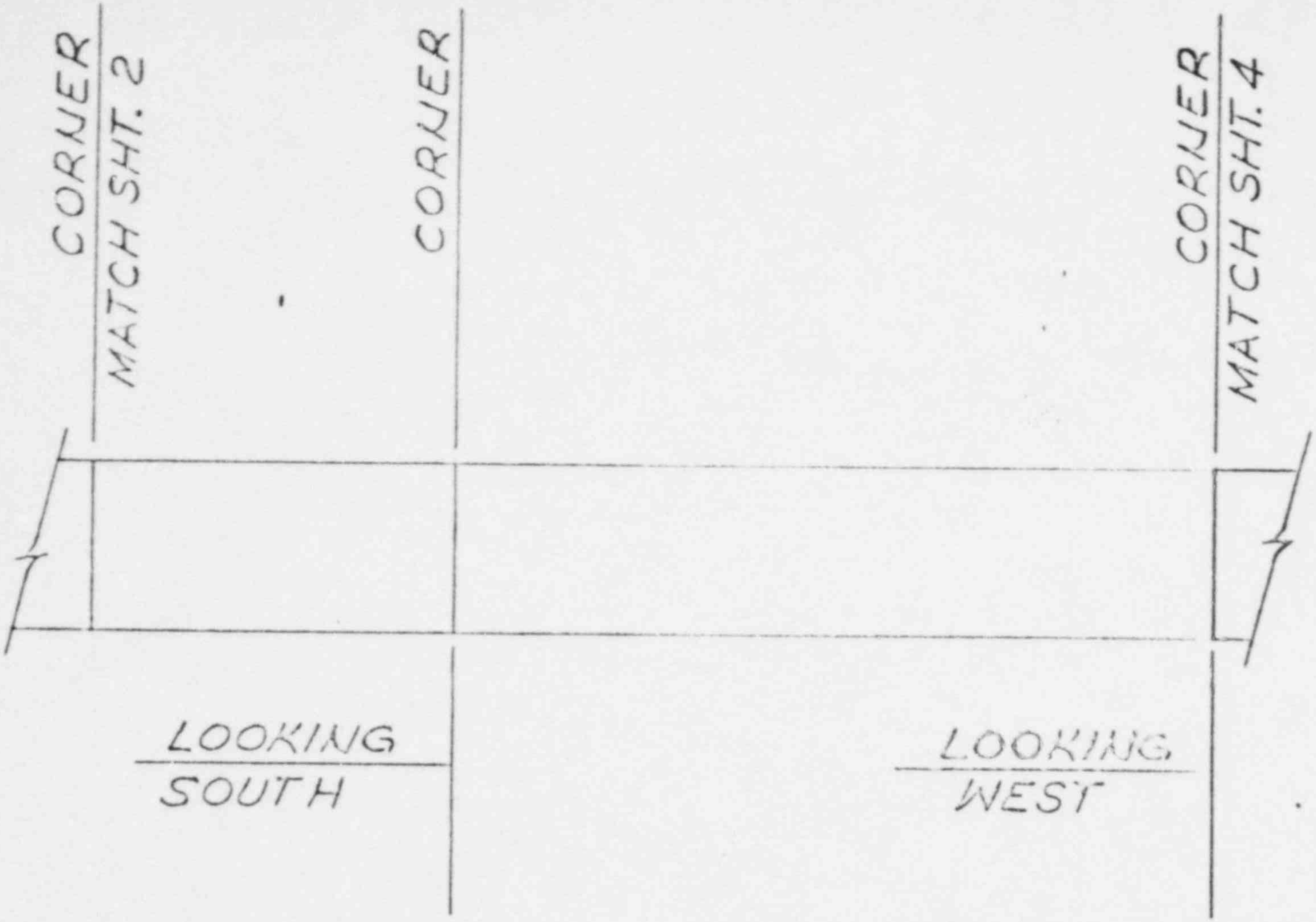
NOTES:

1. THERE ARE NOT ANY SIGNIFICANT ITEMS ATTACHED TO EITHER SIDE OF THIS WALL.
2. THE WALL IS NOT IN PROXIMITY TO A SAFETY RELATED SYSTEM.
3. 6 FT. CHAIN LINK FENCE IS INSTALLED ON TOP OF WALL AS SHOWN ON ENG. DWG.'S.
4. WALL THICKNESS = 8"

LOOKING WEST

WALL CARRIES SAFETY RELATED ITEMS - YES (NO)

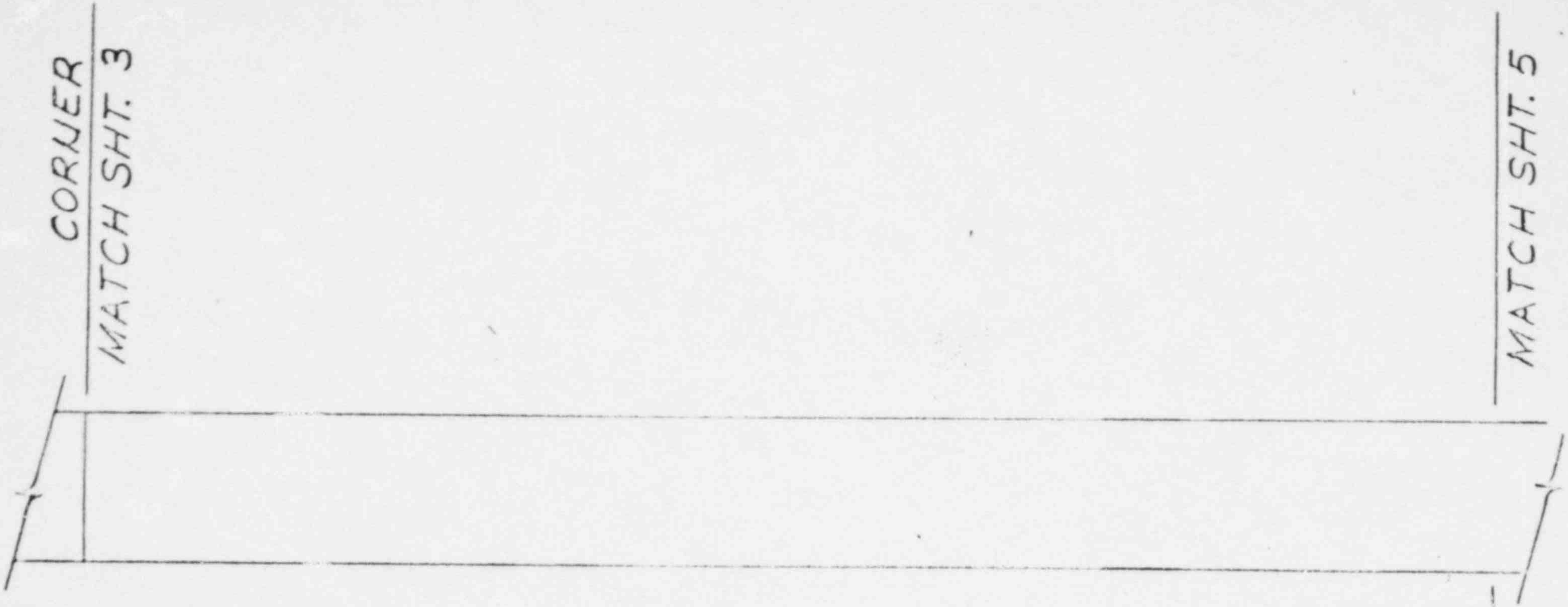
BUILDING TANK SECURITY FENCE FLOOR ELEV. GRADE SCALE 1/8" = 1'-0" BY [illegible] DATE 6-24-80 CH'K [illegible]	DISCIPLINE CIVIL TYPE OF CONSTRUCTION (01) 02 03 FIELD REVIEW BY [illegible] DATE 7/11/80 CH'K [illegible]	BECHTEL - RANCHO SECO LOS ANGELES JOB NO. 12334-616 MASONRY WALL SURVEY WALL NO 181.2W SHT 2 OF 3



NOTES:

1. THERE ARE NOT ANY SIGNIFICANT ITEMS ATTACHED TO EITHER SIDE OF THIS WALL.
2. THE WALL IS NOT IN PROXIMITY TO A SAFETY RELATED SYSTEM.
3. 6 ft. CHAIN LINK FENCE IS INSTALLED ON TOP OF WALL AS SHOWN ON ENG. DWG.'S
4. WALL THICKNESS = 8"

WALL CARRIES SAFETY RELATED ITEMS - YES (NO)		BECHTEL - RANCHO SECO LOS ANGELES - JOB NO. 12334-613
BUILDING TANK SECURITY FENCE FLOOR ELEV. GRADE SCALE 1/8" = 1'-0" BY C.E.B. DATE 6-24-80 CH'K'D J.m.m.	DISCIPLINE CIVIL TYPE OF CONSTRUCTION (01) 02 03 FIELD REVIEW BY [illegible] DATE 7/11/80 CH'K'D [illegible]	MASONRY WALL SURVEY WALL NO 181.3S#W SHT 3 OF 8

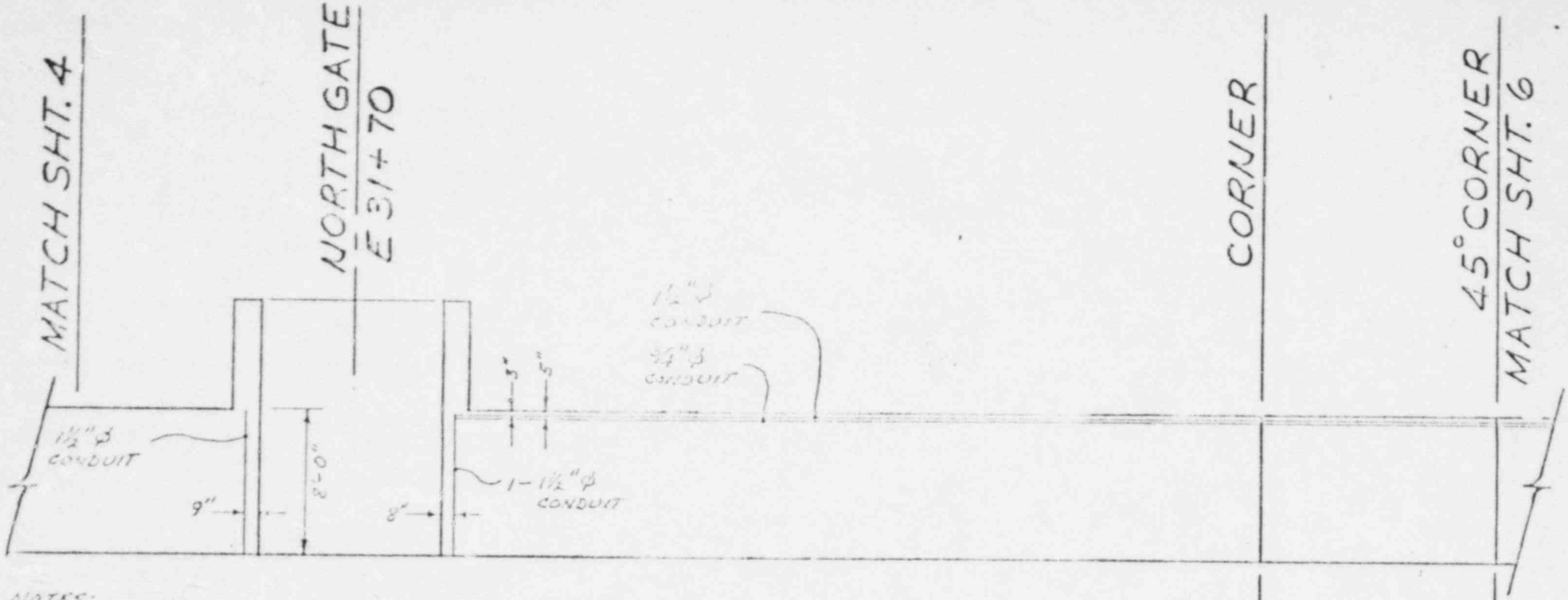


NOTES:

1. THERE ARE NOT ANY SIGNIFICANT ITEMS ATTACHED TO EITHER SIDE OF THIS WALL.
2. THE WALL IS NOT IN PROXIMITY TO A SAFETY RELATED SYSTEM.
3. 6 ft. CHAIN LINK FENCE IS INSTALLED ON TOP OF WALL AS SHOWN ON ENG. DWG.'S
4. WALL THICKNESS = 8"

LOOKING SOUTH

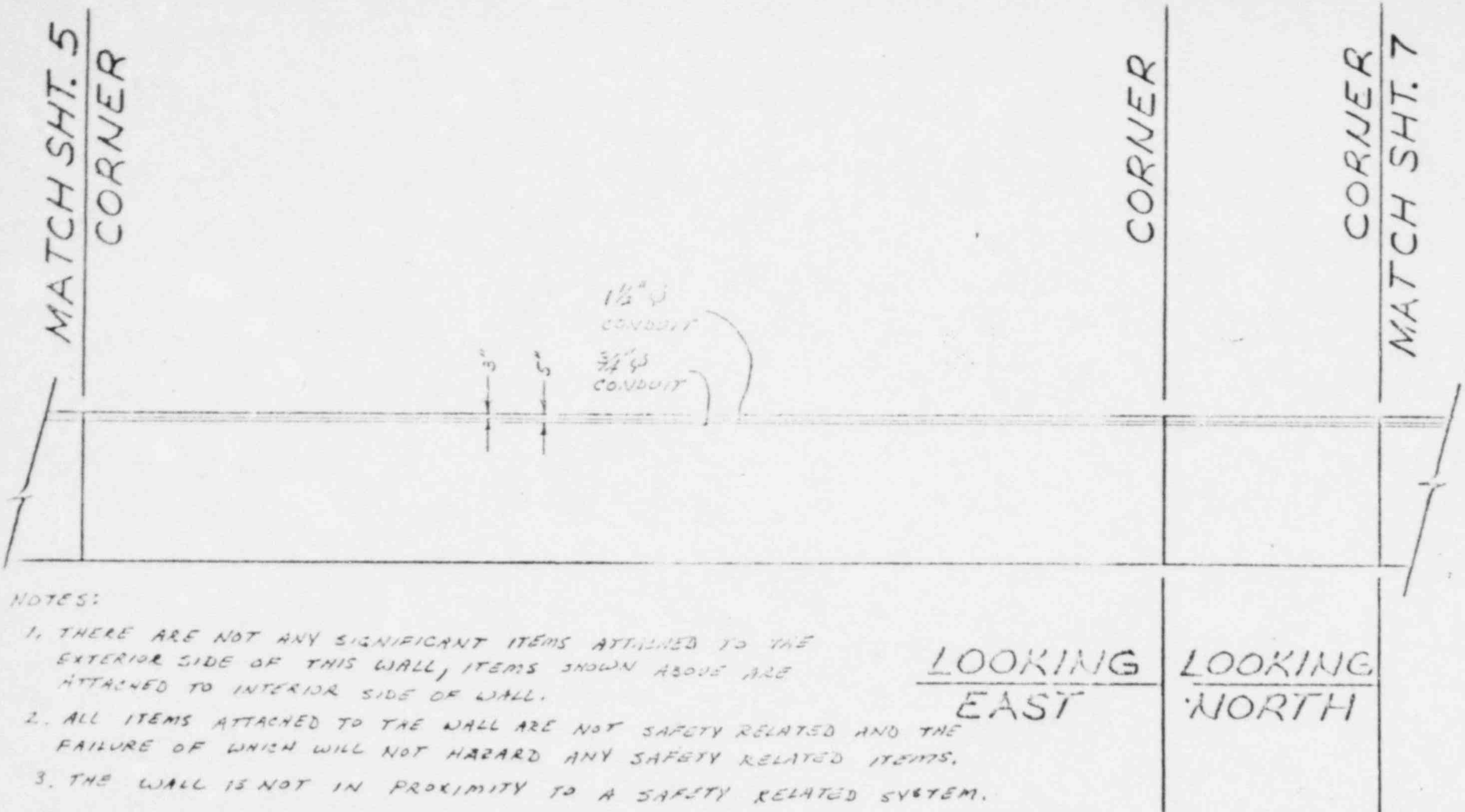
WALL CARRIES SAFETY RELATED ITEMS - YES (NO)		BECHTEL — RANCHO SECO LOS ANGELES JOB NO. 12334-G13
BUILDING TANK SECURITY FENCE	DISCIPLINE CIVIL	
FLOOR ELEV. GRADE	TYPE OF CONSTRUCTION (D1) D2 D3	MASONRY WALL SURVEY
SCALE 1/8"=1'-0" BY	FIELD REVIEW BY	
DATE 6-24-80 CH'K	DATE 7/11/80 CH'K	WALL NO 181.4S SHT 4 OF 11



NOTES:

1. THERE ARE NOT ANY SIGNIFICANT ITEMS ATTACHED TO THE EXTERIOR SIDE OF THIS WALL, ITEMS SHOWN ABOVE ARE ATTACHED TO INTERIOR SIDE OF WALL.
2. ALL ITEMS ATTACHED TO THE WALL ARE NOT SAFETY RELATED AND THE FAILURE OF WHICH WILL NOT HAZARD ANY SAFETY RELATED ITEMS.
3. FOR LOCATION OF SAFETY RELATED ITEMS IN PROXIMITY OF THIS WALL SEE SKETCH NO. 181.11
4. 6 ft. CHAIN LINK FENCE IS INSTALLED ON TOP OF WALL AS SHOWN ON ENG. DWG.'S.
5. WALL THICKNESS = 8"

WALL CARRIES SAFETY RELATED ITEMS-YES (NO)		
BUILDING TANK SECURITY FENCE	DISCIPLINE CIVIL	BECHTEL - RANCHO SECO LOS ANGELES JOB NO. 12334-616
FLOOR EL. Y, GRADE	TYPE OF CONSTRUCTION (01) 02 03	MASONRY WALL SURVEY
SCALE 1/8"=1'-0" BY EBB	FIELD REVIEW BY [signature]	
DATE 6-20-80 CH'K mm	DATE 7/11/80 CH'K PAB	WALL NO 181.5S SHT 5 of 8



NOTES:

1. THERE ARE NOT ANY SIGNIFICANT ITEMS ATTACHED TO THE EXTERIOR SIDE OF THIS WALL, ITEMS SHOWN ABOVE ARE ATTACHED TO INTERIOR SIDE OF WALL.
2. ALL ITEMS ATTACHED TO THE WALL ARE NOT SAFETY RELATED AND THE FAILURE OF WHICH WILL NOT HAZARD ANY SAFETY RELATED ITEMS.
3. THE WALL IS NOT IN PROXIMITY TO A SAFETY RELATED SYSTEM.
4. 6 ft. CHAIN LINK FENCE IS INSTALLED ON TOP OF FENCE AS SHOWN ON ENG. DWG.'S
5. WALL THICKNESS = 8"

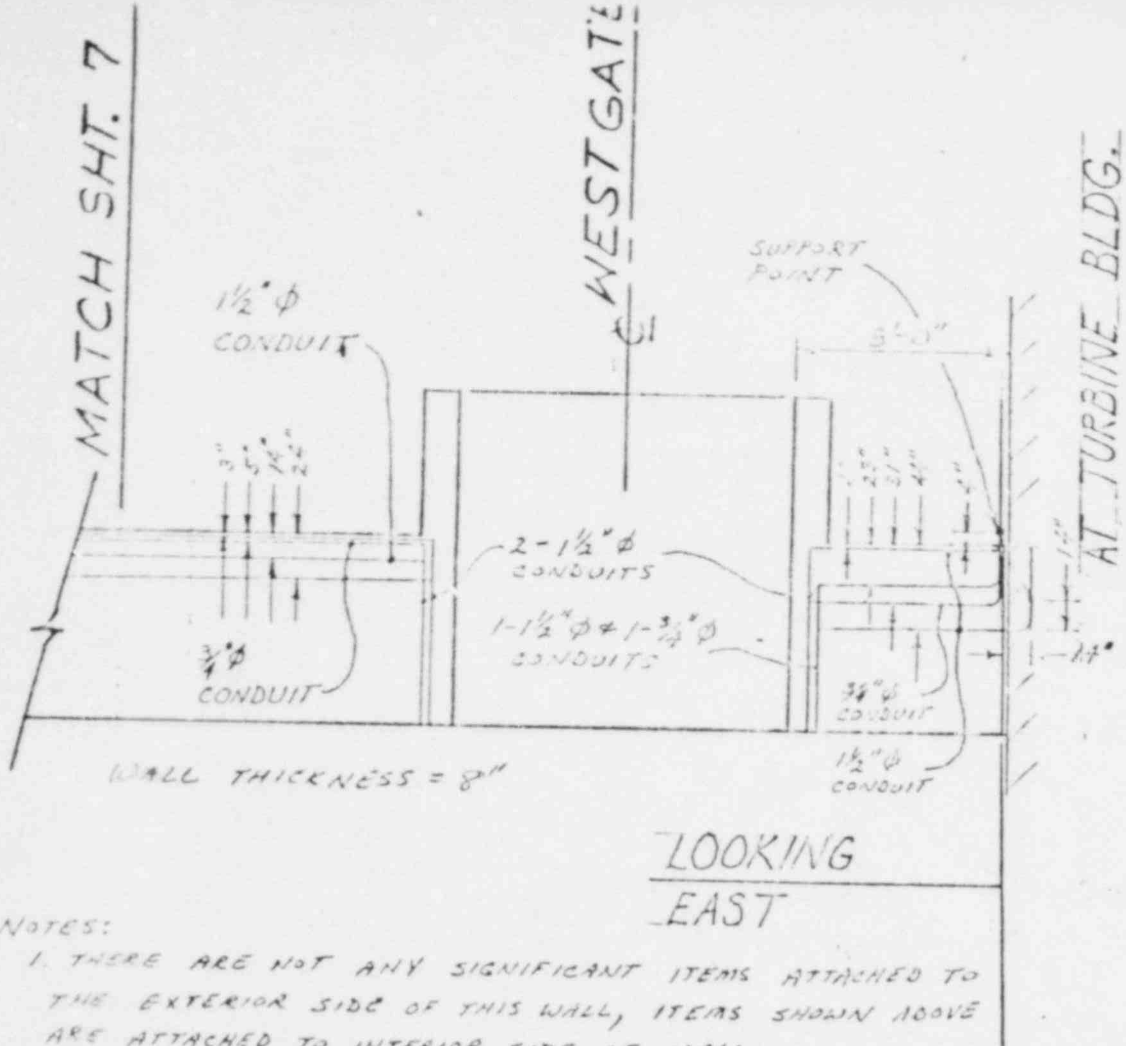
WALL CARRIES SAFETY RELATED ITEMS - YES (NO)		BECHTEL - RANCHO SECO
BUILDING TANK SECURITY FENCE	DISCIPLINE CIVIL	LOS ANGELES JOB NO. 12334-616
FLOOR ELEV. GRADE	TYPE OF CONSTRUCTION (C) D2 D3	MASONRY WALL SURVEY
SCALE ⅛" = 1'-0" BY GEB	FIELD REVIEW BY G.K. [illegible]	
DATE 6-24-80 CH'K'D [illegible]	DATE 7/11/80 CH'K R.G.	WALL NO 181.6E 11 SHT 6 OF 8

NOTES:

1. THERE ARE NOT ANY SIGNIFICANT ITEMS ATTACHED TO THE EXTERIOR SIDE OF THIS WALL, ITEMS SHOWN ABOVE ARE ATTACHED TO INTERIOR SIDE OF WALL.
2. ALL ITEMS ATTACHED TO THE WALL ARE NOT SAFETY RELATED AND THE FAILURE OF WHICH WILL NOT HAZARD ANY SAFETY RELATED ITEMS.
3. THE WALL IS NOT IN PROXIMITY TO A SAFETY RELATED SYSTEM.
4. 6 ft. CHAIN LINK FENCE IS INSTALLED ON TOP OF WALL AS SHOWN ON ENG. DWG.'S.
5. WALL THICKNESS = 8".

LOOKING EAST

WALL CARRIES SAFEY RELATED ITEMS - YES (NO)		BECHTEL - RANCHO SECO LOS ANGELES JOB NO. 12334-613
BUILDING TANK SECURITY FENCE FLOOR ELEV. GRADE SCALE 1/8"=1'-0" BY GEH DATE 6-24-80 CH'K	DISCIPLINE CIVIL TYPE OF CONSTRUCTION (01) 02 03 FIELD REVIEW BY [signature] DATE 7/11/80 CH'K [initials]	MASONRY WALL SURVEY WALL NO 181.7E SHT 7 OF 8



NOTES:

1. THERE ARE NOT ANY SIGNIFICANT ITEMS ATTACHED TO THE EXTERIOR SIDE OF THIS WALL, ITEMS SHOWN ABOVE ARE ATTACHED TO INTERIOR SIDE OF WALL.
2. ALL ITEMS ATTACHED TO THE WALL ARE NOT SAFETY RELATED AND THE FAILURE OF WHICH WILL NOT HAZARD ANY SAFETY RELATED ITEMS.
3. THE WALL IS VISIBLY FREE OF ATTACHMENT TO TURBINE BLDG.
4. THE WALL IS NOT IN PROXIMITY TO A SAFETY RELATED SYSTEM.
5. 6 ft. CHAIN LINK FENCE IS INSTALLED ON TOP OF WALL AS SHOWN ON ENG. DWG.'S.

WALL CARRIES SAFETY RELATED ITEMS - YES (NO)		
BUILDING TANK SECURITY FENCE FLOOR ELEV. GRADE SCALE 1/8":1'-0" BY [illegible] DATE 6-24-80 CH'K [illegible]	DISCIPLINE CIVIL TYPE OF CONSTRUCTION (01) 02 03 FIELD REVIEW BY [illegible] DATE 7/11/80 CH'K [illegible]	BECHTEL - RANCHO SECO LOS ANGELES JOB NO. 12333-613 MASONRY WALL SURVEY WALL NO 181.8E SHT 8 OF 8

CALCULATION SHEET

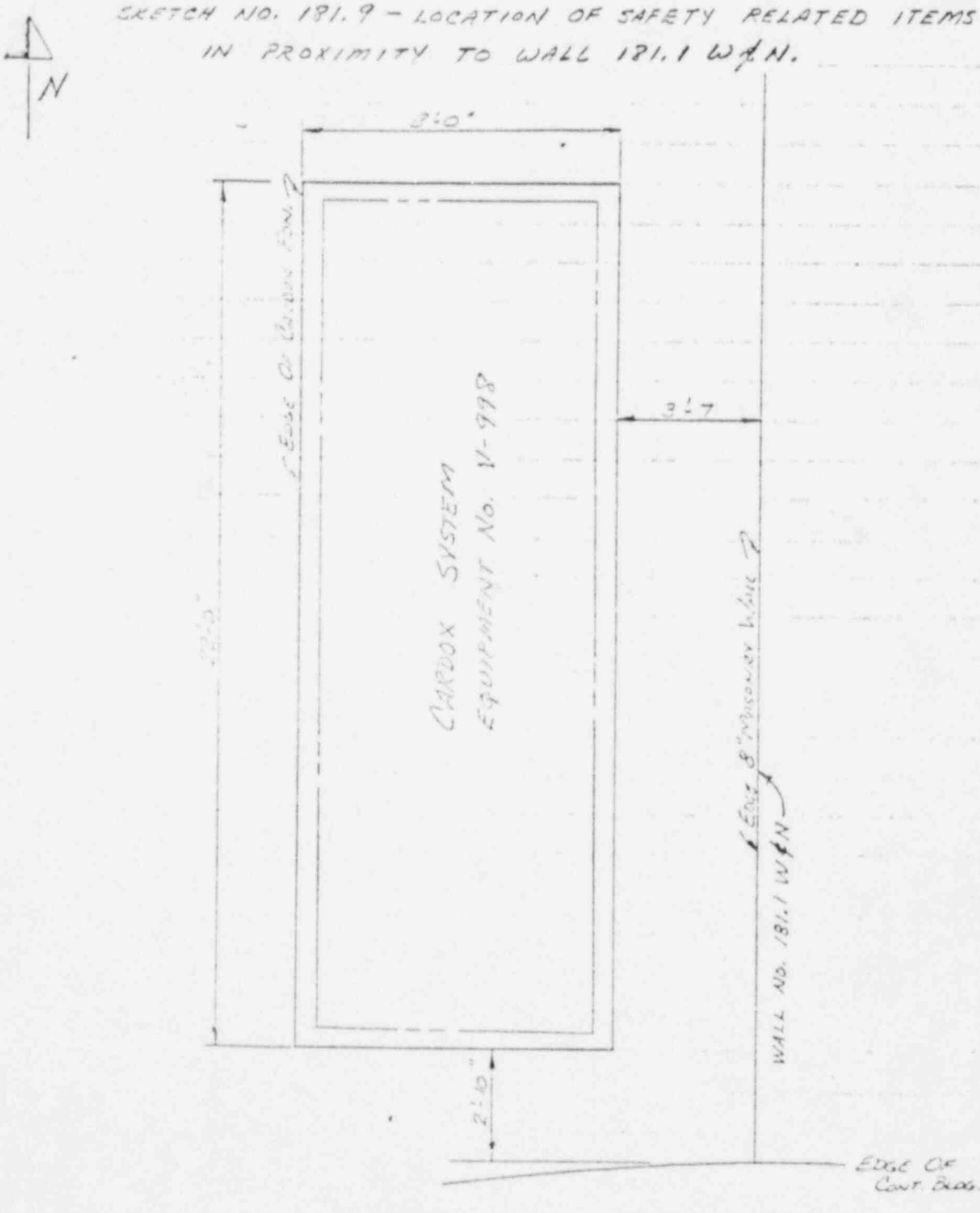
CALC. NO. C-616

SIGNATURE Robert L Benson DATE 11 July 80 CHECKED JKA DATE 7/11/80

PROJECT Rancho Seco JOB NO. 12334-616

SUBJECT MASONRY WALLS SHEET 47 OF 49 SHEETS

SKETCH NO. 181.9 – LOCATION OF SAFETY RELATED ITEMS IN PROXIMITY TO WALL 181.1 W/N.



PLAN VIEW

LAO 0513 1-73

CALCULATION SHEET

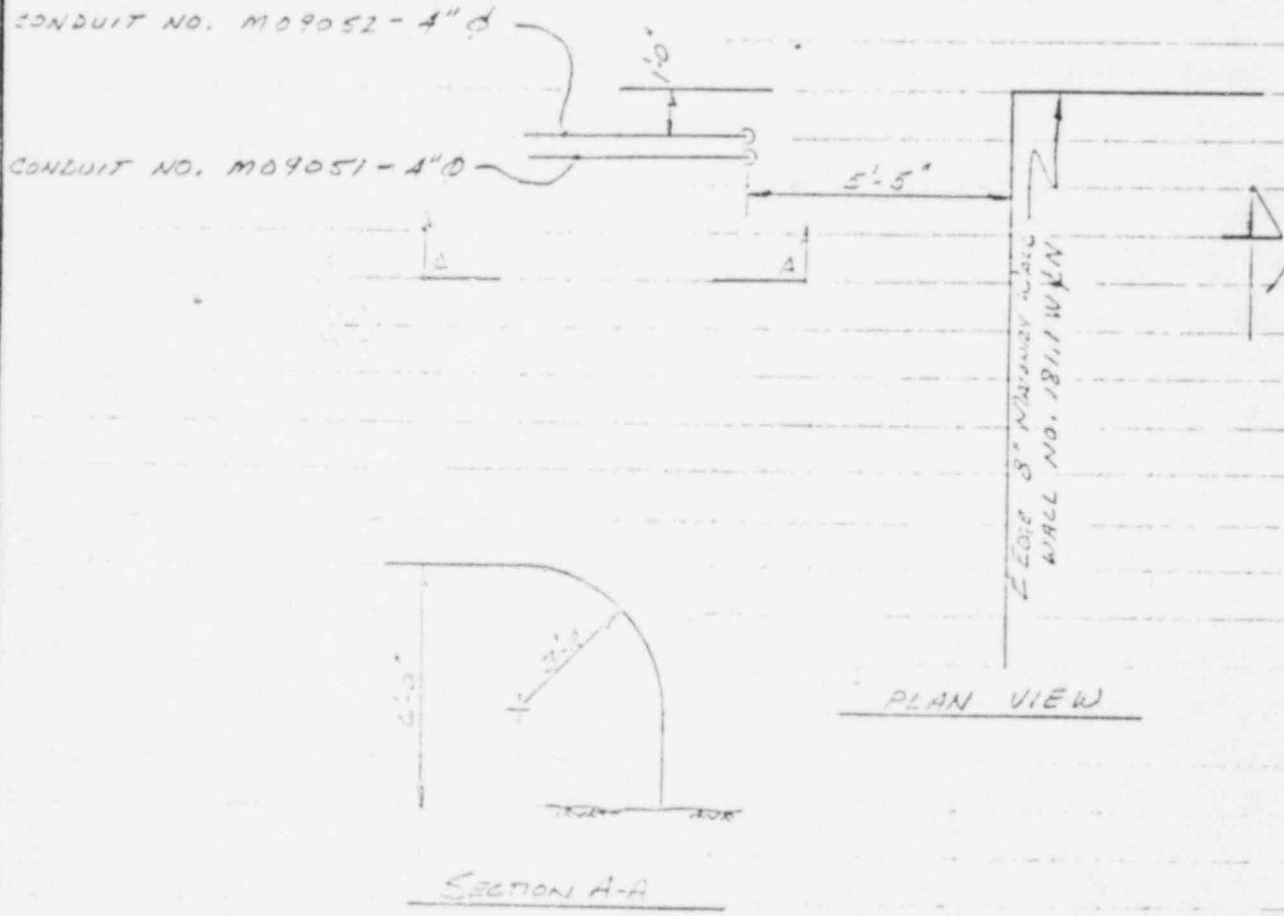
CALC. NO. C-616

SIGNATURE [signature] DATE 11 July 80 CHECKED OKA DATE 7/11/80

PROJECT Rancho Seco JOB NO. 12334-616

SUBJECT MASONRY WALLS SHEET 48 OF 49 SHEETS

SKETCH NO. 181.10 - LOCATION OF SAFETY RELATED ITEMS IN PROXIMITY TO WALL NO. 181.1 W&N.

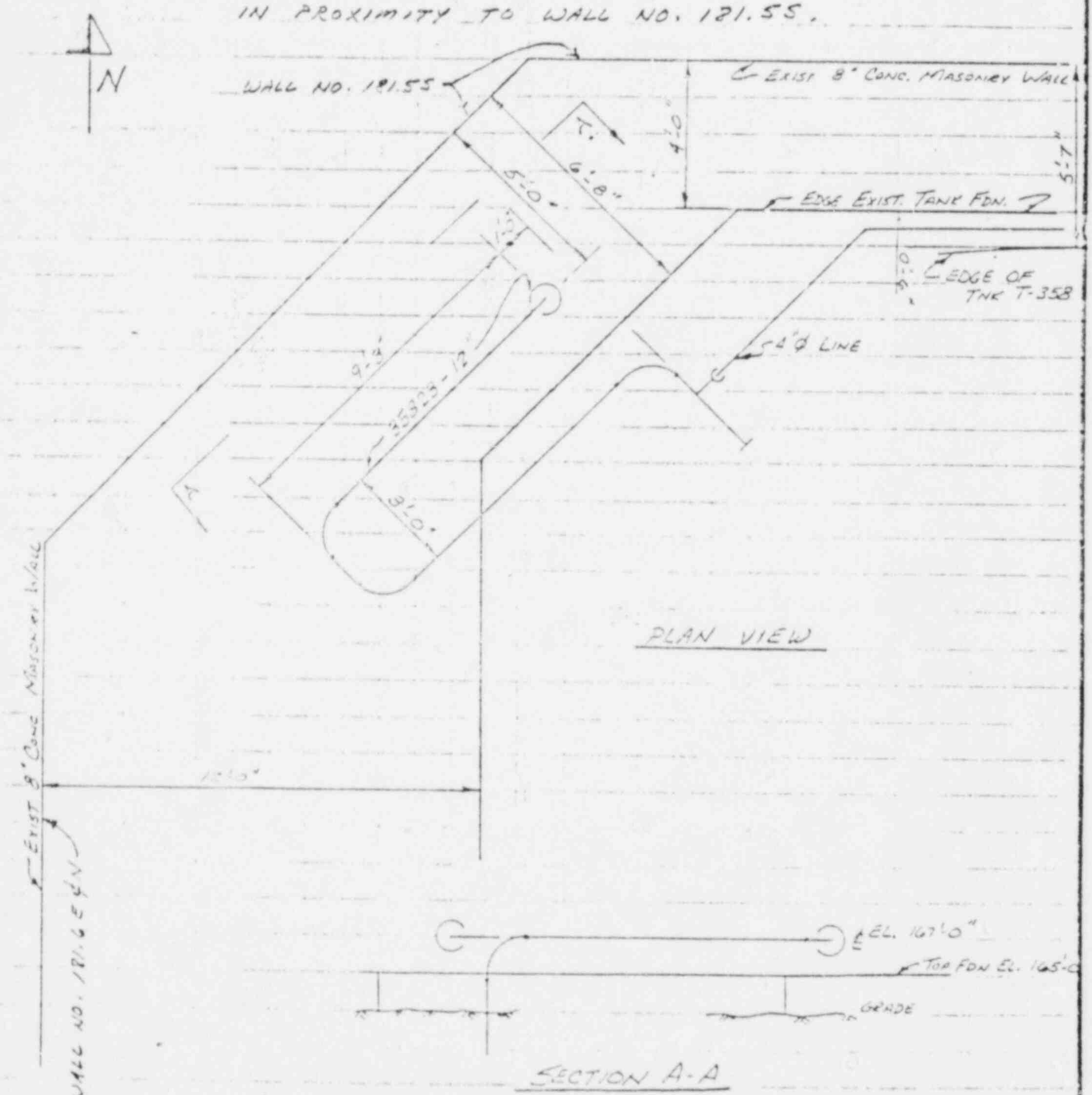


CALCULATION SHEET

LAO 0513 8-73

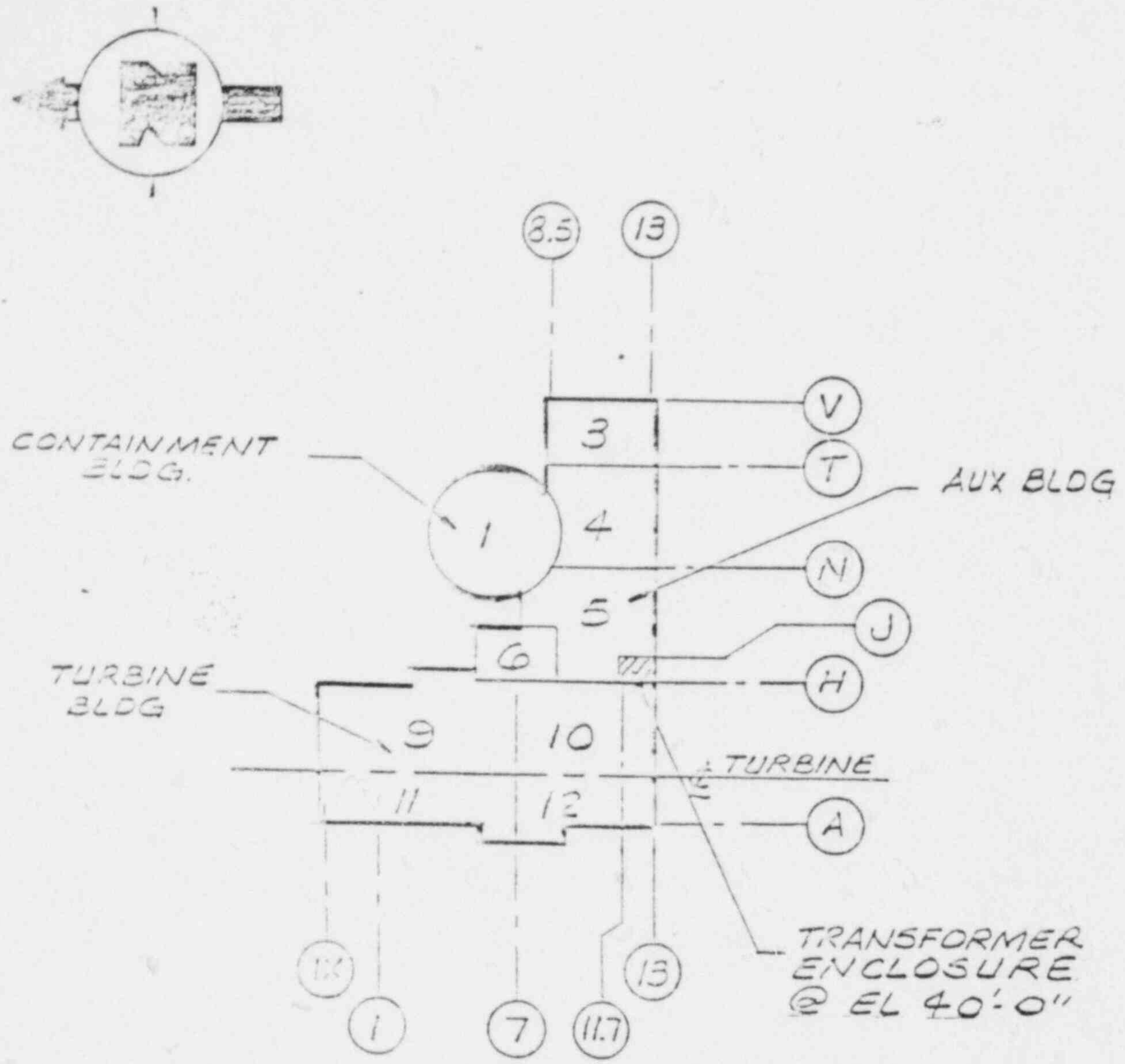
SIGNATURE	Robert H. Benson	DATE	11 July 80
CALC. NO.	C-616	CHECKED	CKG
DATE	7/11/80	PROJECT	Rancho Seco
JOB NO.	12334-616	SUBJECT	MASONRY WALLS
SHEET	49	OF	49 SHEETS

SKETCH NO. 181.11 – LOCATION OF SAFETY RELATED ITEMS IN PROXIMITY TO WALL NO. 181.55.

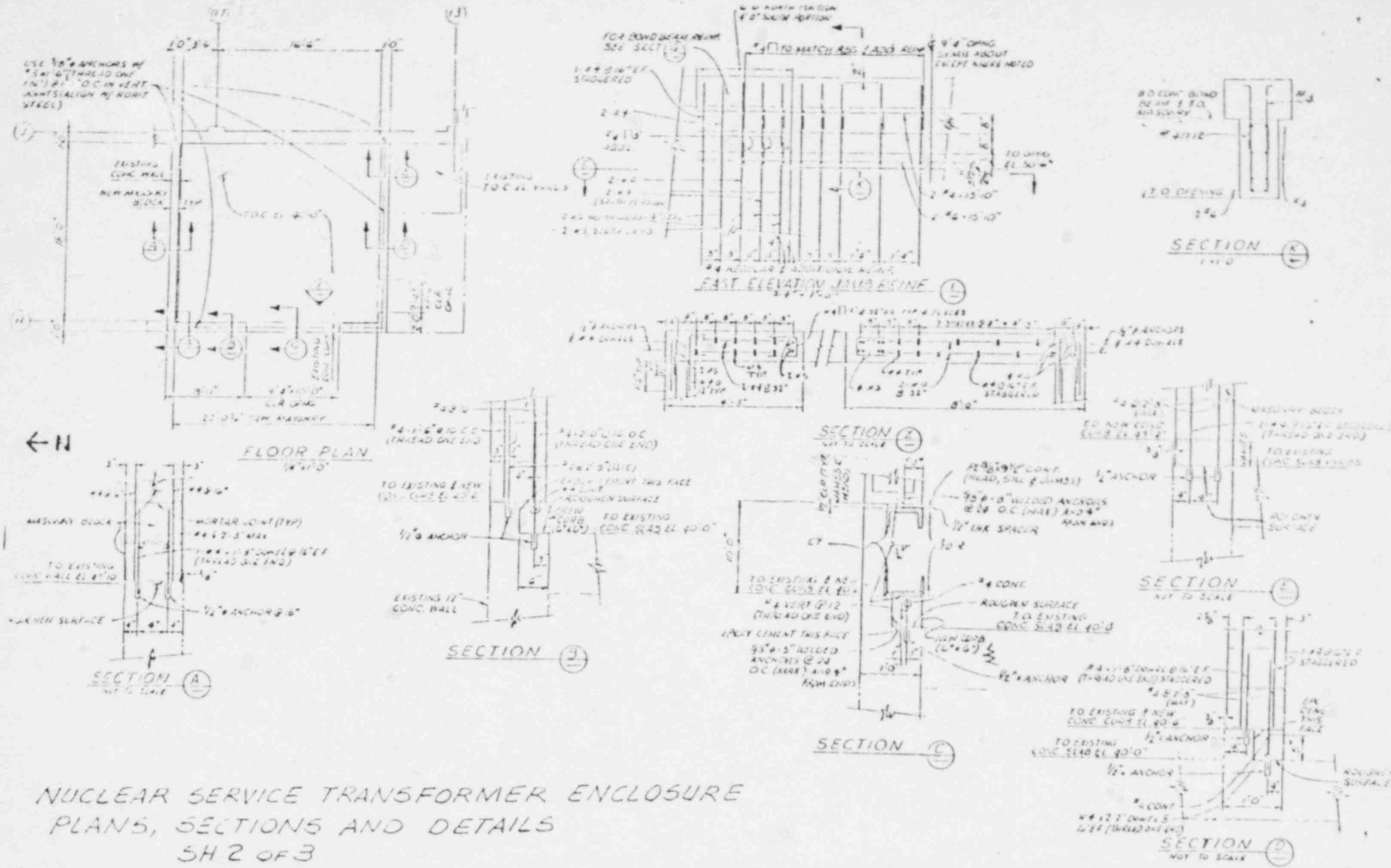


ATTACHMENT D

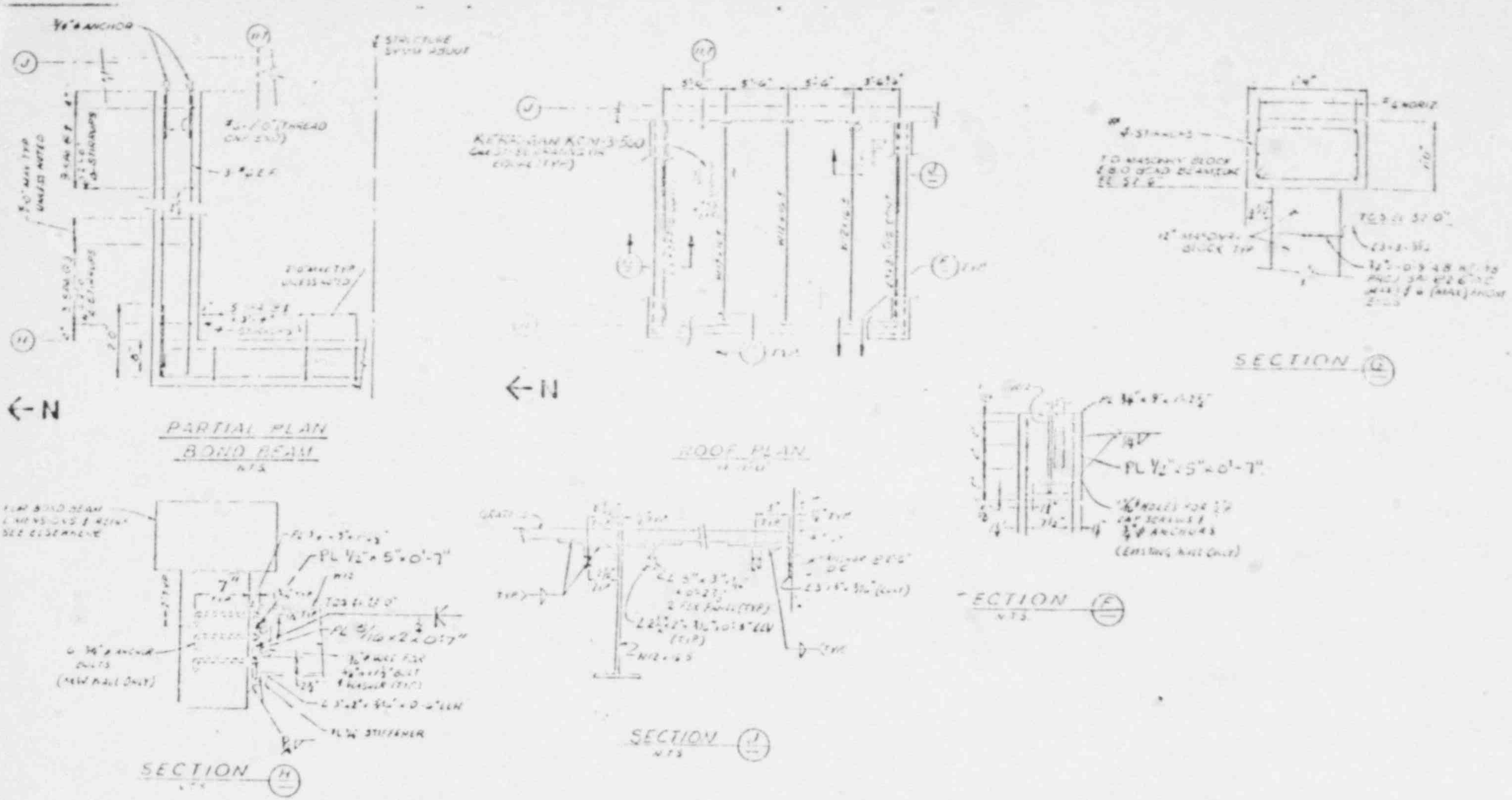
PLOT PLAN AND SKETCHES



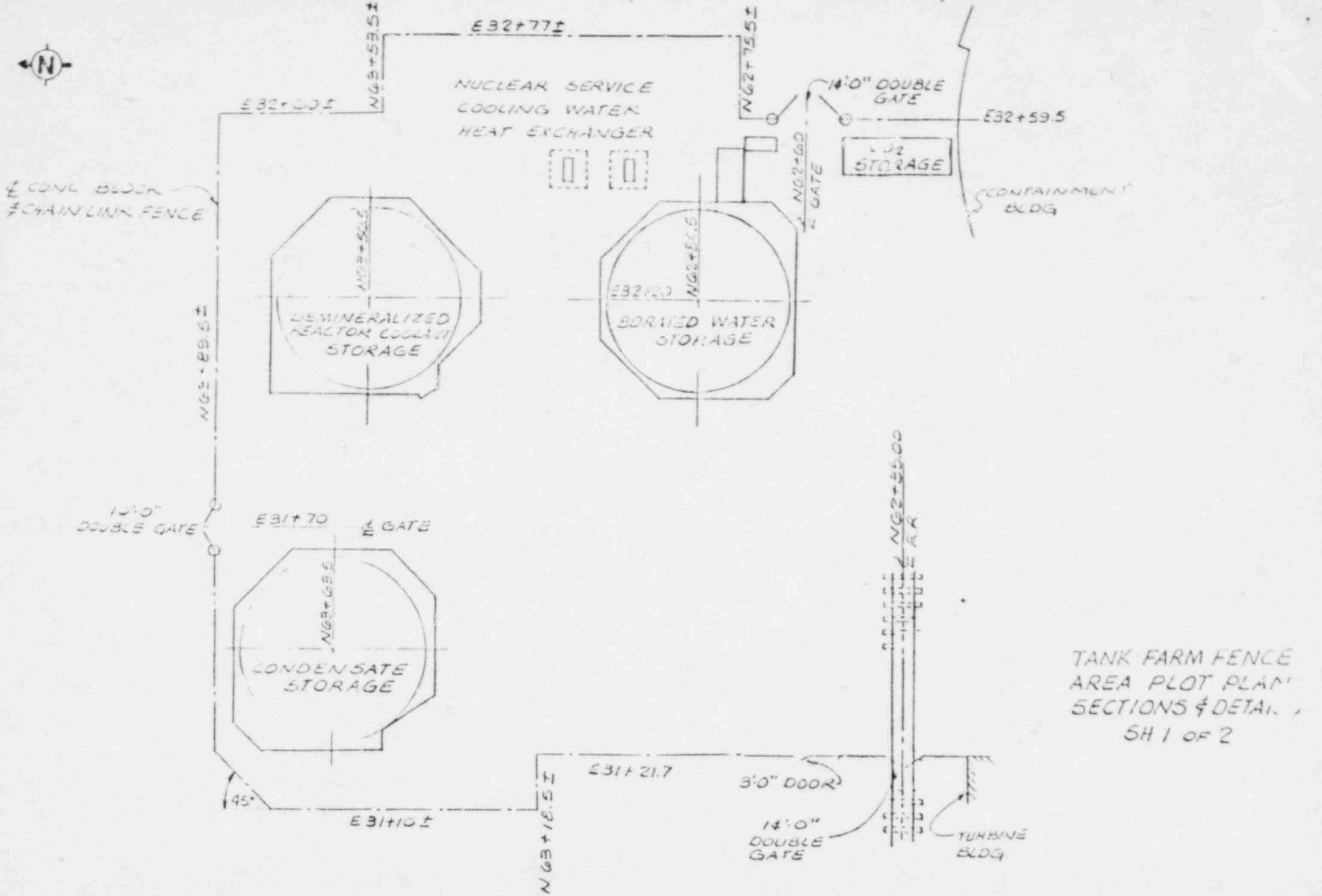
NUCLEAR SERVICE TRANSFORMER ENCLOSURE
AREA LOCATION PLAN
SHEET 1 OF 3



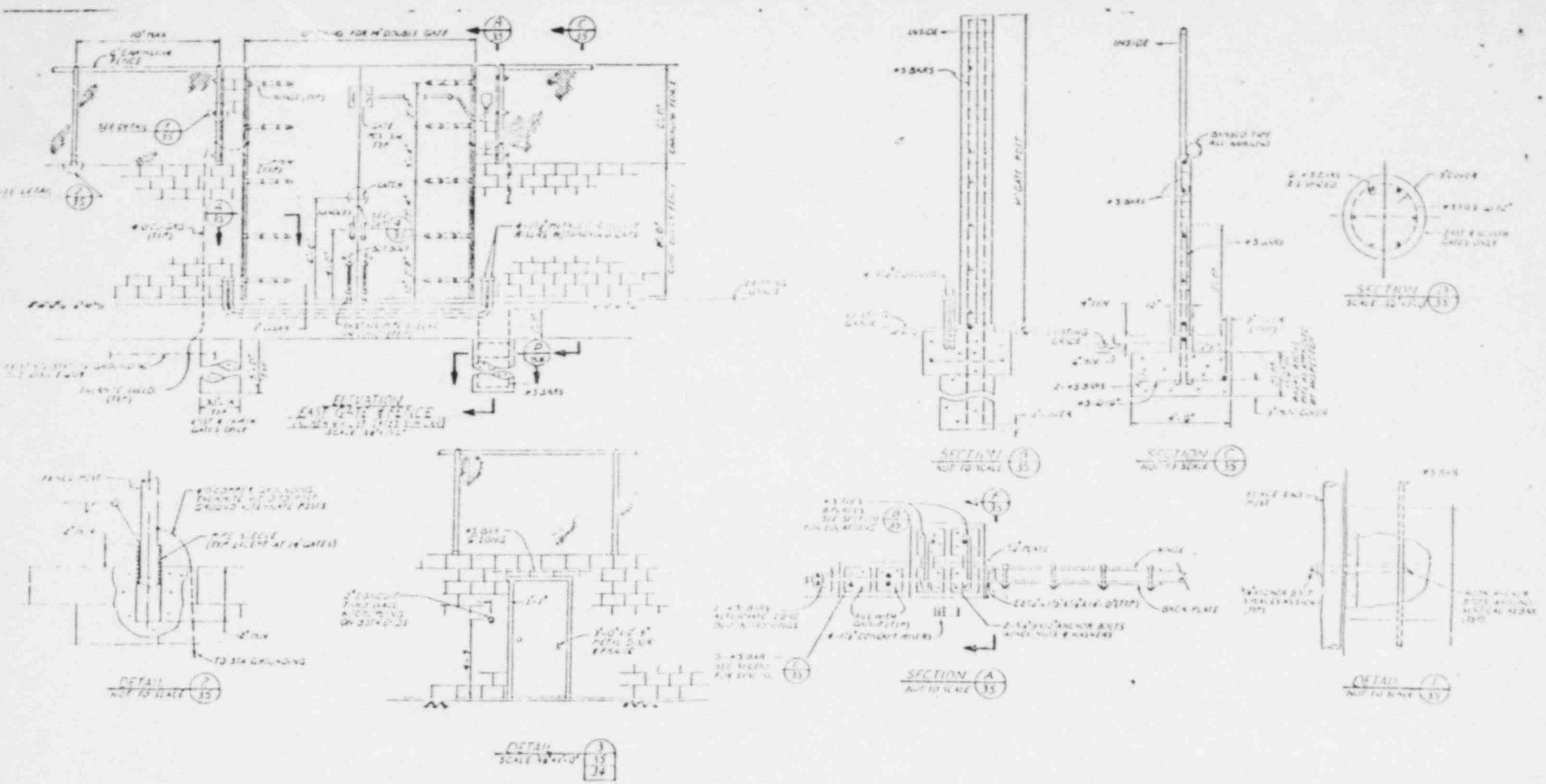
NUCLEAR SERVICE TRANSFORMER ENCLOSURE
PLANS, SECTIONS AND DETAILS
SH 2 OF 3



NUCLEAR SERVICE TRANSFORMER ENCLOSURE
PLANS, SECTIONS AND DETAILS
SH 3 OF 3



TANK FARM FENCE
AREA PLOT PLAN
SECTIONS & DETAIL
SH 1 OF 2



TANK FARM FENCE
AREA PLOT PLAN
SECTIONS AND DETAILS
SH 2 OF 2