Southern California Edison Company

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K. P. BASKIN
MANAGER OF NUCLEAR ENGINEERING,
SAFETY, AND LICENSING

TELEPHONE
(213) 572-1401

July 9, 1982

Director, Office of Nuclear Reactor Regulation
Attention: D. M. Crutchfield, Chief
Operating Reactors Branch No. 5
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Gentlemen:

Subject: Docket No. 50-206
Masonry Wall Evaluations
SEP Topic III-6
Seismic Design Considerations
San Onofre Nuclear Generating Station
Unit 1

During the week of May 10, 1982 we met with the NRC staff to discuss technical comments made by the staff regarding the methodology used to evaluate the masonry walls at San Onofre Unit 1. At that meeting several additional comments were made by the staff. The responses to these additional comments are provided as an enclosure to this letter.

If you have any questions regarding this information, please let us know.

Very truly yours,

M. O. Medford for K.P.B.

A095

SAN ONOFRE NUCLEAR GENERATING STATION, UNIT 1

MASONRY WALL EVALUATION

RESPONSE TO ITEMS RAISED AT MEETING OF MAY 11-13, 1982

1. Item

Provide a summary of the past performance of reinforced masonry block walls during major earthquakes.

Response

Masonry construction at SONGS-1 consists of hollow concrete block units of reinforced running bond construction. Walls vary in height from 10 feet to 22 feet. The performance of this type of construction in past earthquakes has been reviewed. Personal communications have been held with the following masonry experts: Mr. Karl V. Steinbrugge, Mr. James E. Amhrein, Professor Robert Schneider and Dr. Samy Adham (References 1.1 through 1.4). Reports on all major U.S. earthquakes were reviewed. Only the reports on the earthquakes listed below give detailed information relevant to the performance of masonry walls similar to those at SONGS 1.

a. Taft Earthquake of July 21, 1952--Reference 1.5.

b. San Fernando Earthquake of February 9, 1971--Reference 1.6.

The performance of well constructed reinforced, running bond, hollow concrete block construction was found to be very satisfactory. There were a significant number of industrial type buildings of similar construction with wall heights varying from 14 feet to 22 feet near the epicenter region of the San Fernando earthquake. Buildings with good detailing requirements between the roof diaphragm and masonry walls (pp. 87-88, Reference 1.6) suffered little or no earthquake damage. There were several buildings that were damaged (Reference 1.6), but the damage was not initiated by the failure of the masonry walls. The primary cause of damage was poor connection details between the roof diaphragm and masonry walls which resulted in progressive failures. The personal communications revealed that there were a significant number of reinforced concrete block buildings that were undamaged in the San Fernando earthquake and not included in Reference 1.6.

There were only two reinforced concrete block masonry buildings reported in Reference 1.5 and neither suffered any damage. The conclusion stated in Reference 1.5 is as follows:

> "Unit masonry construction such as reinforced brick and reinforced hollow concrete block can be earthquake resistant, but requires good design as well as competent engineering supervision during construction."

It is therefore concluded that the past earthquake performance of well constructed reinforced masonry, similar to that used at SONGS-1, is very satisfactory.

REFERENCES

1.1 Steinbrugge, K. V., consultant, personal communication.

1.2 Amhrein, J. E., Director of Engineering, Masonry Institute of America, personal communication.

1.3 Schneider, R., California Polytechnic State University, Pomona.

1.4 Adham, S., Agbabian and Associates, personal communication.

1.5 Steinbrugge, K. V. and Moran, D. F., "An Engineering Study of the Southern California Earthquake of July 21, 1952 and its Aftershocks," Bulletin of Seismological Society of America, Vol. 44, No. 2B, April 1954.

1.6 Murphy, L. M., "San Fernando, California Earthquake of February 9, 1971," National Oceanic and Atmospheric Administration, 1973.

2. Item

Explain the basis and applicability of the ACI-349 compressive strain limits.

Response

The strain limits given in Appendix C of ACI-349 are based on data presented in Reference 2.1. This data is the result of a test series carried out by the Portland Cement Association and reported in Reference 2.2. The series of tests in this latter reference included a total of 37 simply supported beams. The formulation for maximum compressive strain, u, was derived from these tests and is presented in Appendix C of ACI-349 as follows:

$$u = 0.003 + 0.5/z \leq .012$$

where z = distance from point of maximum moment to point of zero moment in inches

This test series was later extended by a further series of 40 beams which examined other variables (Reference 2.3). From this investigation a modified expression for the ultimate strain was obtained with the additional variables of the beam width and the confining pressure. This more complex formulation was not included in ACI-349 Appendix C, but for the SONGS-1 walls would produce similar strain limits to the equation above.

Each of the test series produced ultimate compressive strains ranging from 0.0029 to 0.062. Of the total 77 test specimens only 4 provided ultimate strains less than 0.004. The formulation given above provides a generally lower bound on these results. Reference 2.2 notes: "They are not true strains in the generally accepted sense of the word since the concrete at the face is almost invariably extensively cracked and damaged at ultimate strength." The field observations from the tests noted that although the first visible sign of distress in the compression zone occurred at a maximum concrete compressive strain in the range 0.0025 to 0.0035, the response of the beam to load was not affected.

Based on these results it is considered that the limiting strain of 0.004 employed for the SONGS-1 masonry analyses is a conservative value in that practically all of the tests discussed above showed that load carrying capacity was maintained at strain levels much higher than this value.

REFERENCES

2.1 Mattock, Alan H. "Rotational Capacity of Hinging Region in Reinforced Concrete Beams," Flexural Mechanics of Reinforced Concrete. SP-12 American Concrete Institute/American Society of Civil Engineers, Detroit, 1965, pp. 143-181.

2.2 Mattock, Alan H. "Rotational Capacity of Hinging Regions in Reinforced Concrete Beams," Portland Cement Association, Bulletin D101.

2.3 Corley, W. Gene, "Rotational Capacity of Reinforced Concrete Beams," Portland Cement Association, Bulletin D108.

3. Item

Document how soil structure interaction was accounted for in the masonry wall evaluation.

Response

Possible soil-structure interaction effects were investigated for the masonry walls subjected to nonlinear analysis. The frequencies associated with the cracked section stiffness of the subject masonry walls are relatively low, typically 1 to 2 Hertz. Once the walls enter the inelastic range this frequency is reduced further. In this low frequency range the displacement controlled region of the strong ground motion is the significant factor. However, over this frequency range the instructure response spectra essentially follows the spectral characteristics of the ground motion and is not affected by SSI or the filtering effects due to the buildings. In addition, as the soil stiffness is relatively high, compared to the masonry walls, the overall frequency of the walls would not be affected. Furthermore, for the San Onofre Unit 1 site, the soil hysteretic damping is approximately 13%. This value is further increased by radiation damping, resulting in some cases with up to 50% of critical damping which, if considered, would decrease the effective input to the walls.

The need for the inclusion of SSI parameters into the masonry wall nonlinear analysis was assessed on a building by building basis with respect to the above general considerations and additional specific considerations as appropriate. A summary of these assessments is as follows:

a. The Reactor Auxiliary Building is a fully embedded reinforced concrete structure. SSI does not need to be considered since the masonry walls are located on top of and are attached solely to this fully embedded rigid structure.

b. The Fuel Storage Building analysis utilized a three dimensional finite element model. The masonry walls were fully coupled with this model in which full account of SSI was taken. Section 4.4 of Reference 3.1 provides information on the methods by which SSI was included into this model.

c. The Turbine Building is a single story steel framed building with a prestressed concrete roof slab. The masonry walls form the exterior enclosure wall for this building. The top of these walls are connected to the building's steel framing and the bottom of the walls are supported by a reinforced concrete foundation at grade. A single degree of freedom oscillator was utilized to represent the response of Turbine Building at the top of the masonry walls. This oscillator included the effect of SSI on the Turbine Building. At

the base of the masonry walls SSI effects were not necessary because the horizontal out-of-plane translational soil spring is typically very stiff with relation to the wall and damping values of 26% or more could reduce the input to the base of the wall.

D. The Ventilation Equipment Building is a single story rectangular masonry structure. Due to the considerations outlined above no account of SSI was deemed necessary for the nonlinear analysis of the masonry walls in this building.

In conclusion, SSI effects were assessed for each building with respect to the masonry walls. On the basis of this assessment, SSI effects were included in those analyses in which SSI could have an effect on the masonry wall analysis results.

REFERENCE

3.1 Computech Engineering Services, Inc., "San Onofre Nuclear Generating Station Unit 1, Seismic Reevaluation of Reinforced Concrete Masonry Walls," Volume 4: Fuel Storage Building, Report No. R543-02, April 1982.

4. Item

Demonstrate that the representation of the Turbine Building Extensions as single-degree-of-freedom oscillators is appropriate.

Response

Of the four Turbine Building extensions only the North Extension is not connected to the top of the masonry enclosure wall. The East and West Heater Platforms are symmetric and their seismic response is therefore essentially the same. Therefore, examination of the responses of only the West Heater Platform and the South Extension is sufficient to assess the adequacy of the single-degree-of-freedom representation of these structures in the nonlinear masonry wall analysis.

The instructure response spectra (IRS) for the two horizontal directions in the West Heater Platform and the South Turbine Building Extension are presented in Figures 4.1 through 4.4. As can be seen by these figures, with the exception of the East-West motion in the South Extension all the IRS show only one predominant peak. Detailed evaluation revealed that the two peaks shown in Figure 4.3 are completely decoupled. In this single case the input into the masonry walls would be due to two distinct modes. However, the masonry walls in the South Extension have frequencies based on the cracked section of approximately 1 Hertz. Of the two peaks the low frequency peak at approximately 3 Hertz is of more consequence than the peak at approximately 9 Hertz since its amplification effects are not fully disipated at the frequency associated with the masonry wall (see Figure 4.3). Therefore, the low frequency single degree of freedom representation of the South Extension was utilized in the analysis. It should also be noted that in all cases the dominant modes associated with the peaks have at least 15% damping due to soil-structure interaction. The single degree of freedom oscillator utilized in the masonry wall analysis was in all cases assigned 7% damping. This indicates that the idealized representation of the Turbine Building incorporated in the analysis would yield significantly more amplification than would occur with a more detailed representation.

5. Item

Provide a comparison of relevant parameters for the masonry walls at SONGS-1 and those used in the SEAOSC test program.

Response

A number of tests on masonry and concrete walls were carried out by SEAOSC. Nine tests were performed on concrete masonry walls, consisting of 6, 8 and 12 inch masonry units. Table 5.1 provides a comparison of the dimensions and reinforcing of the three 8" thick SEAOSC concrete masonry specimens compared with the walls in the SONGS-1 structures.

The following comparisons can be noted from this table:

a. The SEAOSC test specimens were 24'-8" high, about 20% higher than the highest SONGS-1 walls. Therefore the H/t ratio was correspondingly higher for the test specimens.

b. The reinforcing provided in the test specimens was 1.00 square inch per 4'-0" strip, 10% more than the Ventilation Building walls and twice the steel area in the Turbine Building walls.

c. The steel rebars were 60 ksi specified minimum strength compared with 40 ksi for the SONGS-1 walls.

This combination of higher steel areas plus higher steel strengths in the SEAOSC specimens produced considerably higher face shell forces than could occur at SONGS-1 since the face shell forces must balance the forces developed in the steel. Due to these higher face-shell forces the SEAOSC walls would have more severe face-shell stresses and strains. The measured masonry strength of the SEAOSC walls, as determined by ASTM tests, was 2,595 psi. The original specified minimum value of masonry strength, f'm, for the SONGS-1 masonry walls was 1,350 psi. Assuming an increase over fourteen years of fifty percent, the anticipated masonry strength of the walls at SONGS-1 is similar to that of the SEAOSC specimens. Therefore, the SEAOSC specimens would represent a more critical case for face-shell stresses and strains.

TABLE 5.1: COMPARISON OF SEAOSC TEST WALL AND SONGS-1 WALLS

WALL	HEIGHT (Feet)	$\frac{H}{t}$	REINFORCING Per 4'-0" (Sq. Inches)
SEAOSC Tests (3 walls)	24'-8"	37	1.00
VB1-VB4	19'-4"	29	0.90
TB1, TB5-TB7 (1)	20'-6"	31	0.46
TB9-TB11	20'-0"	30	0.46
TB1, TB7 (1)	13'-8"	21	0.46
TB2-TB4, TB8	14'-0"	21	0.46
SB5 (2)	8'-4"	16	0.31
SB2 (2)	15'-0"	23	0.31

NOTES:

1. The Turbine Building walls TB1 and TB7 have two typical sections.

2. The reinforcing in the Reactor Auxiliary Building walls SB2 and SB5 varies. The area listed in the table is based on No. 5 at 48", the least reinforcement ratio for the building.

6. Item

Discuss the appropriateness of the methods used to incorporate damping into the nonlinear analysis.

Response

The method of specifying viscous damping in the nonlinear analysis followed the normal procedure of applying damping constants to the mass and stiffness matrices to form the viscous damping matrix. Because direct integration of the equations of motion is used in the solution procedure it is not possible to explicitly extract the modal damping ratios. However it is our judgment that the method used to incorporate damping represents the best current state-of-the-art and provides damping levels that are consistent with that specified in the BOPSSR criteria.

7. Item

What is the effect of any impact due to the displacements of the masonry walls in the Turbine Building on adjacent structural steel members and on the walls themselves.

Response

Only two walls in the Turbine Building, TB6 and TB11, are situated such that the postulated masonry wall deflections would result in an impact between the wall and steel framing columns at mid-height. For TB6 the clearance is 1" and for TB11 the clearance is 3".

The force of this impact has been assessed by equating the kinetic energy of the moving wall and the potential energy of deformation of the steel column under the applied impact loading. The velocity was estimated using the maximum possible displacements as limited by the clearances given above and the relevant period of the wall for the deflections of this order of magnitude, i.e., the elastic period for TB6 and the inelastic period for TB11.

The maximum postulated impact force was calculated as 27 kips for TB6 and 9.5 kips for TB11. For the former wall this force is distributed over the 14" flange width of the column which it would contact. Based on a 2" high impact zone, the stresses would not be sufficient to cause distress in the masonry.

Wall TB11 impacts steel columns about their weak axis and thus contacts the edges of the column flanges. This reduces the area of contact and could cause local crushing of the masonry. However, this crushing would be restricted to a small area near the wall mid-height and forms a small proportion of the wall relative to the length of approximately 18'-0" between columns. It is concluded that the effects of the impact would be such as not to impair the overall integrity of the wall.

In addition, these impact forces considered along with other appropriate seismic and non-seismic forces would result in stresses less than the allowable stresses of the BOPSSR criteria in either the impacted structural steel columns or the steel bracing at walls TB6 and TB11.

8. Item

Provide copies of the available reports regarding the original construction of the masonry walls.

Response

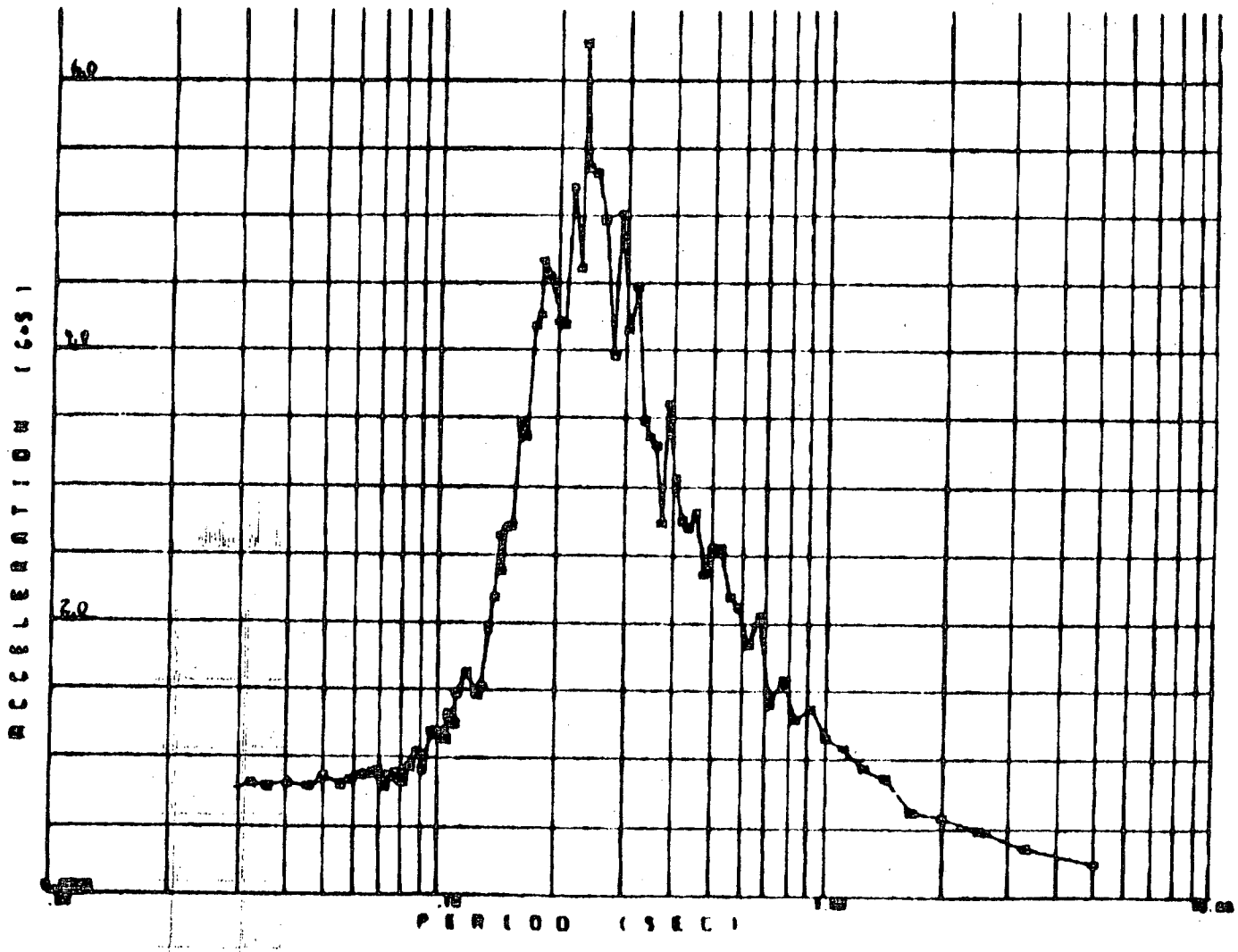
Enclosed are copies of the following reports which were referenced in our letter from J. G. Haynes to R. H. Engelken dated November 10, 1980.

a. Addendum No. 1 to Specification BSO-112, Concrete Block Masonry at San Onofre Nuclear Generating Station, Unit 1.

b. Purchase Order BSO-261, Reinforcing Steel At San Onofre Nuclear Generating Station, Unit 1.

c. Bill of Material BSO-253, Testing Laboratory Services at San Onofre Nuclear Generating Station, Unit 1.

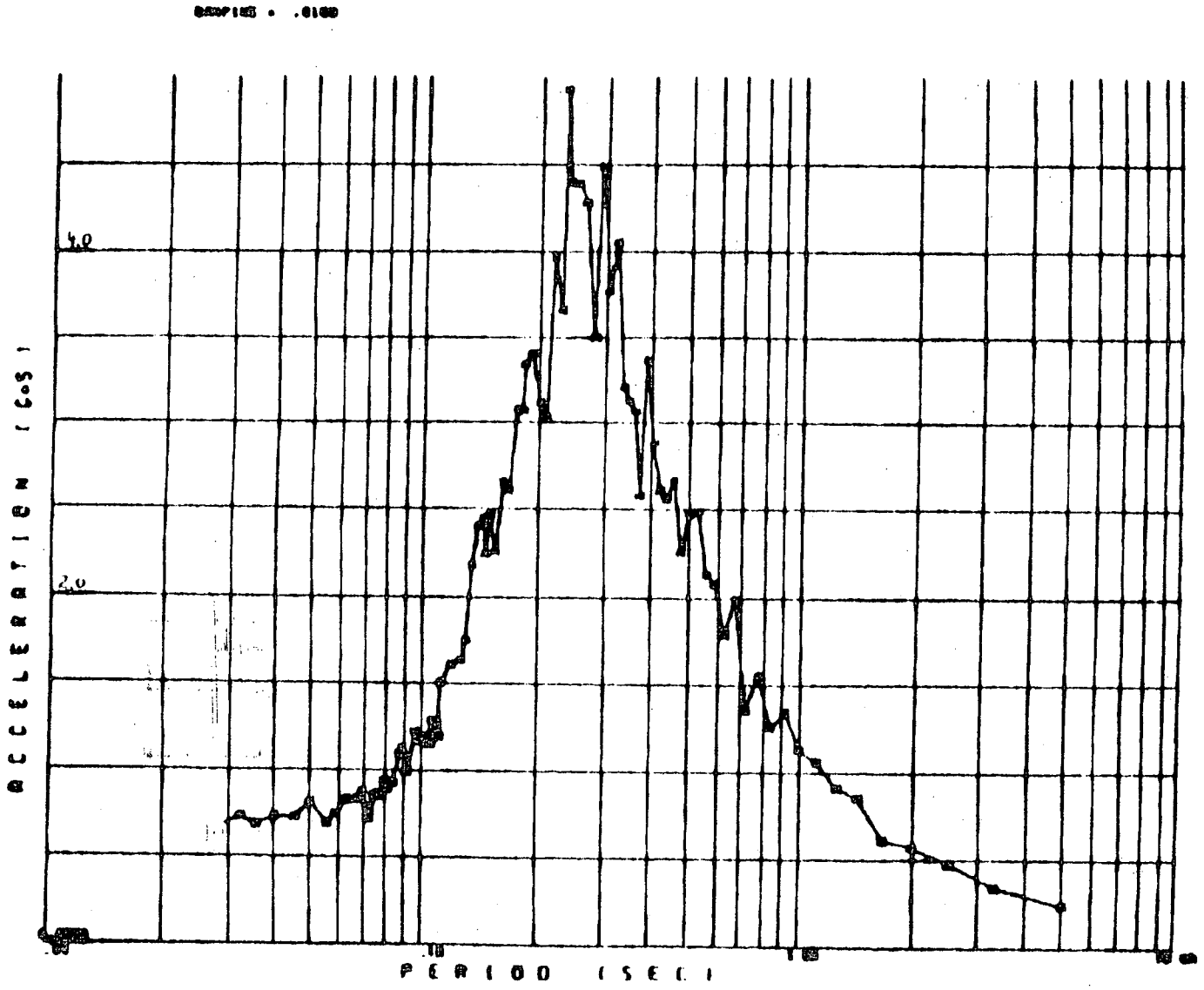
d. Twining Laboratories Laboratory Report, entitled "Report on Hollow Load Bearing Masonry Units".



SPECTRA AT TURBINE BLDG. WEST HEATER PLATFORM, EL. 35-6"

EAST-WEST MOTION

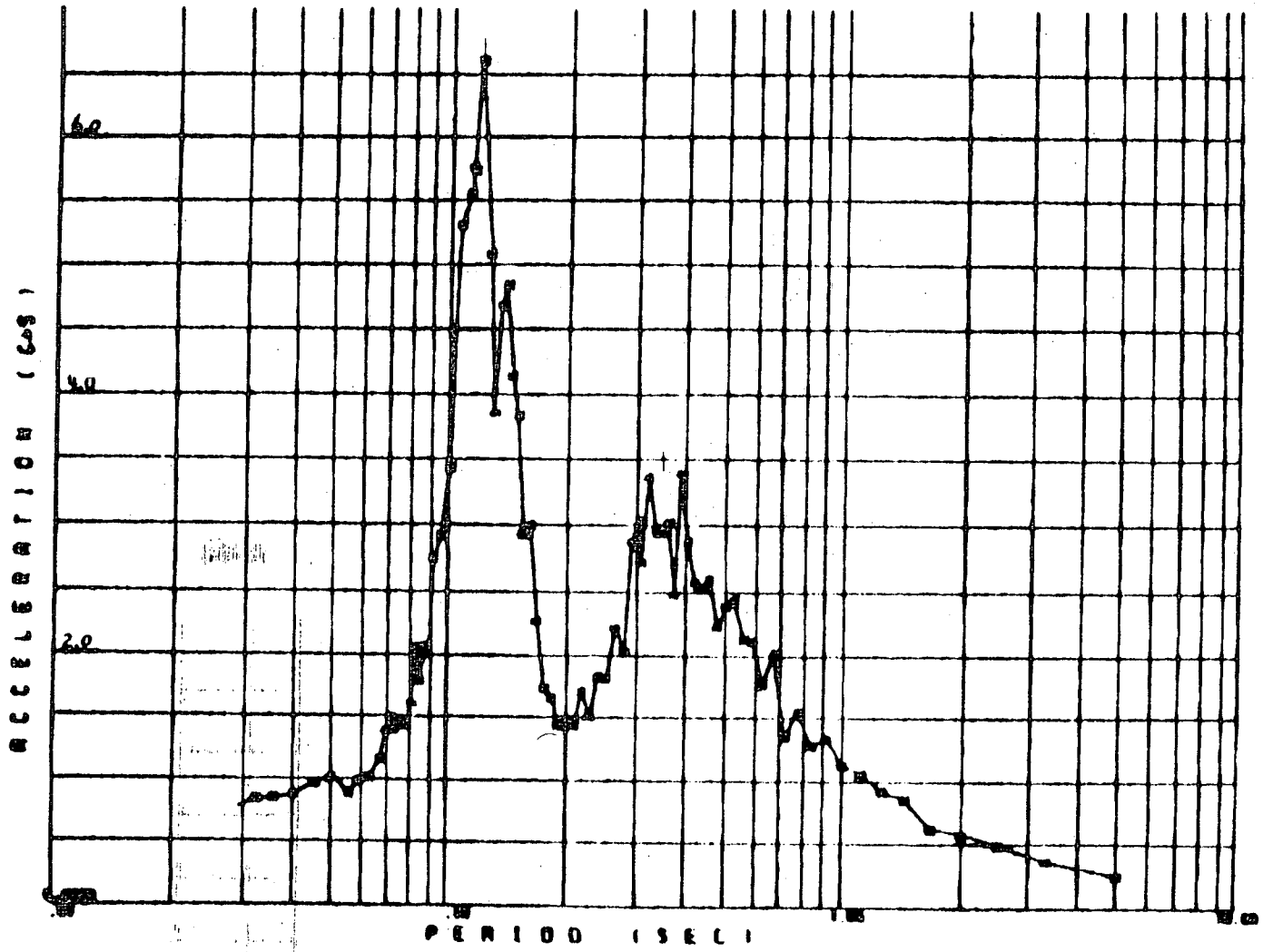
FIGURE 4.1



SPECTRA AT TURBINE BLDG. WEST HEATER PLATFORM EL. 35'-6"

NORTH-SOUTH MOTION

FIGURE 4.2



SPECTRA AT TURBINE BLDG. SOUTH EXTENSION, EL. 42'-0"

EAST-WEST MOTION"

FIGURE 4.3

BILL OF MATERIAL

ITEM	QUAN	UNIT	DESCRIPTION
			Furnish all labor, material and miscellaneous equipment to perform the following services, as directed by the Engineer, in connection with construction of the San Onofre Nuclear Generating Station, Unit 1:
1			Concrete cylinder testing, including furnishing of molds, as directed.
2			Structural and reinforcing steel testing
3			Core test from concrete
4			Welding inspection as required
5			Test of cement and aggregate combinations for alkali reactivity in accordance with Specification ASTM C-289 as amended to date

REV	MADE	CHECKED	APPROVED	DATE
0	WKM			5-27-64

TITLE: Testing Laboratory Services

SAN ONOFRE NUCLEAR GENERATING STATION

BECHTEL

REFERENCE DRAWINGS: None

JOB No. 3246

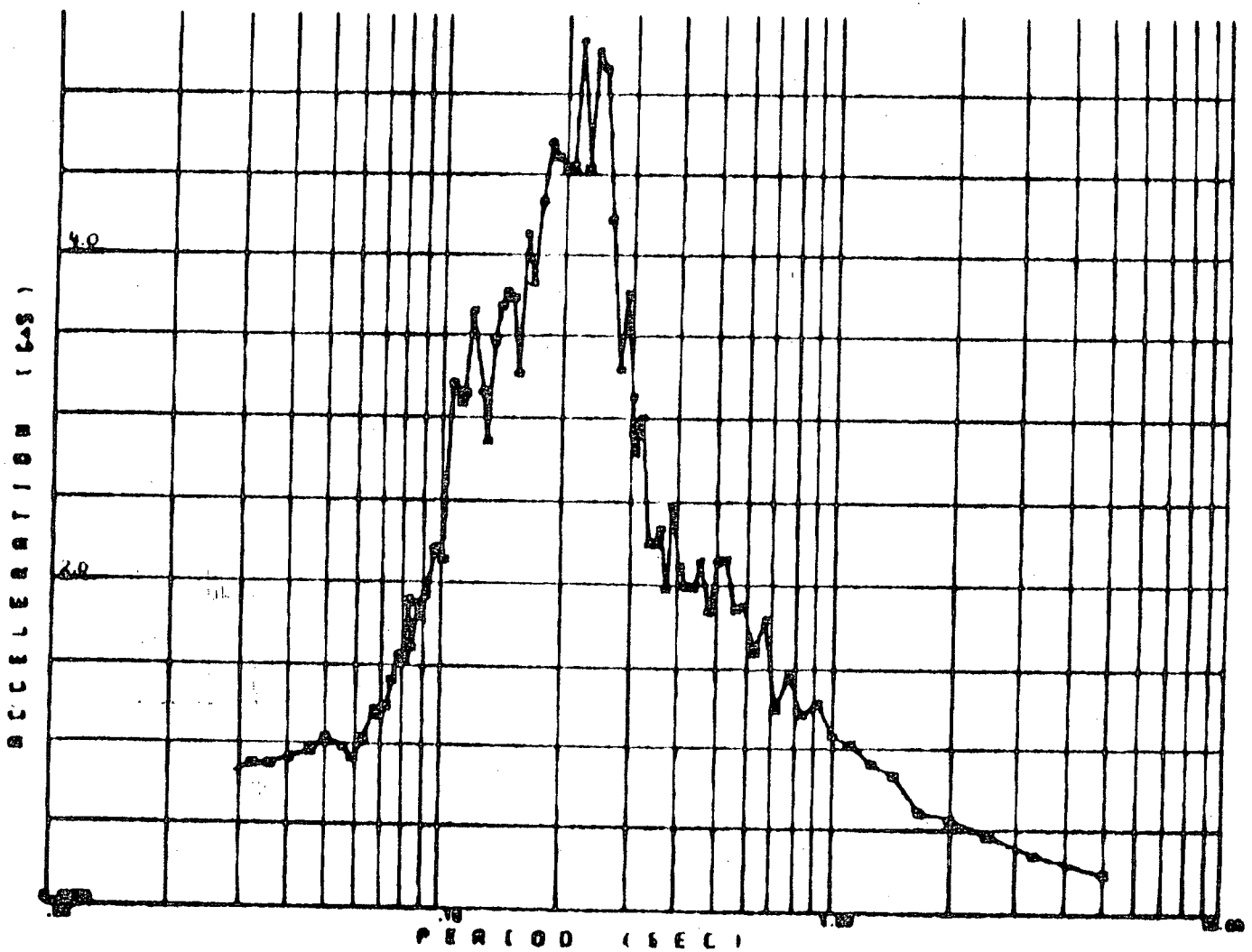
B/M No. BSO-253

REV 0

ACCOUNT No.

SHEET 1 OF 3

BSO 10/63



SPECTRA AT TURBINE BLDG. SOUTH EXTENSION, EL. 42"-0"

NORTH-SOUTH MOTION

FIGURE 4.4

BILL OF MATERIAL

ITEM	QUAN	UNIT	DESCRIPTION
15			Concrete block compression test
			A. Two block high prism (8 in block)
			B. Three block high prism (12 in block)
16			Tension and compression test of breeching expansion units
17			Alkali reactivity test of cement-aggregate combinations in accordance with ASTM Specification C-227
			The Engineer will deliver to the testing laboratory the quantity of materials necessary for testing purposes.
			The testing laboratory shall work closely with the Engineer in evaluating all test results.
			Charges are to be made in accordance with the current published price schedule of the testing laboratory, in effect at the time of performing the above services.

REV	MADE	CHECKED	APPROVED	DATE
0	WKM			5-27-64

TITLE: Testing Laboratory Services

SAN ONOFRE NUCLEAR GENERATING STATION

REFERENCE DRAWINGS:

JOB No. 3246

B/M No. BSO-253

REV 0

ACCOUNT No.

SHEET 3 OF 3

BECHTEL

BSO 10/63

B-5-1
2

MAIN OFFICE
1635 WEST GAYLORD ST. — P.O. BOX 9065
LONG BEACH 10, CALIFORNIA
HEMLOCK 8-7493
SPRUCE 5-8524
JACKSON 7-3661

BRANCH OFFICE
1514-D NORTH HARBOR ST.
SANTA ANA, CALIFORNIA
JEFFERSON 1-2045
JEFFERSON 1-2046

Twining Laboratories of Southern California, Inc.

Inspection and Testing Engineers • Soil Foundation Analysis • Chemical Analysis

December 31, 1965

Bechtel Corporation
Attn: Mr. D. A. Bonano
P.O.Box 58587, Vernon Branch
Los Angeles, California 90058

Job# 3246
P.O.# 150-253

PROJECT: SAN ONOFRE NUCLEAR GENERATING STATION - Unit I
San Onofre, California

REPORT ON HOLLOW LOAD BEARING MASONRY UNITS

Blocks were submitted by Bechtel Corporation to Twining Laboratories of Southern California, Inc. at December 22, 1965.

COMPRESSION

Sample No.	Total Load, Lbs.	Lbs. per Sq. Inc.
A-1	155,000	1,300
A-2	156,500	1,314
A-3	159,000	1,335
A-4	160,500	1,347
A-5	163,000	1,368
	AVERAGE	1,333 PSI

NOTE: These strengths comply with ASTM C90, Grade "A" Masonry Units.

TWINING LABORATORIES OF SOUTHERN CALIFORNIA, INC.

Neale R. Zuidema
Assistant Manager, Santa Ana Laboratory

NRZ:slb

cc: Bechtel - McEntee - 2
Edison - Day
Bechtel - Horn
Edison - Leasure
Edison - Dennis

JOB NO. 3246
FILE NO. B-5-1A
MGR. ENG.
ASST. MGR. ENG.
ASST. PROJ. ENG.
SECT. SUP. M. E.
SECT. SUP. P. E.
SECT. SUP. C. E.
SECT. SUP. NUCLEAR
SECT. SUP. ARCH.
PROJECT M. E.
PROJECT E. E.
PROJECT C. E.
PROJECT NUCLEAR
PROJ. ARCH.
CONTROLS
SERVICES
AREA MGR.
ADMINISTRATIVE
ESTIMATING
PURCHASING
WESTINGHOUSE
SOURCE

NOV 14 1964

STM																								
WAR	JOB NO. 3246	FILE NO.	MGR. ENG.	ASST. MGR. ENG.	ASS'T. ENG.	ASS'T. PROJ. ENG.	SECT. SUP. M. E.	SECT. SUP. E. E.	SECT. SUP. C. E.	SECT. SUP. NUCLEAR	SECT. SUP. ARCH.	PROJECT M. E.	PROJECT E. E.	PROJECT C. E.	PROJECT NUCLEAR	PROJ. MGR.	CONTROLS	SERVICES	AREA	ADMINISTRATIVE	ESTIMATING	PURCHASING	RESTRICTED	
DWLTG																								

ENGINEERS . CONSTRUCTORS

BSO-261

Acceptance of this order constitutes acceptance of Purchase Order Terms and Conditions, shown on reverse side hereof.

BECHTEL CORPORATION

PURCHASE ORDER

NUMBER

BSO-261

DATE 10-14-63

Page 1 of 6 Pages

Req. No. 3246-M-8

Venders Promised Shipment

SEE BELOW

If shipment cannot be made as specified above advise immediately on receipt of this order.

TO

BETHLEHEM STEEL CO.
P. O. BOX 2057, TERMINAL ANNEX
LOS ANGELES 54, CALIF.

JOB SITE
SAN ONOFRE, CALIF.

F.O.B. SEE BELOW

SHIP VIA VENDOR'S DELIVERY

TERMS 1/2 OF 1% 10TH PROX.

1. Furnish the material specified below in full accordance with conditions printed on the face and back hereof, and any other page made a part of this order.
2. Purchase order number and code or equipment number must appear on all invoices, correspondence, containers, shipping papers, and packing lists in each container.
3. All prices shown herein are firm prices unless stated otherwise. If order allows escalation, submit revised quotation for approval if escalation occurs. Do not invoice until escalation is approved.

ITEM NO.	QUANTITY	DESCRIPTION	CODE OR EQUIP. NO.	UNIT PRICE	EXTENSION
				$	$
		FURNISH, DETAIL, FABRICATE AND SHIP IN ACCORDANCE WITH BILL OF MATERIAL 3246-M-8, DATED JUNE 14, 1963 AND ENGINEERING DRAWINGS RELEASED BY BECHTEL CORPORATION.			
1	2450 TONS (APPROX.)	FABRICATED REINFORCING STEEL. SIZES 2 THROUGH 18 INCLUSIVE.		5.60/CWT.	274,400.00
		FURNISH AND DELIVER IN THE SPECIFIC QUANTITIES REQUESTED BY THE BECHTEL CORPORATION CONSTRUCTION SUPERINTENDENT OR HIS DESIGNATED REPRESENTATIVE IN ACCORDANCE WITH BILL OF MATERIAL 3246-M-8, DATED JUNE 14, 1963.			
2	25 TONS (APPROX.)	REINFORCING STEEL, STANDARD STOCK LENGTHS. SIZES 2 THROUGH 18 INCLUSIVE.		5.60/CWT.	2,800.00
3	2100 S.F. (APPROX.)	ELECTRIC WELDED WIRE MESH 6"X6" NO.6 X NO.6 (STOCK ROLLS)		4.33/CSF.	98.00
4	5600 S.F. (APPROX.)	ELECTRIC WELDED WIRE MESH 6"X6" NO.10 X NO.10 (STOCK ROLLS)		1.75/CSF.	98.93
		THE ABOVE PRICES ARE FIRM THROUGH DECEMBER, 1965. NOT SUBJECT TO ESCALATION.			
		(CONTINUED)			

TOTAL AMOUNT THIS ORDER $ 277,388.93

BUYER W. A. FRANKLIN

REGISTER NO. 3246

ACCOUNT NO. VARIOUS

BILLING INSTRUCTIONS

MAIL 3 COPIES OF INVOICE TO:
BECHTEL CORPORATION
P. O. BOX 58587, VERNON BRANCH
LOS ANGELES 58, CALIF.

BECHTEL CORPORATION

By D. A. Boeano
D. A. BOEANO
FOR N. R. AYERS, VICE PRESIDENT

PLUS TAX AND TRANSPORTATION

P. O. No. BSO-261

ITEM NO.	QUANTITY	DESCRIPTION	CODE OR EQUIP. NO.	UNIT PRICE	EXTENSION
				$	$
		F.O.B.: CARRIER, YOUR VERNON CALIFORNIA PLANT WITH TITLE PASSING TO BECHTEL CORPORATION AT THAT POINT.			
		ALL FREIGHT IS TO BE PREPAID.			
		FOR SHIPMENTS IN EXCESS OF 6,100 LBS. FREIGHT WILL BE BILLED @ $0.30 CWT.			
		FOR SHIPMENTS OF LESS THAN 6,100 LBS., SHIPPED AT THE REQUEST OF THE BECHTEL CORPORATION CONSTRUCTION SUPERINTENDENT, THE VENDOR RESERVES THE RIGHT TO SHIP AT THE APPLICABLE COMMON CARRIER RATES FOR THE PURCHASER'S ACCOUNT.			
		DELIVERY:			
		(A) IN ACCORDANCE WITH A SCHEDULE ESTABLISHED AND DIRECTED BY THE BECHTEL CORPORATION CONSTRUCTION SUPERINTENDENT.			
		(B) FABRICATED BARS WILL BE DELIVERED WITHIN 14 DAYS AFTER RECEIPT OF ENGINEERING DRAWINGS. (THIS SCHEDULE IS BASED ON RAPID APPROVAL OF DETAILS).			
		(C) STOCK MATERIAL: DELIVERY WITHIN 5 DAYS MAXIMUM.			
		DRAWINGS & CORRESPONDENCE:			
		A. THE PURCHASER WILL PREPARE ENGINEERING DRAWINGS AS THE DESIGN PROGRESSES. THESE WILL BE SENT TO THE VENDOR WITH SUFFICIENT TIME ALLOWED FOR DETAILING AND FABRICATION, PRIOR TO THE REQUIRED DELIVERY DATE.			
		B. THE VENDOR WILL PREPARE PLACING AND/OR FABRICATION DRAWINGS. THESE WILL BE SUBMITTED TO THE PURCHASER FOR REVIEW AND APPROVAL. THE PURCHASER'S APPROVAL WILL BE OF A GENERAL NATURE ONLY AND WILL NOT RELIEVE THE VENDOR OF RESPONSIBILITY FOR THE ACCURACY OF THE DETAILS.			
		C. DETAIL DRAWINGS SHALL BE PREPARED IN SUFFICIENT DETAIL TO ALLOW ACCURATE PLACING OF STEEL AND WILL BE DONE IN ACCORDANCE WITH WEST COAST STANDARD LISTING PRACTICE.			

(CONTINUED)

ITEM NO.	QUANTITY	DESCRIPTION	CODE OR EQUIP. NO.	UNIT PRICE	EXTENSION
		DRAWINGS & CORRESPONDENCE - CONT'D.		$	$
		D. CORRESPONDENCE FORWARDING DRAWINGS AND OTHER ENGINEERING CORRESPONDENCE SHALL BE SENT IN DUPLICATE AND ADDRESSED TO THE BECHTEL CORPORATION, POWER DIVISION, P. O. BOX 58587 - VERNON BRANCH, LOS ANGELES 58, CALIFORNIA, ATTENTION: MR. J. R. MC ENTEE, PROJECT ENGINEER.			
		E. CORRESPONDENCE AFFECTING PRICES OR CONTRACTS SHALL BE FORWARDED IN DUPLICATE AND ADDRESSED TO THE BECHTEL CORPORATION, P. O. BOX 58587 - VERNON BRANCH, LOS ANGELES 58, CALIFORNIA, ATTENTION: MR. D. A. BONANO, PURCHASING SUPERVISOR.			
		IDENTIFICATION: EACH SHIPMENT SHALL BE ACCOMPANIED BY TWO COPIES OF A SHIPPING NOTICE OR BAR LIST. ALL BUNDLES SHALL HAVE LEGIBLE AND INDESTRUCTIBLE TAGS ATTACHED. ALL IDENTIFICATION SHALL BE IN ACCORDANCE WITH THE STANDARD PRACTICE OF THE AMERICAN CONCRETE INSTITUTE.			
		TEST REPORTS: THE VENDOR SHALL FORWARD TO THE PURCHASER TWO SETS OF CERTIFIED MILL TEST REPORTS FOR EACH SHIPMENT OF REINFORCING STEEL.			
		RETURN FOR CREDIT: STANDARD STOCK ITEMS IN CONDITION ACCEPTABLE TO VENDOR MAY BE RETURNED FOR CREDIT AT $65.00 PER TON, NET FOB TRUCKS, LOS ANGELES, CALIF.			
		CREDIT FOR NON-STOCK ITEMS SUCH AS FABRICATED AND NON-STOCK LENGTH BARS: TO BE NEGOTIATED AS MATERIAL ACCUMULATES.			
		SPECIAL PROVISIONS: A. ADDITIONAL QUANTITIES OF REINFORCING STEEL AND WIRE MESH AS MAY BE REQUIRED WILL BE FURNISHED AT THE SAME UNIT PRICES. HOWEVER, ADDITIONAL QUANTITIES SHALL NOT BE SUPPLIED WITHOUT PRIOR APPROVAL AND REVISION TO THIS PURCHASE ORDER.			

(CONTINUED)

ITEM NO.	QUANTITY	DESCRIPTION	CODE OR EQUIP. NO.	UNIT PRICE	EXTENSION
		SPECIAL PROVISIONS - CONT'D.		$	$
		B. CANCELLATION OPTION: IT IS AGREED THAT THE PURCHASER SHALL HAVE THE SOLE OPTION TO CANCEL THIS PURCHASE ORDER IN PART OR IN ITS ENTIRETY PRIOR TO FEBRUARY 1, 1964 WITHOUT ANY CANCELLATION CHARGES OR OBLIGATIONS WHATSOEVER.			
		EXPEDITING: THE MATERIAL ORDERED HEREIN SHALL BE EXPEDITED BY THE BECHTEL CORPORATION.			
		PURCHASE ORDER CONDITIONS:			
		THE ATTACHED "PURCHASE ORDER CONDITIONS JOB 3246" BY REFERENCE ARE MADE A PART HEREOF.			

BILL OF MATERIAL

ITEM	QUAN	UNIT	DESCRIPTION
6			Petrographic analysis of aggregate to be used for concrete, in accordance with ASTM Specification C-295 as amended to date
7			Concrete mix designs and the testing of cylinders from these mixes to confirm compliance with requirements
8			Bearing tests for road base aggregate
9			Compression tests for concrete blocks
10			Soil compaction tests
11			Concrete inspection at batch plant and or jobsite
12			Masonry inspection
13			Chemical analysis of cement
14			Concrete beam flexure test (6in x 6in)

REV	MADE	CHECKED	APPROVED	DATE

TITLE: Testing Laboratory Services

SAN ONOFRE NUCLEAR GENERATING STATION

BECHTEL

REFERENCE DRAWINGS:

ACCOUNT No.

JOB No. 3246

B/M No. BSO- 253

REV 0

SHEET 2 OF 3

BSO 10/69