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RECIP.NAME	RECIPIENT AFFILIATION
MIRAGLIA,F.J.	Licensing Branch 3

SUBJECT: Lists actions taken to prevent situation similar to Millstone 2 undervoltage event.Obtaining guarantees from all manufacturers that equipment would operate continuously at 70% rated voltage inpractical.Alternative proposed.

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March 31, 1982
ANPP-20596 - JMA/MLR

Mr. Frank J. Miraglia, Chief
Licensing Branch No. 3
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Palo Verde Nuclear Generating Station
(PVNGS) Units 1, 2 and 3
Docket Nos. STN-50-528/529/530
File: 82-056-026; G.1.10

Reference: Letter from F. J. Miraglia to E. E. Van Brunt, Jr. dated January 19, 1982, subject: Under Voltage Protection

Dear Mr. Miraglia:

Throughout the design and construction of PVNGS, a number of APS actions were taken to prevent a situation similar to the Millstone II undervoltage event. These included:

1. Procurement of startup transformers with one 2.5% tap above and three 2.5% taps below rated voltage.

2. Procurement of essential safety feature transformers with two 2.5% taps above and two 2.5% taps below rated voltage.

3. Procurement of special motor control center motor contractors with 62% and 75% rated voltage dropout and pickup respectively.

4. Installation of a blocking circuit, bypassing the undervoltage relays, after initial load shed and during diesel generator loading and operation.

5. Procurement of motors which would accelerate under full load at 75% rated voltage where practicable.

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6. Taken together, the first five items have, in our opinion, significantly lessened the probability of a Millstone II event. Supplementing these, we also proposed undervoltage relay settings of 68% and 75% rated voltage for dropout and pickup respectively. These settings were selected to permit Class IE electrical systems to "ride through" short duration undervoltage events. In effect, the proposal balances the reduced risk against the desirability of minimizing risks of disconnecting the preferred power source.

In addition to the undervoltage relay design discussed above, we are also providing a parallel, second level of undervoltage protection with each of the induction disc relays. This second level will provide additional undervoltage protection between 70.4% and 90% of design voltage where relay operation is not predictable (70.4% to 78%) and where relay timeout will not occur (78% to 90%). This design will use an instantaneous undervoltage relay with a timing relay, in parallel with each of the induction disc relays to start a long timeout if bus voltage drops below 90%. Should there be a severe degradation or complete loss of bus voltage, the induction disc relays will timeout significantly before the instantaneous relays with timers.

In the referenced letter, NRC indicated that acceptance of the proposed settings hinged upon securing guarantees from all manufacturers that their equipment would operate continuously at 70% rated voltage. Due to the large number of suppliers of the numerous items of equipment in the Class IE systems and the absence of contractual provisions which would obligate such suppliers to provide such guarantees, it is impractical to expect that we can obtain all the guarantees that NRC would require to support the proposed settings.

Therefore, if NRC is unwilling to accept our balancing of the competing risks, we will modify the undervoltage relay settings on the Class IE 4.16kV busses to 78% and 86% rated voltage for dropout and pickup respectively (i.e., 93V tap and lever 3 setting).

Please contact me if you have any further questions.

Very truly yours,

JMAllen for

E. E. Van Brunt, Jr.
APS Vice President,
Nuclear Projects
ANPP Project Director

EEVBJr/MLR/av
cc: E. Licitra
P. L. Hourihan
R. L. Greenfield
A. C. Gehr
G. C. Andognini
J. Vorees

STATE OF ARIZONA)
) ss.
COUNTY OF MARICOPA)

I, John M. Allen, represent that I am Nuclear Engineering Manager of Arizona Public Service Company, that the foregoing document has been signed by me for Edwin E. Van Brunt, Jr., Vice President Nuclear Projects, on behalf of Arizona Public Service Company with full authority so to do, that I have read such document and know its contents, and that to the best of my knowledge and belief, the statements made therein are true.

John M. Allen
John M. Allen

Sworn to before me this 30th day of March, 1982

Jem Allen
Notary Public

My Commission expires:

Oct 2, 1982

I.A INTRODUCTION

In a meeting with the NRC's Structural Engineering Branch on August 27, 1981, MP&L committed to resolve NRC concerns in the area of soil-structure interaction for seismic analysis (Ref. 1). Part I of this report addresses these concerns.

The containment, auxiliary, control and diesel generator buildings are analyzed using the FLUSH computer program. The approach used in FLUSH is to model the elastic half-space using a finite element soil mesh. Appropriate soil properties necessary as input to the analysis were determined based on existing soils data presented in FSAR Section 2.5.

Acceleration response spectra at significant locations for each structure were developed using the FLUSH program and compared with the design floor response spectra (FRS) generated using lumped parameter models. The latter approach is well documented in FSAR Section 3.7 and will not be reiterated herein. The observed differences and impact to equipment or structures are discussed.

The purpose of this comparison is to provide a check on the lumped parameter analysis and to determine if similar results may be obtained between the finite element and lumped parameter analyses. A one-to-one correspondence between the lumped parameter and the more rigorous FLUSH analysis is not expected. The additional considerations provided in the FLUSH analysis are expected to result in variations between the results of the FLUSH analysis when compared to the lumped parameter model analysis. Such variations are legitimate and are the result of the considerations included in a more rigorous analysis. The purpose of this comparison, therefore, is not to demonstrate that the lumped parameter analyses are at all locations and at all frequencies more conservative than the FLUSH results. Rather, the purpose is to provide evidence that the lumped parameter analyses were properly conducted, in that no gross abnormalities exist between the results as compared with a more rigorous technique.

I.B. FLUSH ANALYSIS

Seismic soil-structure interaction analyses were performed using the FLUSH computer program. The four Category I power block structures modelled included the containment, auxiliary, control, and diesel generator buildings. Each structure was modelled separately as shown in Figures 1 to 4.

The soil was modelled using finite elements with strain dependent shear modulus and damping values. Average soil properties were used. The super structures were modelled using the same lumped parameter models as given in FSAR Section 3.7 Symmetrical models were used to reduce the number of elements. Nodes along the symmetry plane were pinned in the horizontal direction. A transmitting boundary was employed on the other side of the model to reduce the size of the soil block while still representing the infinite half space. The transmitting boundary was placed two elements beyond the edge of the basemat of the structure.

The FLUSH program has the option to provide viscous boundaries representing radiation damping perpendicular to the plane of the model. Since the superstructure models are two-dimensional, the viscous boundary option was not employed to represent the three-dimensional effect of the soil. The typical reduction in response to be expected when using viscous boundaries is illustrated in Figures 5 and 6.

The acceleration time history is in accordance with Regulatory Guide 1.60. The motion was applied in the free field at the base of the superstructure. Only one horizontal direction was analyzed for each structure. Note that the design FRS were generated using a time history based on the modified Newmark-Hall spectra which preceded R.G. 1.60 (See FSAR Section 3.7).

The FLUSH models only have embedment over the depth of the basemat. Figures 2.5-40 and 2.5-49 of the FSAR show the soil profiles in the area of the power block structures. From these figures the following observations can be made on the actual embedment of the power block structures.

1. The containment rests directly on the Catahoula formation and is completely surrounded by the auxiliary building. There is no actual embedment.

2. The auxiliary building rests directly on the Catahoula formation. On the east side it is bounded by the turbine building and on the north side, it is partially bounded by the control building. The auxiliary building has complete embedment on two sides and partial embedment on one side.

3. The control building rests directly on the Catahoula formation and is bounded on three sides by the turbine building and the auxiliary buildings of Units 1 and 2.

4. The diesel generator building rests on the surface of Category I structural backfill.

The auxiliary building is the only one of the four structures with any significant embedment and it is only partially embedded. The effect of the embedment will be to increase the stiffness and damping of the soil at the base of the structure. The FRS will generally decrease due to the embedment. Thus, not considering the partial embedment of the auxiliary building should provide an upper bound result from the FLUSH analysis.

Damping for the structures is in accordance with Regulatory Guide 1.61.

I.C. RESULTS

The design FRS are compared to those generated using the FLUSH program. Both spectra have been enveloped using ±15% widening. Spectra are compared at the following significant locations for the SSE using 3% damping in Figures 7 to 22.

Containment Building, EW direction

Top of containment, Elev. 290'-5"
Near mid-height of containment, Elev. 184'-6"
Base of containment, Elev. 93'-0"
Top of drywell, Elev. 208'-10"
Near mid-height of drywell, Elev. 161'-10"
Top of RPV pedestal, Elev. 121'-4"
Top of Shield Wall, Elev. 169'-4"
Top of reactor, Elev. 188'-8"

Auxiliary Building, NS direction

Near top, Elev. 247'-0"
Near mid-height, Elev. 166'-0"
Base, Elev. 93'-0"

Control Building, NS direction

Near top, Elev. 189'-0"
Near mid-height, Elev. 150'-0"
Base, Elev. 93'-0"

Diesel Generator Building, EW direction

Top, Elev. 170'-0"
Base, Elev. 133'-0"

The FLUSH FRS for the containment, auxiliary, and control buildings generally exhibit lower spectral accelerations with lower frequency content. The frequency shift is due to the reduction in soil shear modulus due to an increase in strain. The design FRS generated using the lumped parameter models were based on the maximum value of the soil shear modulus. After iteration of the soil properties using FLUSH, the shear modulus observed in the finite elements generally falls below one-half of the maximum value. Thus, the soil is much "softer" than the elastic half space springs would indicate causing a frequency shift to the lower frequency region.

The shaded portion of the figures indicates the area that the FLUSH results exceed the design FRS. Generally, the area is small and located in a low frequency range where it will not have an effect on structures or equipment.

The FLUSH FRS exceeds the design FRS by approximately 25% in the diesel generator building. The frequency content is generally the same.

Mechanical and electrical equipment, piping, and component design qualifications have been reviewed to assess the impact of the results discussed above. This impact assessment is presented in Part III. A.

I.D. FIGURES

Figures 1 to 22 follow.

CONTAINMENT BUILDING

"Flush" Model

East-West Motion

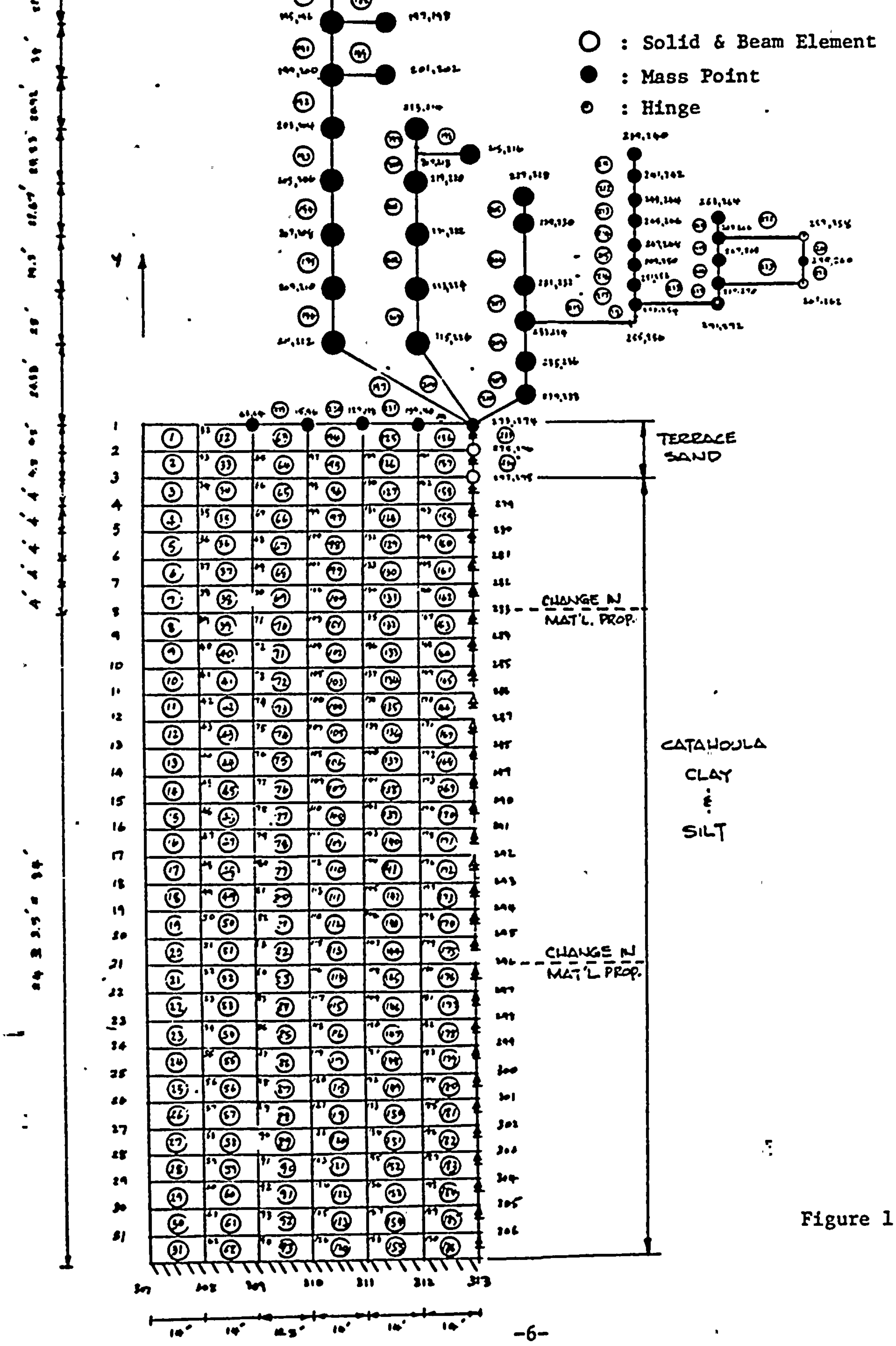


Figure 1

AUXILIARY BUILDING

"Flush" Model

North-South Motion

○ : Solid Element

⬡ : Beam Element

● : Mass Point

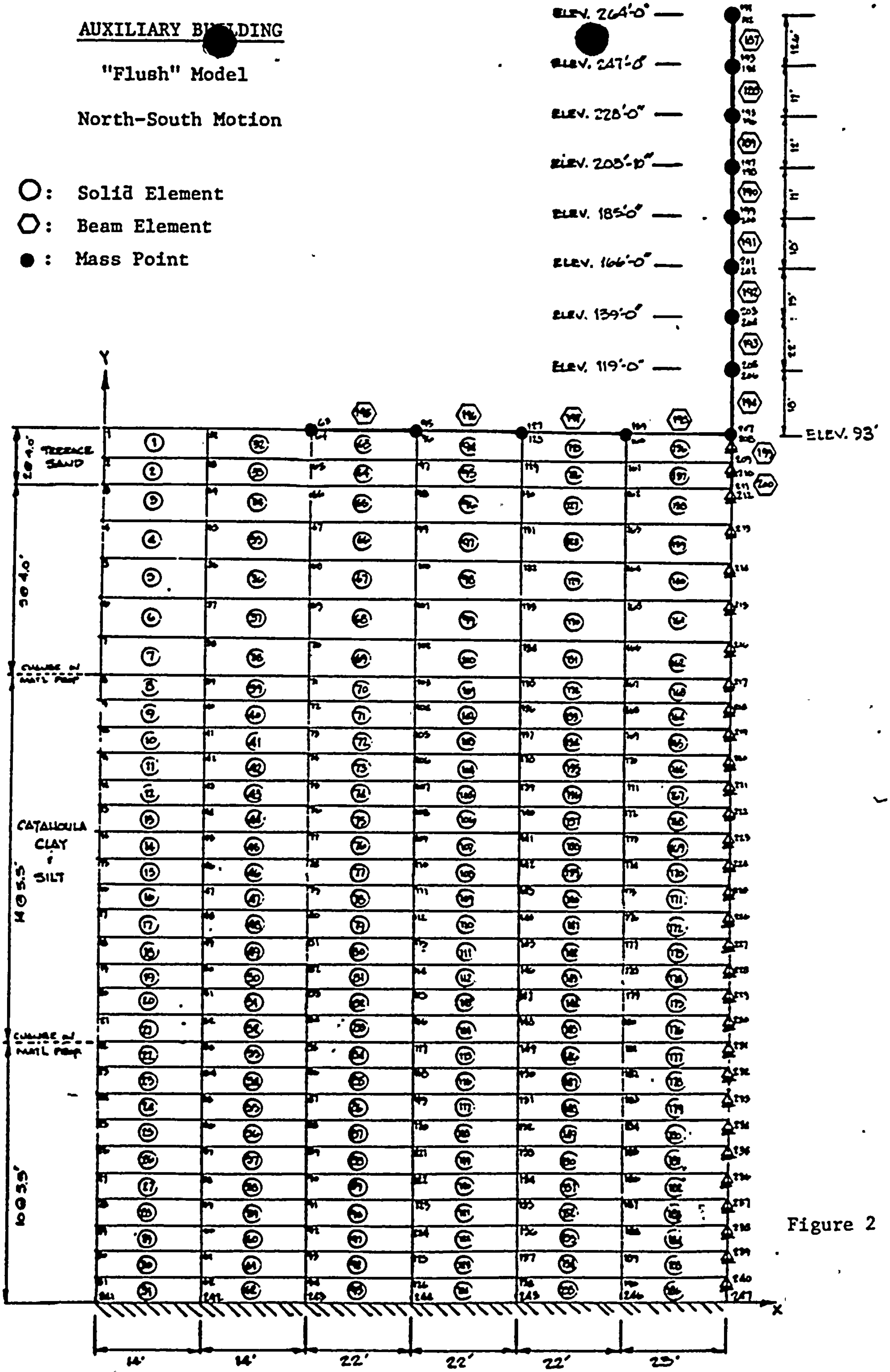


Figure 2

CONTROL BUILDING

"Flush" Model

North-South Motion

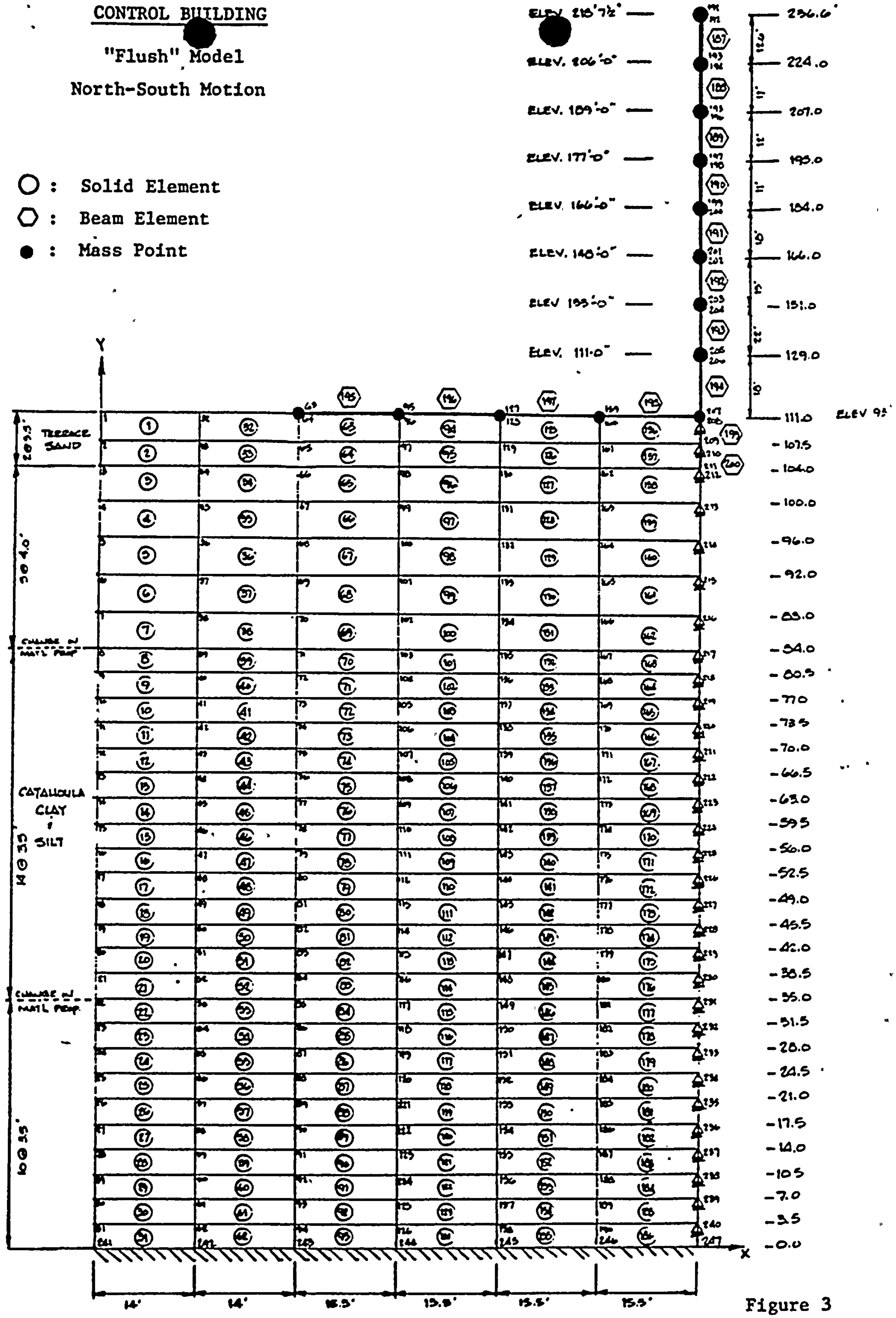


Figure 3

"Flush" Model

East-West Motion

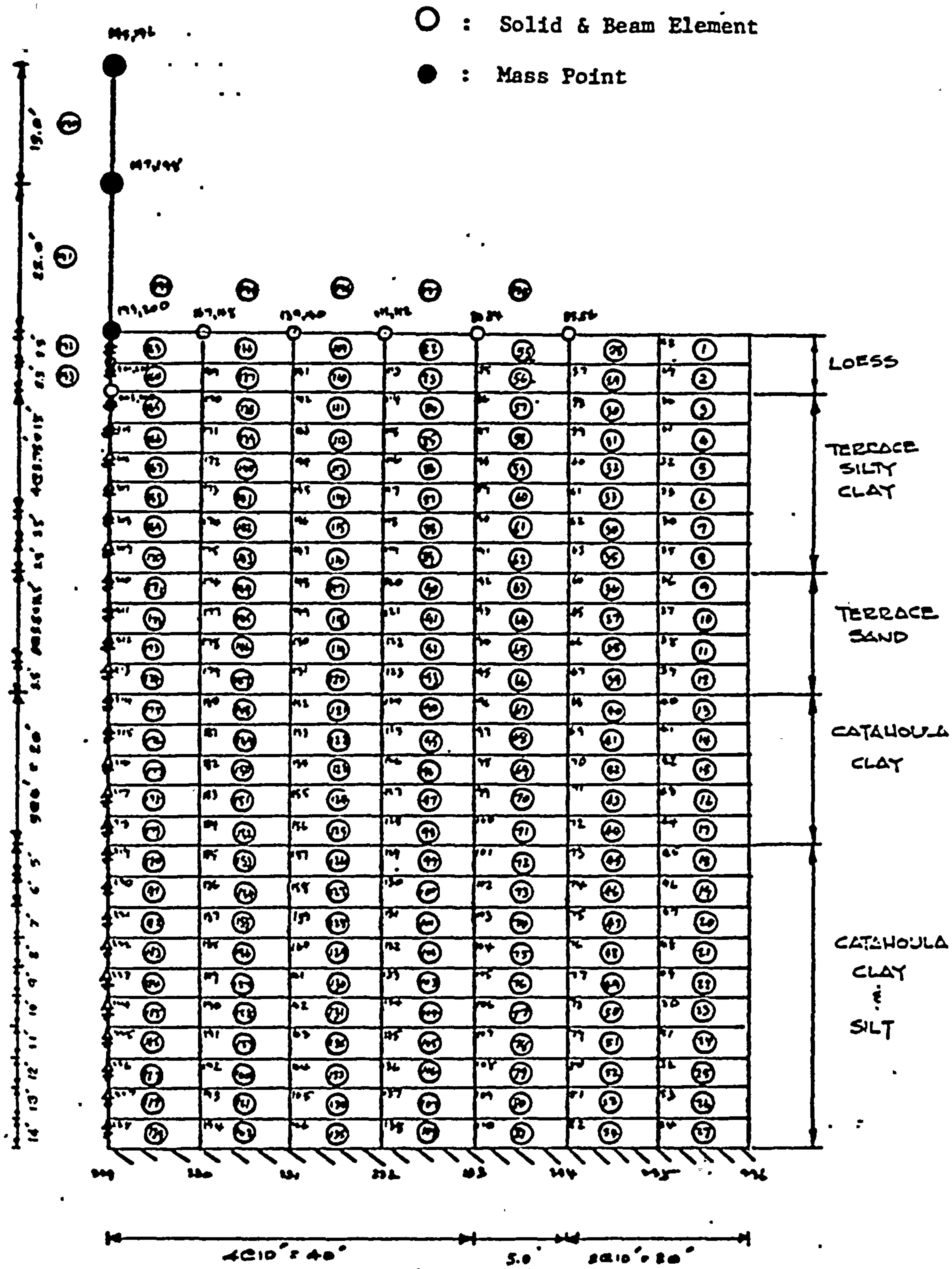


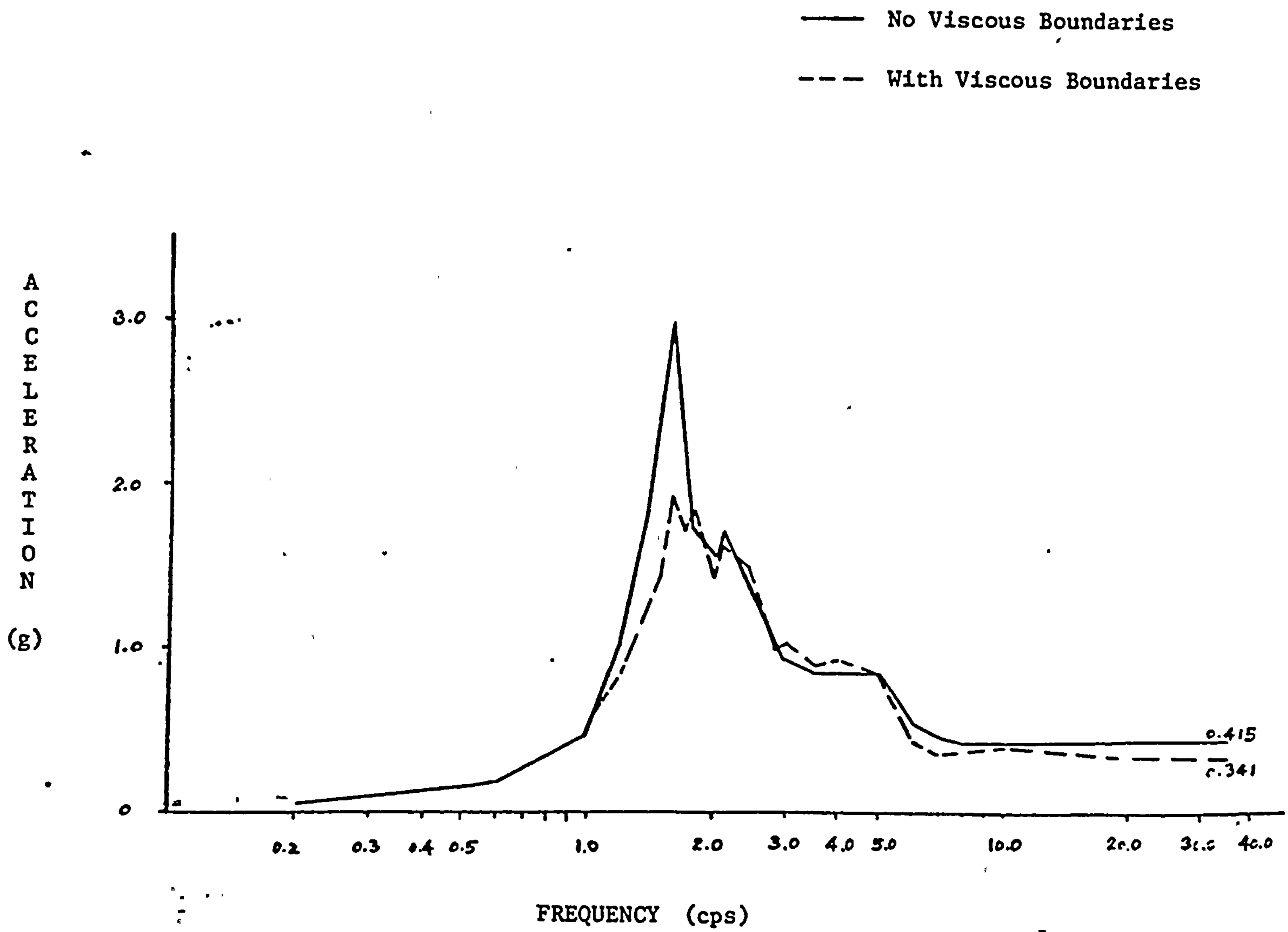
Figure 4

CONTAINMENT BUILDING

Elevation 290'6"

CONTAINMENT DOME TOP

RESPONSE SPECTRA



3% DAMPING EAST-WEST MOTION SSE

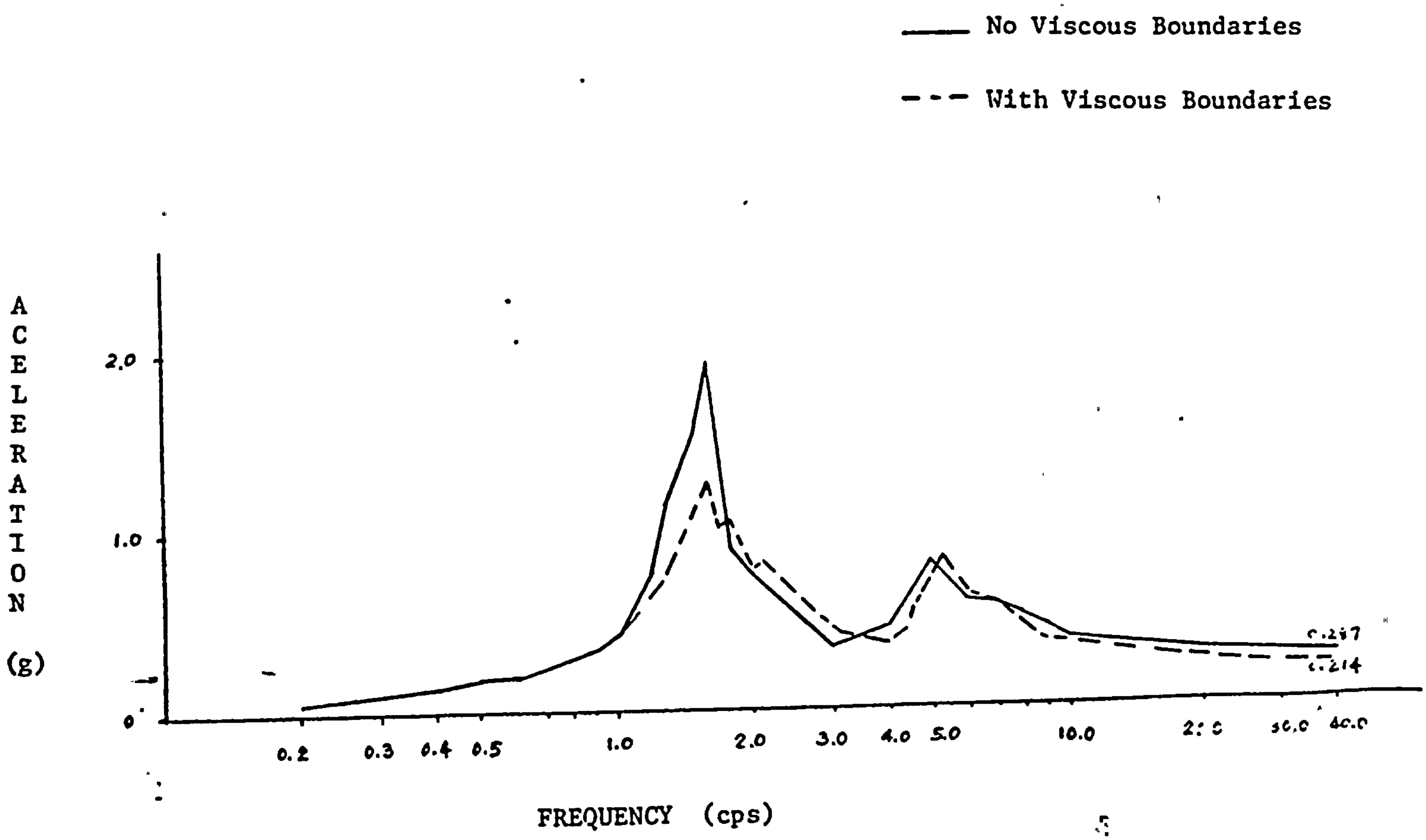
Figure 5

CONTAINMENT BUILDING

Elevation 208'10"

DRYWELL

RESPONSE SPECTRA



3% DAMPING EAST-WEST MOTICN SSE

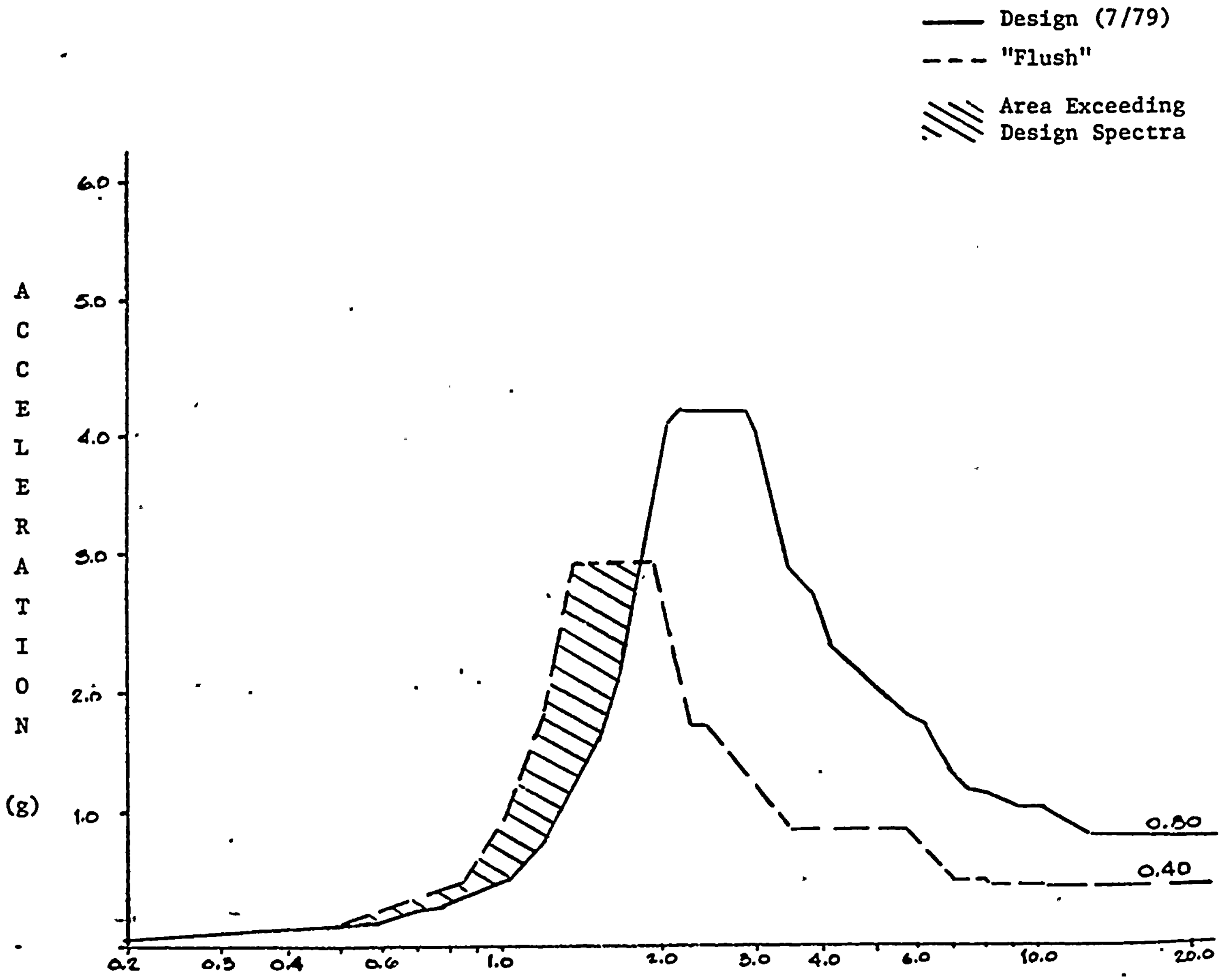
Figure 6

CONTAINMENT BUILDING

Elevation 290'6"

CONTAINMENT DOME TOP

RESPONSE SPECTRA



3% DAMPING EAST-WEST MOTION SSE

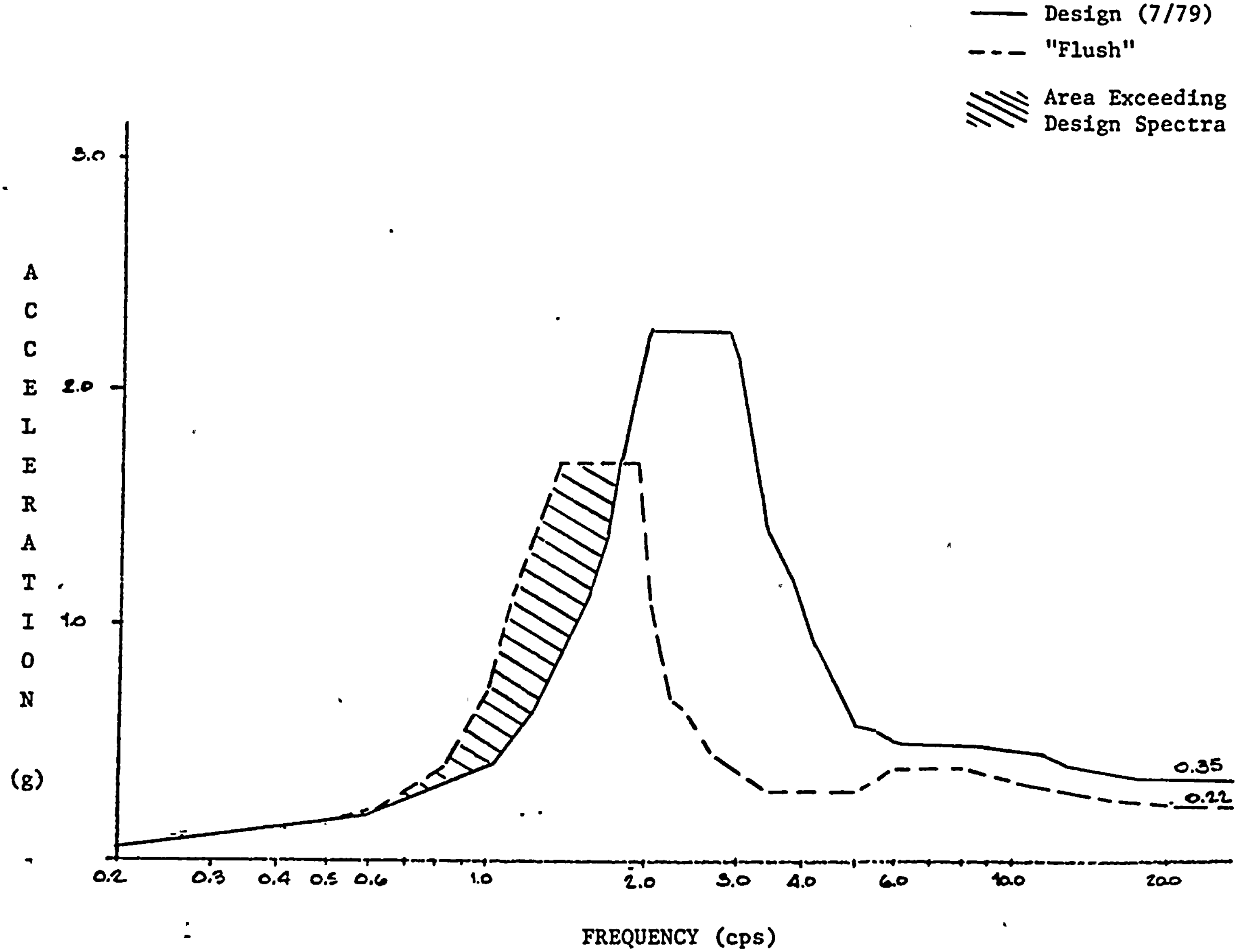
Figure 7

CONTAINMENT BUILDING

Elevation 184'6"

CONTAINMENT SHELL

RESPONSE SPECTRA



3% DAMPING EAST-WEST MOTION SSE

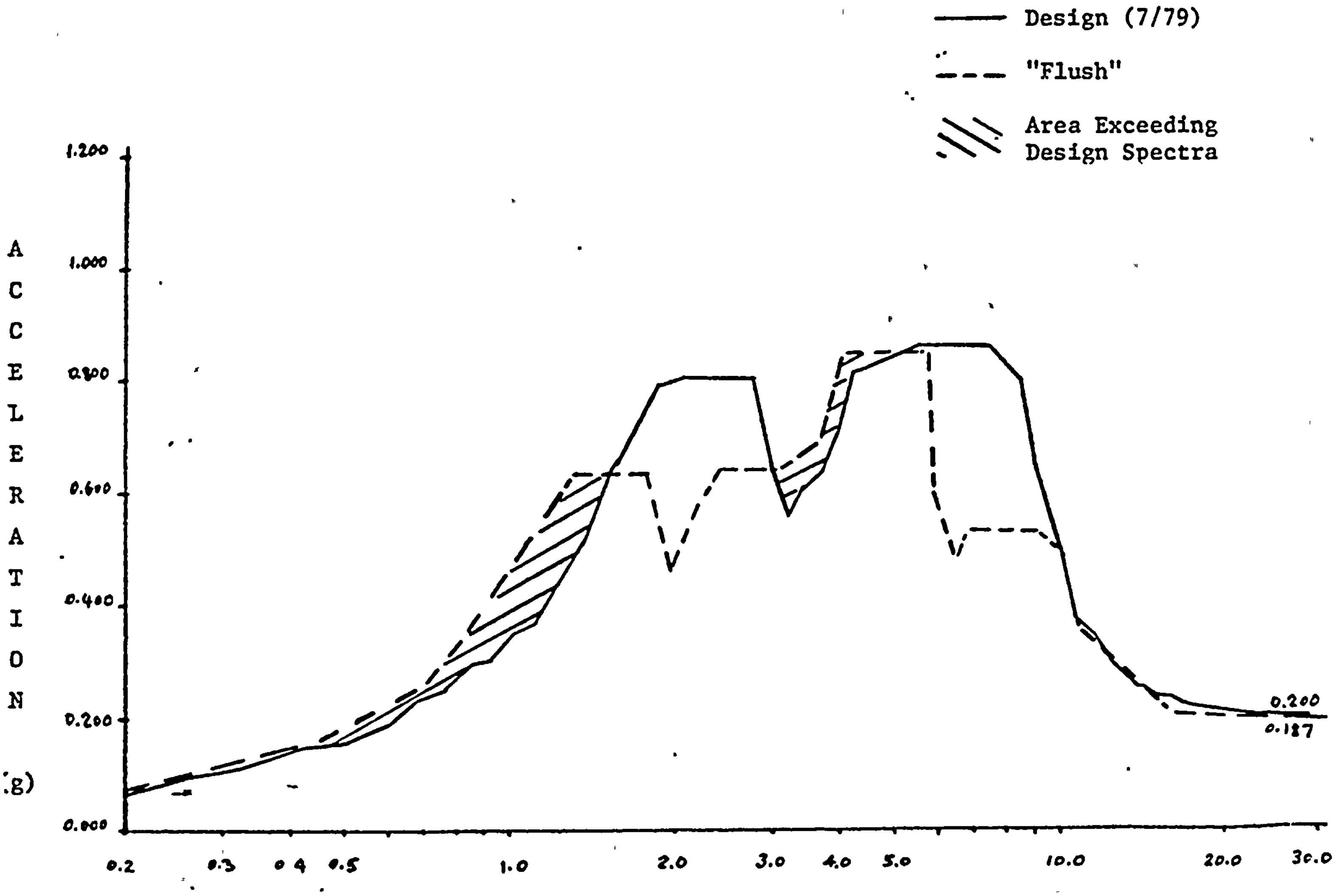
Figure 8

CONTAINMENT BUILDING

Elevation 93'-0"

CONTAINMENT BASEMAT

RESPONSE SPECTRA



3% DAMPING EAST-WEST MOTION SSE

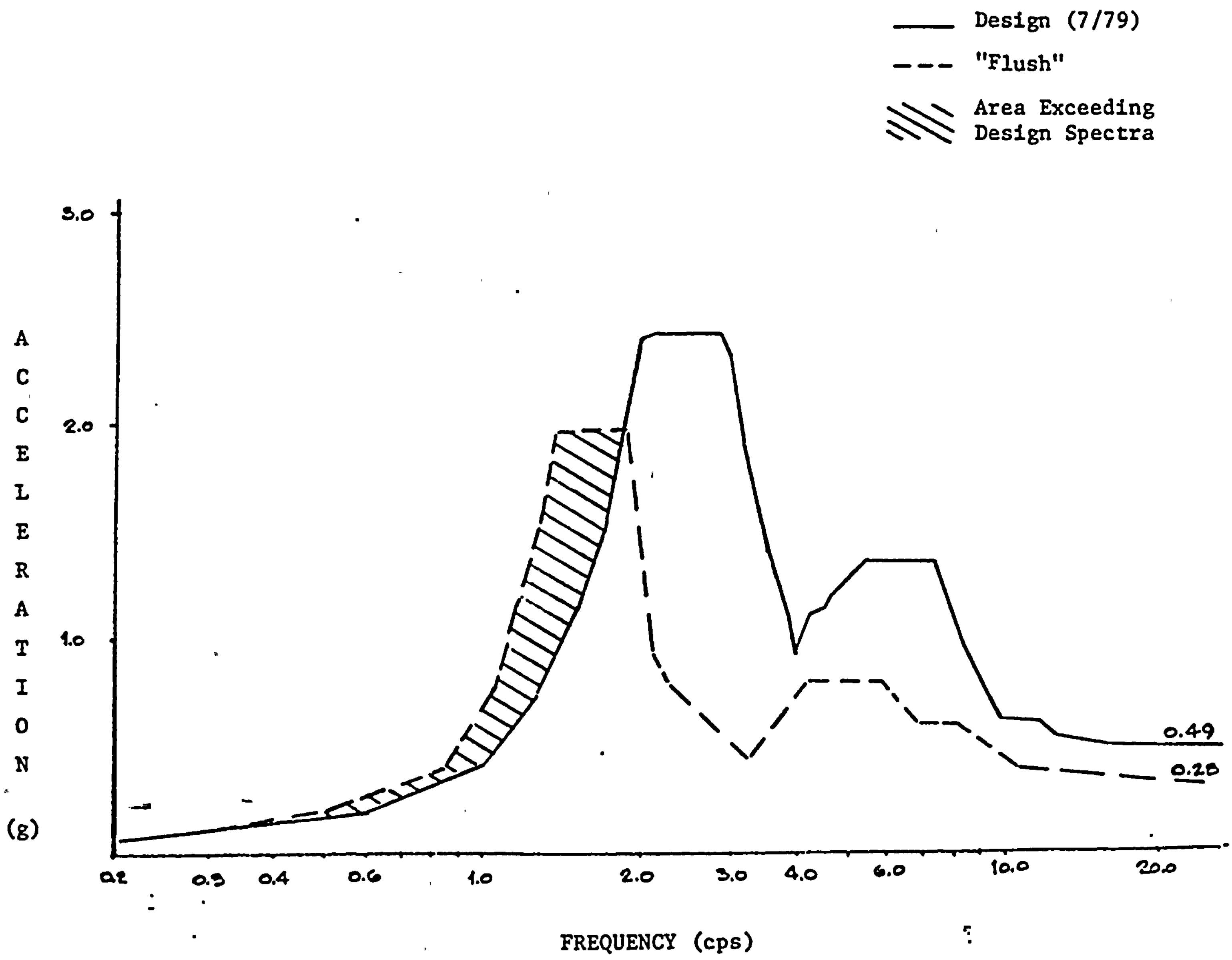
Figure 9

CONTAINMENT BUILDING

Elevation 208'10"

DRYWELL

RESPONSE SPECTRA



3% DAMPING EAST-WEST MOTION SSE

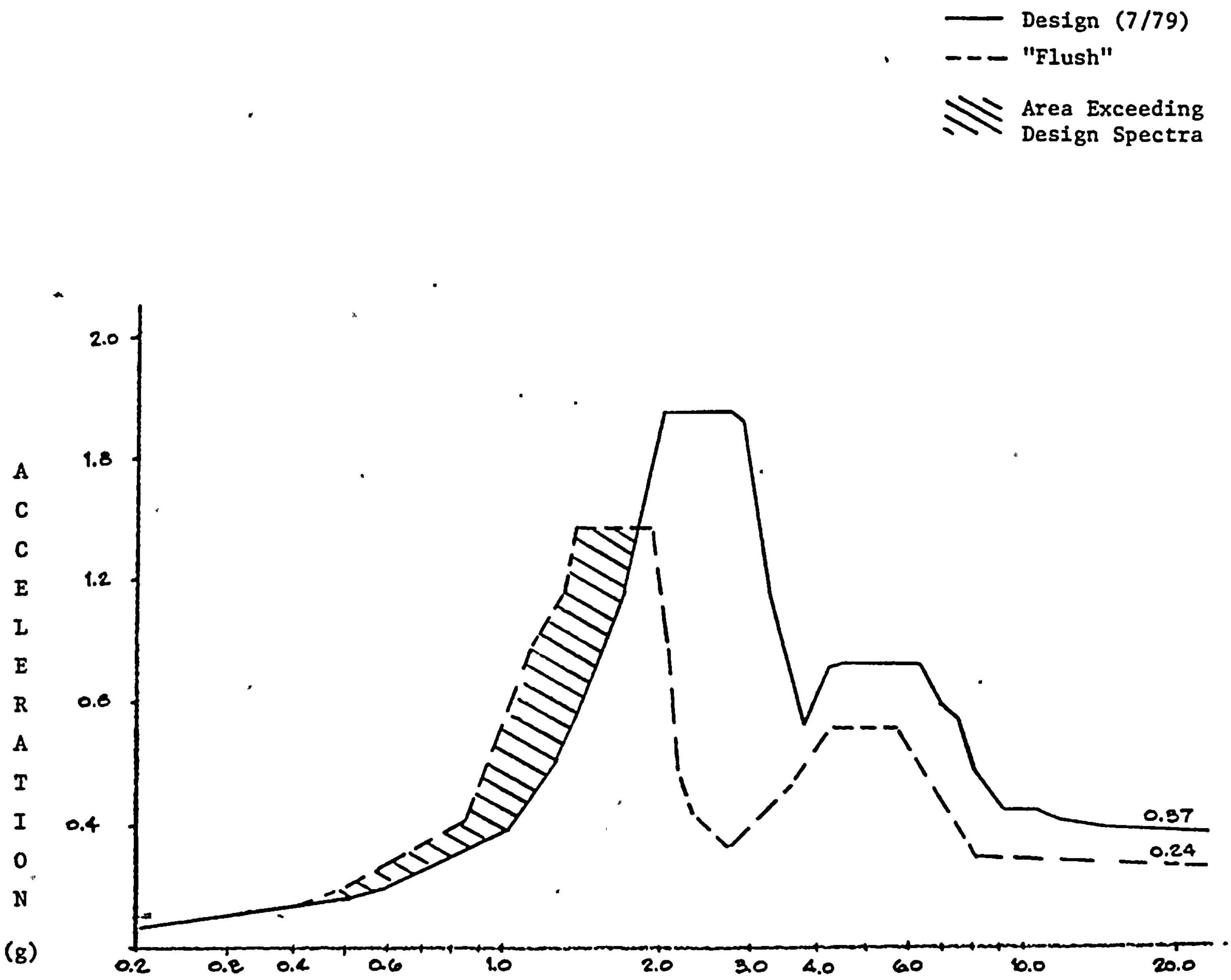
Figure 10

CONTAINMENT BUILDING

Elevation 161'10"

DRYWELL

RESPONSE SPECTRA



FREQUENCY (cps)

3% DAMPING EAST-WEST MOTION SSE

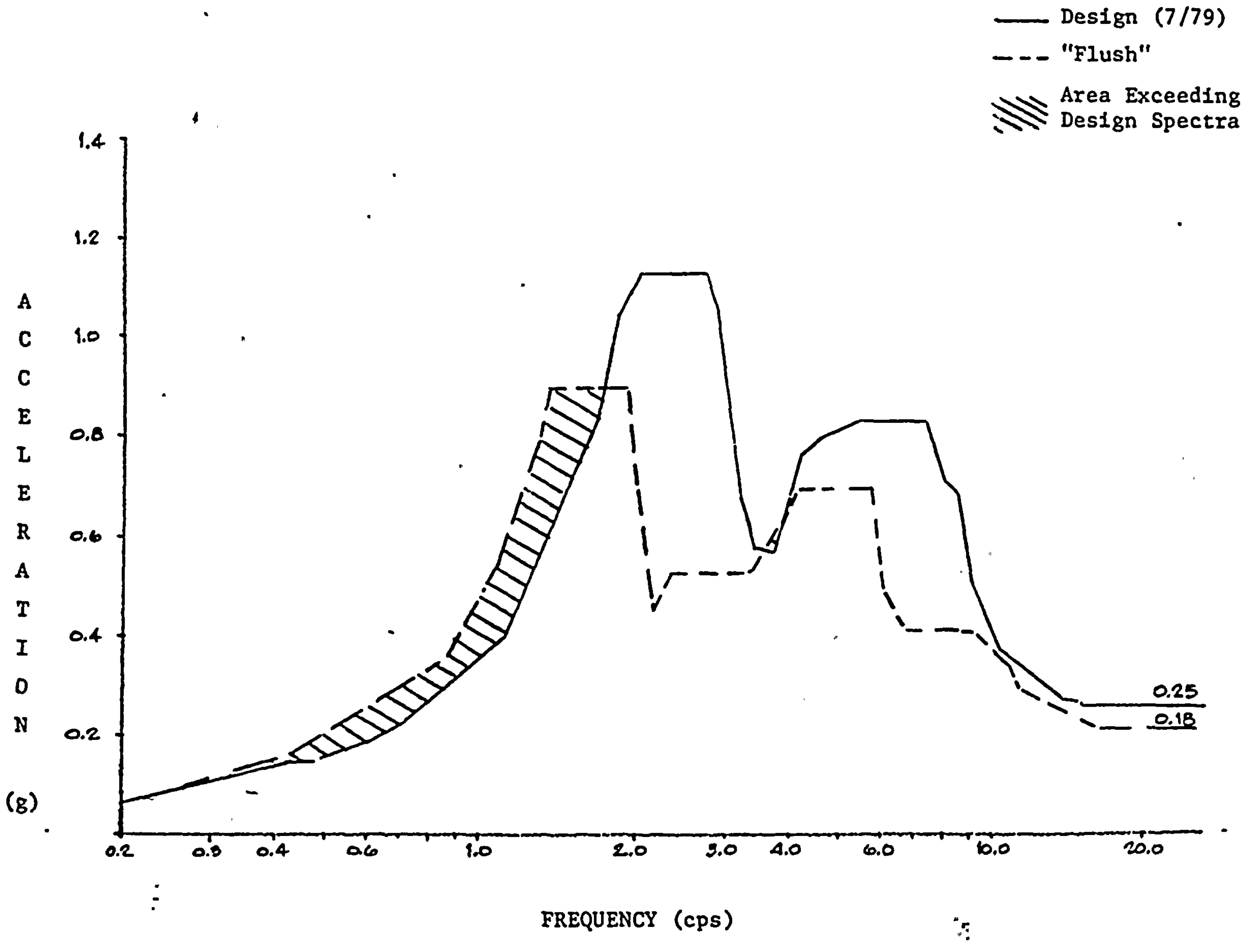
Figure 11

CONTAINMENT BUILDING

Elevation 121'4"

RPV PEDESTAL

RESPONSE SPECTRA



3% DAMPING EAST-WEST MOTION SSE

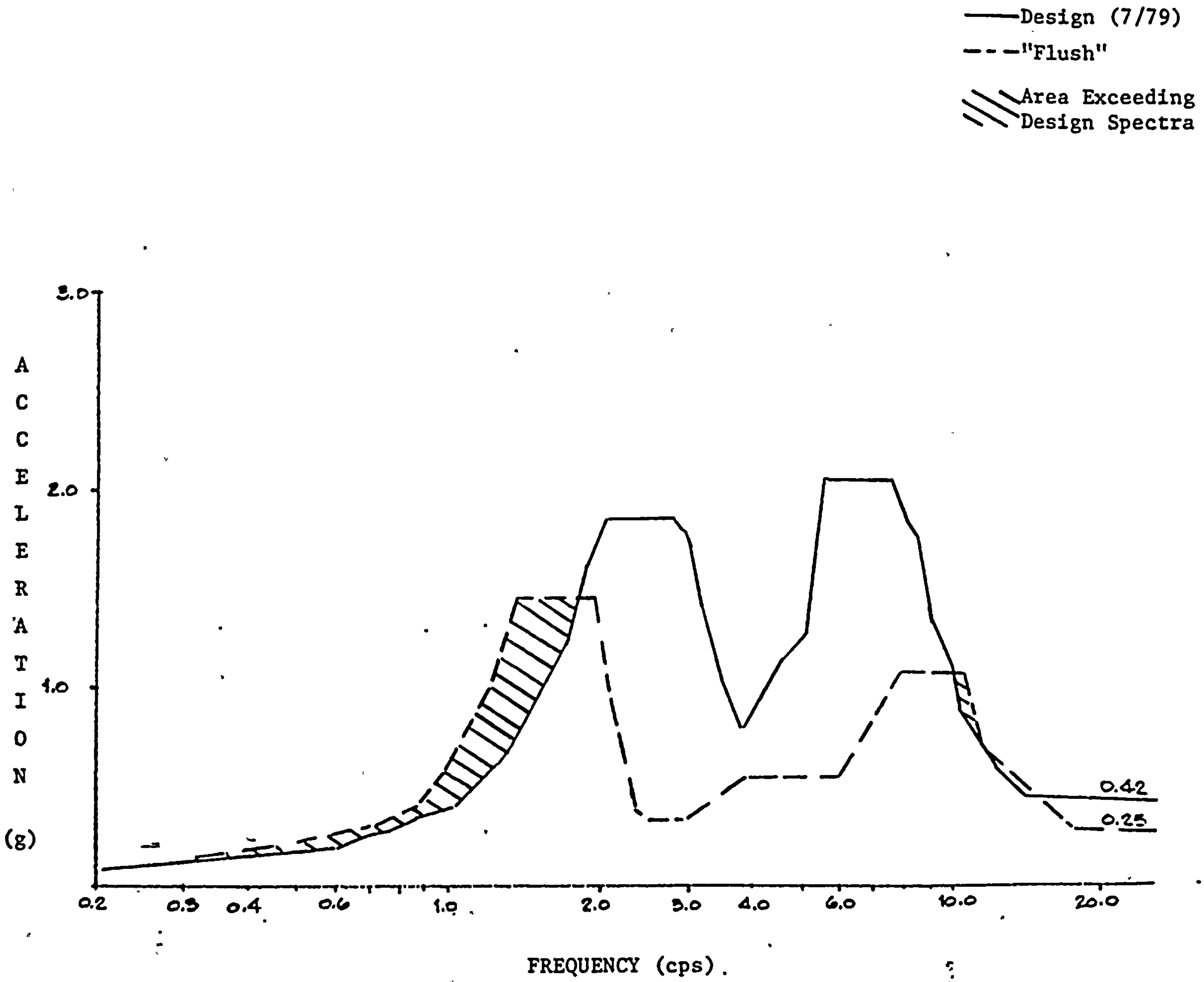
Figure 12

CONTAINMENT BUILDING

Elevation 169'4"

SHIELD WALL

RESPONSE SPECTRA



3% DAMPING EAST-WEST MOTION SSE

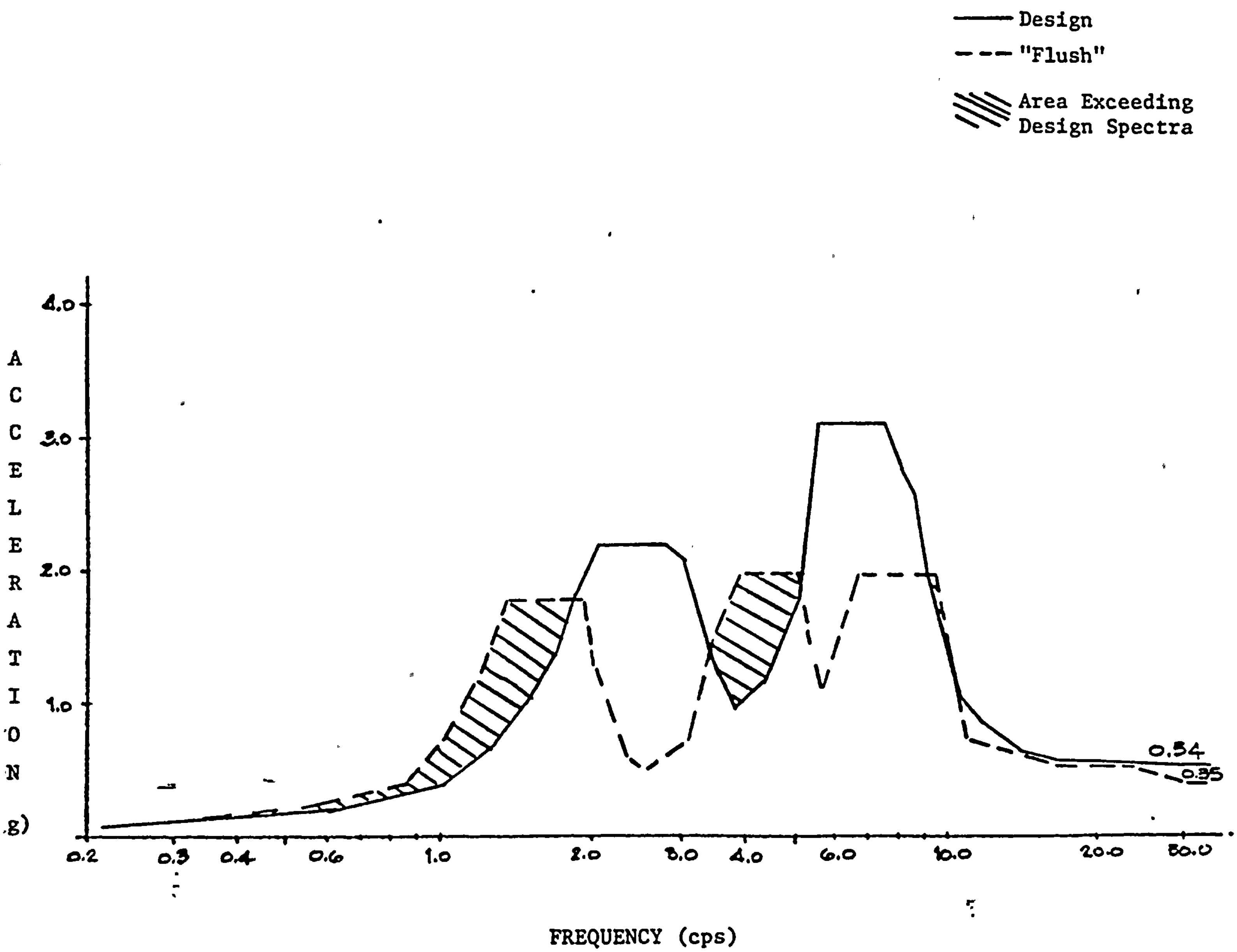
Figure 13

CONTAINMENT BUILDING

Elevation 188'8"

REACTOR

RESPONSE SPECTRA



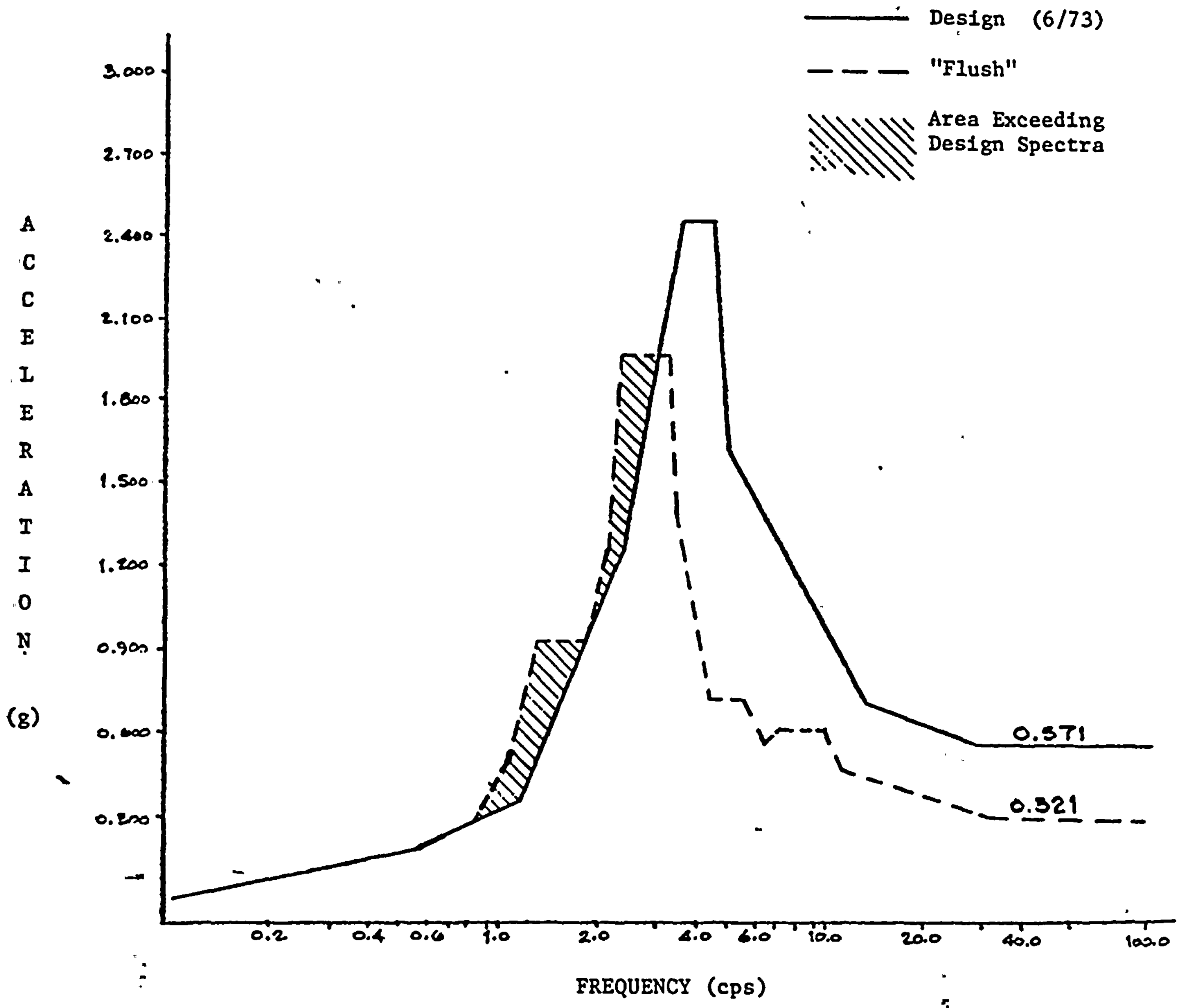
3% DAMPING EAST-WEST MOTION SSE

Figure 14

AUXILIARY BUILDING

Elevation 247'-0"

RESPONSE SPECTRA



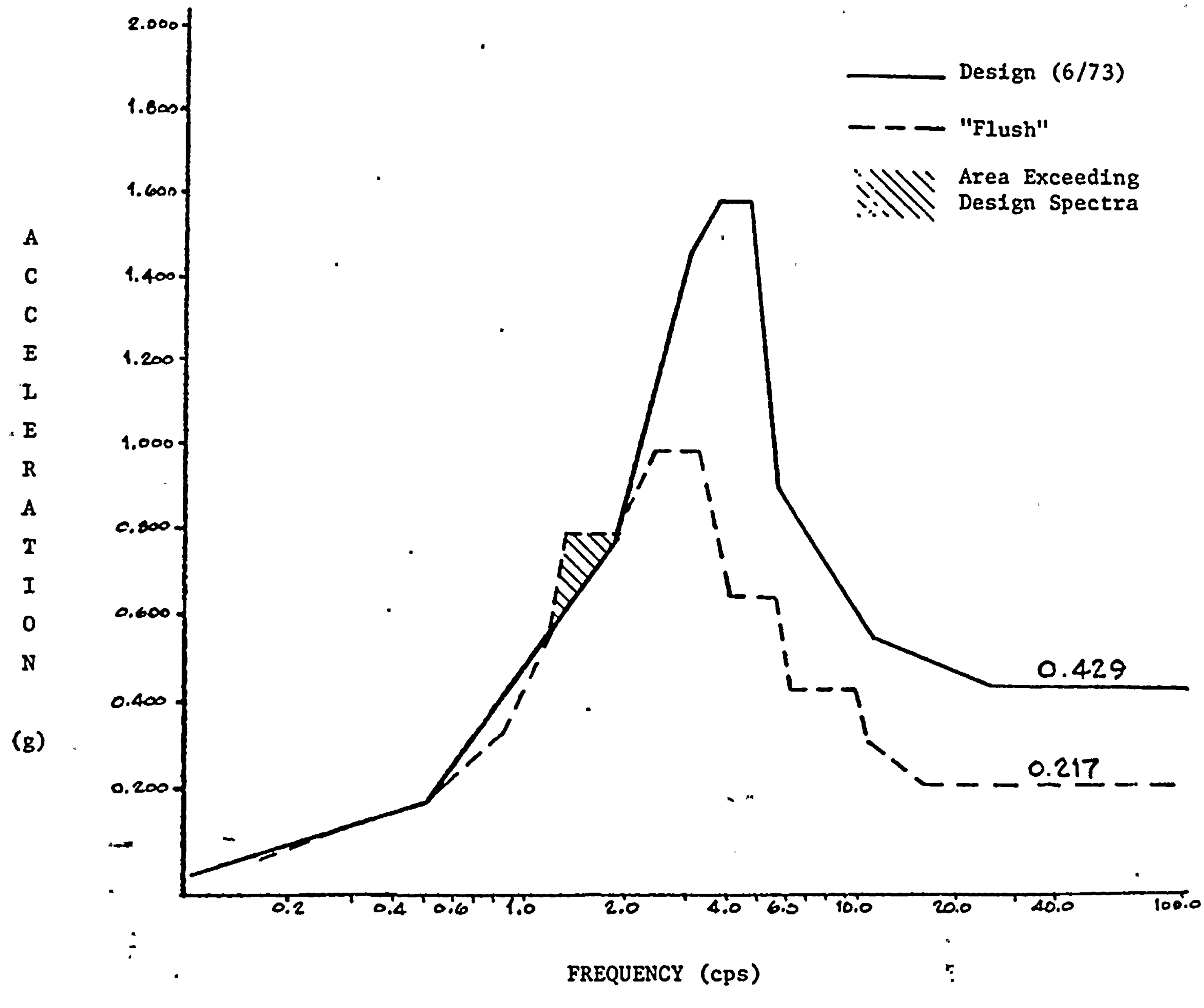
3% DAMPING NORTH-SOUTH MOTION SSE

Figure 15

AUXILIARY BUILDING

Elevation 166'-0"

RESPONSE SPECTRA



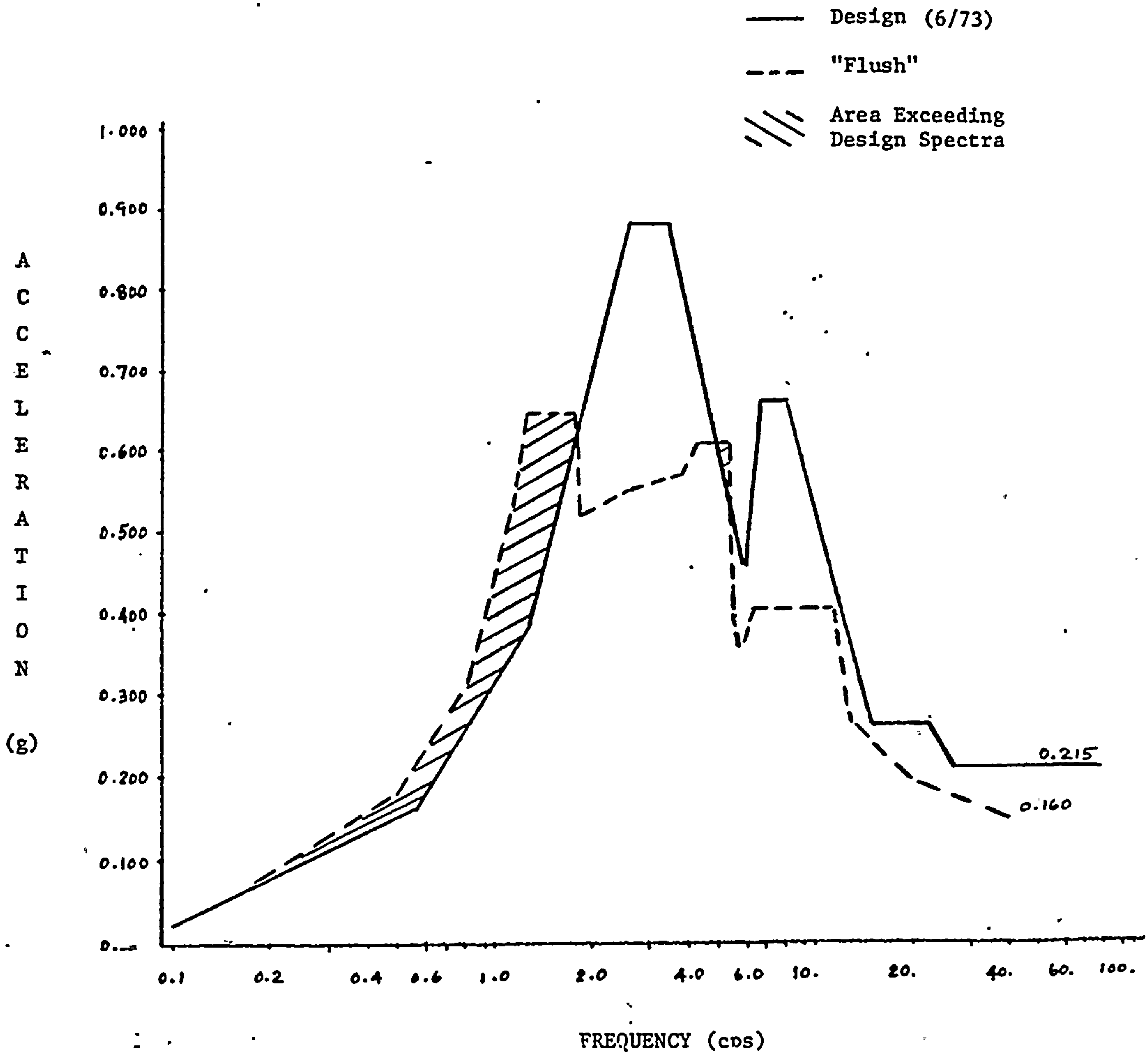
3% DAMPING NORTH-SOUTH MOTION SSE

Figure 16

AUXILIARY BUILDING

Elevation 93'-0"

RESPONSE SPECTRA



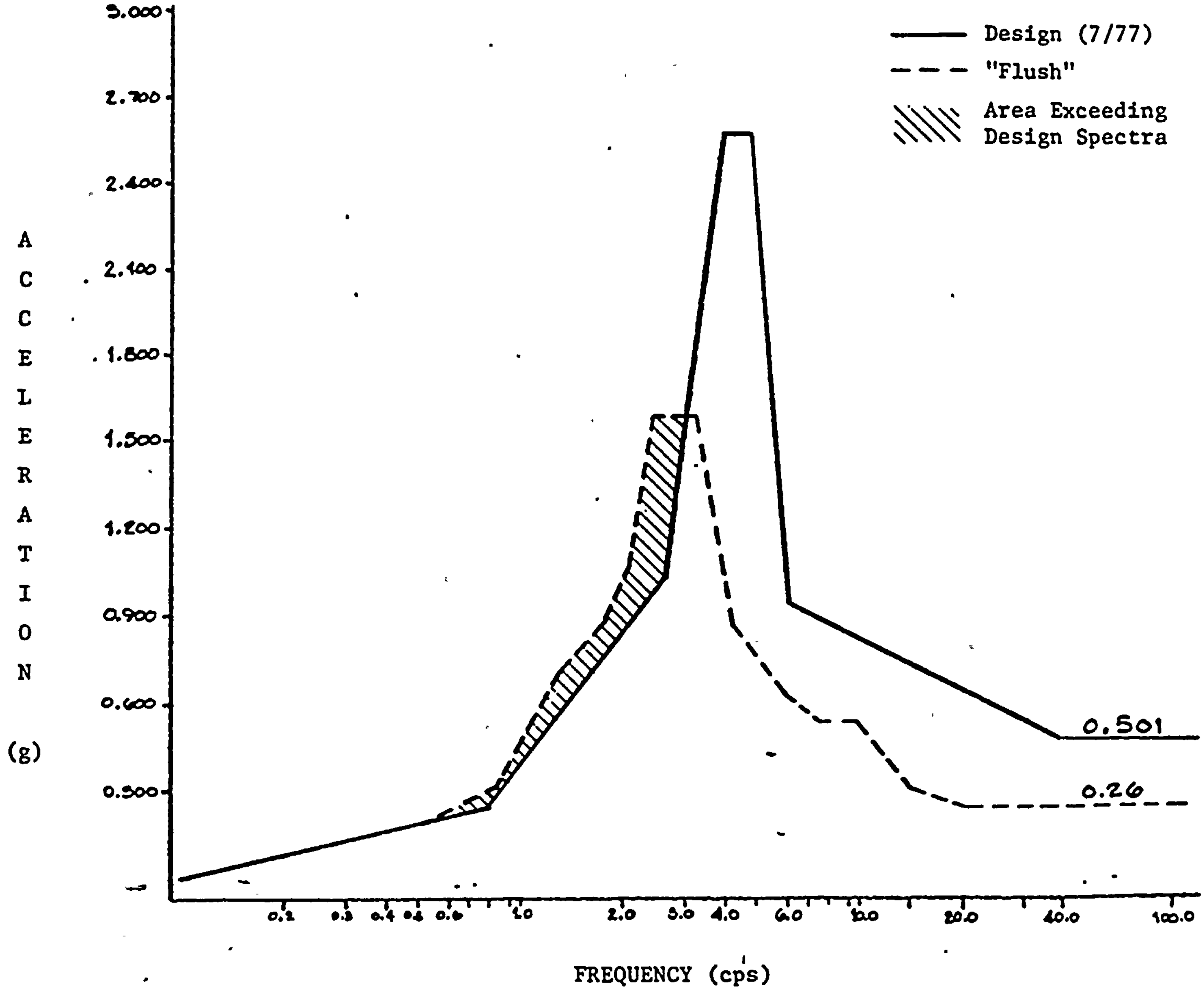
3% DAMPING NORTH-SOUTH MOTION SSE

Figure 17

CONTROL BUILDING

Elevation 189'-0"

RESPONSE SPECTRA



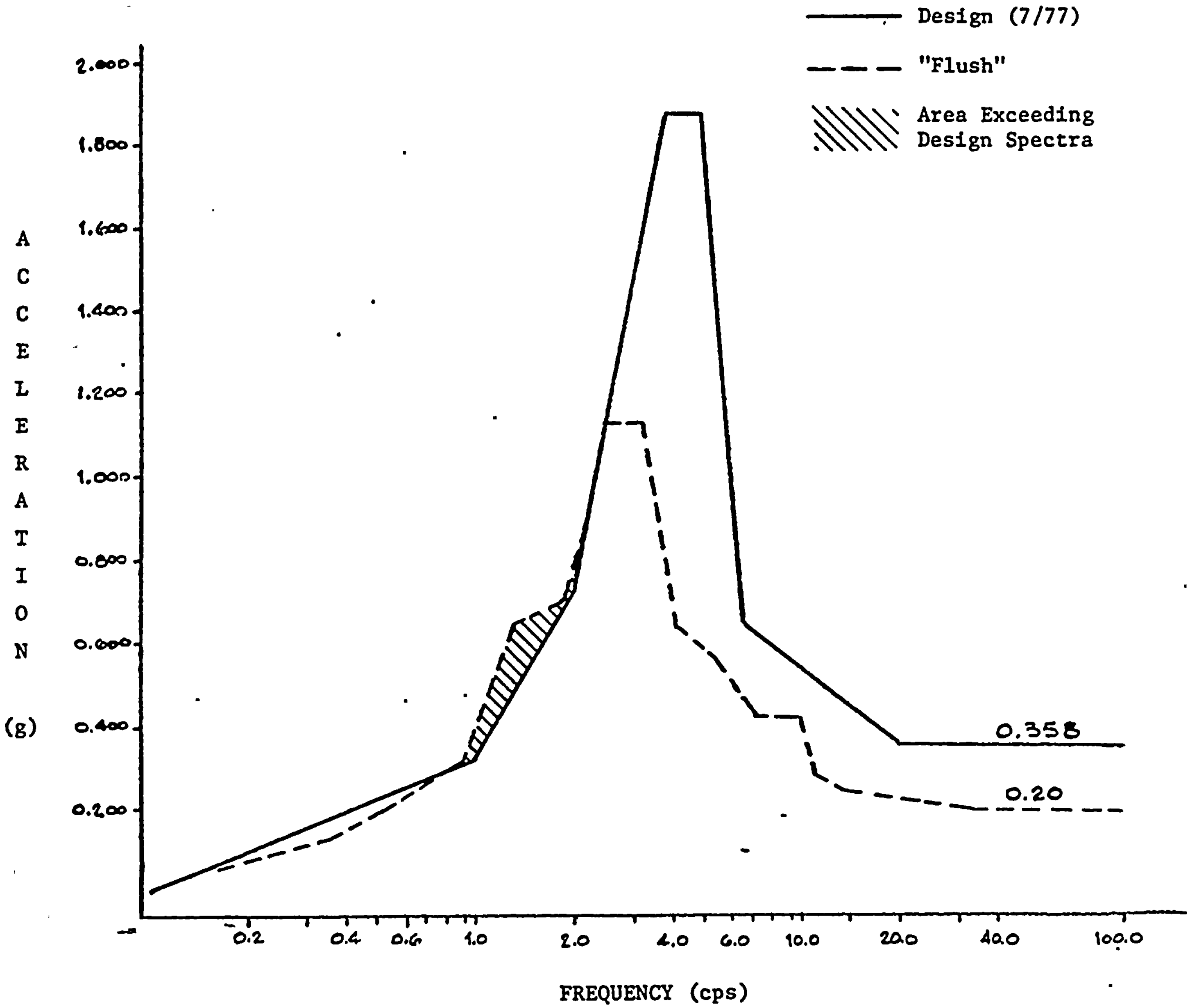
3% DAMPING NORTH-SOUTH MOTION SSE

Figure 18

CONTROL BUILDING

Elevation 150'-0"

RESPONSE SPECTRA



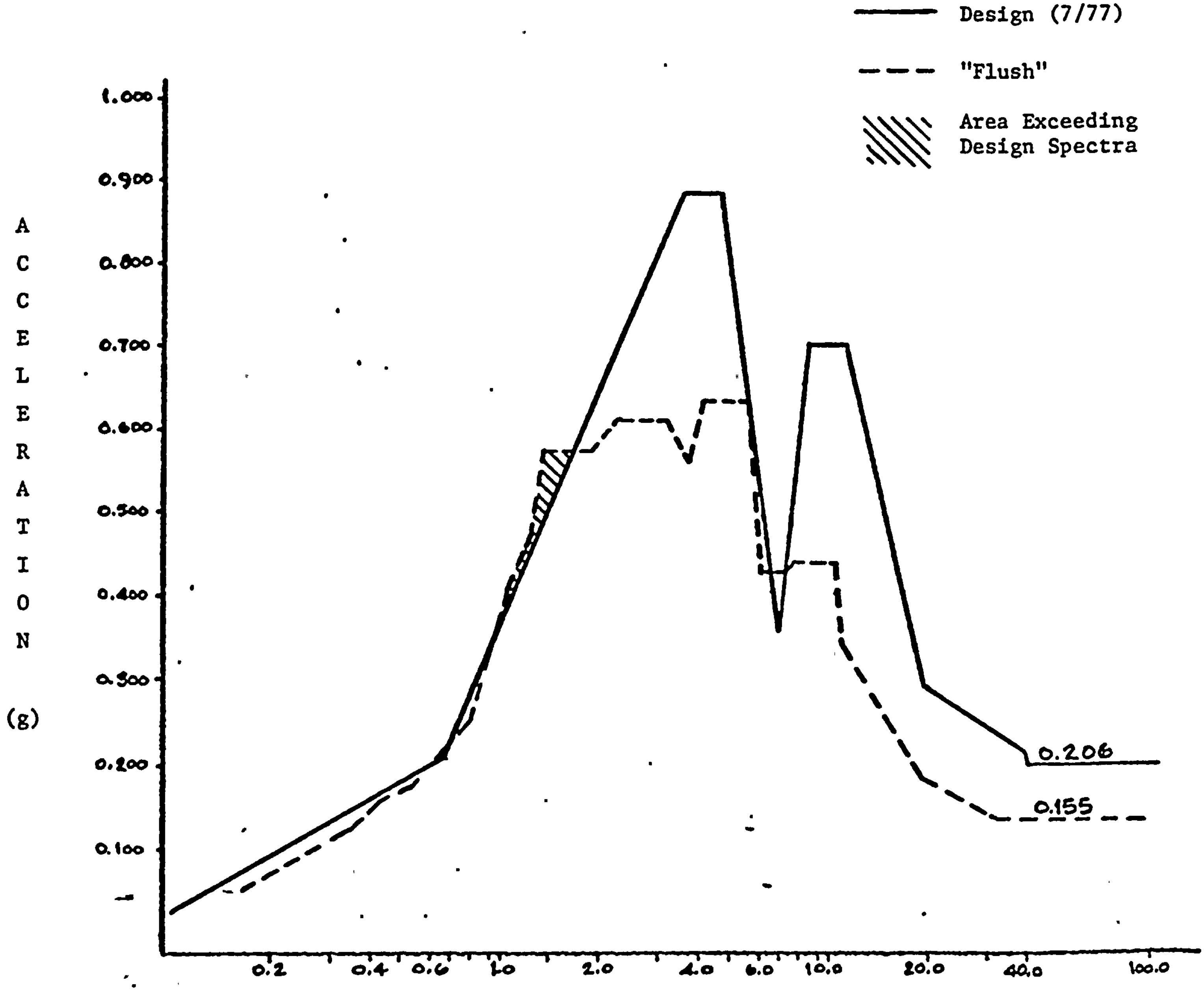
3% DAMPING NORTH-SOUTH MOTION SSE

Figure 19

CONTROL BUILDING

Elevation 93'-0"

RESPONSE SPECTRA



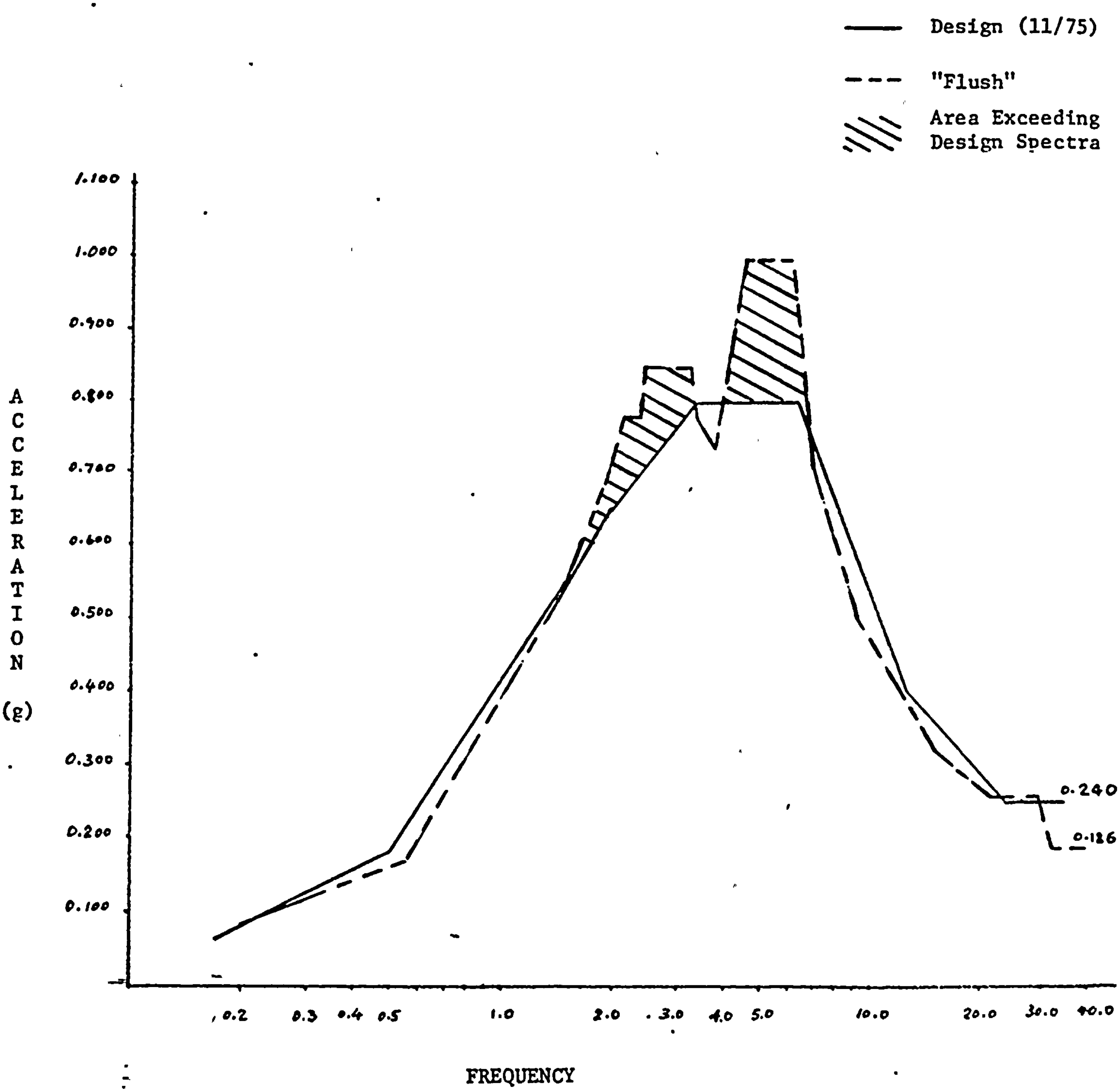
3% DAMPING NORTH-SOUTH MOTION SSE

Figure 20

DIESEL GENERATOR BUILDING

Elevation 170'-0"

RESPONSE SPECTRA



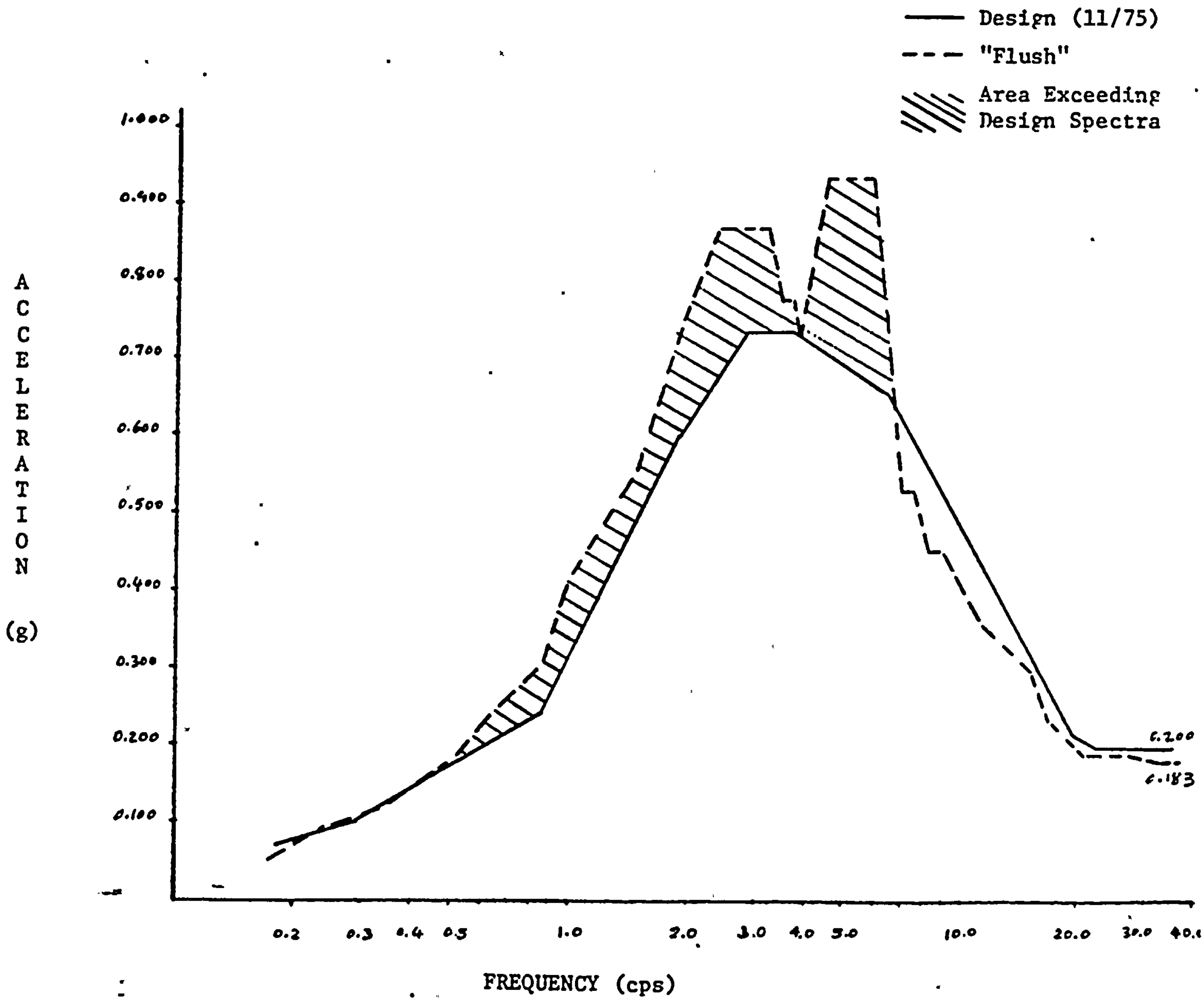
3% DAMPING EAST-WEST MOTION SSE

Figure 21

DIESEL GENERATOR BUILDING

Elevation 133'0"

RESPONSE SPECTRA



3% DAMPING EAST-WEST MOTION SSE

Figure 22

PART II

STANDBY SERVICE WATER COOLING TOWER BASIN

II.A. INTRODUCTION

As part of NRC's Structural Engineering Branch "Request for Additional Information," FSAR question 130.25 requested an assessment of the impact of the SEB staff position for soil-structure interaction seismic analysis methods to the behavior of the standby service water cooling tower basin.

A summary of the impact of the staff's position to the structural design has been presented in the response to question 130.25. A more detailed discussion of the impact of the staff's position to the design of equipment is provided herein. As stated in FSAR Section 3.7.2.1.1.3.5, a finite element method of seismic analysis is used to generate design floor response spectra and a lumped parameter method of seismic analysis is used to generate structural design loadings. Both methods of analysis of the standby service water cooling tower use free field input motion defined by the Grand Gulf design spectrum (FSAR Section 2.7.1.2).

II.B. SHAKE/LUSH ANALYSIS AND LUMPED PARAMETER ANALYSIS

Seismic soil-structure interaction analysis was performed using the SHAKE and LUSH computer programs. A detailed discussion of this seismic analysis is presented in FSAR section 3.7.2.4. The finite element model of this structure is shown in Figure 23 (FSAR Figure 3.7-26). The soil and the structure are modelled using plain strain finite elements. The base of the finite element model soil block is assumed rigid. The vertical boundaries of the soil block are restrained from translation vertically for horizontal input motion, and are restrained from translation horizontally for vertical input motion.

The acceleration time-history for input motion was applied at the base of the soil block. This motion was determined by deconvoluting the given free field motion (FSAR Section 3.7.1.2) at the base of the structure to the base of the finite element model using a one-dimensional wave propagation theory employing strain compatible wave velocities and damping ratios and computer program SHAKE.

Computer program LUSH evaluates the dynamic response of the plane strain finite element model using the input motion determined from computer program SHAKE. The resulting acceleration response and associated design floor response spectra at selected locations throughout the structure are then determined.

To develop floor response spectra for comparison with the design floor response spectra generated using a finite element model (SHAKE, LUSH), a lumped parameter model was used. Since there is no approved method for considering embedment effects using lumped parameter methods, the lumped parameter analysis was performed without consideration of embedment effects.

Input ground motion (FSAR Section 3.7.1.2) is applied in the free field at the base of the structure similar to the other power block structure analyses described in Part I. Structural damping is in accordance with FSAR Table 3.7-3.

II.C. RESULTS

The design FRS generated by LUSH are compared to those generated using the lumped parameter model. LUSH spectra have been broadened using ±15% widening. Spectra are compared at the following significant locations for the lateral SSE using 2% damping in Figures 24 and 25.

Standby Service Water Cooling Tower Basin, Lateral Direction

Operating Slab, Elev. 133'0"
Fill Support Beam Level, Elev. 144'6"

The design (LUSH) floor response spectra for lateral excitation exhibit lower spectral accelerations with lower frequency content than the lumped parameter response spectra. The frequency shift is due to the reduction in soil shear modulus due to an increase in strain. The FRS generated using the lumped parameter models were based on the maximum value of the soil shear modulus. After iteration of the soil properties using SHAKE and LUSH, the shear modulus observed in the finite elements generally falls below one-half of the maximum value. Thus, the soil is much "softer" than the elastic half space springs would indicate causing the frequency shift to the lower frequency region.

The decrease in amplitude in the LUSH analysis is due to the inability of the lumped mass model to completely account for the effect of structural embedment. More than 50 percent of the SSW Cooling Tower Basin is below grade. A finite element study was performed to quantify the variation in amplitude between the embedded and unembedded structure. The results of this study, which employed the FLUSH computer program, are shown in Figures 26 to 29. Examples of embedded and unembedded FLUSH models appear in Figure 30. Figures 26 and 27 compare the embedded and unembedded structure using a finite element model in which the input motion is always applied at the ground surface. Figures 28 and 29 compare finite element models having their input motion always applied at the base of the structure. This parametric study indicates a reduction in response spectra amplitudes from the embedded model to the unembedded model of from 40 percent to 70 percent. By using a 40 percent reduction as a lower bound value for modification of the lumped mass analysis response spectra, excellent agreement is found between the amplitudes of the original (LUSH) analysis and the modified lumped parameter analysis (see Figures 31 and 32).

II.D. FIGURES

Figures 23 to 29 follow.

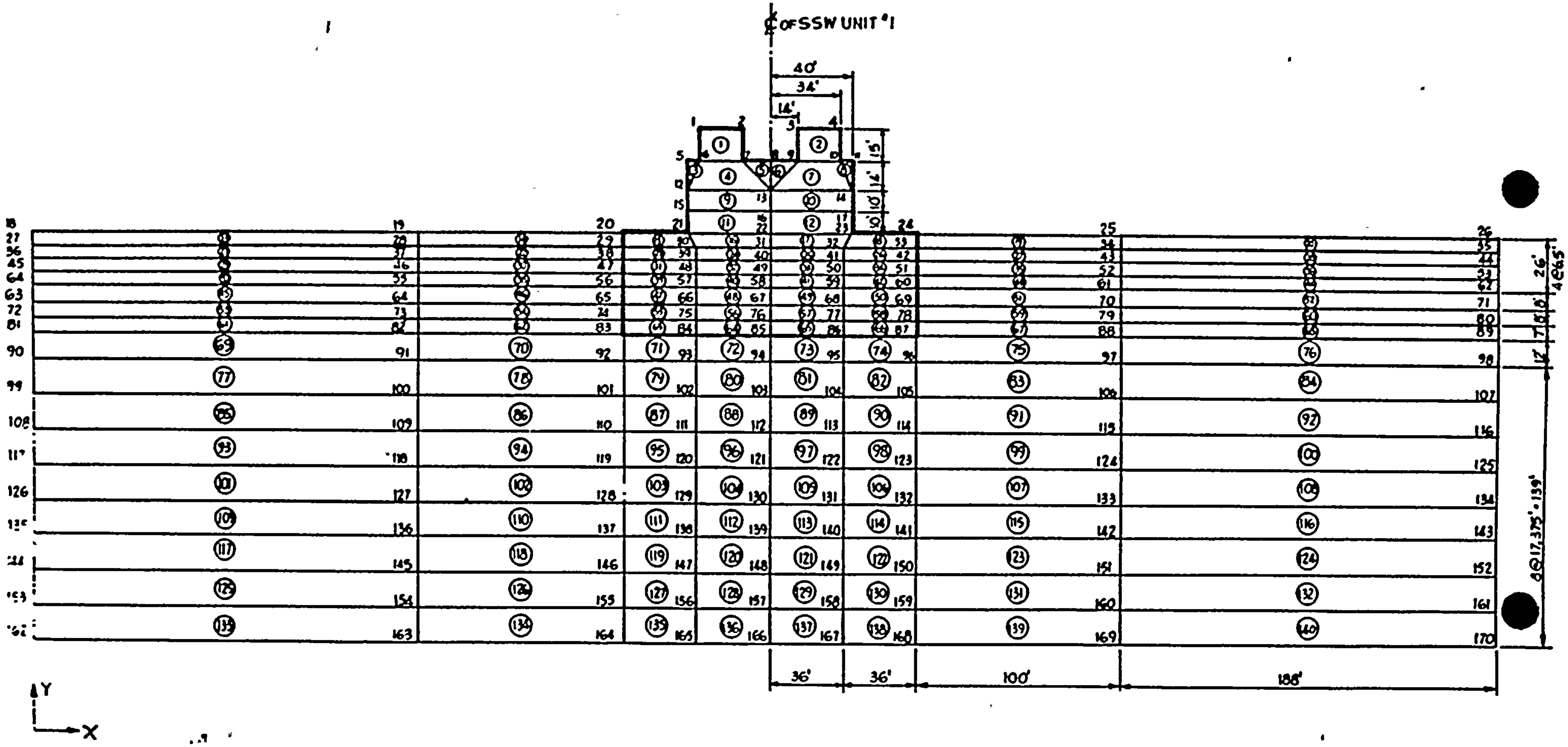


Figure 23
-33-

MISSISSIPPI POWER & LIGHT COMPANY
GRAND GULF NUCLEAR STATION
UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

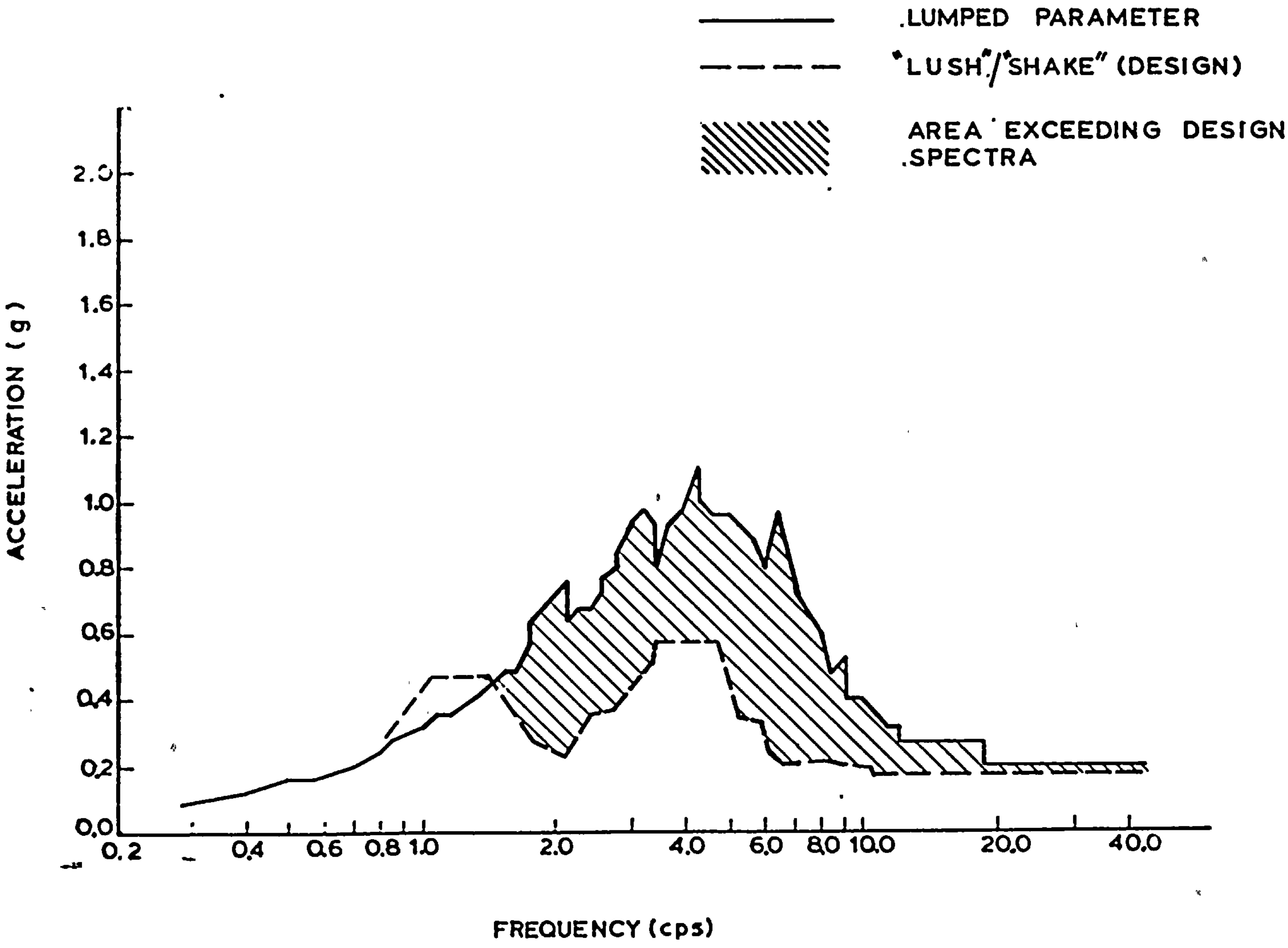
MATHEMATICAL MODEL FOR
SEISMIC ANALYSIS
SSW COOLING TOWER & BASIN
UNDERLAIN BY MULTILAYERED SOIL
(FOR SUBSYSTEM ANALYSIS PURPOSE)
FIGURE 3.7-26

STANDBY SERVICE WATER

COOLING TOWER AND MAKEUP BASIN

ELEVATION 133'-0"

RESPONSE SPECTRA



2% DAMPING HORIZONTAL MOTION SSE

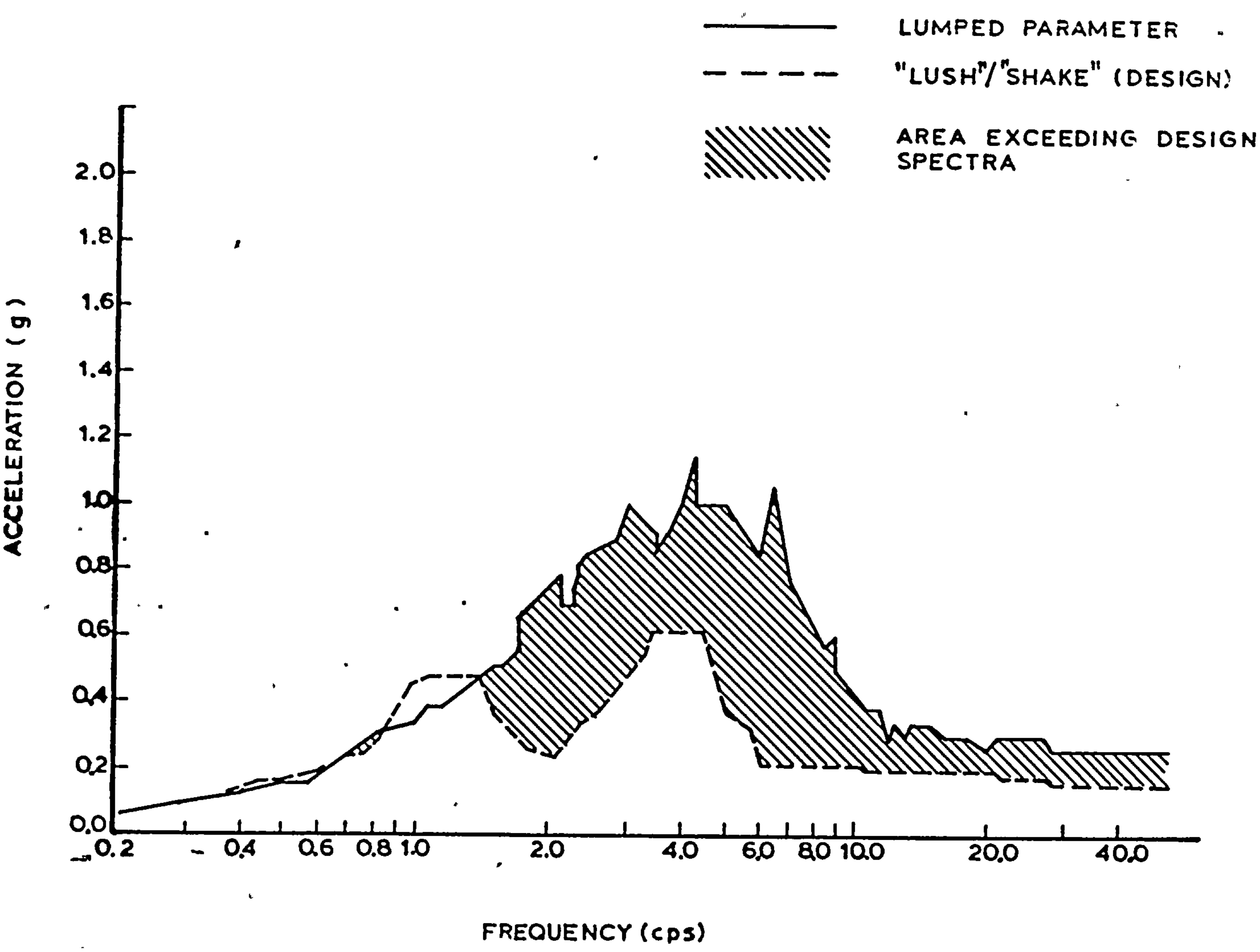
FIGURE 24

STANDBY SERVICE WATER

COOLING TOWER AND MAKEUP BASIN

ELEVATION 144'-6"

RESPONSE SPECTRA



2% DAMPING HORIZONTAL MOTION SSE

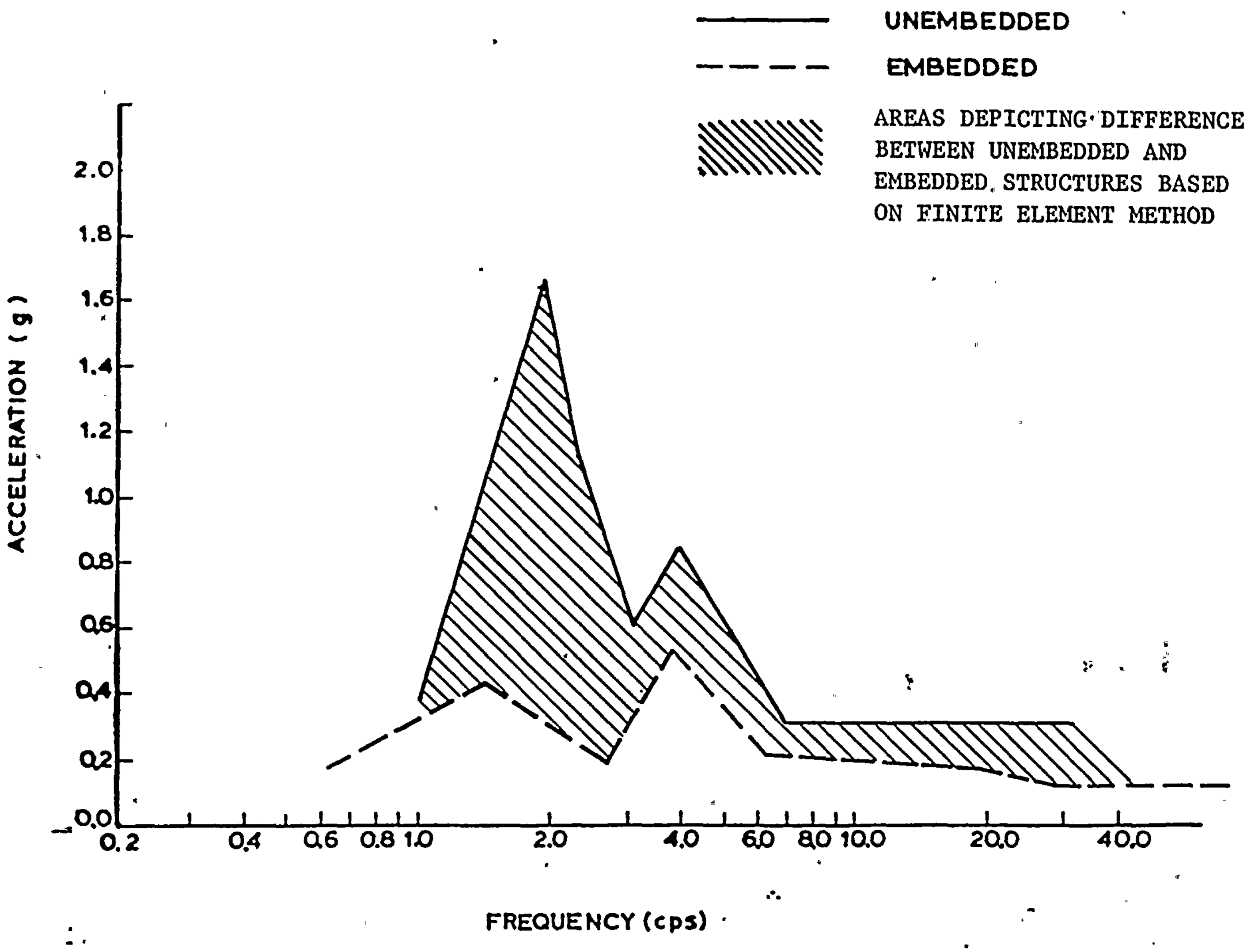
FIGURE 25

STANDBY SERVICE WATER

COOLING TOWER AND MAKEUP BASIN

ELEVATION 133'-0"

RESPONSE SPECTRA



2% DAMPING HORIZONTAL MOTION SSE

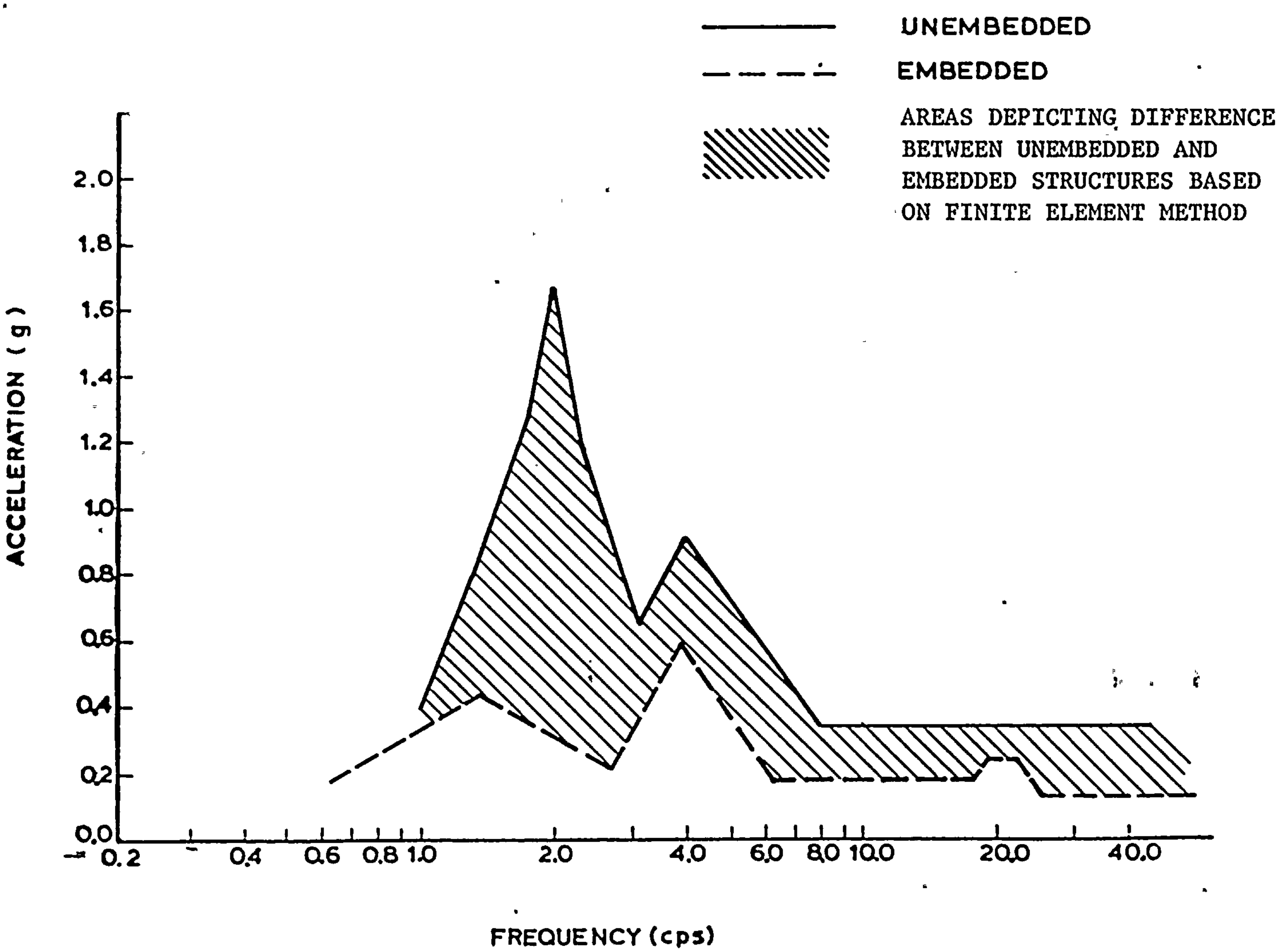
FIGURE 26

STANDBY SERVICE WATER

COOLING TOWER AND MAKEUP BASIN

ELEVATION 144'-6"

RESPONSE SPECTRA



2% DAMPING HORIZONTAL MOTION SSE

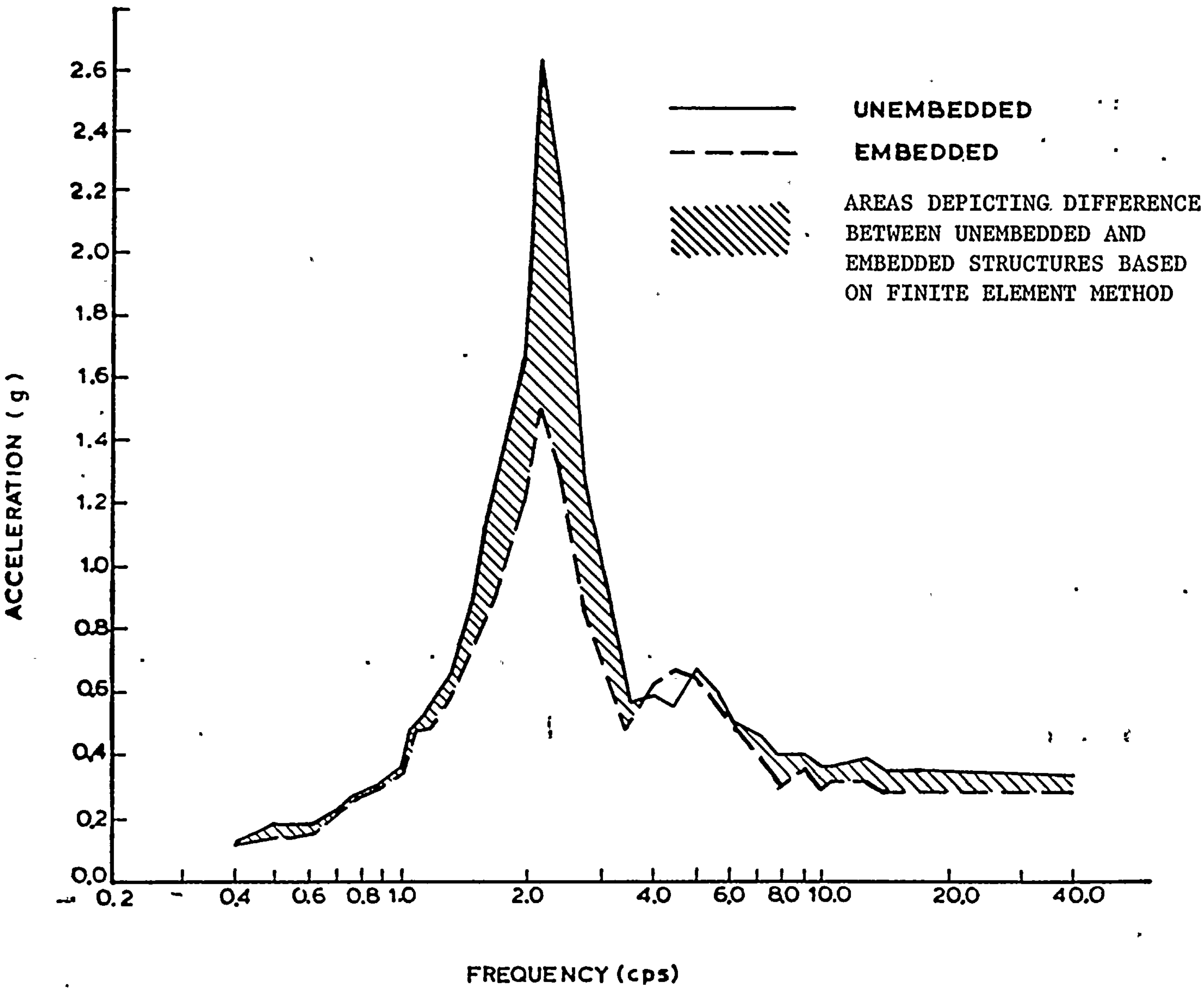
FIGURE 27

STANDBY SERVICE WATER

COOLING TOWER AND MAKEUP BASIN

ELEVATION 133'-0".

RESPONSE SPECTRA



2% DAMPING HORIZONTAL MOTION SSE

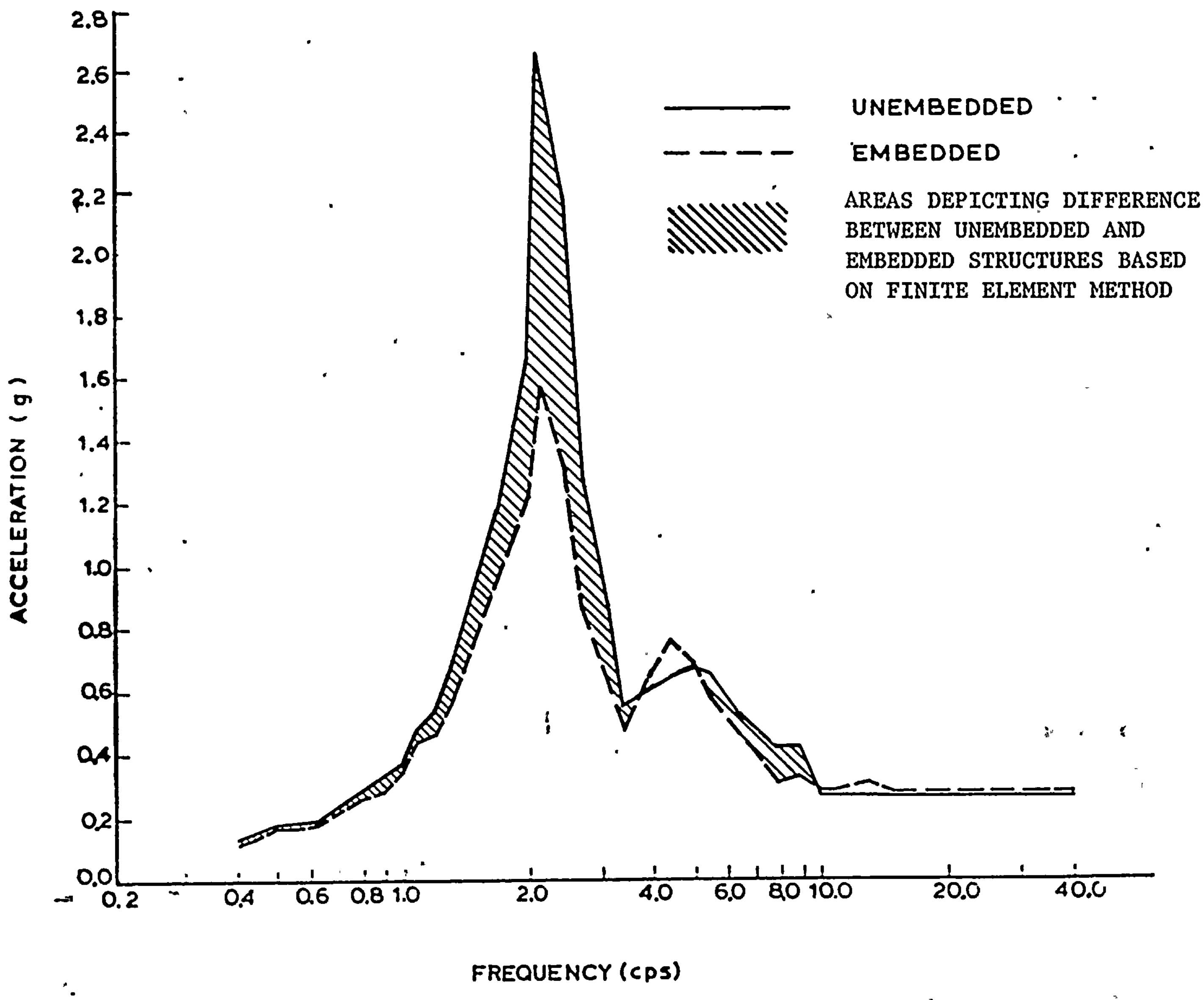
FIGURE 28

STANDBY SERVICE WATER

COOLING TOWER AND MAKEUP BASIN

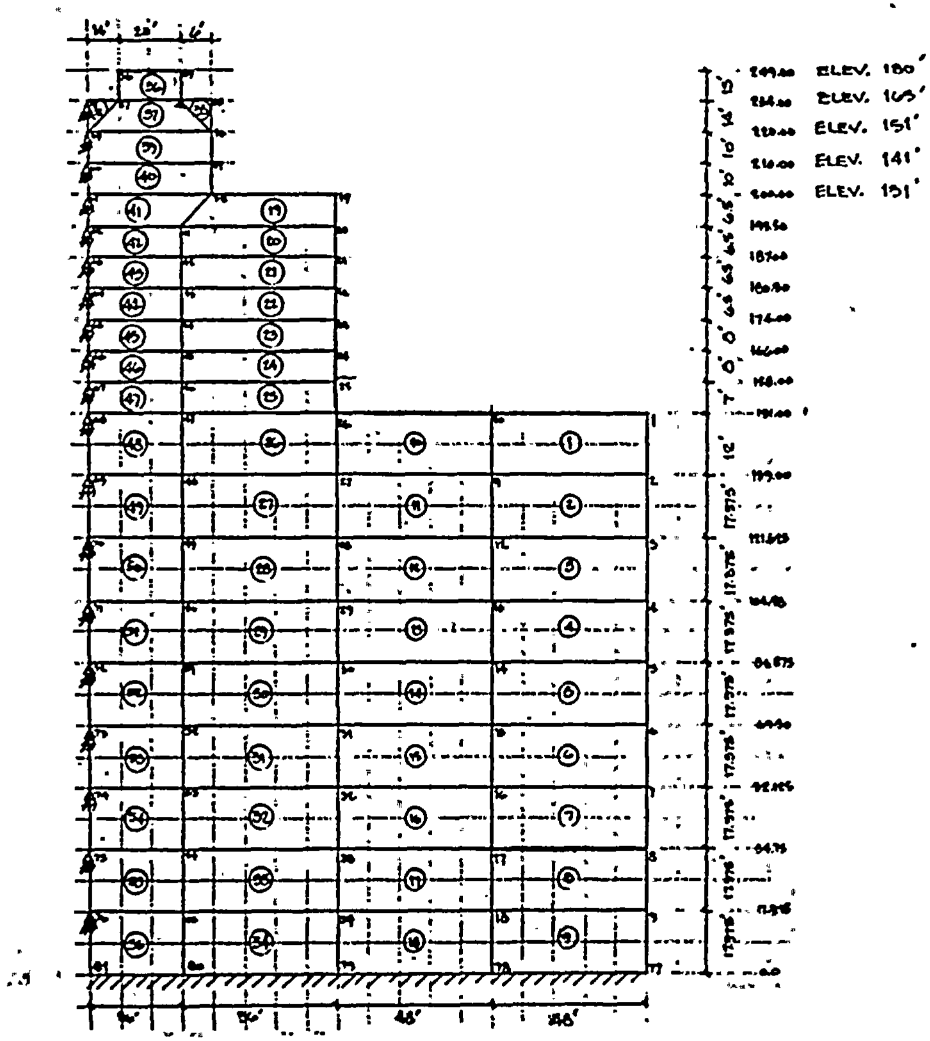
ELEVATION 144'-6"

RESPONSE SPECTRA

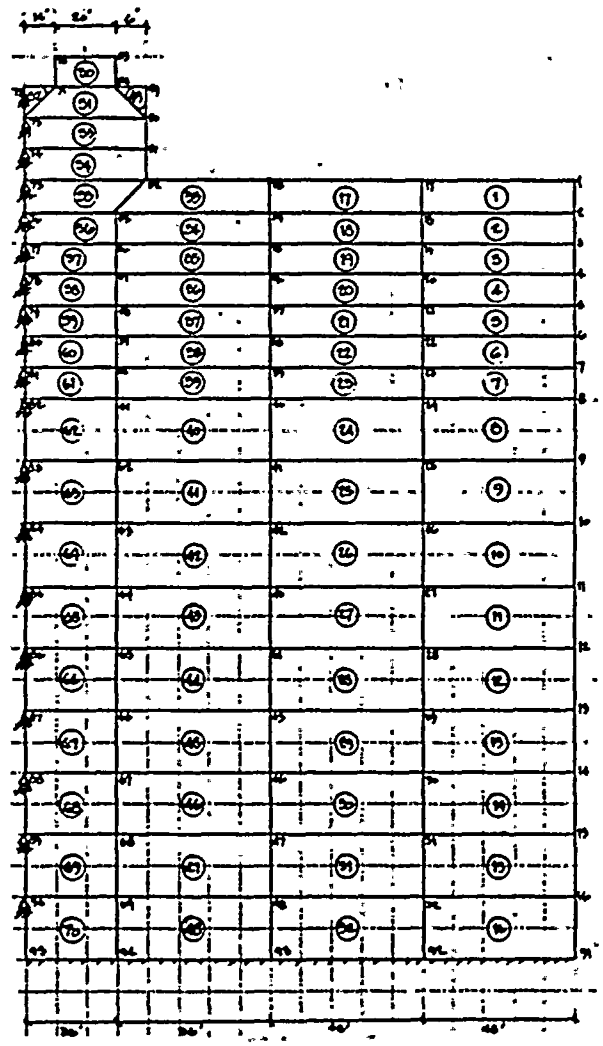


2% DAMPING HORIZONTAL MOTION SSE

FIGURE 29



Unembedded Model



Embedded Model

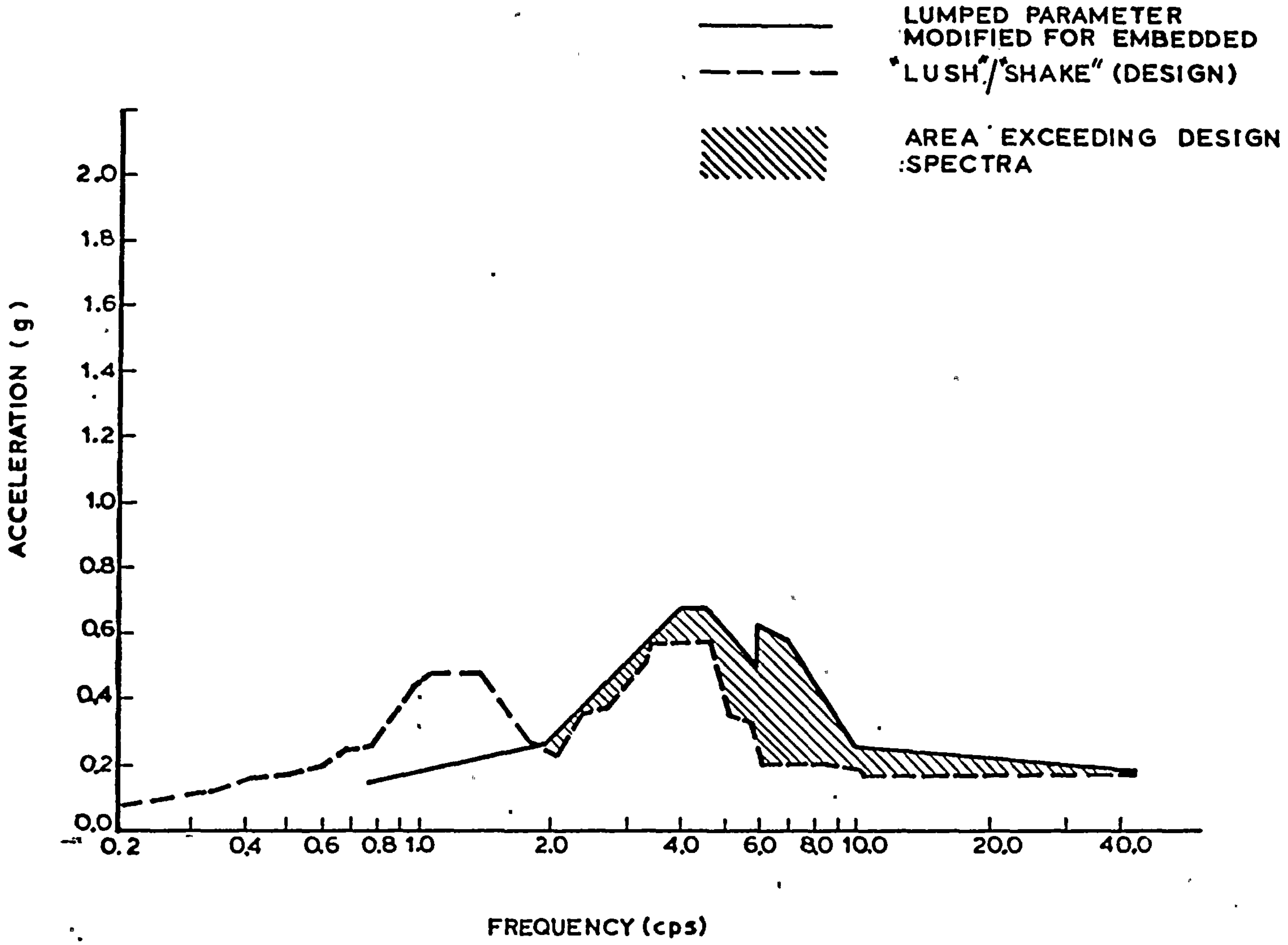
Figure 30

STANDBY SERVICE WATER

COOLING TOWER AND MAKEUP BASIN

ELEVATION 133'-0"

RESPONSE SPECTRA



2% DAMPING HORIZONTAL MOTION SSE

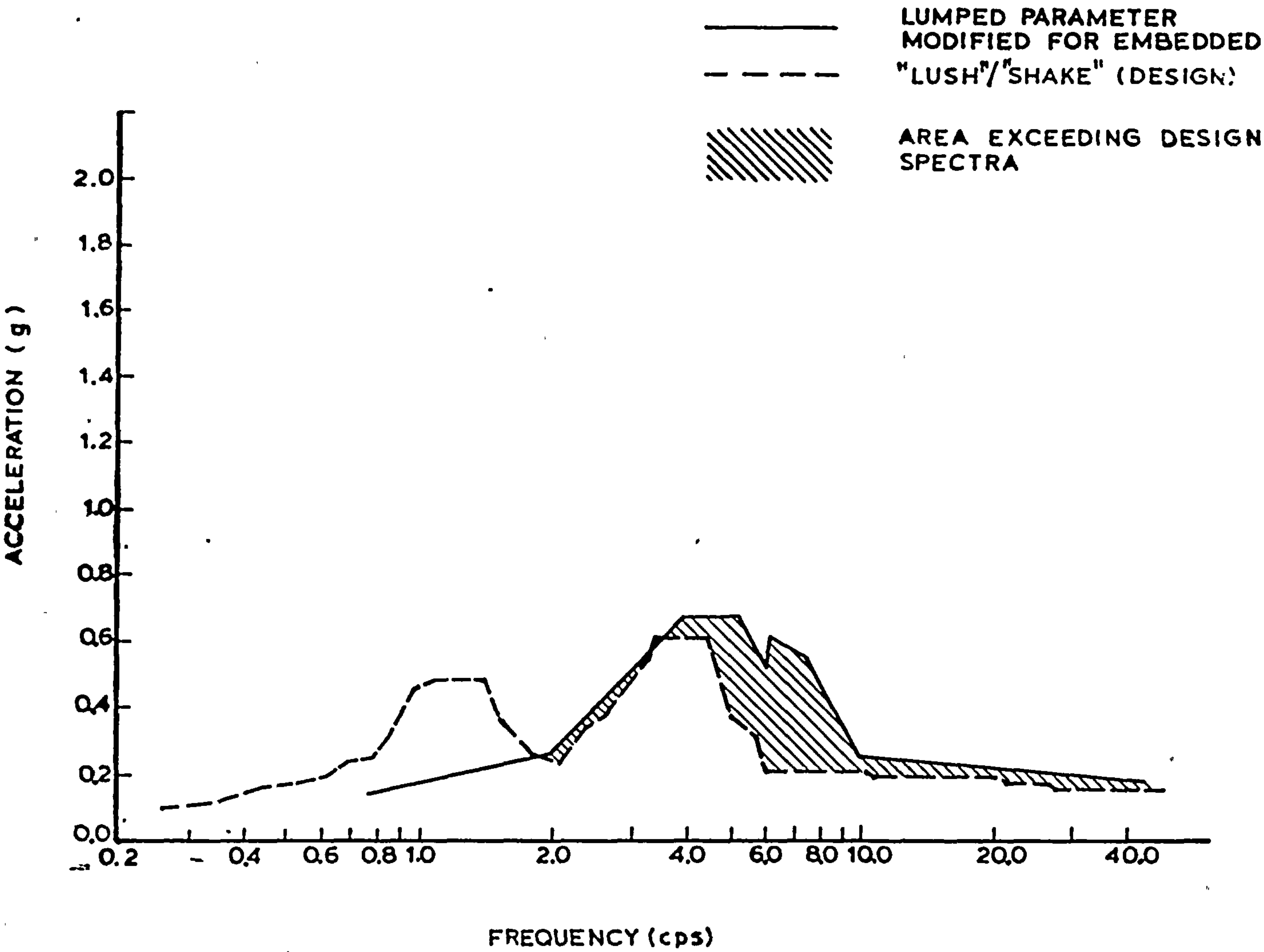
FIGURE 31

STANDBY SERVICE WATER

COOLING TOWER AND MAKEUP BASIN

ELEVATION 144'-6"

RESPONSE SPECTRA



2% DAMPING HORIZONTAL MOTION SSE

FIGURE 32

PART III

IMPACT ASSESSMENT

III.A. CONCLUSIONS

An engineering assessment of the impact to the basis for design qualification of mechanical and electrical equipment, piping, and components at Grand Gulf Nuclear Station has been done considering the NRC/SEB staff position for seismic analysis using the analyses described in Part I and Part II.

Within the containment building (containment, drywell, shield wall, RPV), auxiliary building, and control building, areas where the FLUSH FRS exceeded the design FRS were evaluated and found to have no impact on the existing design basis qualification of mechanical and electrical equipment, piping, and components. The FLUSH FRS exceeded the design FRS at frequencies generally below 2 hz. First mode frequencies of mechanical and electrical equipment, piping, and components are well above 2 hz.

Within the diesel generator building, FLUSH FRS exceed the design response spectra at frequencies up to approximately 7 hz. These exceedences have been evaluated and have no impact on the existing design basis qualification of mechanical and electrical equipment and components.

Within the standby service water cooling tower basin, it can be seen from the parametric study that no significant impact to the design qualification of equipment and components would be expected when considering the NRC/SEB staff position.

As stated in the Grand Gulf Safety Evaluation Report (NUREG-0831) and Supplement No. 1 to NUREG-0831, as well as Attachment 5 to AECM-81/345 (enclosed), additional seismic analyses of Category I structures have been performed according to the requirements of NRC Regulatory Guides 1.60 and 1.61 and have demonstrated the conservative nature of the Grand Gulf seismic design basis. MP&L has also addressed NRC's concerns and demonstrated that the Grand Gulf seismic design response spectrum represents a conservative basis for defining the Grand Gulf site free field seismic input motion.

The additional seismic analyses discussed in Section 3.7.1 of NUREG-0831 and Attachment 5 to AECM-81/345 have been completed and discussed in Parts I and III of this report. These additional analyses using finite element methods were performed according to NRC Regulatory Guides 1.60 and 1.61 at the request of the NRC/SEB staff. The analyses performed in response to FSAR question 130.25 were performed according to the FSAR criteria (Section 3.7.1) and are discussed in Parts II and III of this report.

MP&L proposes the following courses of action based upon the results discussed in this report and how they relate to Attachment 5 to AECM-81/345:

1. MP&L has shown that the Grand Gulf seismic design basis presented in Section 3.7 and 3.8 of the Grand Gulf FSAR is conservative for the design of structures, systems, and components within the containment, auxiliary, control, and diesel generator buildings. This matter is considered closed.

2. MP&L has provided an acceptable and conservative commitment to the NRC in both the Grand Gulf PSAR and FSAR to design equipment and components located in the standby service water cooling tower basin using response spectra developed from a finite element soil-structure interaction seismic analysis for a deeply embedded structure using SHAKE and LUSH. This report has shown that this design basis is exceeded when compared to results obtained from a more conservative lumped parameter model elastic half-space seismic analysis. Complete embedment of a structure such as the standby service water cooling tower basin will result in much lower response predictions using finite element methods. This is because the effect of embedment will be to increase the soil stiffness and damping in the soil near the structure. This embedment effect cannot be completely accounted for using elastic half space analyses. The parametric finite element study of embedment effects discussed in this report supports this conclusion. MP&L will maintain the existing basis for qualification of systems and components in this structure and considers this matter closed.

3. Structural design of the standby service water cooling tower basin has been shown to be conservative in the response to FSAR question 130.25 and NUREG-0831, Sections 3.7 and 3.8. This matter is considered closed.

SER Open Items

Seismic Analysis - Soil Structure Interaction - (SEB)

Response

In a meeting with NRC's Structural Engineering Branch on August 27, 1981, MP&L made the following commitment to resolve NRC concerns in the area of seismic analysis soil-structure interaction.

A finite element seismic (FLUSH) analysis (FEM) will be performed for the containment, auxiliary, control and diesel generator buildings. Appropriate soil properties necessary as input to the analysis will be determined based on existing soils data presented in the FSAR. No further subsurface exploratory work is necessary; however, the basis for seismic soil property determination used in the analysis will be provided. Free field input motions will be in accordance with Regulatory Guide 1.60 with damping values provided in Regulatory Guide 1.61. Ground motion will be applied in the free field at the foundation level of the structures.

After completion of the analyses for each building, acceleration response spectra at key levels will be developed and compared with existing EHS lumped mass response spectra. The SEB position will then be applied to these results in order to assess the impact of the use of both methods of analyses to piping, equipment and components.

The FEM/EHS comparison of ARS will be used as a basis for design qualification of structures, systems and components at Grand Gulf.

NRC-SEB stated that if the FEM/EHS envelope exceeded the Grand Gulf EHS ARS envelope by a considerable amount, modifications to equipment or strengthening of structures may be required. If the EHS envelope is exceeded by less than a considerable amount, a discussion of conservatisms in the analyses will be provided. An explanation of how major differences, if observed, will be disposed will be provided to NRC.

The above stated analyses and comparisons will be completed and submitted to NRC by March 1, 1982. General statements regarding any modifications and associated schedules will also be provided. Specific modifications necessary will be completed before plant restart after the first regularly scheduled refueling outage.

III.B <u>REFERENCES</u>

1. MP&L letter AECM-81/333 dated August 28, 1981 (Dale to Denton).

2. FLUSH User's Manual

3. Bechtel Topical BC-TOP-4A, Rev. 3, Seismic Analysis of Structures and Equipment for Nuclear Power Plants, Approved by AEC, October 31, 1974.

4. Final Safety Analysis Report

5. LUSH User's Manual

6. SHAKE User's Manual