VERMONT YANKEE
NUCLEAR POWER CORPORATION

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REPLY TO
ENGINEERING OFFICE
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FRAMINGHAM, MASSACHUSETTS 01701
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July 10, 1985
FVY 85/64

United States Nuclear Regulatory Commission
Washington, DC 20555

ATTEN: Office of Nuclear Reactor Regulation
Mr. Domenic B. Vassallo, Chief
Operating Reactors Branch
Division of Licensing

References: (a) License Number DPR-28 (Docket Number 50-271)
(b) Letter, VYNPC to USNRC, FVY 85-36, dated April 22, 1985
(c) Letter, VYNPC to USNRC, FVY 85-43, dated May 14, 1985

Subject: Structural and Mechanical Aspects of Vermont Yankee Recirculation Piping Analysis

Dear Sir:

The following information is provided in response to your staff's recent request for additional information to assist in the review of Vermont Yankee's request to utilize ASME Code Case N-411 for analysis of the replacement recirculation system. The following discussion and enclosed Figures are provided in response to the request for a description of the coupled building model and spectra comparison.

Figure 1 is a cross-section view of the reactor building complex at Vermont Yankee. The reactor building complex consists of the reactor building, drywell, reactor pedestal, reactor shield wall, reactor pressure vessel and associated equipment.

The four primary structures are coupled at the 235.48ft. elevation and the 309.96ft. elevation. The recirculation system is supported off the reactor pressure vessel and reactor pedestal. The highest elevation in the recirculation system is approximately elevation 280ft.

The reactor building is the most massive of the structures, possessing over 96 percent of the total mass of the complex.

In the original design of Vermont Yankee, the designer made a simplifying assumption that the reactor building would be the driving force for seismic excitation of the recirculation system. A reactor building amplified response spectrum from elevation 280ft. at 0.5 percent damping was used as input to the recirculation system seismic analysis. A copy of the input spectrum for the original Design Basis Earthquake (comparable to what is currently termed the OBE) is attached as Figure 2. The Maximum Hypothetical Earthquake was exactly twice the DBE. As discussed in Reference (c), the original seismic analysis consisted of one horizontal earthquake coupled with a 0.05g (or 0.10g for the MHE) vertical earthquake. The model used for developing the original ARS is shown as Figure 3.

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1/1

The NRC currently allows more realistic damping values to be used for seismic analyses. Although we wanted to take advantage of the more realistic equipment damping we felt it would be inappropriate to do so if we did not assess the effect, if any, of the original simplifying assumption relative to the use of the reactor building as the input to the recirculation system seismic analysis. We concluded that the assumption would be accurate if there was no secondary amplification by the reactor vessel and pedestal, and could be non-conservative if there was secondary amplification. We discussed the issue with several organizations experienced in the analysis of BWR structures. The consensus was that 1) the assumption could be non-conservative, 2) the degree of non-conservation was probably small, 3) the actual magnitude would be plant specific, and 4) the extreme conservatism resulting from using one-half percent damping would more than compensate for any non-conservatism.

Thus, we concluded that in order to maintain the intended margins of safety we should develop a more accurate structural model to obtain amplified response spectra at the reactor pressure vessel, which is the true input to the recirculation system. A copy of the model used is attached as Figure 4.

A comparison of amplified response spectra at the same elevation from the reactor building and the reactor vessel indicate that the response at the reactor vessel is higher than the reactor building. See Figures 5 and 6.

Figure 7 is an ARS developed using ASME Code Case N-411. It was developed for the jet pump inlet nozzles, and is at the same elevation as Figure 5.

Figures 2,5,6, and 7 are all based upon a Taft earthquake at five (5) percent structural damping, to allow a consistent basis for comparison.

Figure 8 is equivalent to Figure 7, except it was developed using an NRC Reg Guide 1.60 ground response. (As discussed in Reference (c), R.G. 1.60 was used for the analysis of the replacement recirculation system.) Figure 9 shows that the R.G. 1.60 input is conservative with respect to the Taft earthquake at all frequencies greater than 3Hz. Since the primary structural response at Vermont Yankee is greater than 4Hz the new input bounds the FSAR requirements.

In conclusion, we feel that from an engineering standpoint, the non-conservatism resulting from neglecting the secondary amplification of the reactor pressure vessel is inconsequential for the original design, given the very conservative assumption of one-half percent equipment damping. However, we have chosen to adopt the more conservative input in order to allay any concerns about reduction of margin when utilizing "PVRC" damping.

Furthermore, in response to the recent request for clarification of the statement contained in our May 14, 1984 letter (Reference (c)), please be advised that the acceptance criteria to ensure, "...that adequate clearance exists to allow for all piping displacements" includes a review to ensure that mounted equipment can withstand any increased motion due to the increased flexibility of the system.

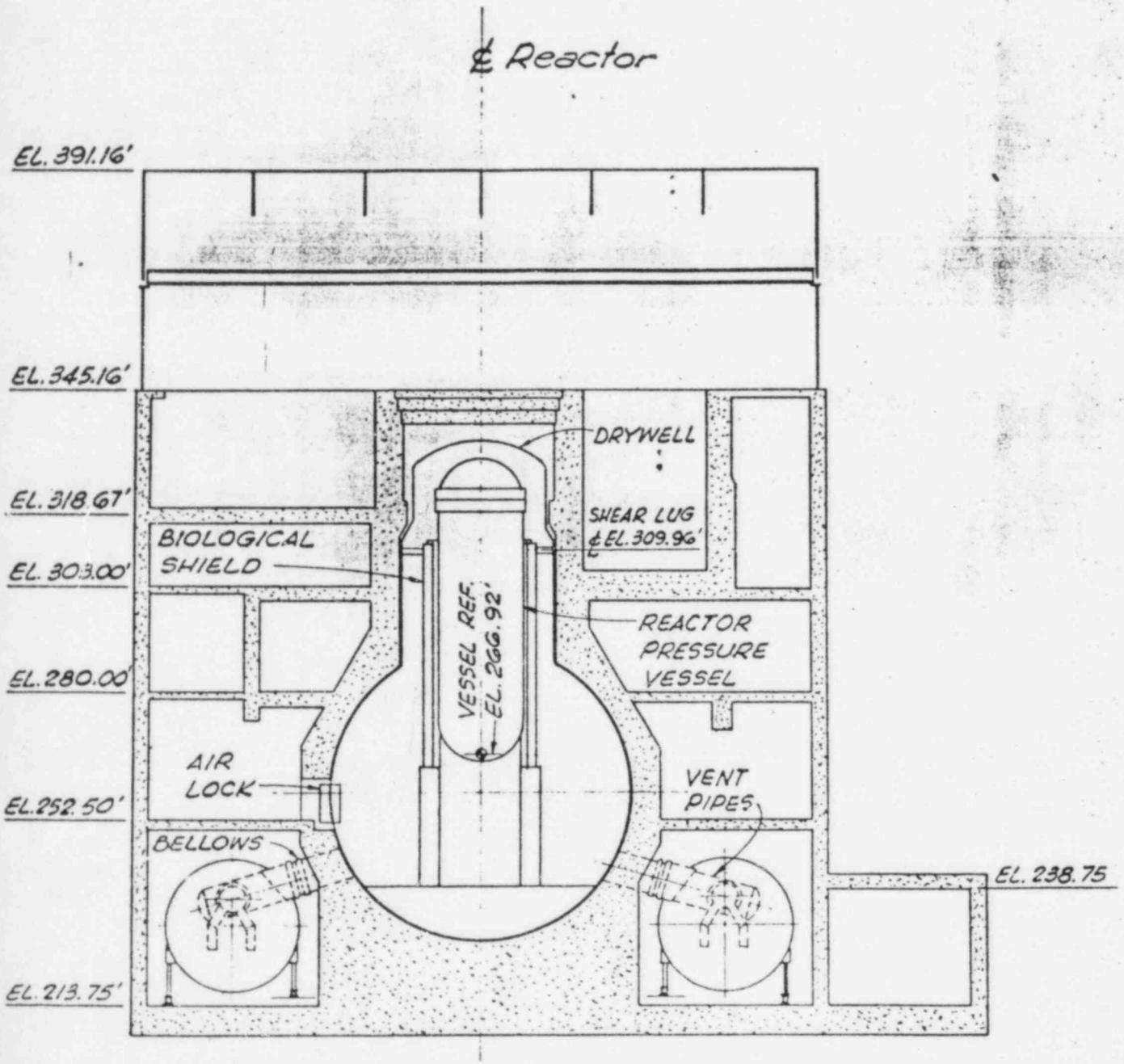
We trust this information is adequate to allow you to perform your review. Should you have any additional questions, please contact Mr. J.R. Hoffman at the Framingham Office.

Very truly yours,
Vermont Yankee Nuclear Power Corporation

Andrew C Kidak for

R.W. Capstick
Licensing Engineer

RWC/1b



LONGITUDINAL SECTION

FIGURE 1

VERMONT YANKEE
NUCLEAR POWER STATION
FINAL SAFETY ANALYSIS REPORT

MASS POINT 7
RESPONSE ACCELERATION SPECTRUM
DAMPING RATIO 0.005

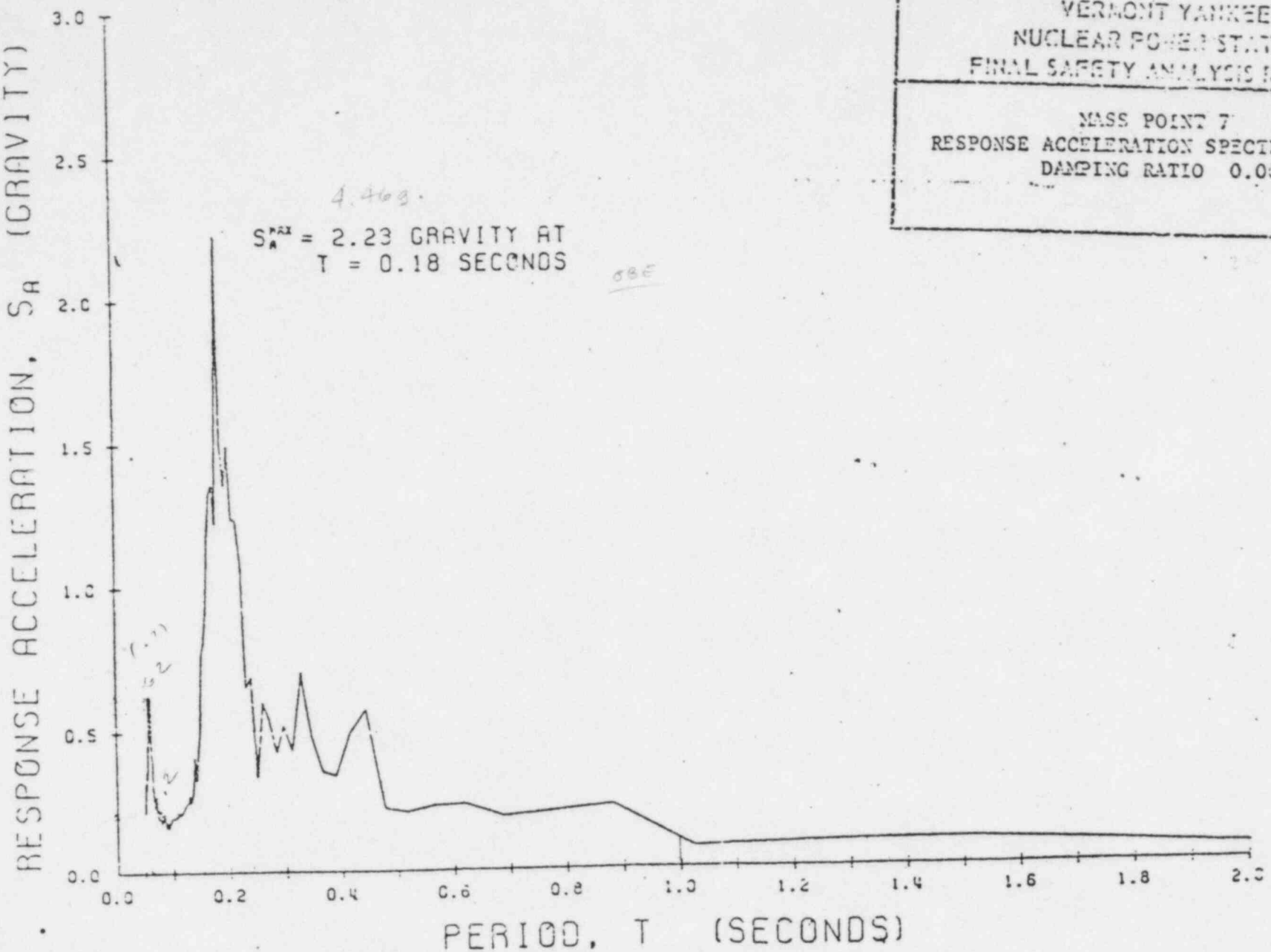
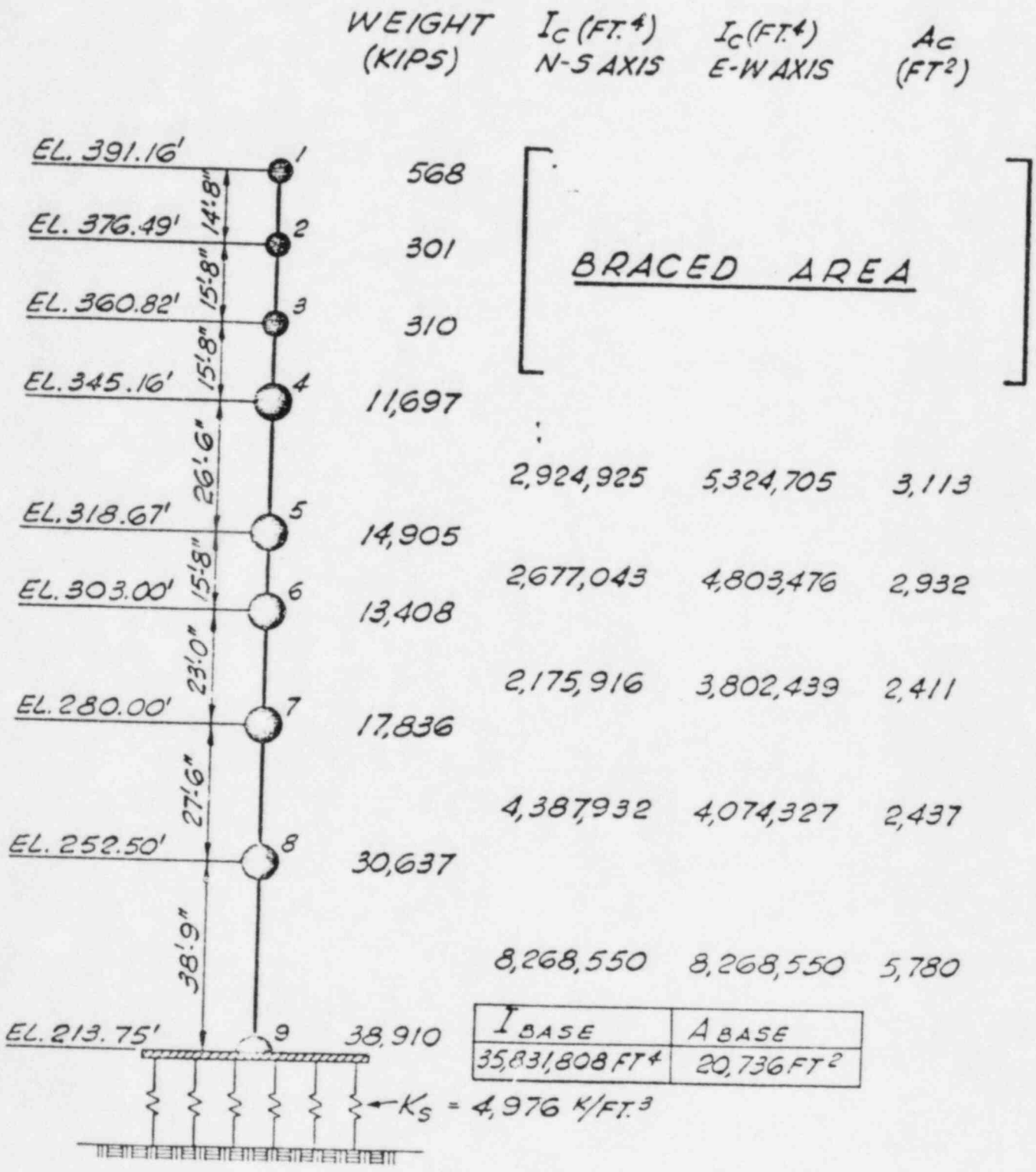
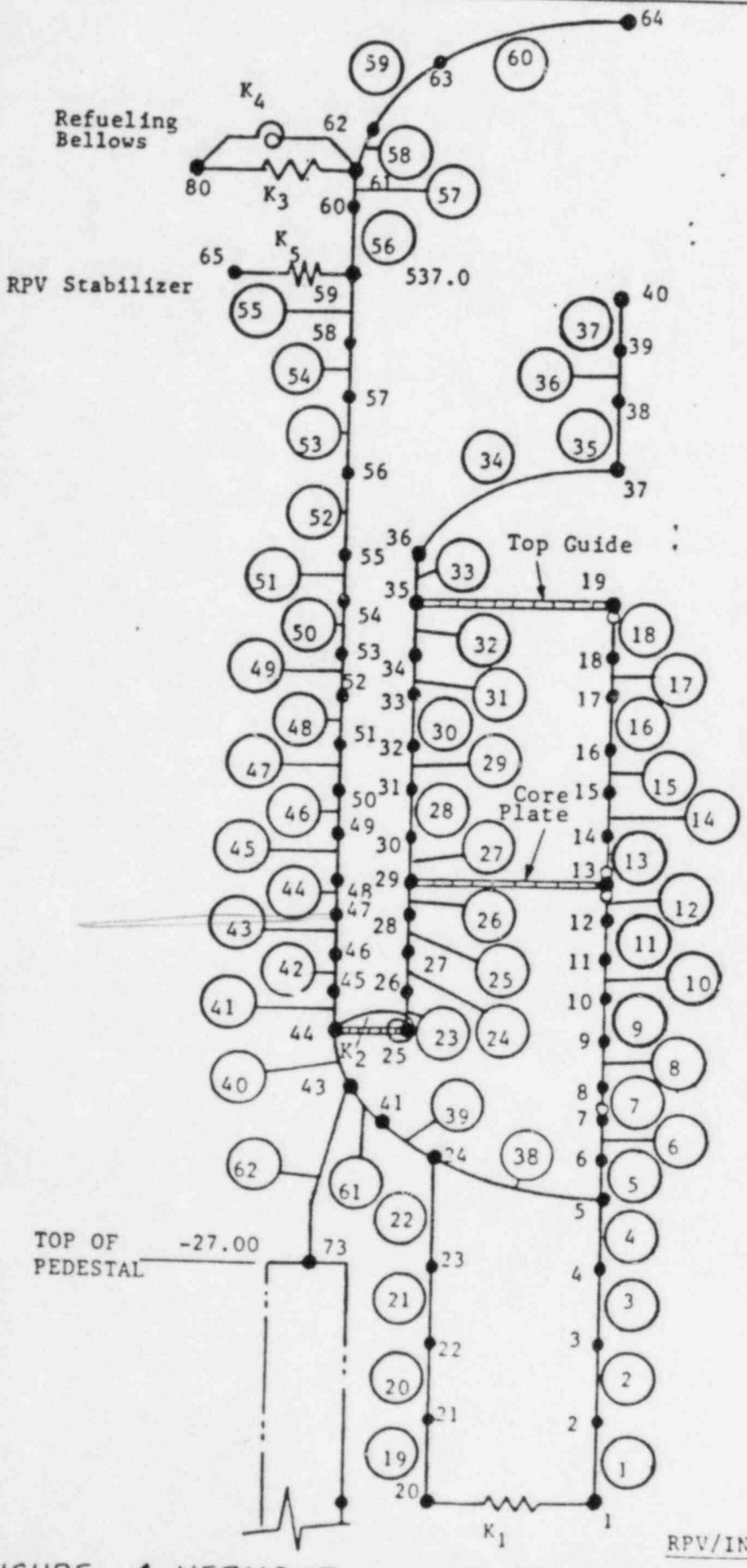


FIGURE 2



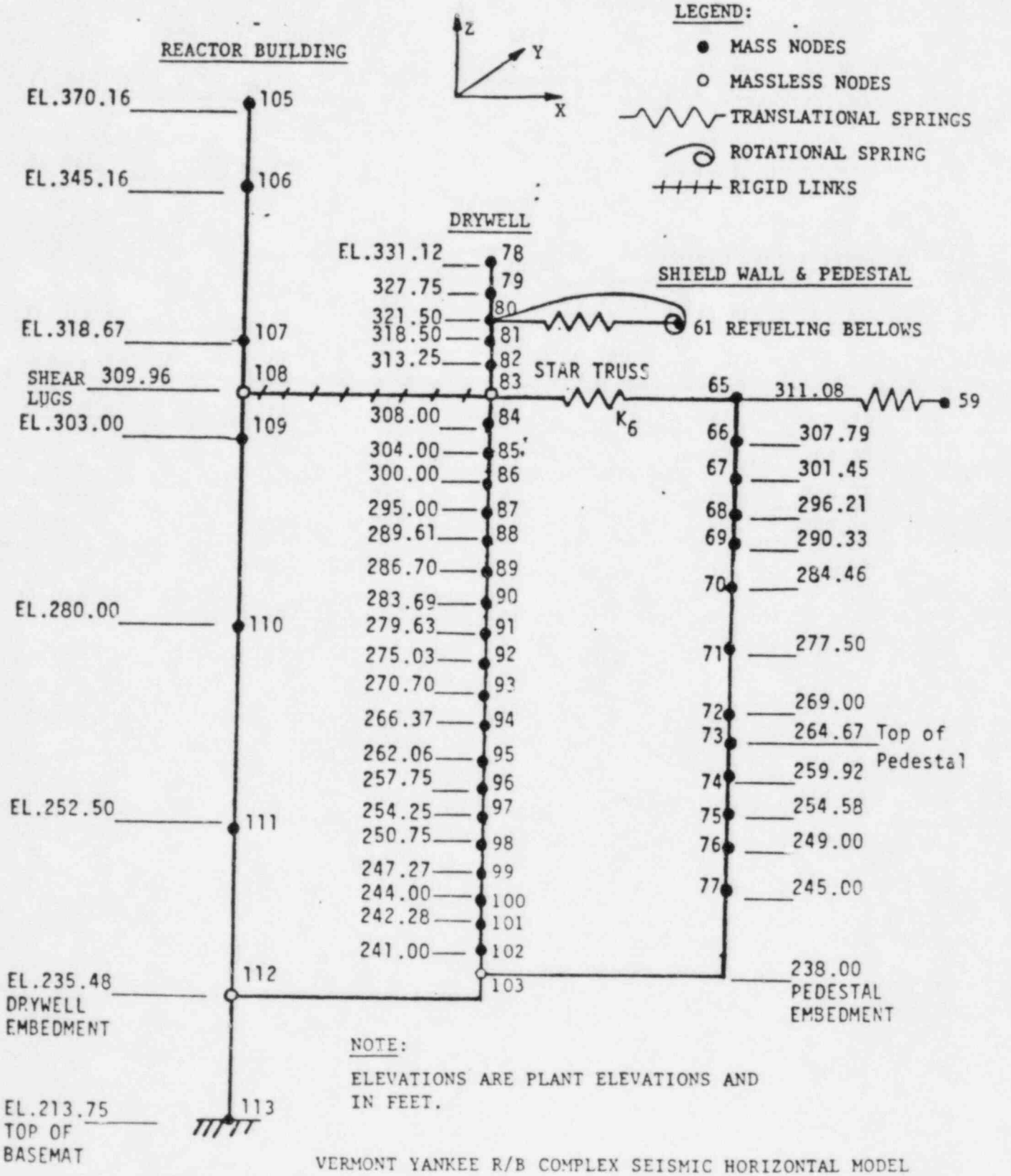
MATHEMATICAL MODEL

FIGURE 3



RPV/INTERNALS HORIZONTAL MODEL

FIGURE 4 VERMONT YANKEE REACTOR BUILDING COMPLEX SEISMIC



NOTE:

ELEVATIONS ARE PLANT ELEVATIONS AND IN FEET.

VERMONT YANKEE R/B COMPLEX SEISMIC HORIZONTAL MODEL

FIGURE 4 (CONTINUED)

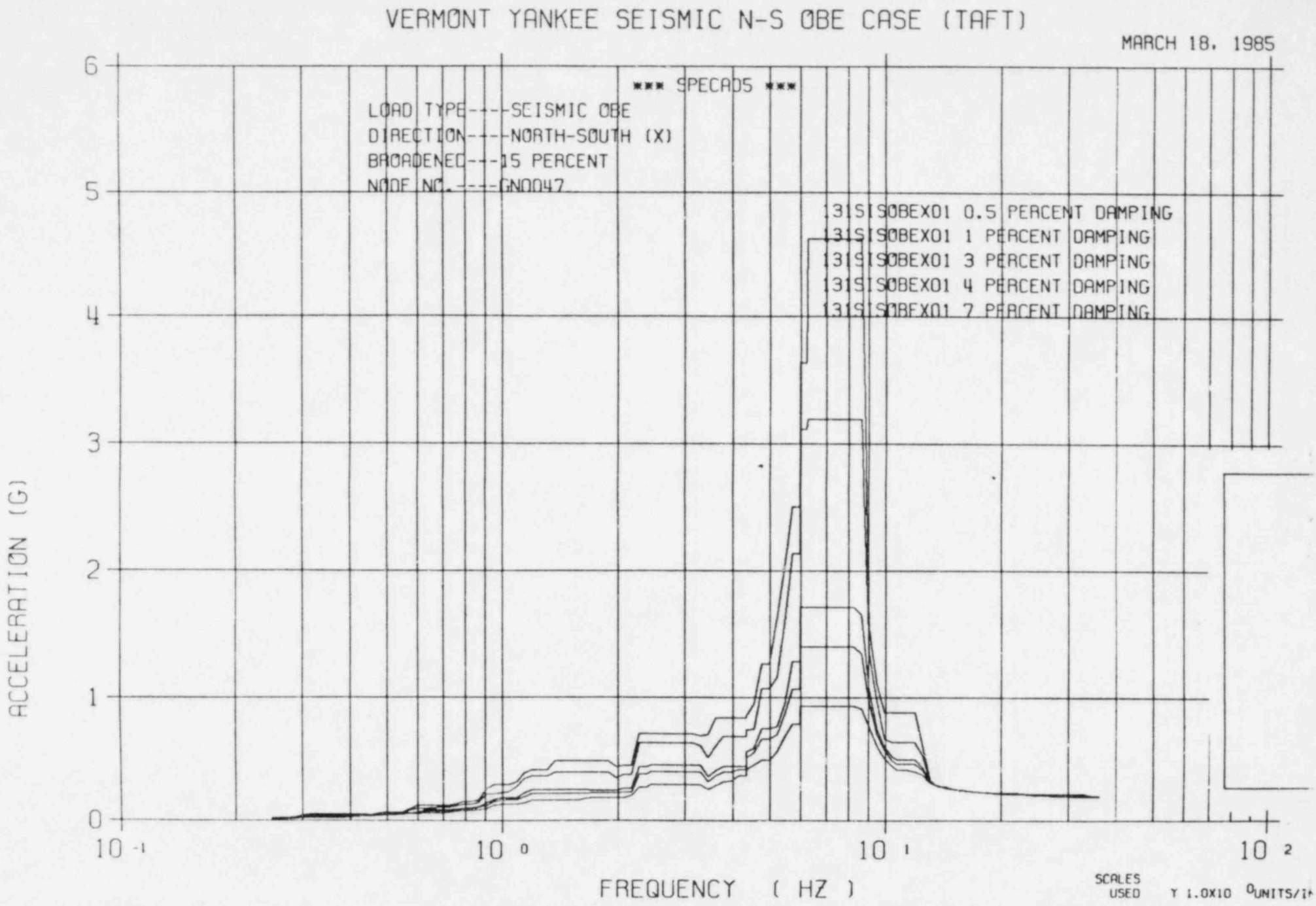

VERMONT YANKEE SEISMIC N-S OBE CASE (TAFT)
MARCH 18, 1985
*** SPECAD5 ***
LOAD TYPE----SEISMIC OBE
DIRECTION----NORTH-SOUTH (X)
BROADENED---15 PERCENT
NODE NO.----GN0047
131SISOBEX01 0.5 PERCENT DAMPING
131SISOBEX01 1 PERCENT DAMPING
131SISOBEX01 3 PERCENT DAMPING
131SISOBEX01 4 PERCENT DAMPING
131SISOBEX01 7 PERCENT DAMPING
ACCELERATION (G)
FREQUENCY (HZ)
SCALES USED
Y 1.0X10 0 UNITS/I

FIGURE 5

PL 1

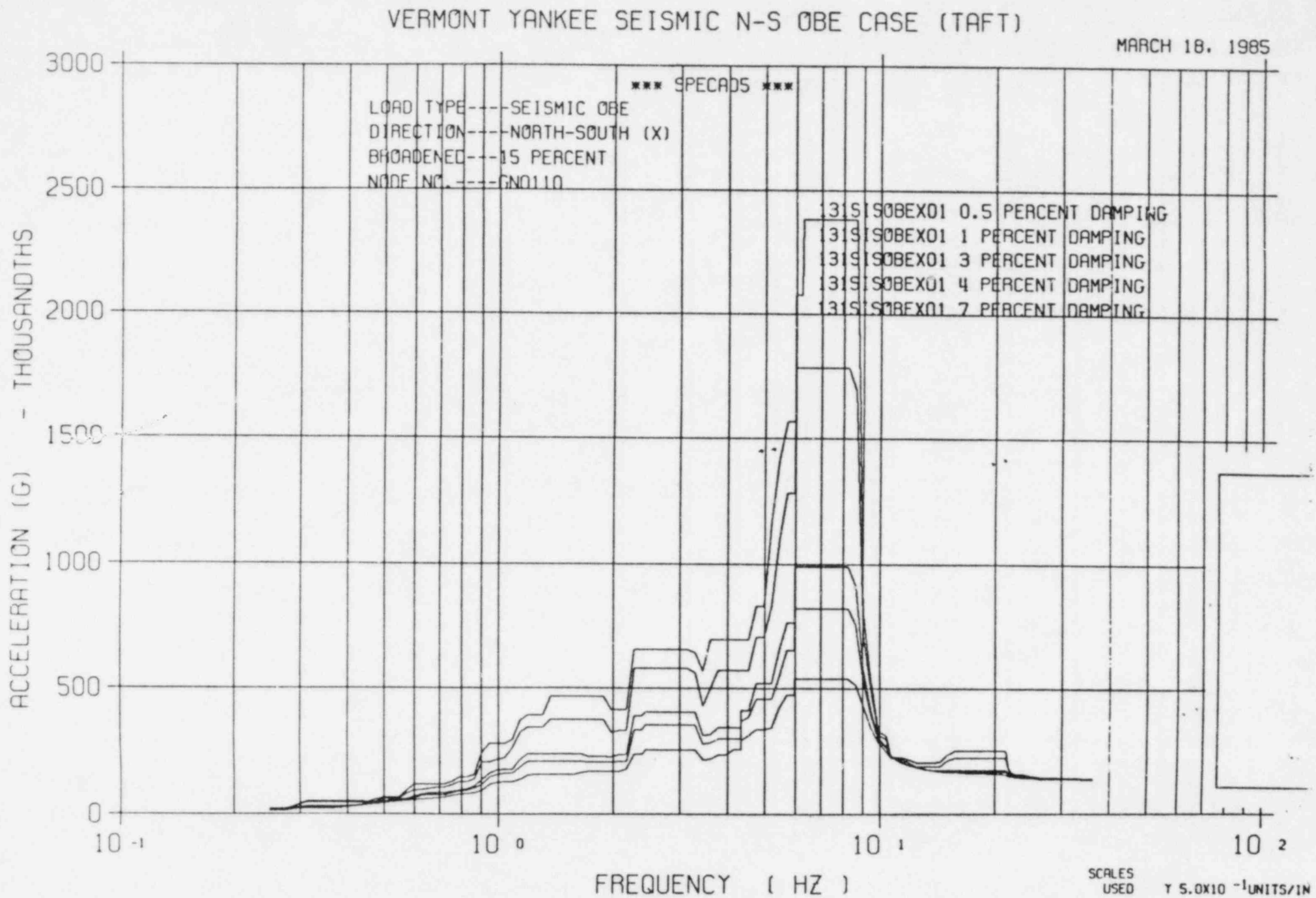

VERMONT YANKEE SEISMIC N-S OBE CASE (TAFT)
MARCH 18. 1985
*** SPECADS ***
LOAD TYPE----SEISMIC OBE
DIRECTION----NORTH-SOUTH (X)
BROADENED---15 PERCENT
NODE NO.----GN0110
131SISOBEX01 0.5 PERCENT DAMPING
131SISOBEX01 1 PERCENT DAMPING
131SISOBEX01 3 PERCENT DAMPING
131SISOBEX01 4 PERCENT DAMPING
131SISOBEX01 7 PERCENT DAMPING
ACCELERATION (G) - THOUSANDTHS
3000
2500
2000
1500
1000
500
0
10 -1
10 0
10 1
10 2
FREQUENCY (HZ)
SCALES USED
Y 5.0X10 -1 UNITS/IN

FIGURE 6

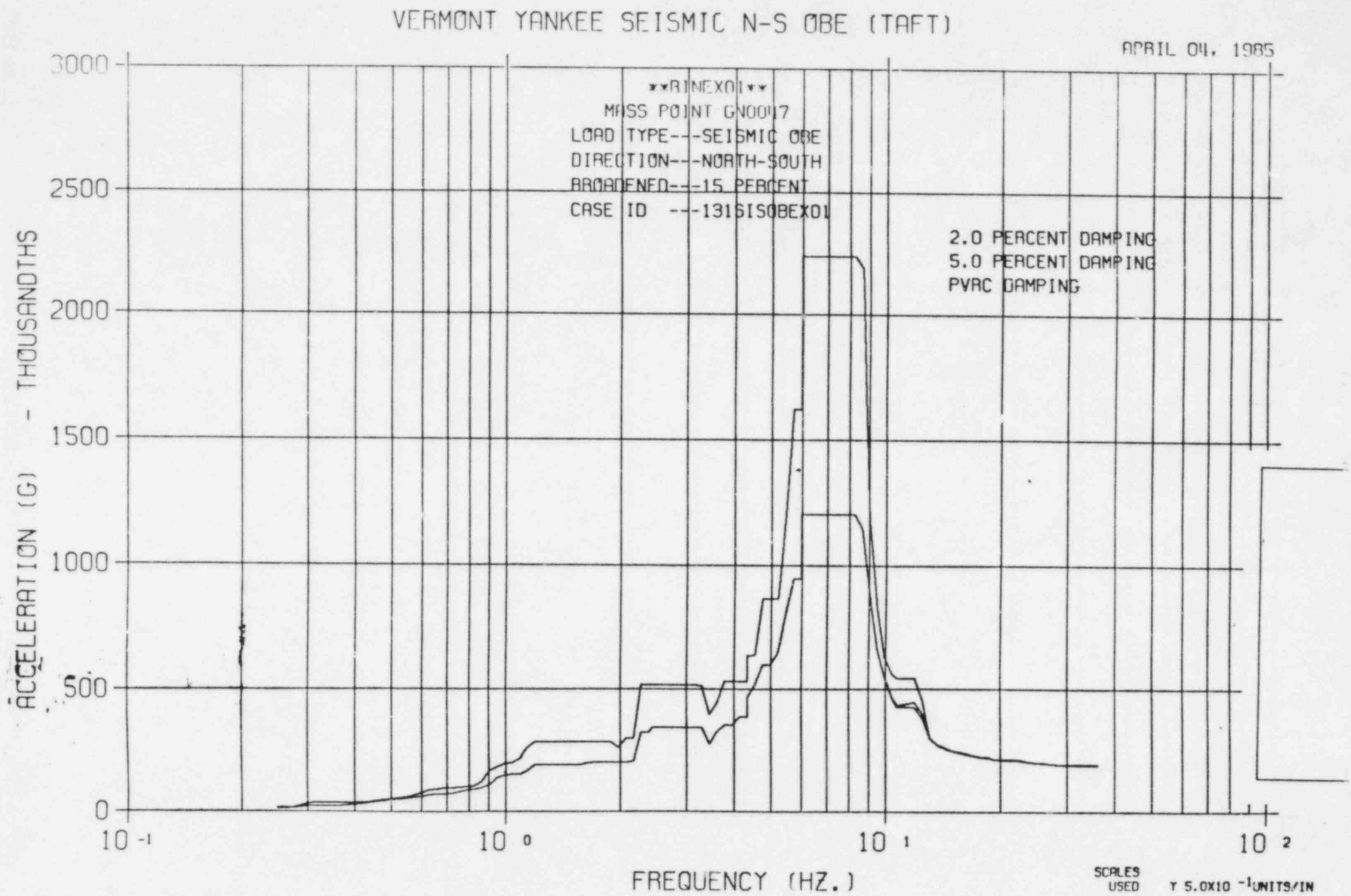

VERMONT YANKEE SEISMIC N-S OBE (TAFT)
APRIL 04, 1985
RINEXO1
MASS POINT GN0017
LOAD TYPE---SEISMIC OBE
DIRECTION---NORTH-SOUTH
BROADENED---15 PERCENT
CASE ID ---1316ISOBEX01
2.0 PERCENT DAMPING
5.0 PERCENT DAMPING
PVRC DAMPING
ACCELERATION (G) - THOUSANDTHS
3000
2500
2000
1500
1000
500
0
10 -1
10 0
10 1
10 2
FREQUENCY (HZ.)
SCALES USED
Y 5.0X10 -1 UNITS/IN

FIGURE 7

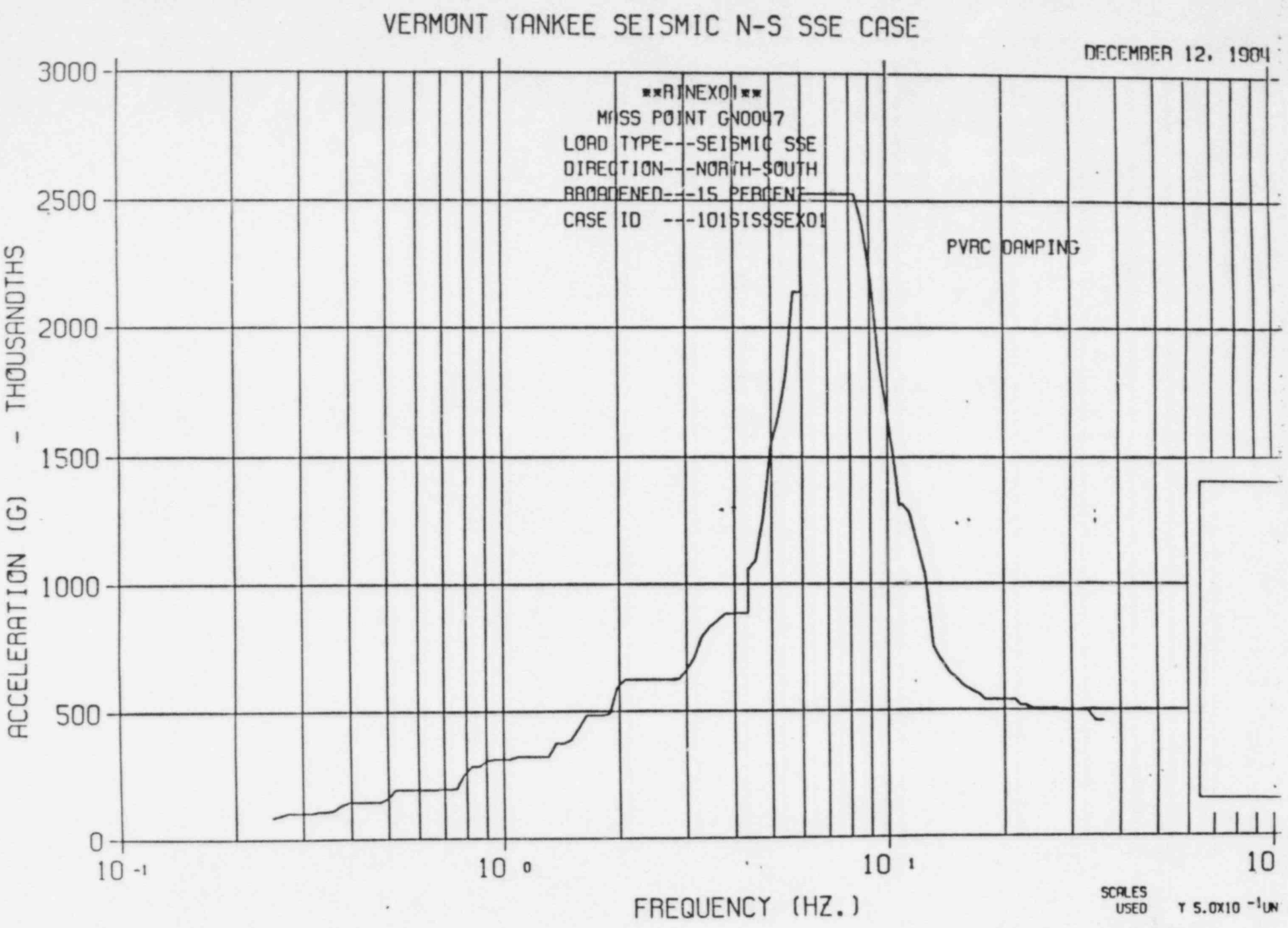

VERMONT YANKEE SEISMIC N-S SSE CASE
DECEMBER 12, 1984
RINEXO1
MASS POINT GN0047
LOAD TYPE---SEISMIC SSE
DIRECTION---NORTH-SOUTH
BROADENED---15 PERCENT
CASE ID ---101SISSSEX01
PVRC DAMPING
ACCELERATION (G) - THOUSANDTHS
3000
2500
2000
1500
1000
500
0
10 -1
10 0
10 1
10
FREQUENCY (HZ.)
SCALES USED
Y 5.0X10 -1 UN

FIGURE 8

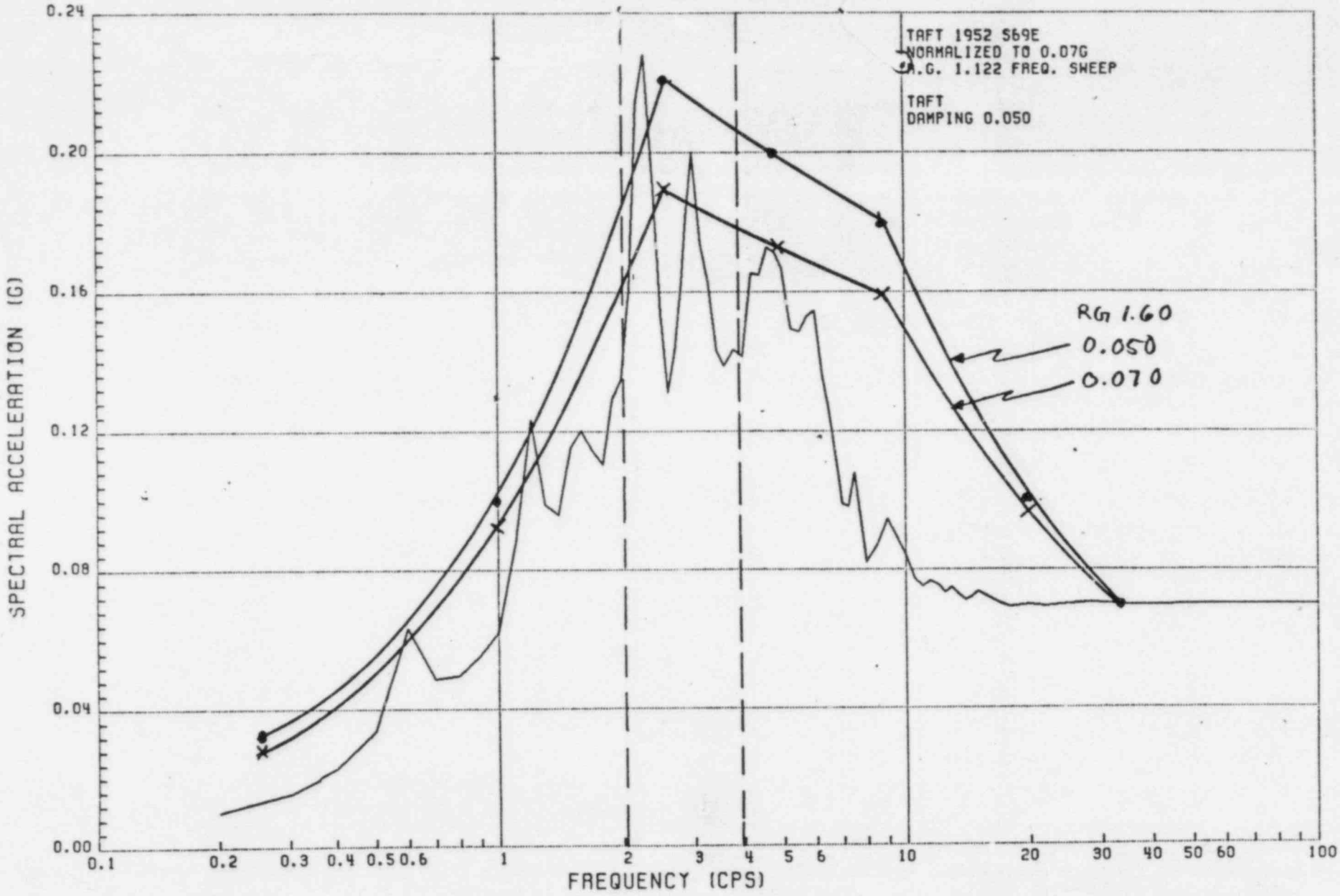

TAFT 1952 S69E
NORMALIZED TO 0.07G
M.G. 1.122 FREQ. SWEEP
TAFT
DAMPING 0.050
RG 1.60
0.050
0.070
SPECTRAL ACCELERATION (G)
FREQUENCY (CPS)
0.00
0.04
0.08
0.12
0.16
0.20
0.24
0.1
0.2
0.3
0.4
0.5
0.6
1
2
3
4
5
6
10
20
30
40
50
60
100

FIGURE 9