PROCESSED DATA FROM THE STRONG-MOTION RECORDS OF THE SANTA BARBARA EARTHQUAKE OF 13 AUGUST 1978

FINAL RESULTS

1979

CALIFORNIA DIVISION OF MINES AND GEOLOGY

SPECIAL REPORT 144
VOLUME 2

STATE OF CALIFORNIA
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SPECIAL REPORT 144

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FINAL RESULTS

1979

IN THREE VOLUMES

By

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FREITAS BUILDING

Freitas Building (Figure 6) is a four-story steel and reinforced concrete office building constructed in 1970 at 200 East Carrillo Street, Santa Barbara, California. A partial basement extends under the west side of the structure. The building is located 5.84 km from the epicenter of the 13 August 1978 Santa Barbara earthquake at an epicenter-station azimuth of 18.34°.

The building (Figures 7 and 8) is generally rectangular with overall plan dimensions of 109 ft. 5 in. by 137 ft. 6 in. and an overall height of 53 ft. 0 in. The lateral load resisting system in both directions is composed of full-height reinforced concrete shear walls. The vertical load carrying system includes a metal deck on steel beams and columns. The fill over the metal deck is 2.5 in. concrete on the floor and light-weight insulation fill on the roof. The foundation is spread footings under columns and walls with concrete caissons at the ends of the concrete shear walls.

Remote accelerometers were placed at the roof, second floor and basement at the locations shown in Figures 7 and 8. All accelerations were recorded simultaneously on 7 in. wide film by a central recorder located in the basement. The building was instrumented in accordance with the procedures developed at the U.S. Geological Survey Seismic Engineering Branch (Rojahn and Matthiesen, 1977).

The digitized uncorrected accelerograms, corrected accelerations, velocity, displacement plots and spectra are shown on pages 6 through 80. Peak north-south (NS) corrected accelerations were 0.29 g at the roof, 0.15 g at the second floor and 0.12 g at the basement level. Peak east-west (EW) corrected accelerations were 0.55 g at the roof, 0.28 g at the second floor and 0.23 g at the basement level. In general the EW accelerations were greater than NS accelerations at all levels. Visible damage to the structure was limited to fine cracks in the lower portion of reinforced concrete shear walls.

TABLE II

Recorder Information, Freitas Building

Instrument Type: Kinemetrics CRA-1
Serial Number 158
Installed 18 March 1977

Film installed: 18 April 1978 Recovered: 14 August 1978

Trace*	Orientation (floor/loc.)	Sensitivity † (mm/g)	Zero Signal A°	Galvanometer Angles deflection for + 1 g B°+	deflection for - 1 g B-	Period (sec)	Crit. Damp. %
1	N (roof/core)	17.4	6.55	5.52	5.51	.01961	62.1
2	E (2nd/core)	17.3	2.58	5.59	5.52	.01912	66.7
3	E (bsmt/W end)	17.4	-1.51	5.70	5.55	.01972	64.6
4	E (roof/core)	17.7	0.90	5.75	5.65	.01988	64.0
5	N (roof/W end)	18.0	-3.86	5.71	5.81	.02062	59.1
6	N (2nd/core)	17.8	-1.93	5.70	5.74	.02008	62.5
7	N (2nd/W end)	1.81	-6.07	5.81	5.72	.01916	65.4
8	N (bsmt/W end)	18.1	-4.09	5.84	5.73	.01916	65.2
9	UP (bsmt/W end)	17.6	-8.00	5.72	5.83	.01969	64.6

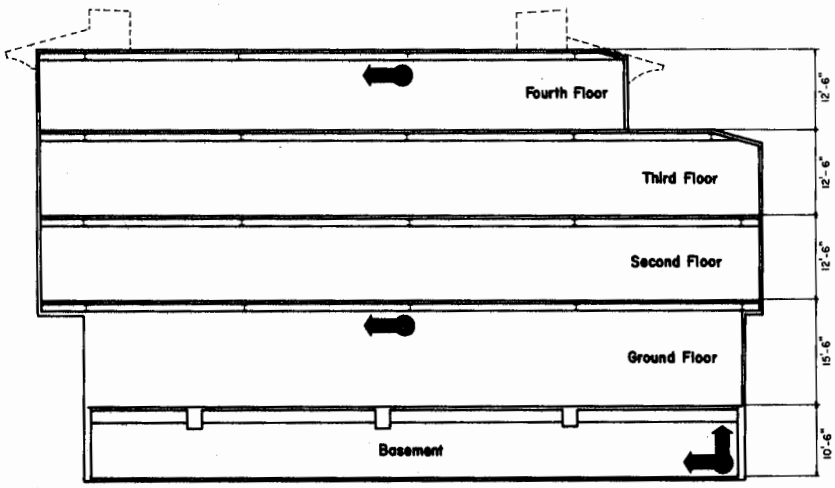
* Trace numbers coincide with accelerometer numbers on Figures 7 and 8.

† Sensitivities which may be used prior to taking into account the oblique-angle recording geometry.

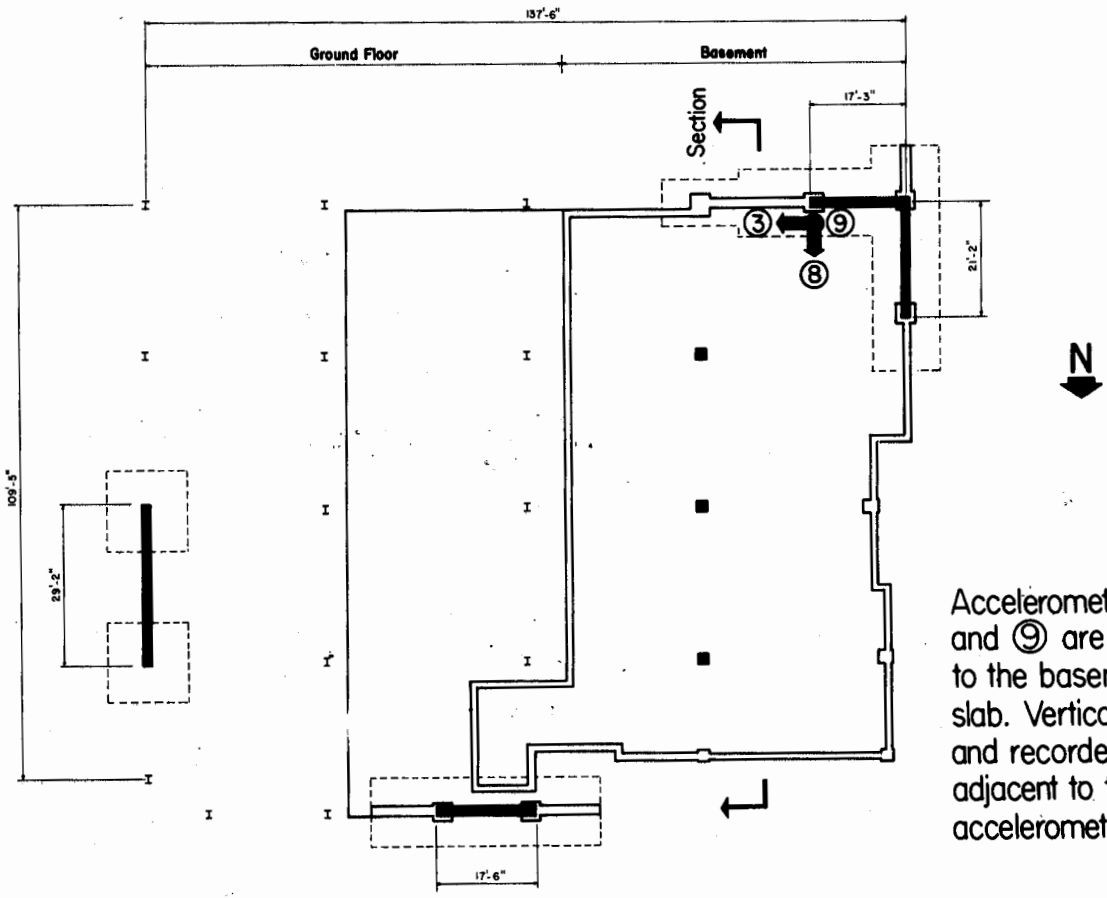
a.

b.

Figure 6. Freitas Building showing north view (a) and west view (b) of the structure.



Section



Accelerometers ③, ⑧ and ⑨ are attached to the basement floor slab. Vertical starter and recorder are located adjacent to these accelerometers.

Ground Floor and Basement Plan

Figure 7. Section and Plan of Freitas Building, Santa Barbara, California

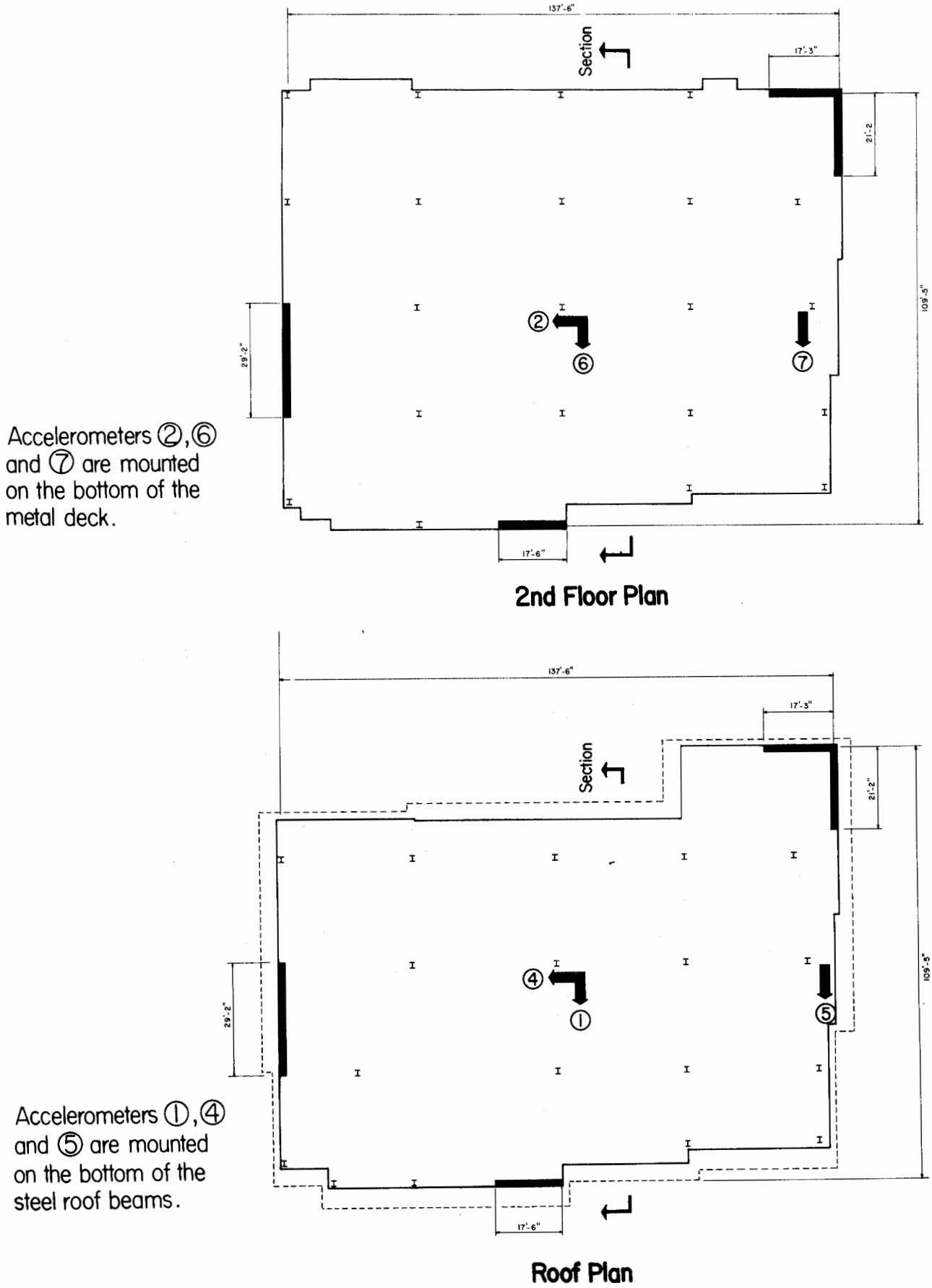
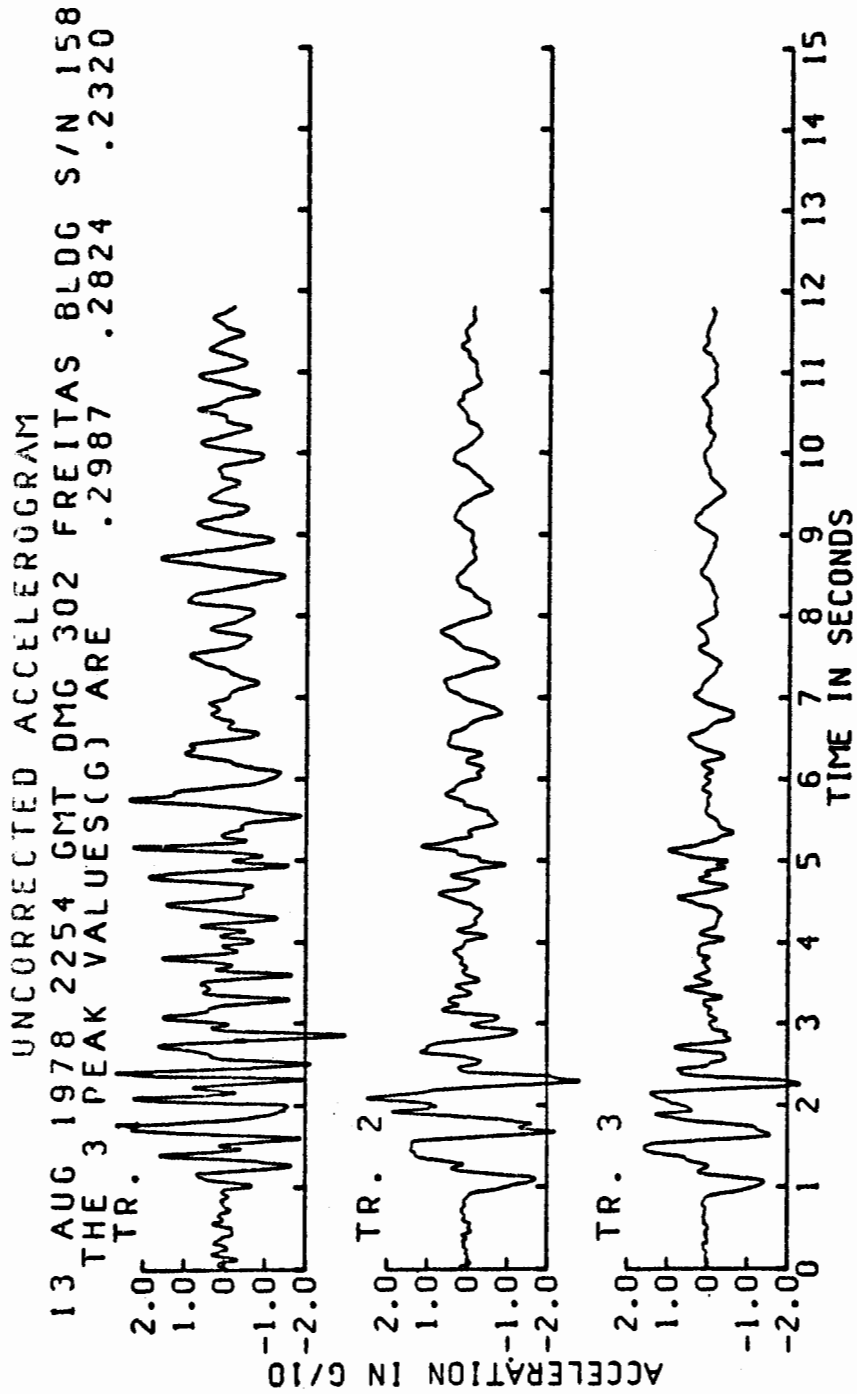
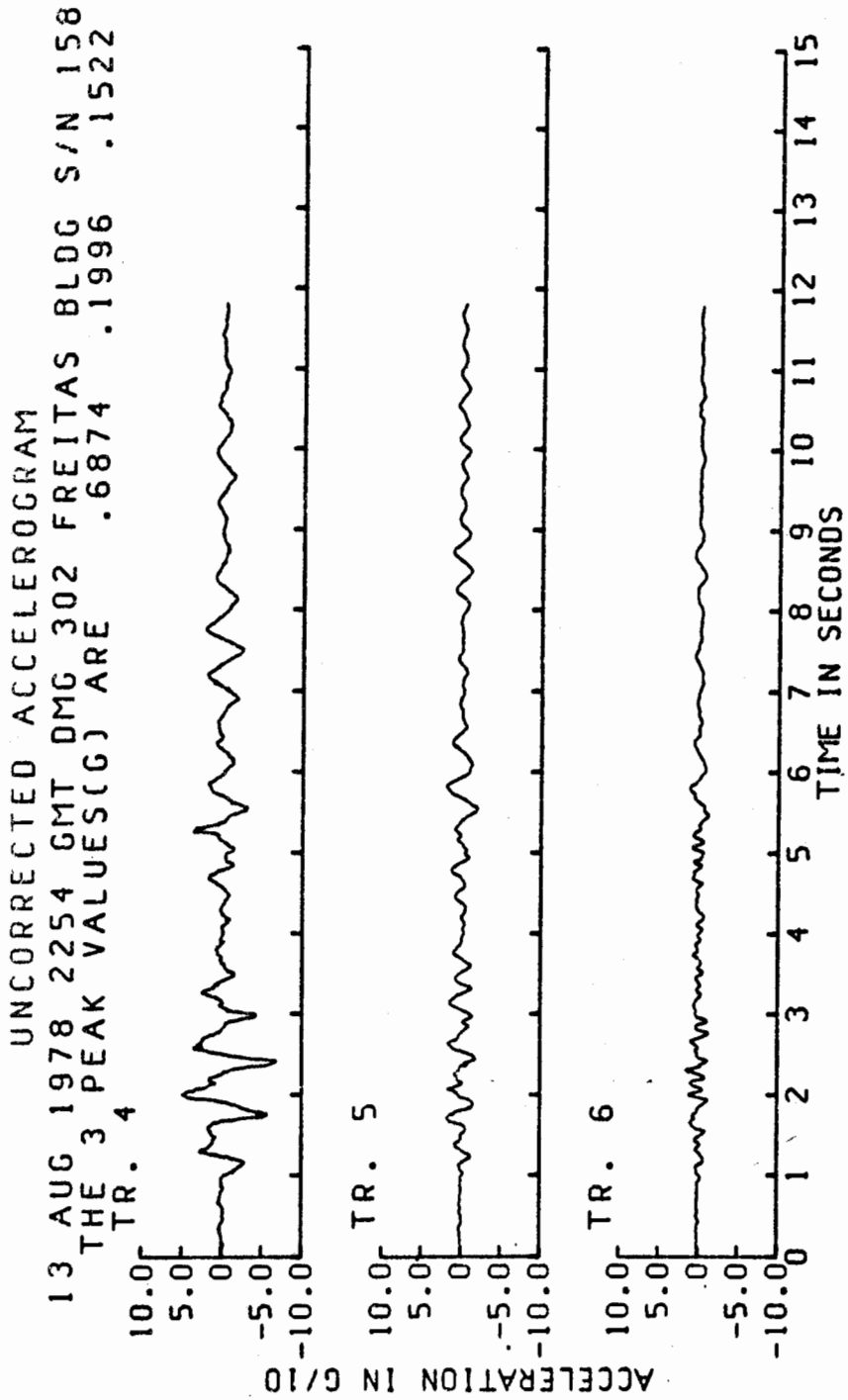
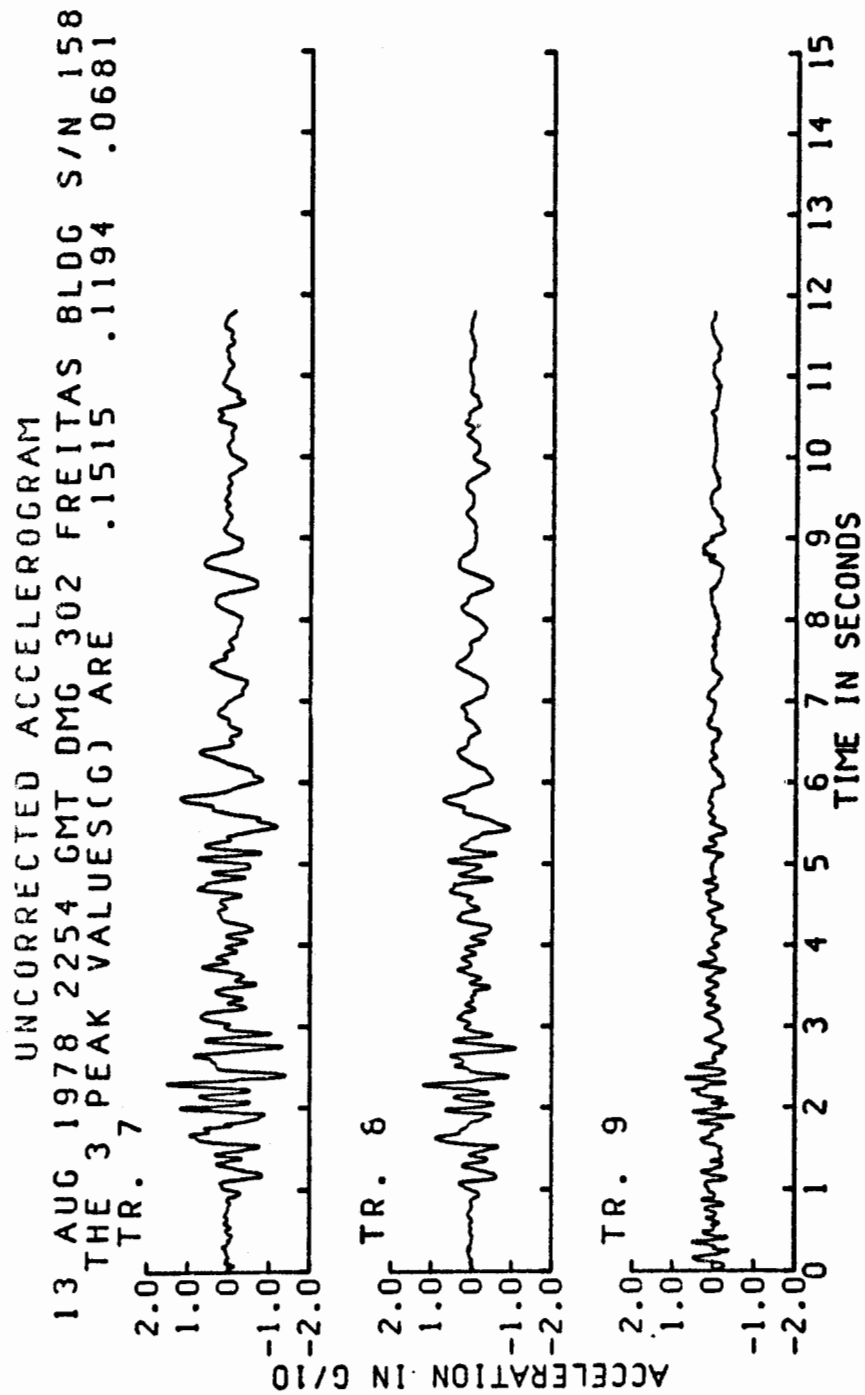


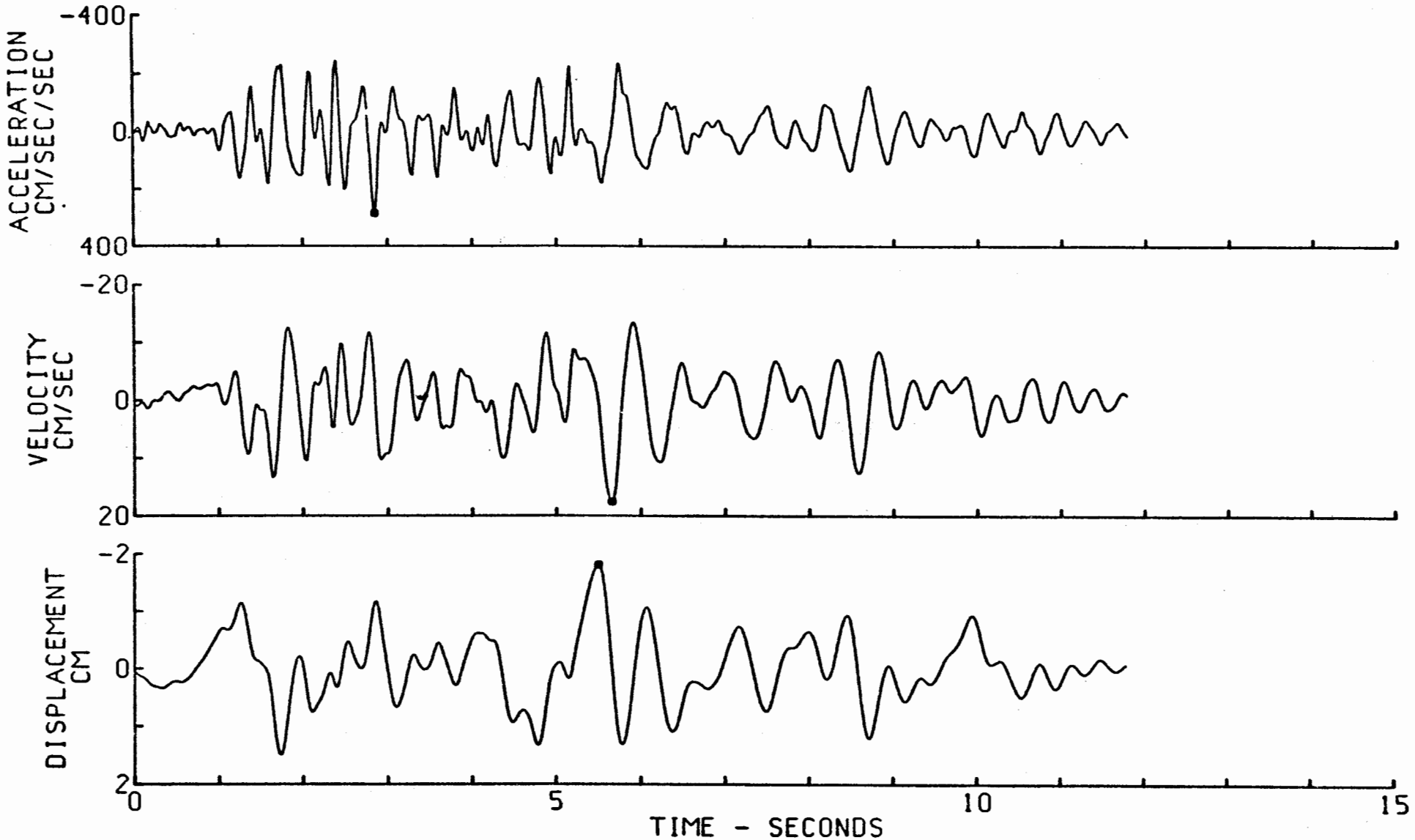
Figure 8. Plans of the Freitas Building, Santa Barbara, California


UNCORRECTED ACCELEROGRAM
13 AUG 1978 2254 GMT DMG 302 FREITAS BLDG S/N 158
THE 3 PEAK VALUES(G) ARE .2987 .2824 .2320
TR. 1
TR. 2
TR. 3
2.0
1.0
0
-1.0
-2.0
ACCELERATION IN G/10
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
TIME IN SECONDS

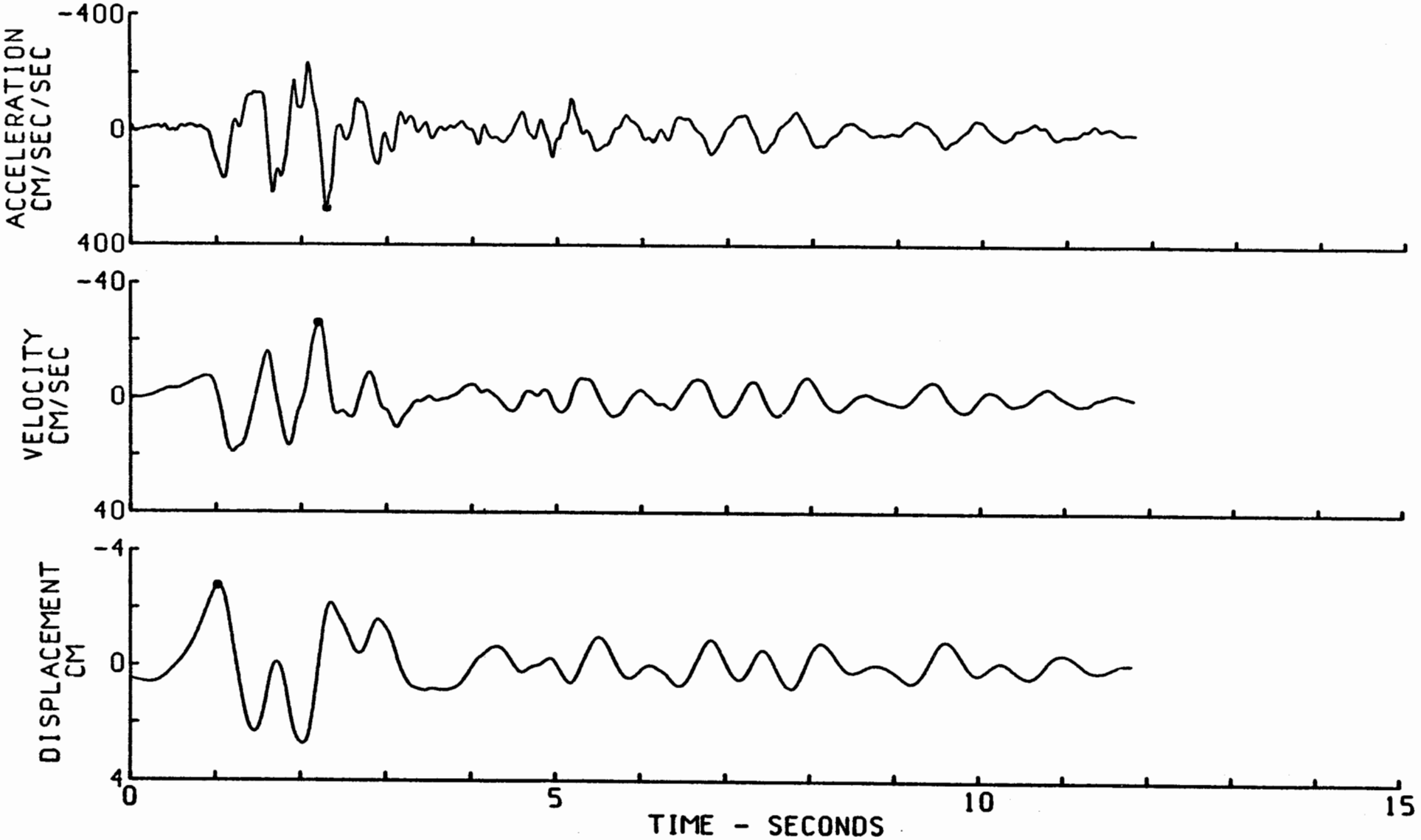

UNCORRECTED ACCELEROGRAM
13 AUG 1978 2254 GMT DMG 302 FREITAS BLDG S/N 158
THE 3 PEAK VALUES(G) ARE .6874 .1996 .1522
TR. 4
TR. 5
TR. 6
10.0
5.0
0
-5.0
-10.0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
TIME IN SECONDS
ACCELERATION IN G/10


UNCORRECTED ACCELEROGRAM
13 AUG 1978 2254 GMT DMG 302 FREITAS BLDG S/N 158
THE 3 PEAK VALUES(G) ARE .1515 .1194 .0681
TR. 7
TR. 6
TR. 9
2.0
1.0
0
-1.0
-2.0
ACCELERATION IN G/10
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
TIME IN SECONDS

CORRECTED ACCELERATION,VELOCITY,DISPLACEMENT
SANTA BARBARA EARTHQUAKE OF 13 AUGUST 1978 2254 GMT
DMG 302 SANTA BARBARA FREITAS BLDG S/N 158 TR. 1
DATA IS PLOTTED AT EQUAL TIME INCREMENTS OF .02000 SEC
ACCELEROGRAM IS BAND PASS FILTERED BETWEEN .200 - .500 AND 23.00 - 25.00 CYC/SEC
• PEAK VALUES ACCEL=284.1 CM/SEC/SEC,VELOCITY=17.52 CM/SEC,DISPL=-1.800 CM



CORRECTED ACCELERATION,VELOCITY,DISPLACEMENT
SANTA BARBARA EARTHQUAKE OF 13 AUGUST 1978 2254 GMT
DMG 302 SANTA BARBARA FREITAS BLDG S/N 158 TR. 2
DATA IS PLOTTED AT EQUAL TIME INCREMENTS OF .02000 SEC
ACCELEROGRAM IS BAND PASS FILTERED BETWEEN .200 - .500 AND 23.00 - 25.00 CYC/SEC
• PEAK VALUES ACCEL=270.3 CM/SEC/SEC,VELOCITY=-26.01 CM/SEC,DISPL=-2.750 CM



CORRECTED ACCELERATION,VELOCITY,DISPLACEMENT
SANTA BARBARA EARTHQUAKE OF 13 AUGUST 1978 2254 GMT
DMG 302 SANTA BARBARA FREITAS BLDG S/N 158 TR. 3
DATA IS PLOTTED AT EQUAL TIME INCREMENTS OF .02000 SEC
ACCELEROGRAM IS BAND PASS FILTERED BETWEEN .200 - .500 AND 23.00 - 25.00 CYC/SEC
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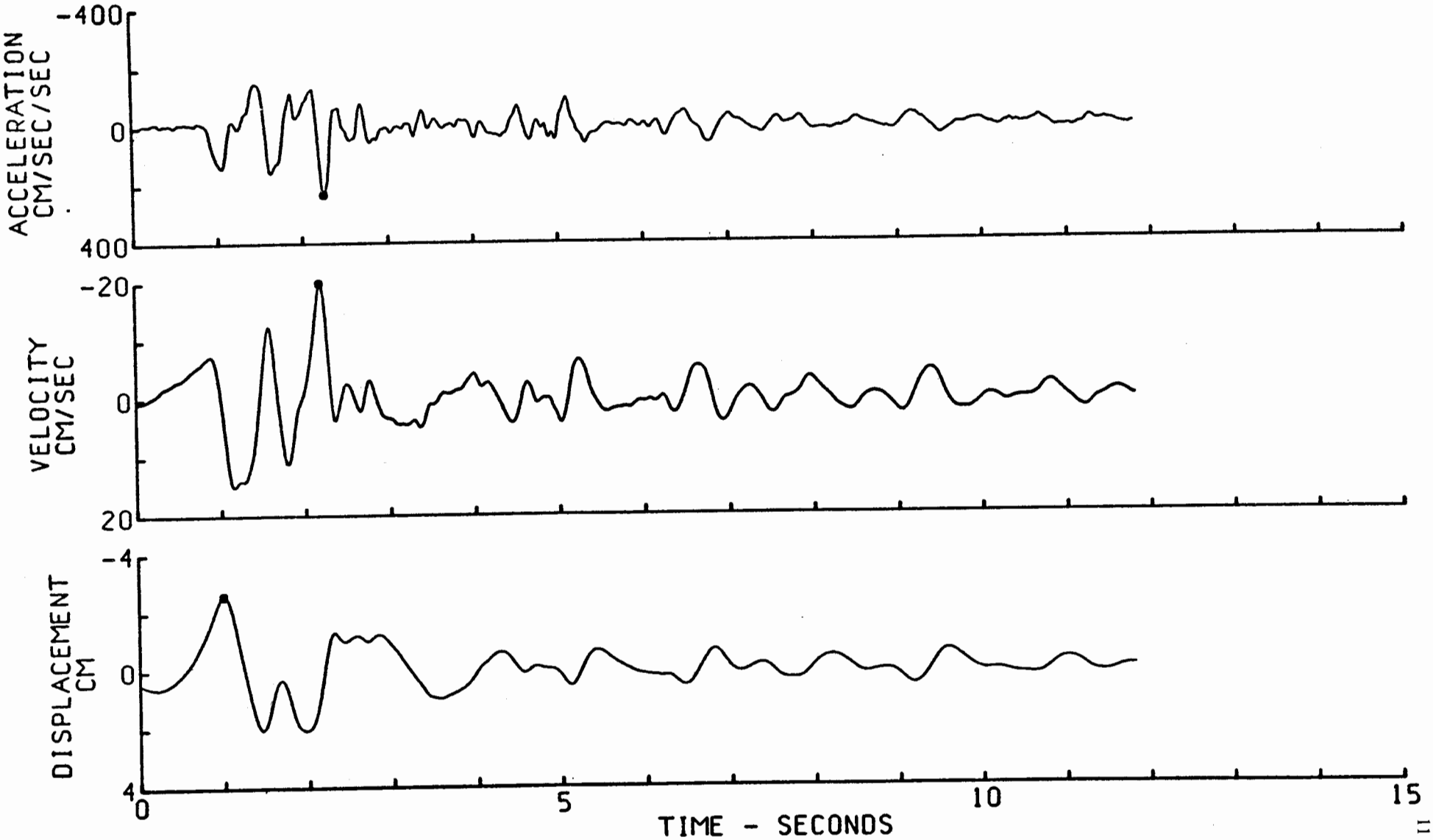

CORRECTED ACCELERATION,VELOCITY,DISPLACEMENT
SANTA BARBARA EARTHQUAKE OF 13 AUGUST 1978 2254 GMT
DMG 302 SANTA BARBARA FREITAS BLDG S/N 158 TR. 4
DATA IS PLOTTED AT EQUAL TIME INCREMENTS OF .02000 SEC
ACCELEROGRAM IS BAND PASS FILTERED BETWEEN .200 - .500 AND 23.00 - 25.00 CYC/SEC
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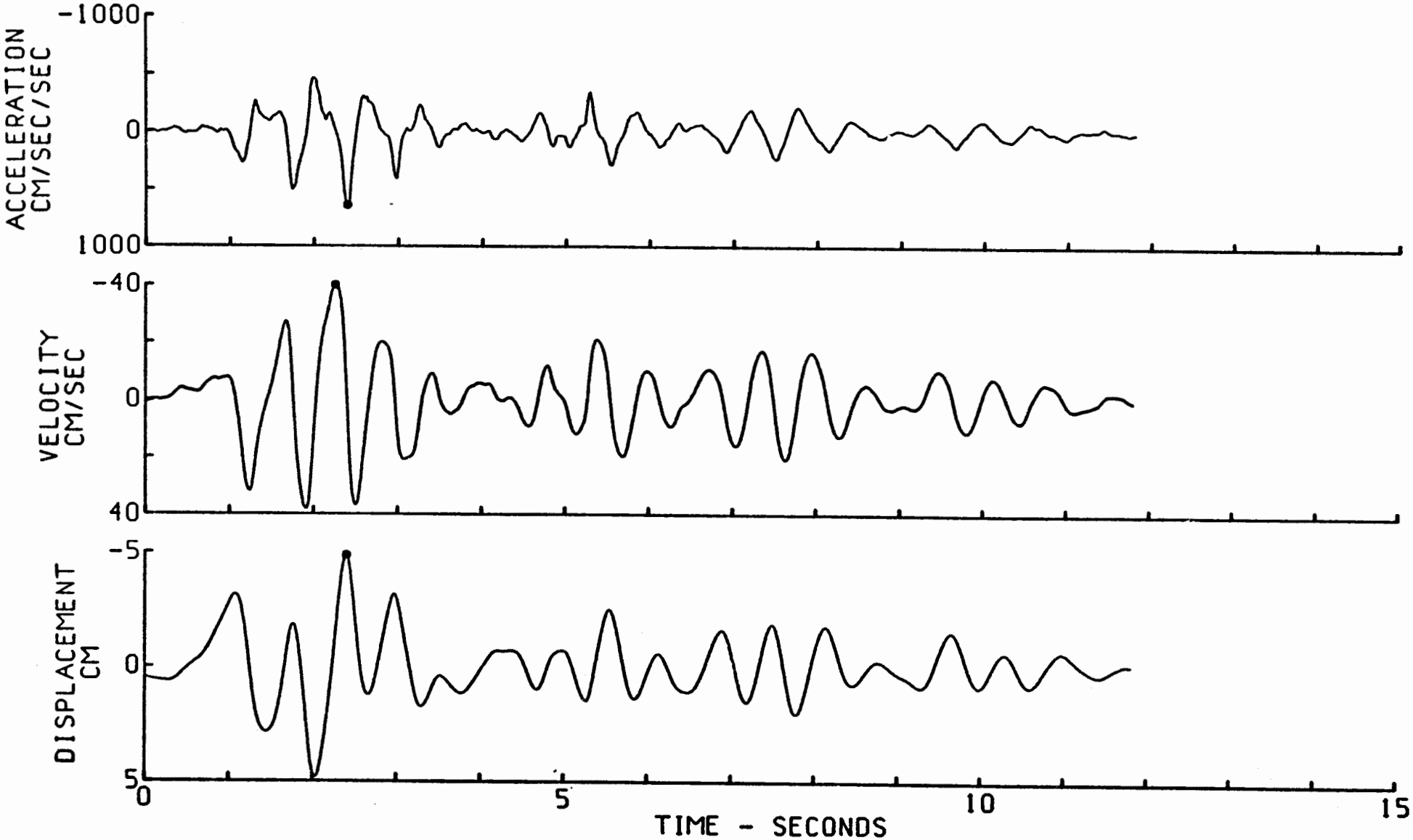

CORRECTED ACCELERATION,VELOCITY,DISPLACEMENT
SANTA BARBARA EARTHQUAKE OF 13 AUGUST 1978 2254 GMT
DMG 302 SANTA BARBARA FREITAS BLDG S/N 158 TR. 5
DATA IS PLOTTED AT EQUAL TIME INCREMENTS OF .02000 SEC
ACCELEROGRAM IS BAND PASS FILTERED BETWEEN .200 - .500 AND 23.00 - 25.00 CYC/SEC
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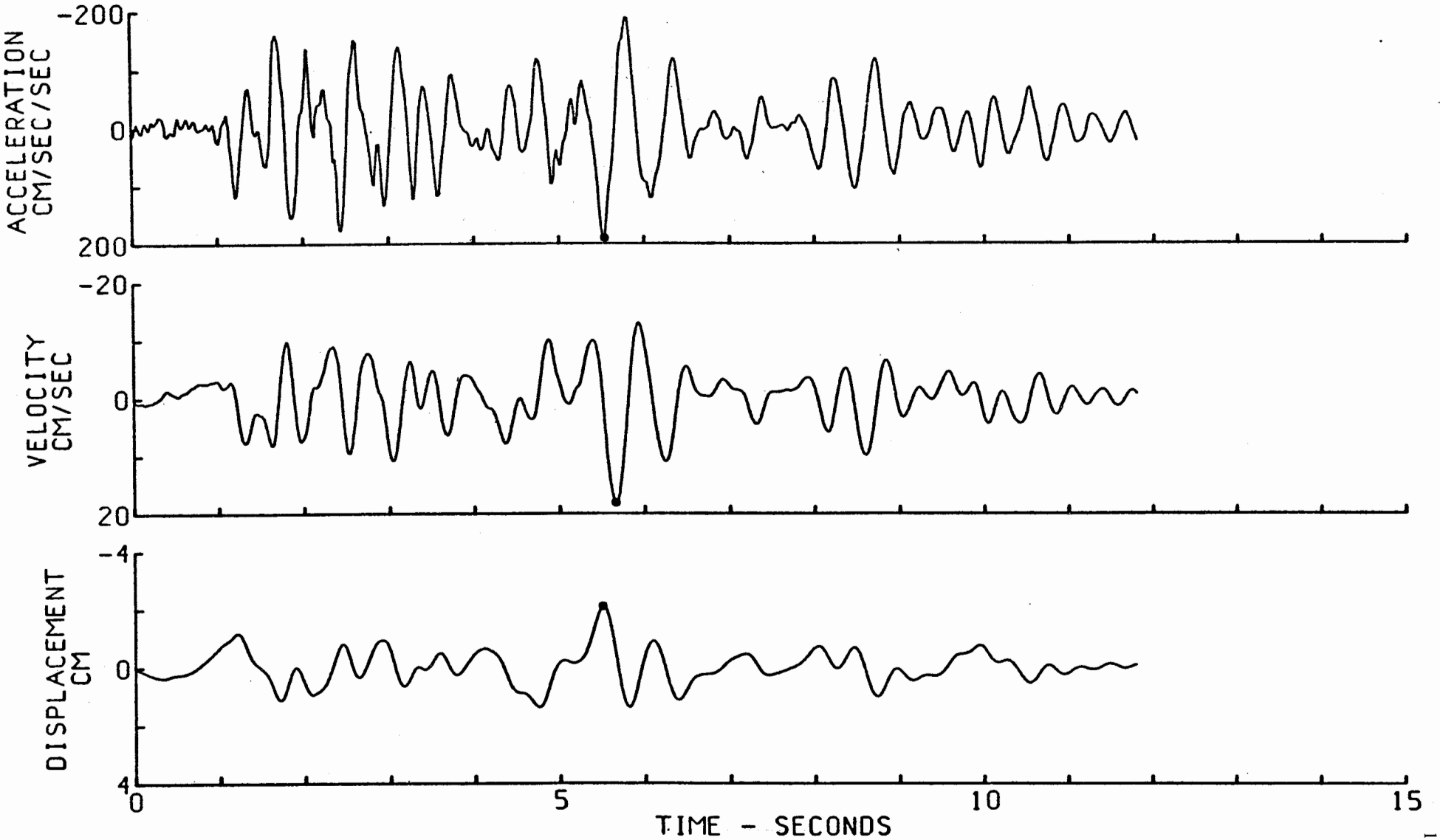
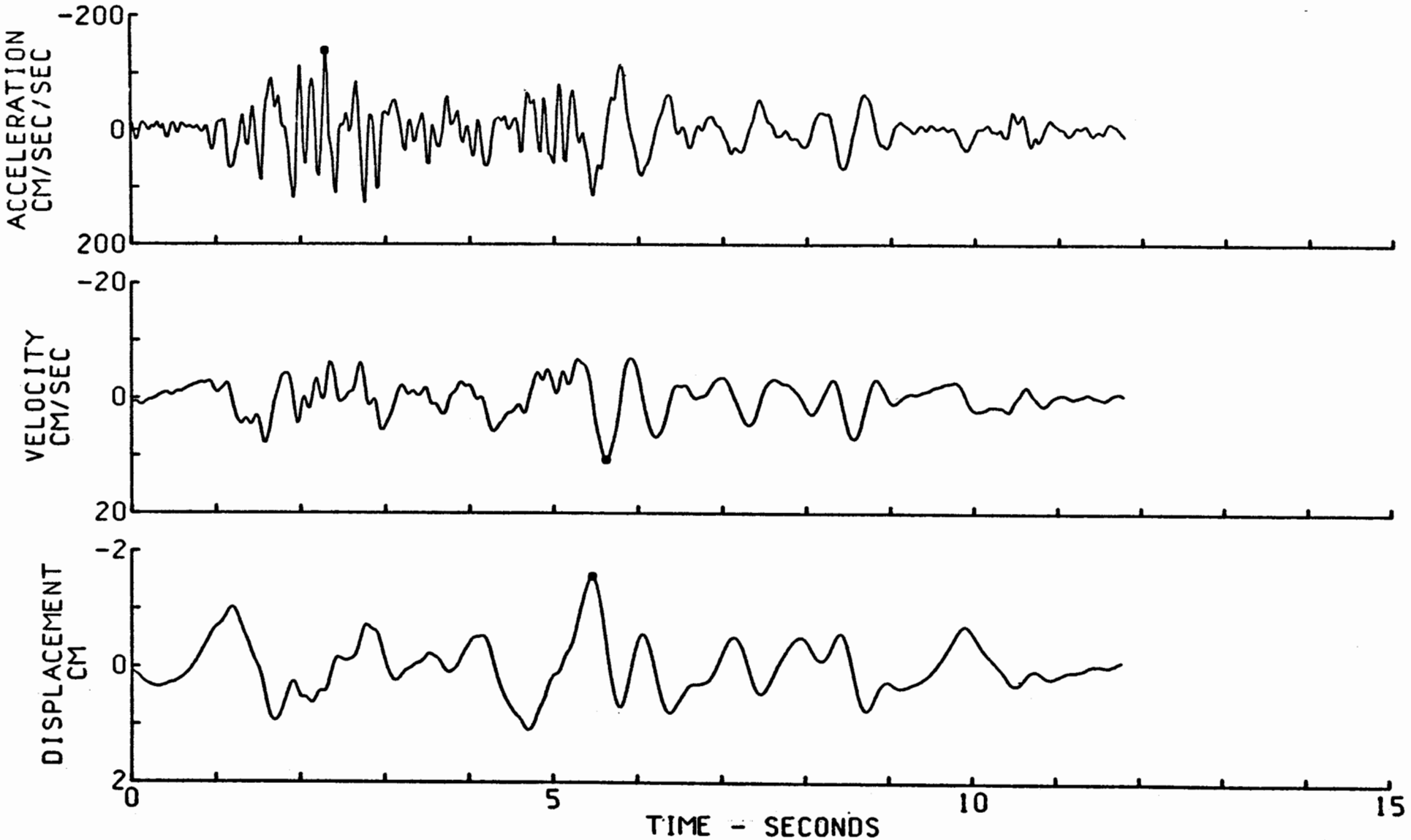
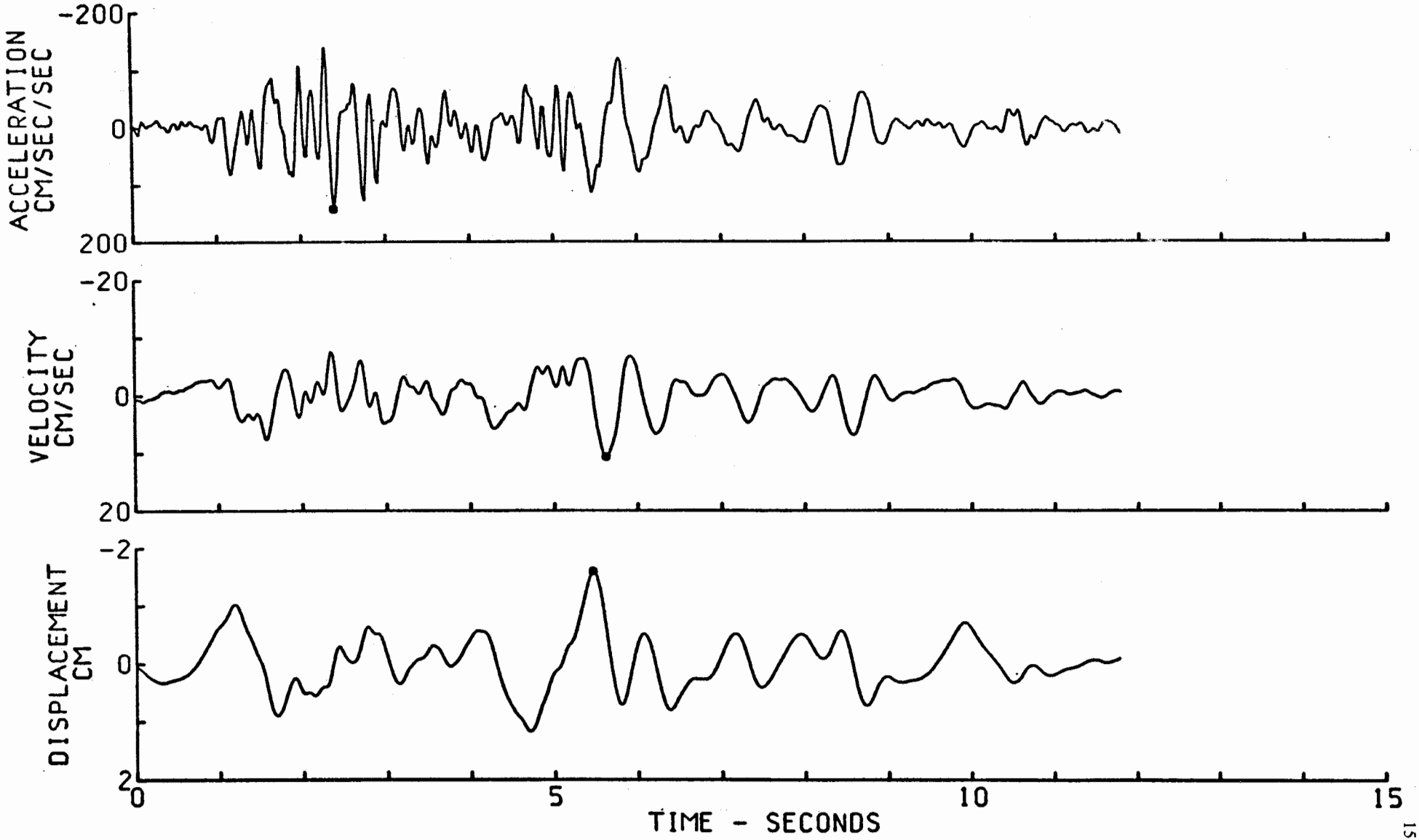


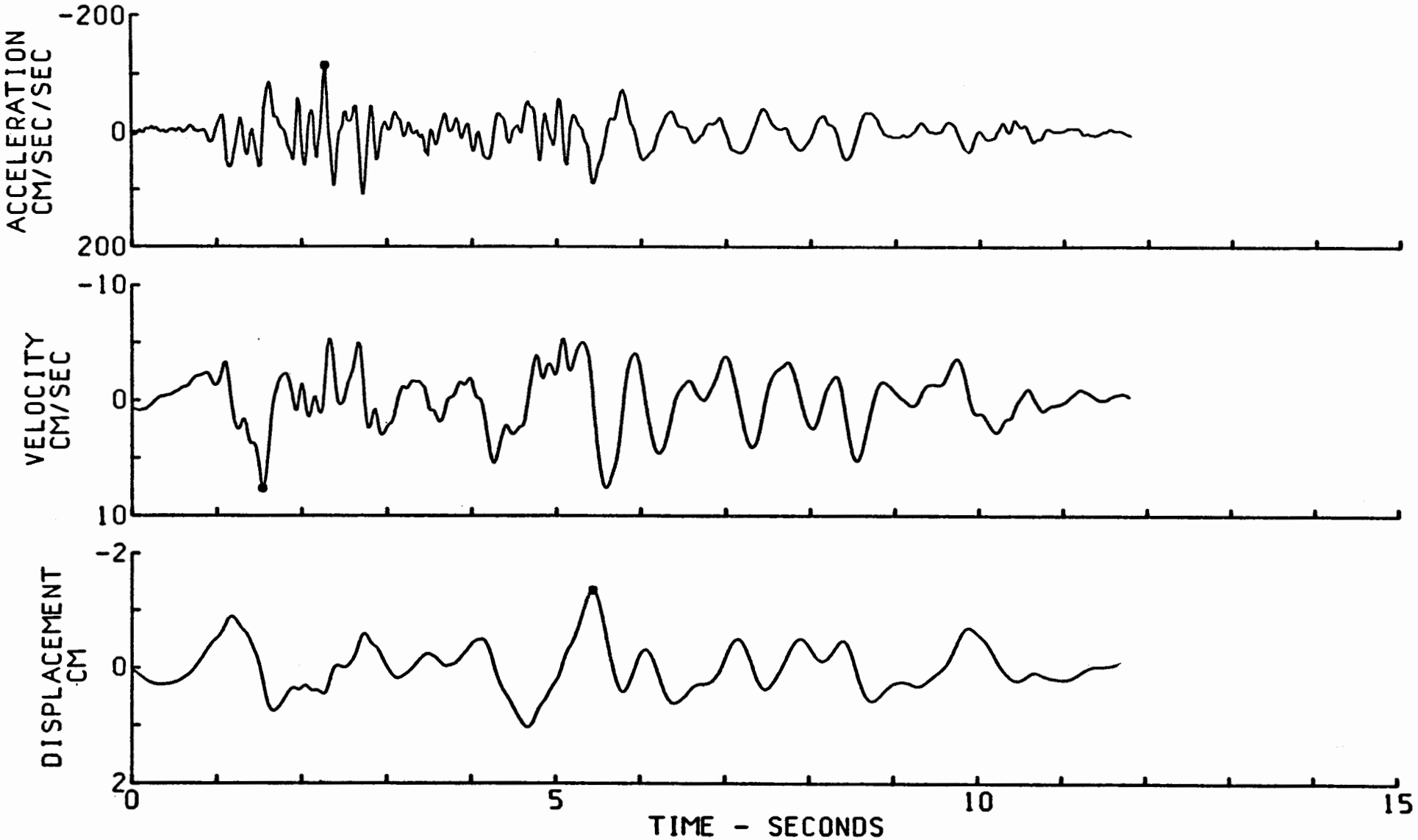
CORRECTED ACCELERATION,VELOCITY,DISPLACEMENT
SANTA BARBARA EARTHQUAKE OF 13 AUGUST 1978 2254 GMT
DMG 302 SANTA BARBARA FREITAS BLDG S/N 158 TR. 6
DATA IS PLOTTED AT EQUAL TIME INCREMENTS OF .02000 SEC
ACCELEROGRAM IS BAND PASS FILTERED BETWEEN .200 - .500 AND 23.00 - 25.00 CYC/SEC
• PEAK VALUES ACCEL=-139.8 CM/SEC/SEC,VELOCITY=10.67 CM/SEC,DISPL=-1.560 CM



CORRECTED ACCELERATION,VELOCITY,DISPLACEMENT
SANTA BARBARA EARTHQUAKE OF 13 AUGUST 1978 2254 GMT
DMG 302 SANTA BARBARA FREITAS BLDG S/N 158 TR. 7
DATA IS PLOTTED AT EQUAL TIME INCREMENTS OF .02000 SEC
ACCELEROGRAM IS BAND PASS FILTERED BETWEEN .200 - .500 AND 23.00 - 25.00 CYC/SEC
• PEAK VALUES ACCEL=142.2 CM/SEC/SEC,VELOCITY=10.62 CM/SEC,DISPL=-1.590 CM



CORRECTED ACCELERATION,VELOCITY,DISPLACEMENT
SANTA BARBARA EARTHQUAKE OF 13 AUGUST 1978 2254 GMT
DMG 302 SANTA BARBARA FREITAS BLDG S/N 158 TR. 8
DATA IS PLOTTED AT EQUAL TIME INCREMENTS OF .02000 SEC
ACCELEROGRAM IS BAND PASS FILTERED BETWEEN .200 - .500 AND 23.00 - 25.00 CYC/SEC
• PEAK VALUES ACCEL=-114.6 CM/SEC/SEC,VELOCITY=7.610 CM/SEC,DISPL=-1.350 CM



CORRECTED ACCELERATION,VELOCITY,DISPLACEMENT
SANTA BARBARA EARTHQUAKE OF 13 AUGUST 1978 2254 GMT
DMG 302 SANTA BARBARA FREITAS BLDG S/N 158 TR. 9
DATA IS PLOTTED AT EQUAL TIME INCREMENTS OF .02000 SEC
ACCELEROGRAM IS BAND PASS FILTERED BETWEEN .200 - .500 AND 23.00 - 25.00 CYC/SEC
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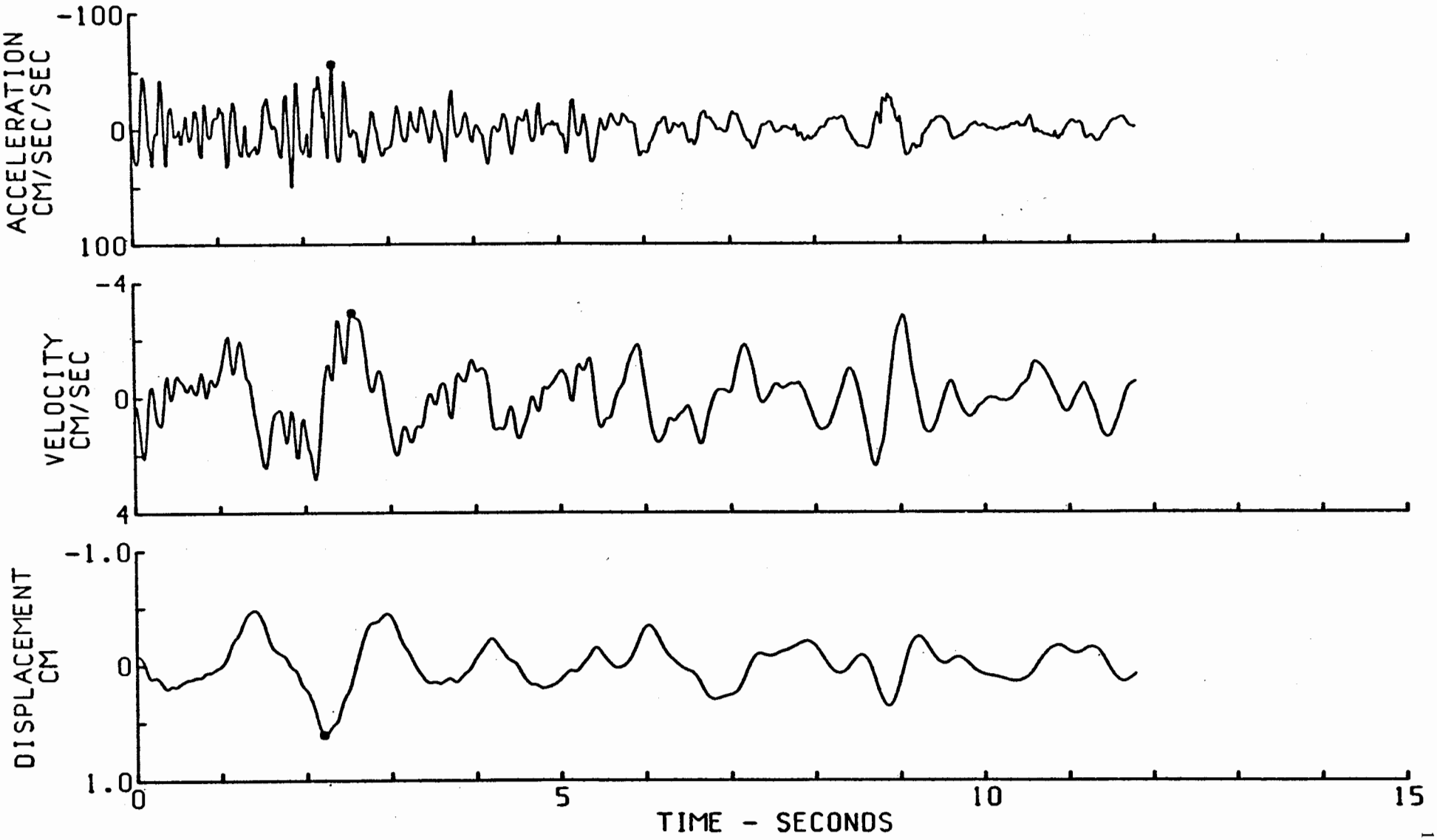
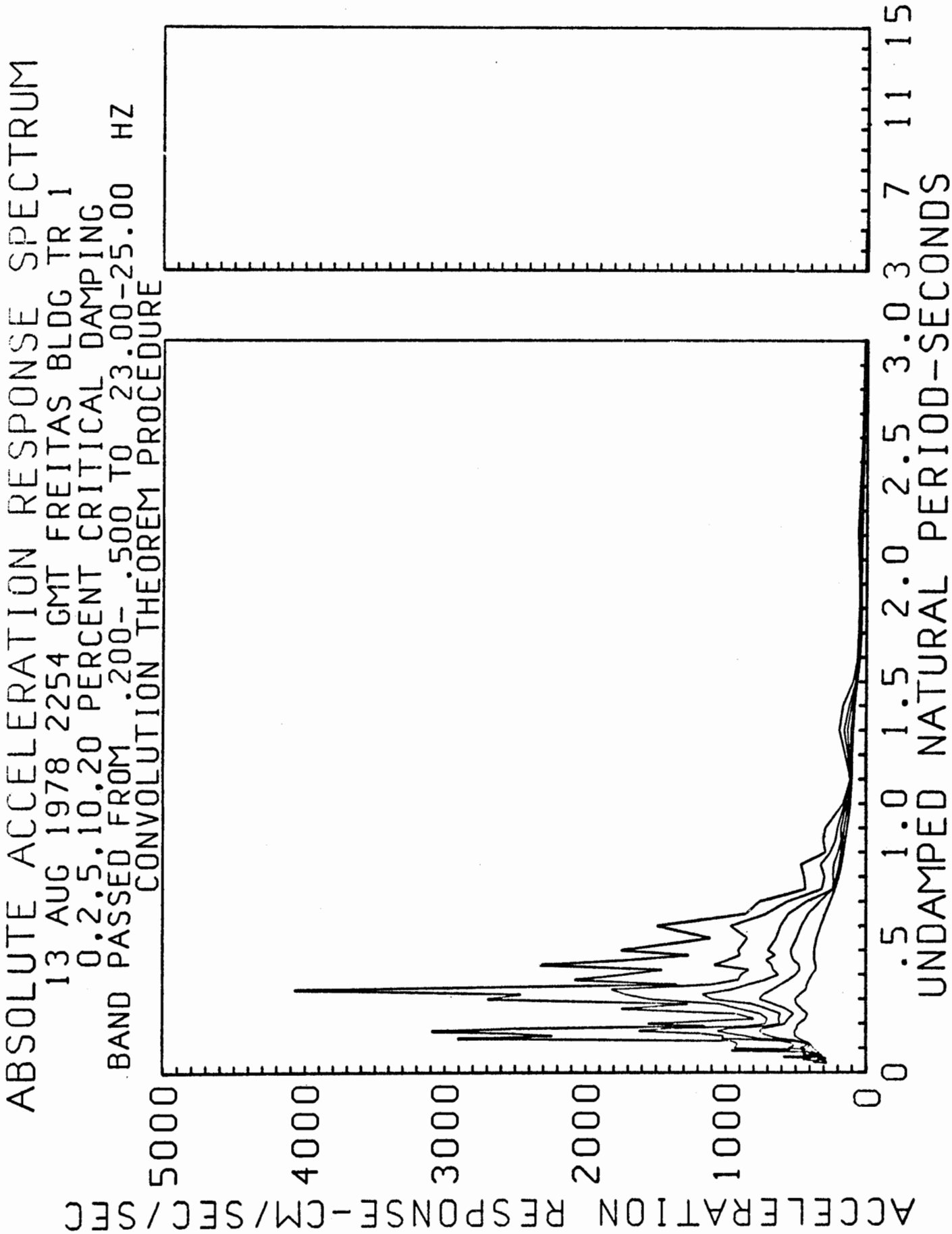
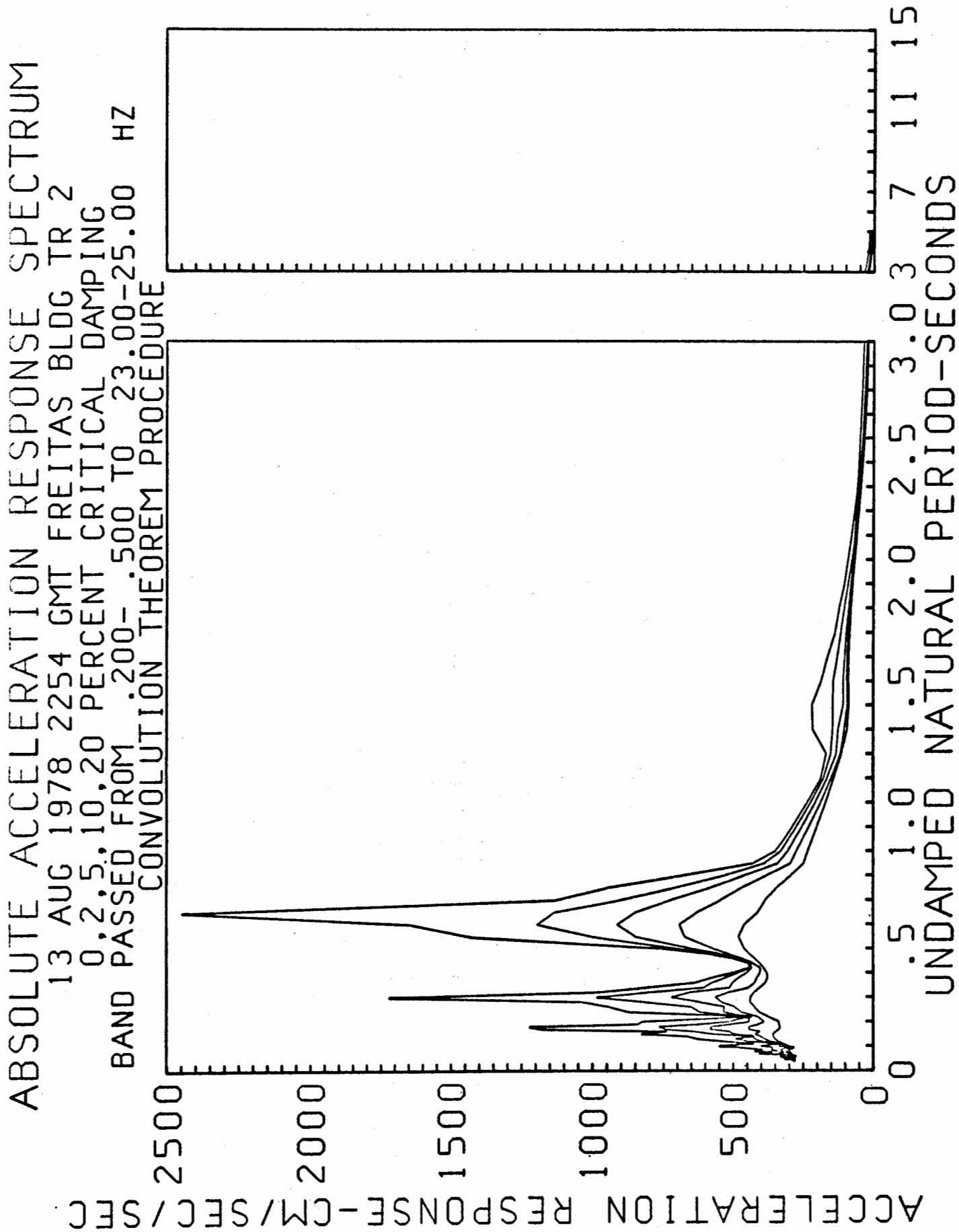



ABSOLUTE ACCELERATION RESPONSE SPECTRUM
13 AUG 1978 2254 GMT FREITAS BLDG TR 1
0.2.5.10.20 PERCENT CRITICAL DAMPING
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
CONVOLUTION THEOREM PROCEDURE
ACCELERATION RESPONSE-CM/SEC/SEC
5000
4000
3000
2000
1000
0
0
.5
1.0
1.5
2.0
2.5
3.0
3
7
11
15
UNDAMPED NATURAL PERIOD-SECONDS


ABSOLUTE ACCELERATION RESPONSE SPECTRUM
13 AUG 1978 2254 GMT FREITAS BLDG TR 2
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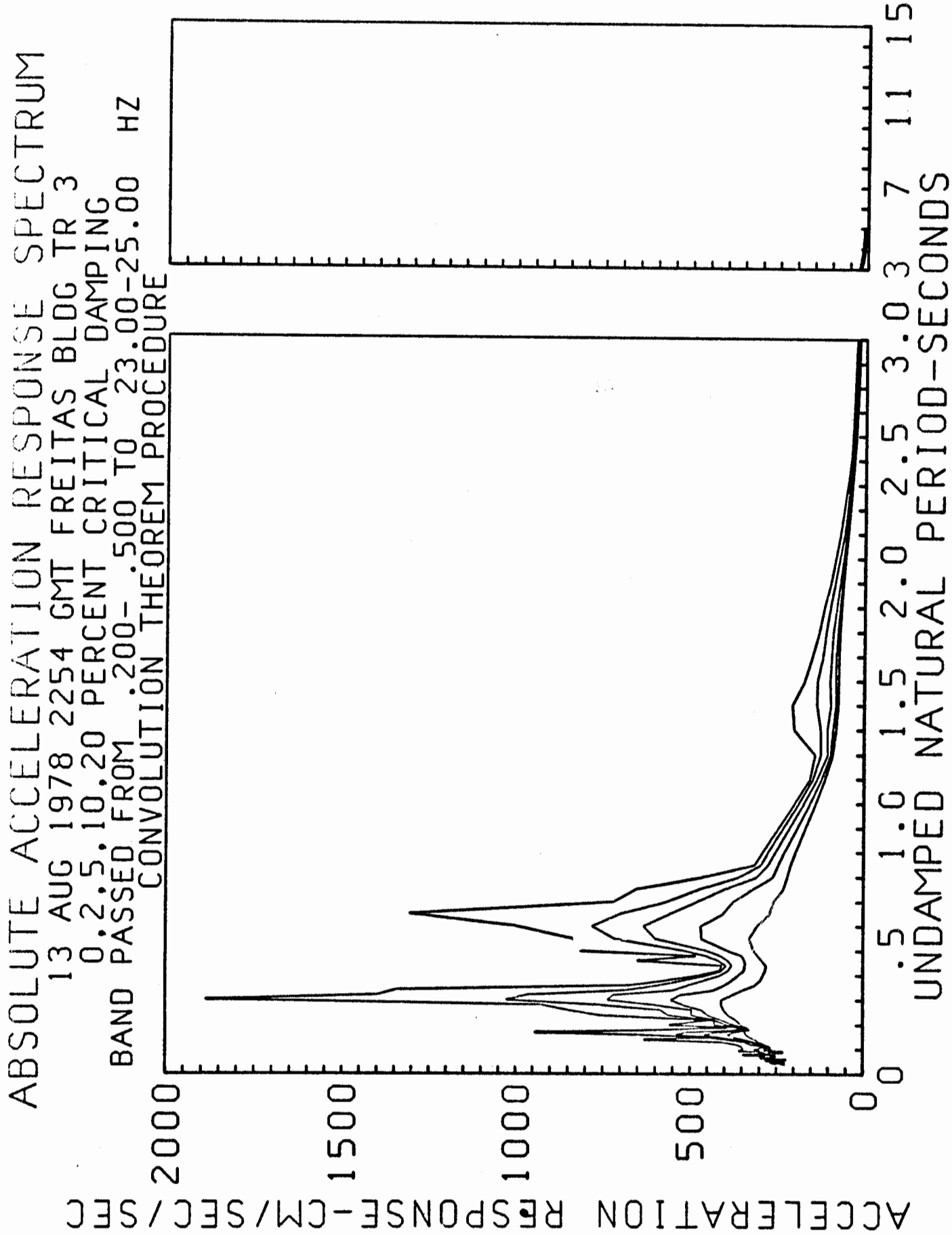
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
CONVOLUTION THEOREM PROCEDURE
ACCELERATION RESPONSE-CM/SEC/SEC
2500
2000
1500
1000
500
0
.5
1.0
1.5
2.0
2.5
3.0
3
7
11
15
UNDAMPED NATURAL PERIOD-SECONDS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13 AUG 1978 2254 GMT FREITAS BLDG TR 3
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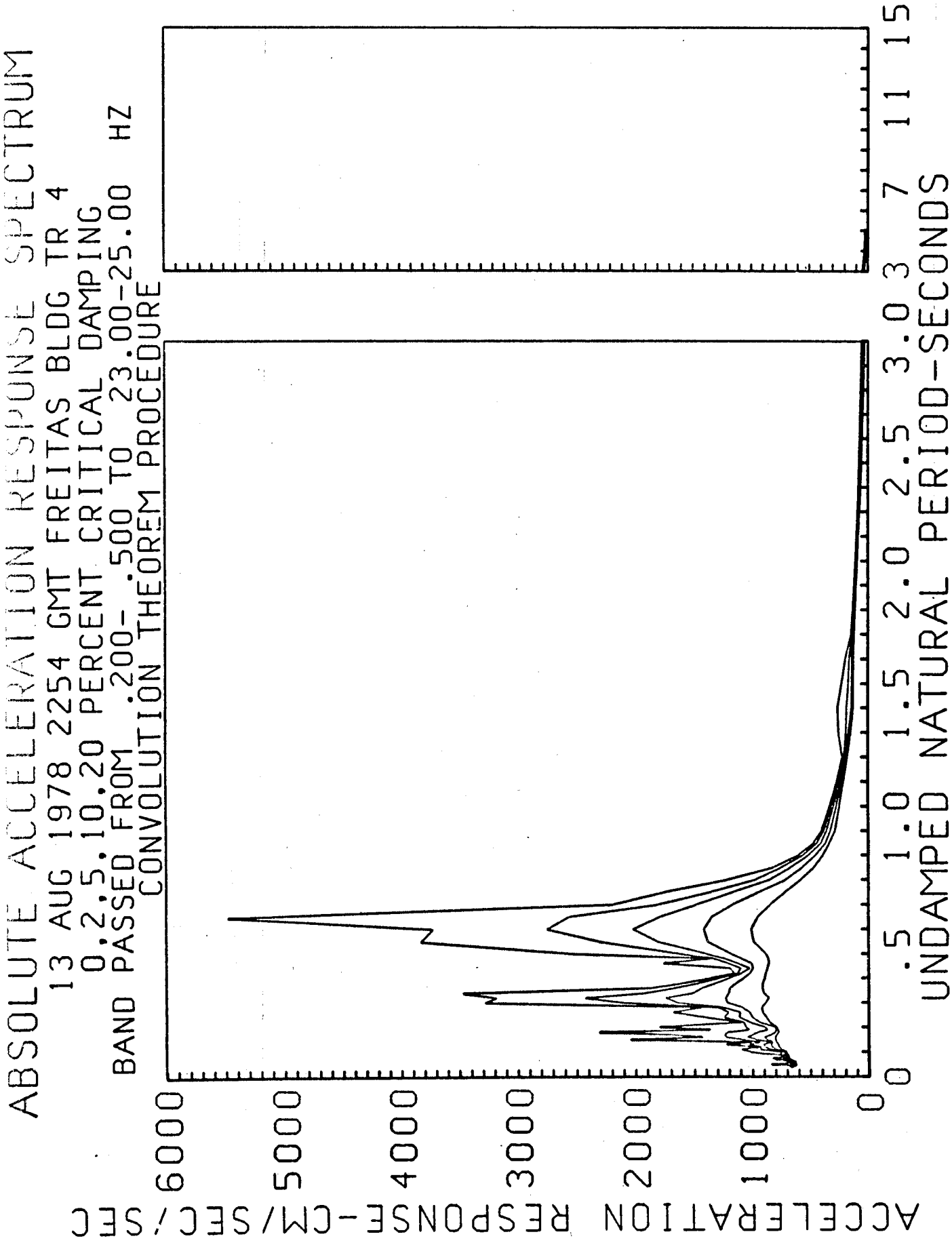
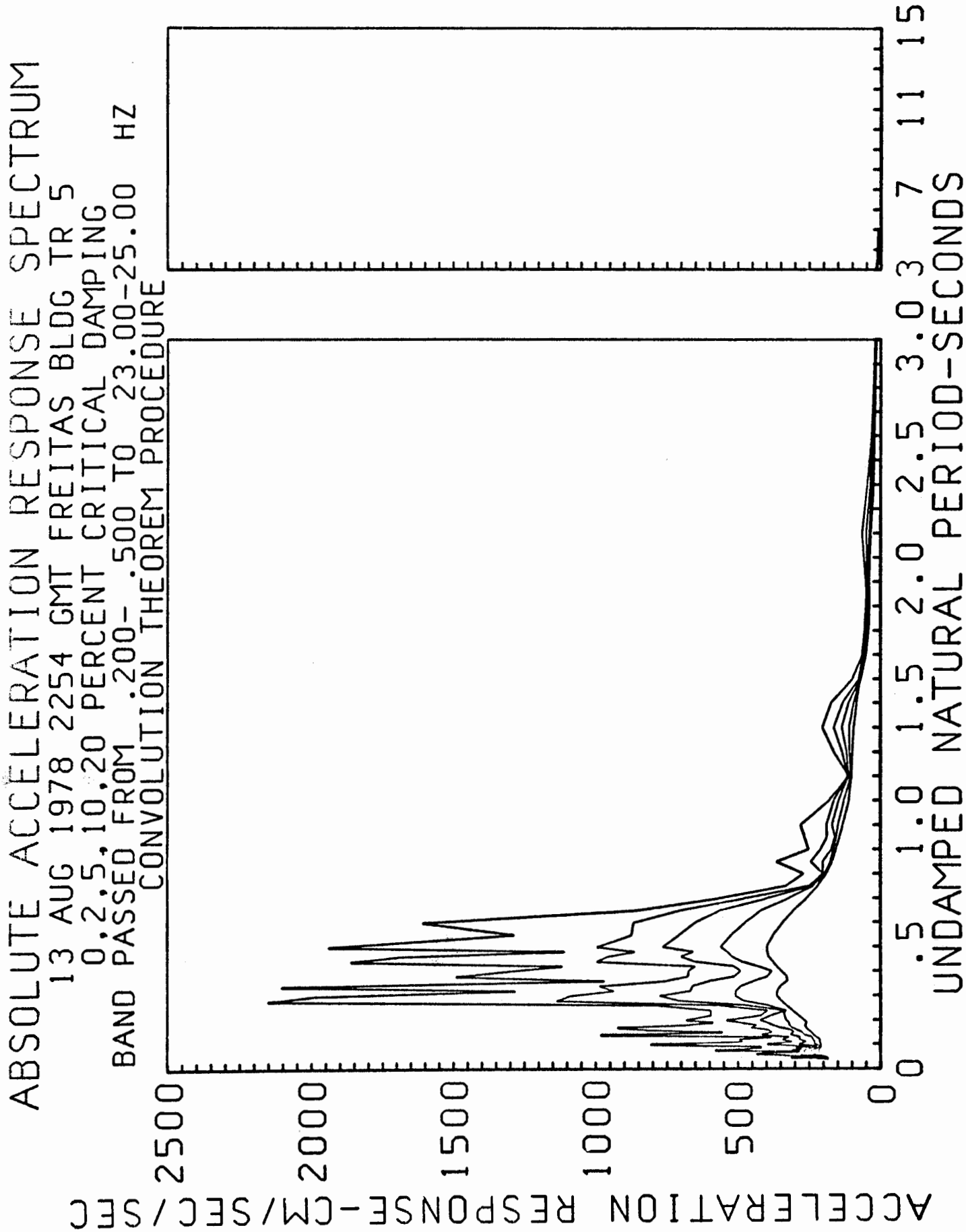
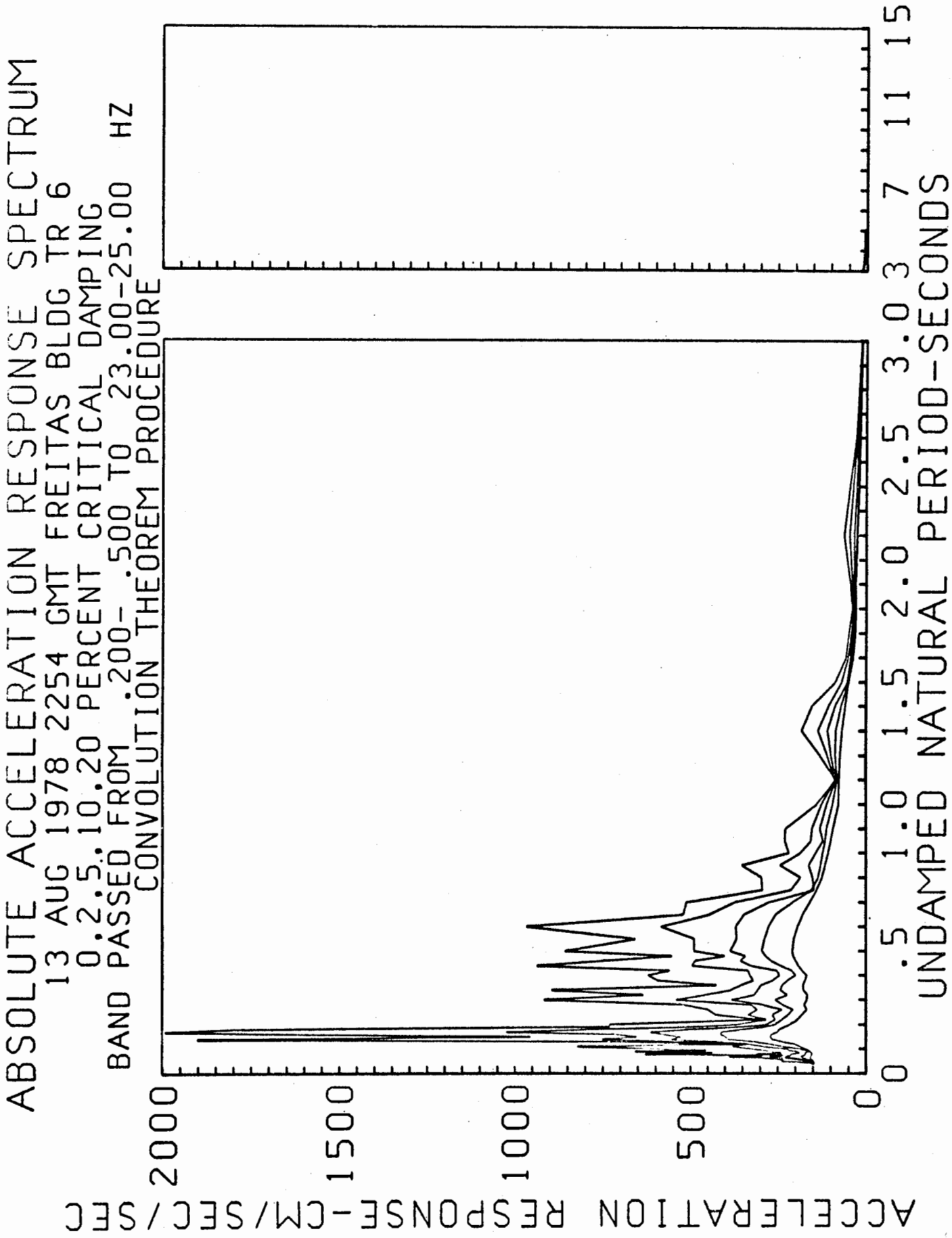
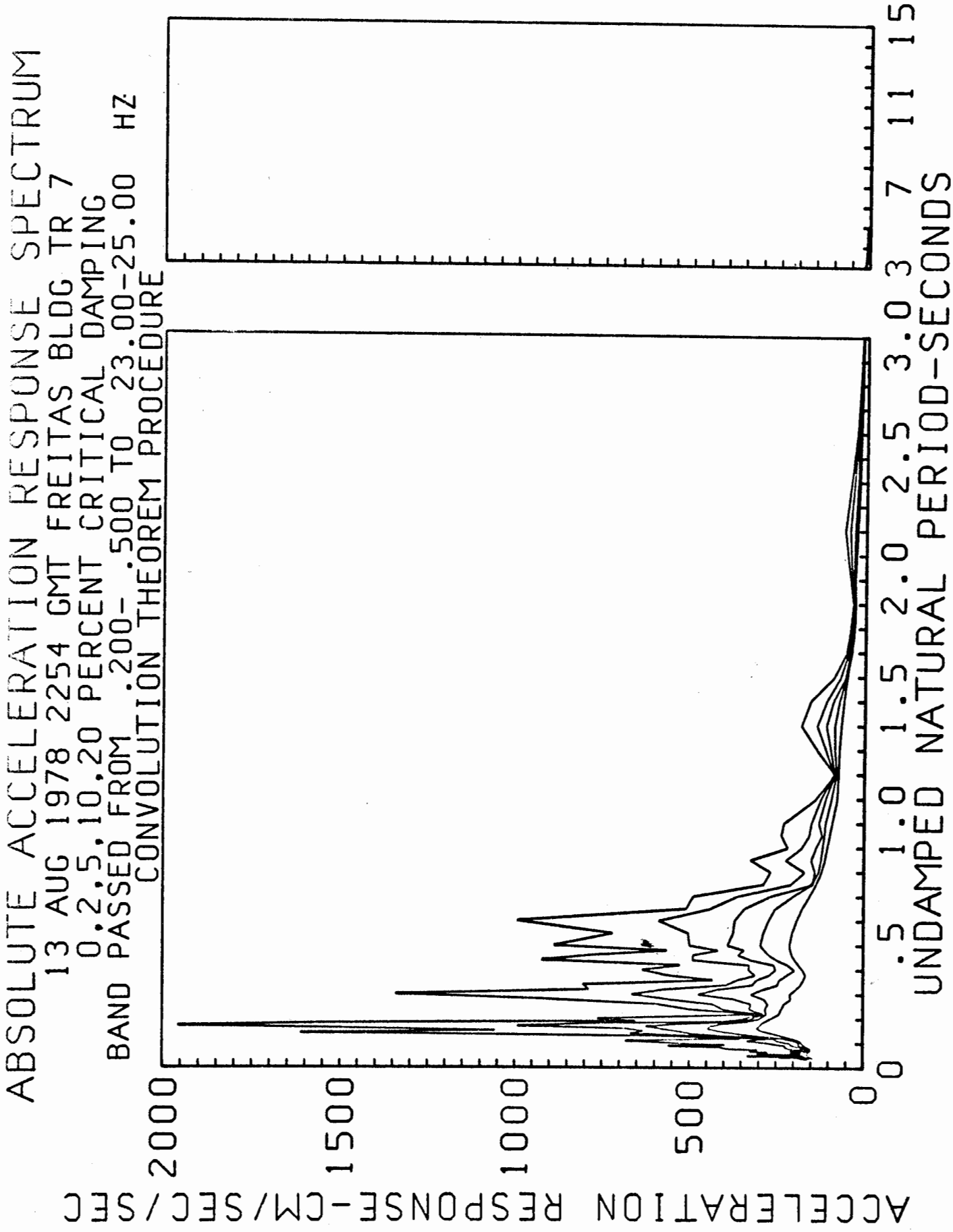
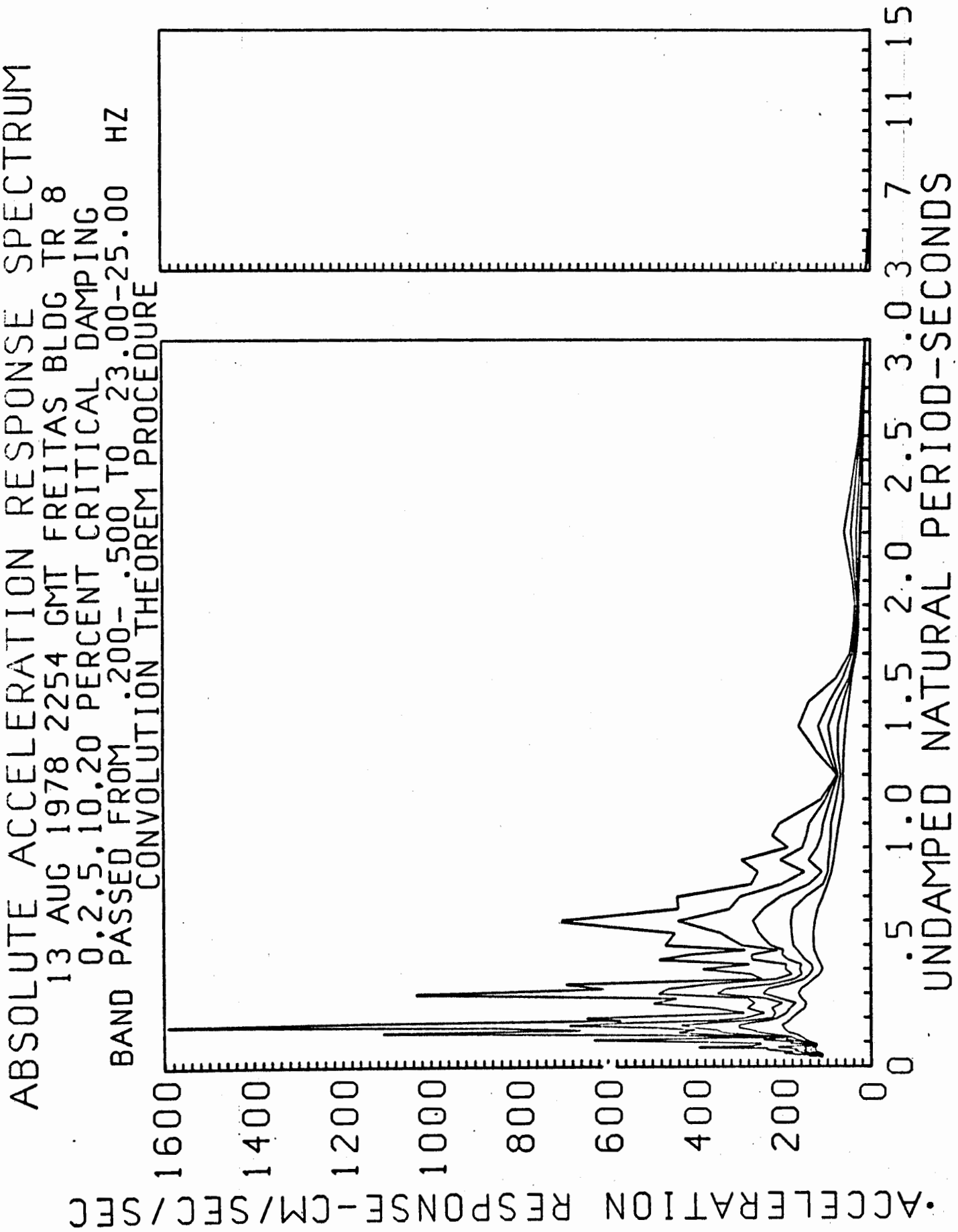
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
CONVOLUTION THEOREM PROCEDURE
ACCELERATION RESPONSE-CM/SEC/SEC
2000
1500
1000
500
0
0
.5
1.0
1.5
2.0
2.5
3.0
3
7
11
15
UNDAMPED NATURAL PERIOD-SECONDS

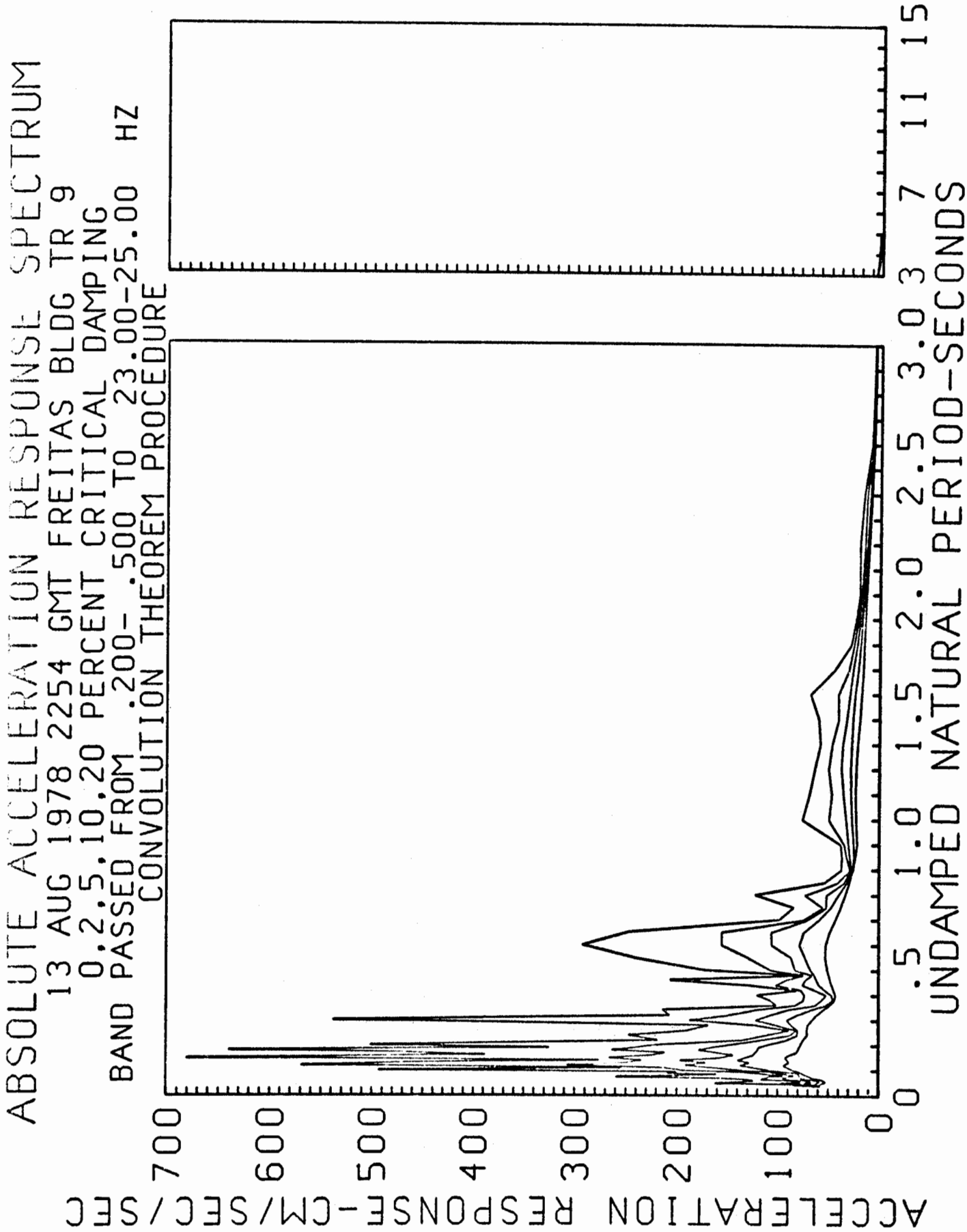

ABSOLUTE ACCELERATION RESPONSE SPECTRUM
13 AUG 1978 2254 GMT FREITAS BLDG TR 4
0.2.5.10.20 PERCENT CRITICAL DAMPING
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
CONVOLUTION THEOREM PROCEDURE
ACCELERATION RESPONSE-CM/SEC/SEC
6000
5000
4000
3000
2000
1000
0
0
.5
1.0
1.5
2.0
2.5
3.0
3
7
11
15
UNDAMPED NATURAL PERIOD-SECONDS

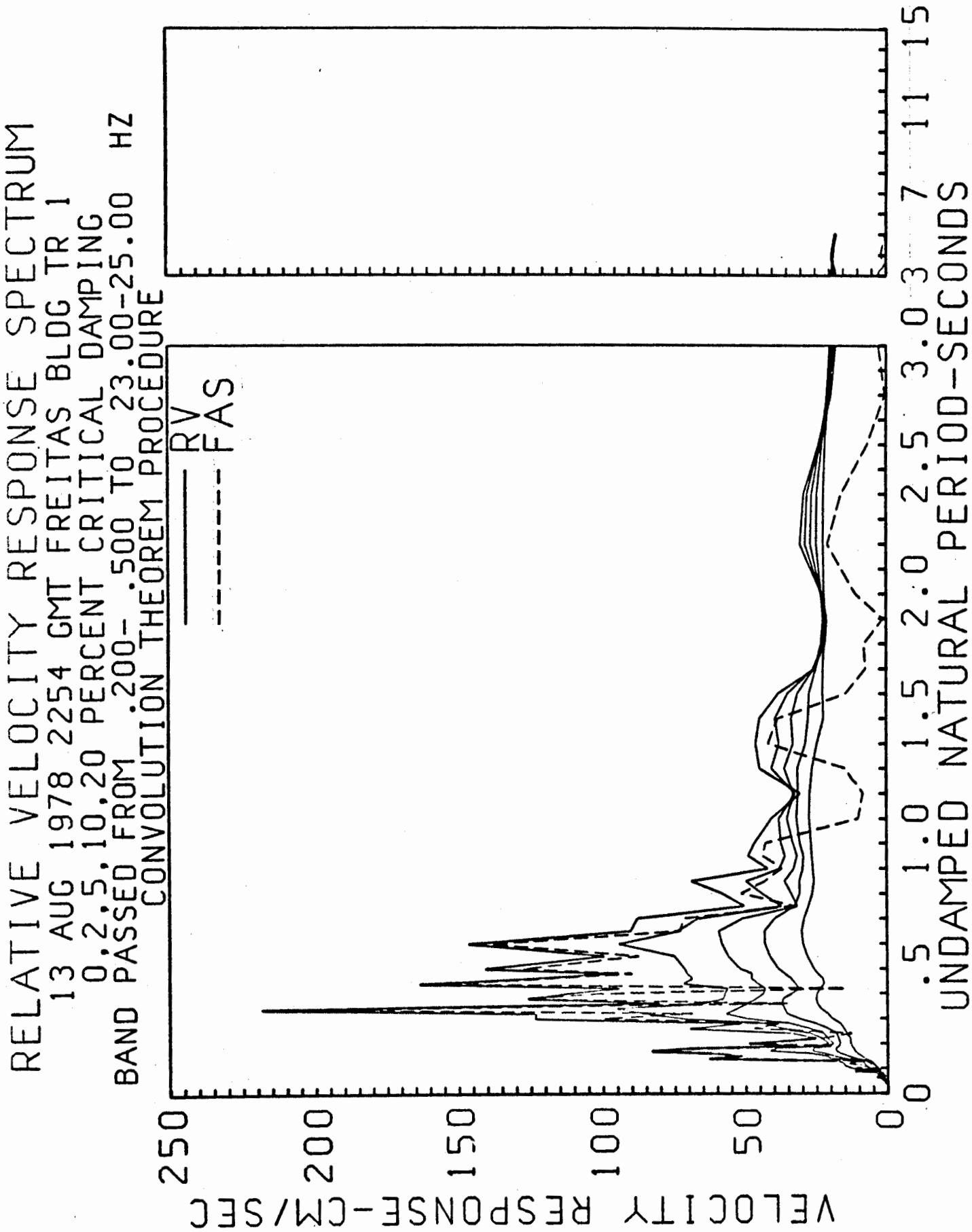

ABSOLUTE ACCELERATION RESPONSE SPECTRUM
13 AUG 1978 2254 GMT FREITAS BLDG TR 5
0.2.5.10.20 PERCENT CRITICAL DAMPING
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
CONVOLUTION THEOREM PROCEDURE
ACCELERATION RESPONSE-CM/SEC/SEC
2500
2000
1500
1000
500
0
.5 1.0 1.5 2.0 2.5 3.0 3 7 11 15
UNDAMPED NATURAL PERIOD-SECONDS

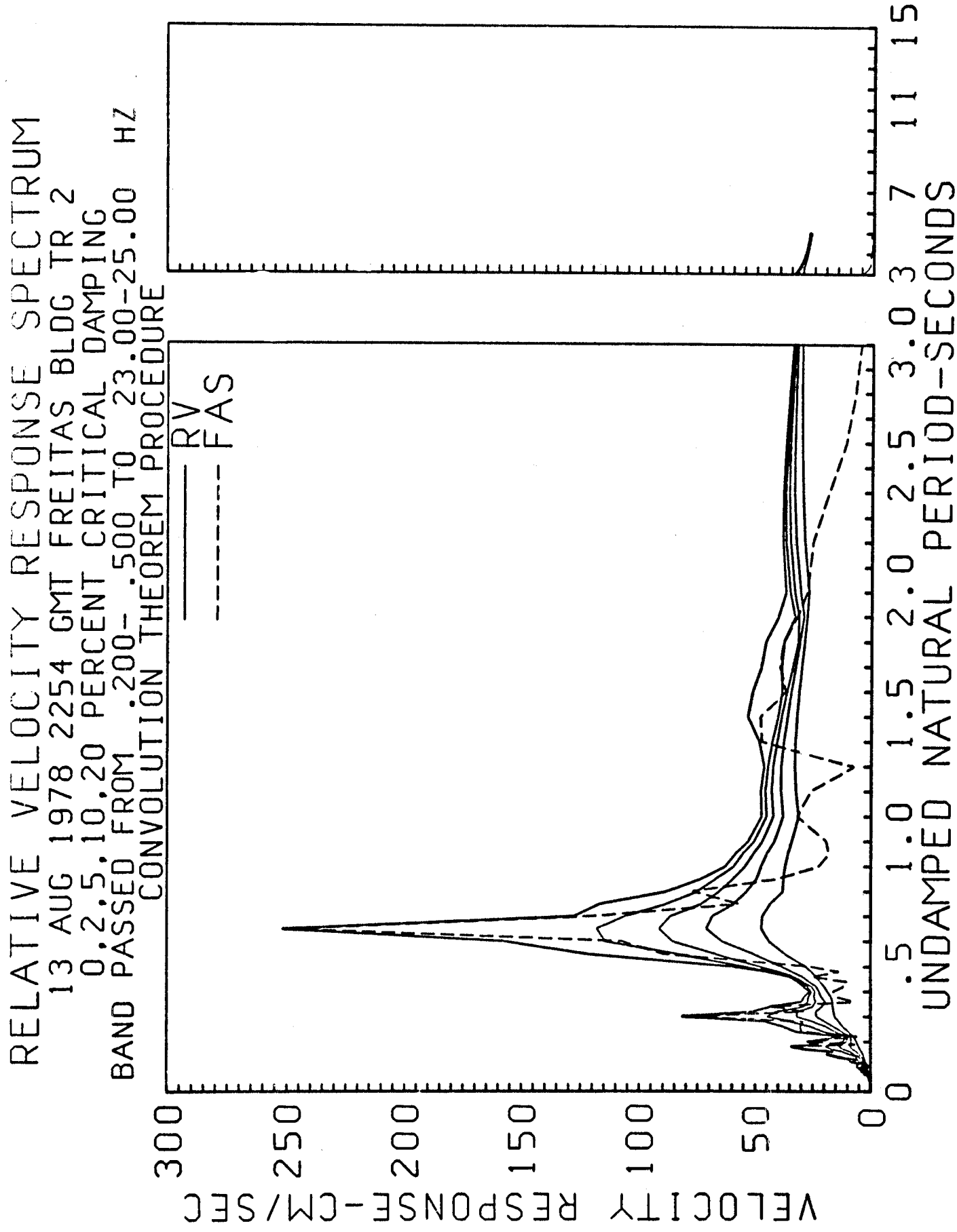

ABSOLUTE ACCELERATION RESPONSE SPECTRUM
13 AUG 1978 2254 GMT FREITAS BLDG TR 6
0.2.5.10.20 PERCENT CRITICAL DAMPING
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
CONVOLUTION THEOREM PROCEDURE
ACCELERATION RESPONSE-CM/SEC/SEC
2000
1500
1000
500
0
0
.5
1.0
1.5
2.0
2.5
3.0
3
7
11
15
UNDAMPED NATURAL PERIOD-SECONDS

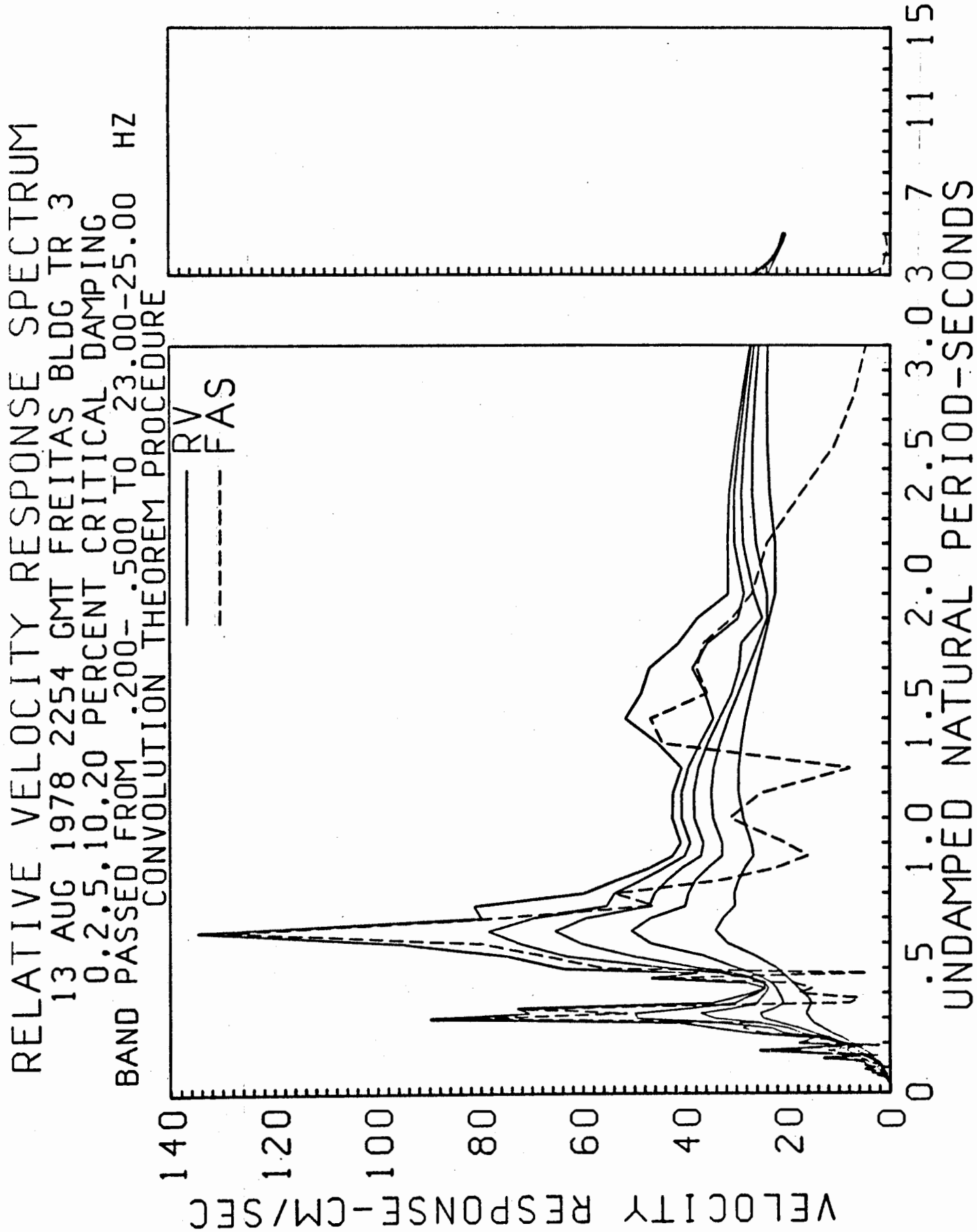

ABSOLUTE ACCELERATION RESPONSE SPECTRUM
13 AUG 1978 2254 GMT FREITAS BLDG TR 7
0.2.5.10.20 PERCENT CRITICAL DAMPING
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
CONVOLUTION THEOREM PROCEDURE
ACCELERATION RESPONSE-CM/SEC/SEC
2000
1500
1000
500
0
0
.5
1.0
1.5
2.0
2.5
3.0
3
7
11
15
UNDAMPED NATURAL PERIOD-SECONDS

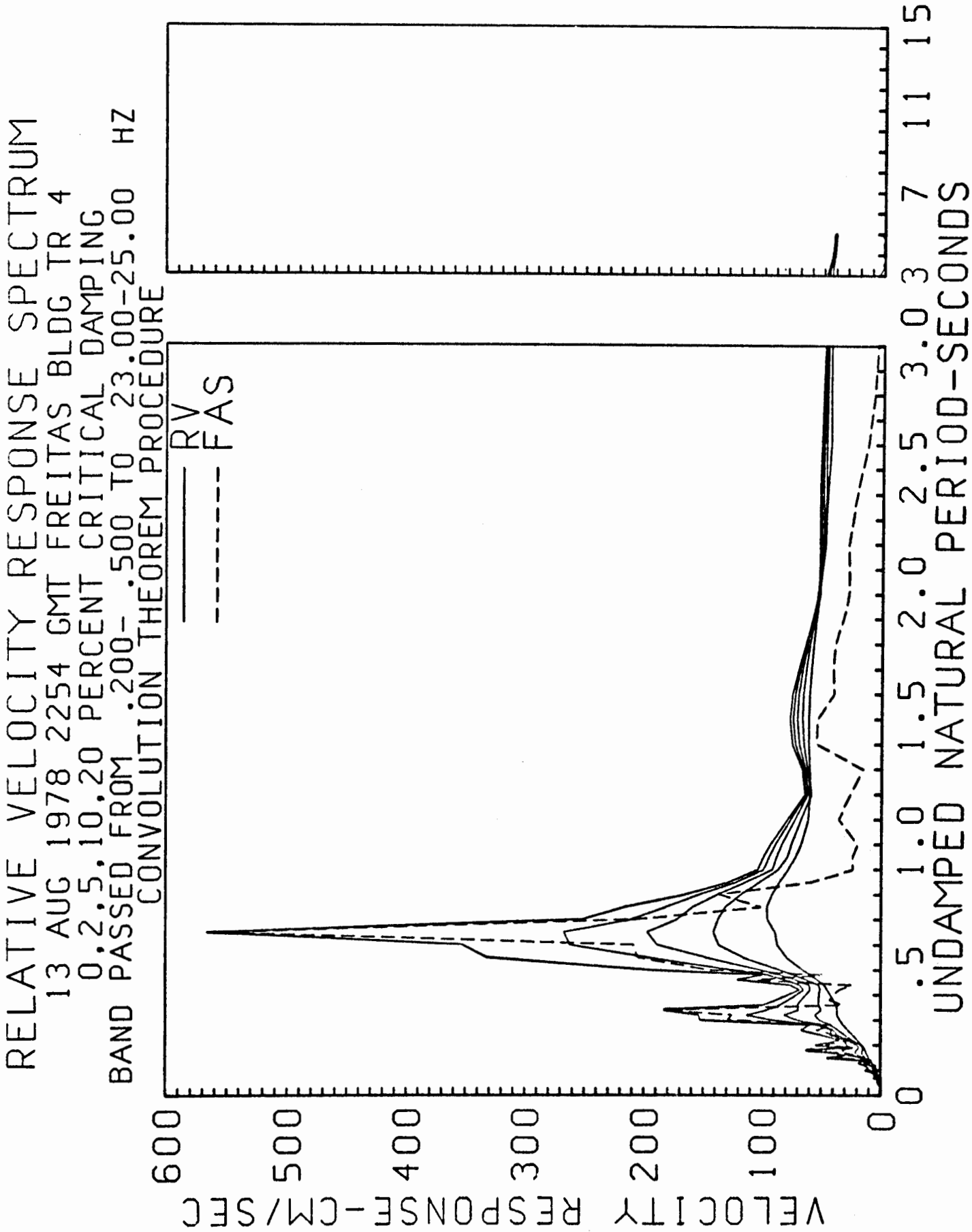

ABSOLUTE ACCELERATION RESPONSE SPECTRUM
13 AUG 1978 2254 GMT FREITAS BLDG TR 8
0.2.5.10.20 PERCENT CRITICAL DAMPING
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
CONVOLUTION THEOREM PROCEDURE
ACCELERATION RESPONSE-CM/SEC/SEC
1600
1400
1200
1000
800
600
400
200
0
0
.5
1.0
1.5
2.0
2.5
3.0
3
7
11
15
UNDAMPED NATURAL PERIOD-SECONDS

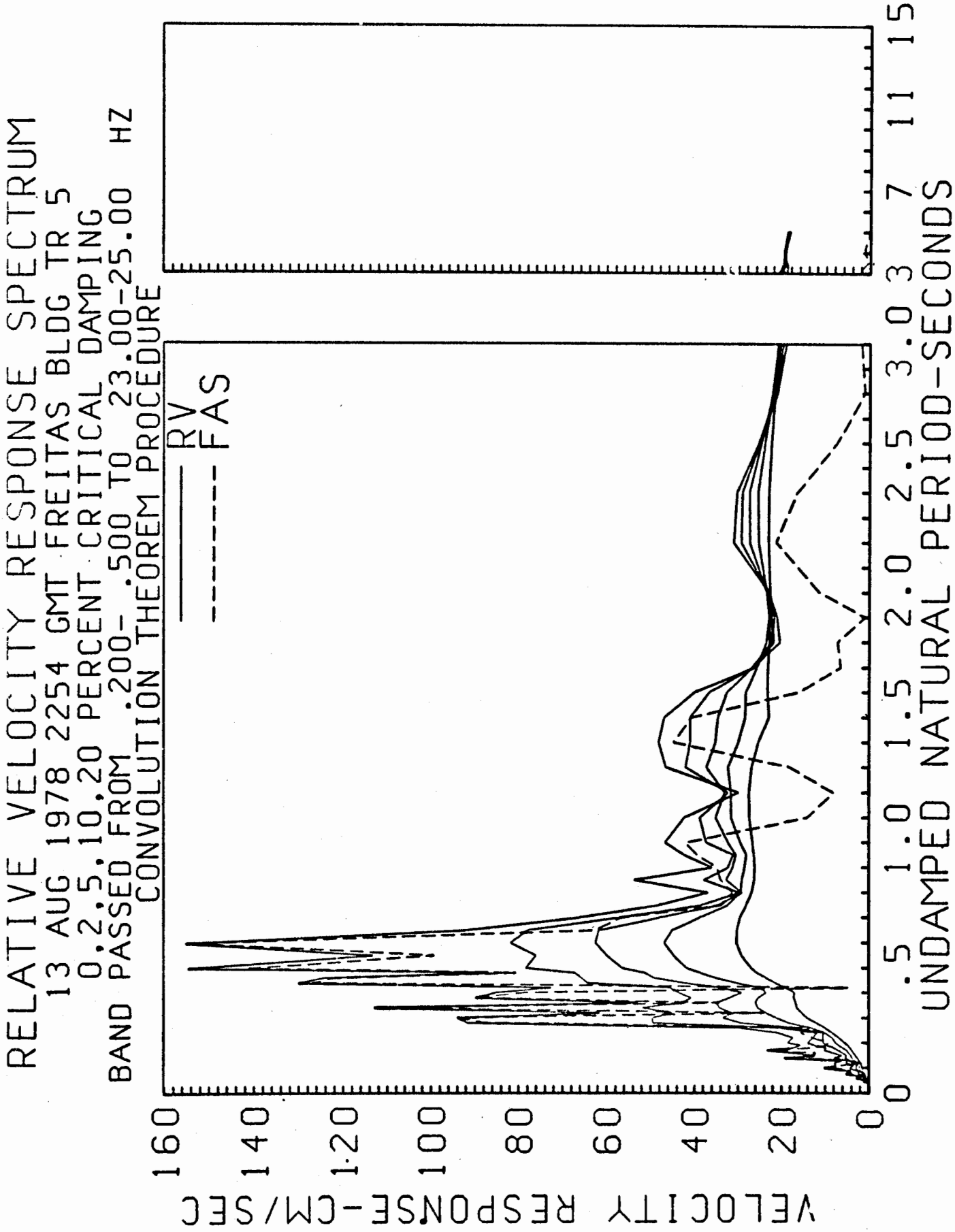

ABSOLUTE ACCELERATION RESPONSE SPECTRUM
13 AUG 1978 2254 GMT FREITAS BLDG TR 9
0.2.5.10.20 PERCENT CRITICAL DAMPING
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
CONVOLUTION THEOREM PROCEDURE
ACCELERATION RESPONSE-CM/SEC/SEC
0
100
200
300
400
500
600
700
0
.5
1.0
1.5
2.0
2.5
3.0
3
7
11
15
UNDAMPED NATURAL PERIOD-SECONDS

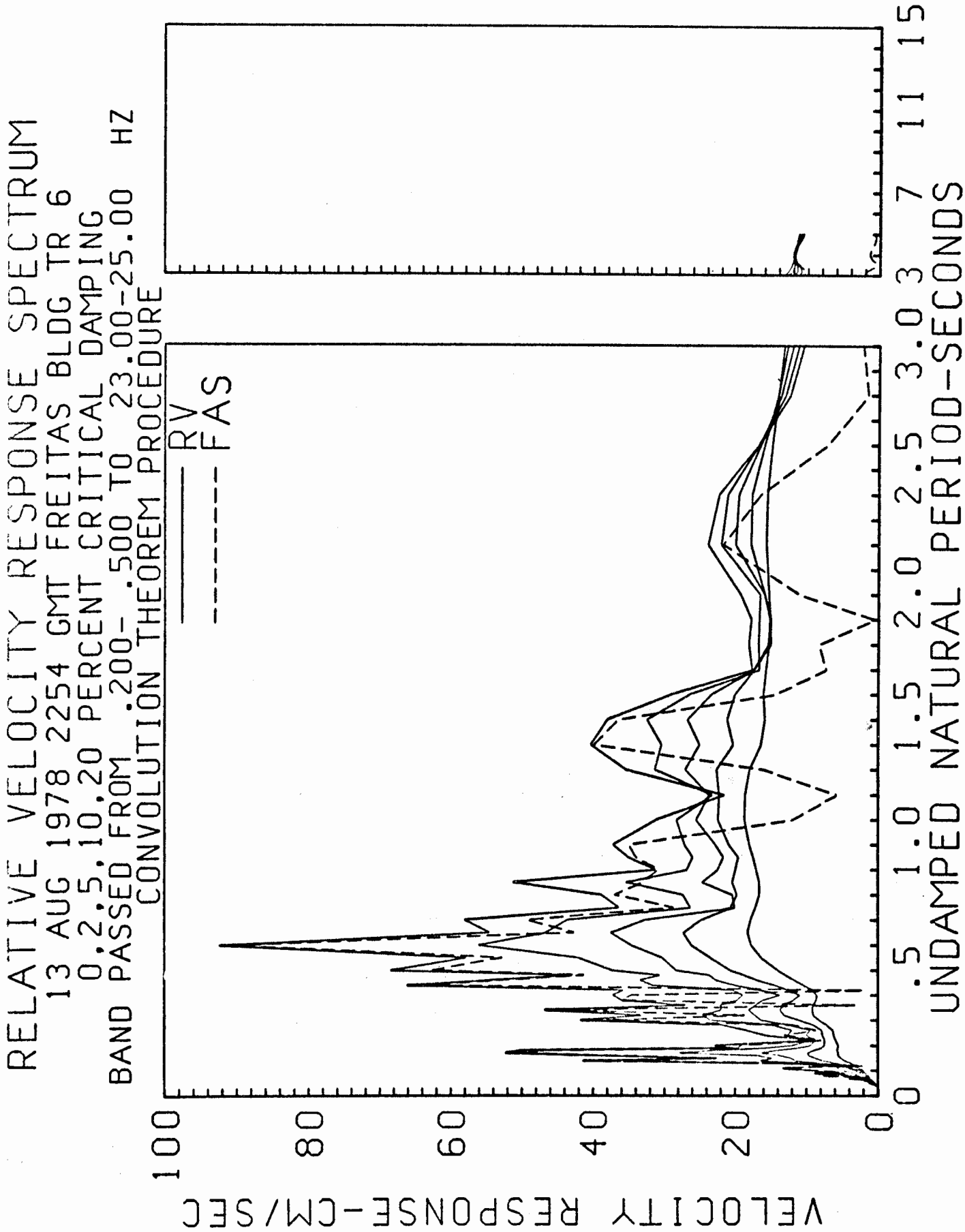

RELATIVE VELOCITY RESPONSE SPECTRUM
13 AUG 1978 2254 GMT FREITAS BLDG TR 1
0.2,5,10,20 PERCENT CRITICAL DAMPING
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
CONVOLUTION THEOREM PROCEDURE
RV
FAS
VELOCITY RESPONSE-CM/SEC
250
200
150
100
50
0
.5
1.0
1.5
2.0
2.5
3.0
3
7
11
15
UNDAMPED NATURAL PERIOD-SECONDS

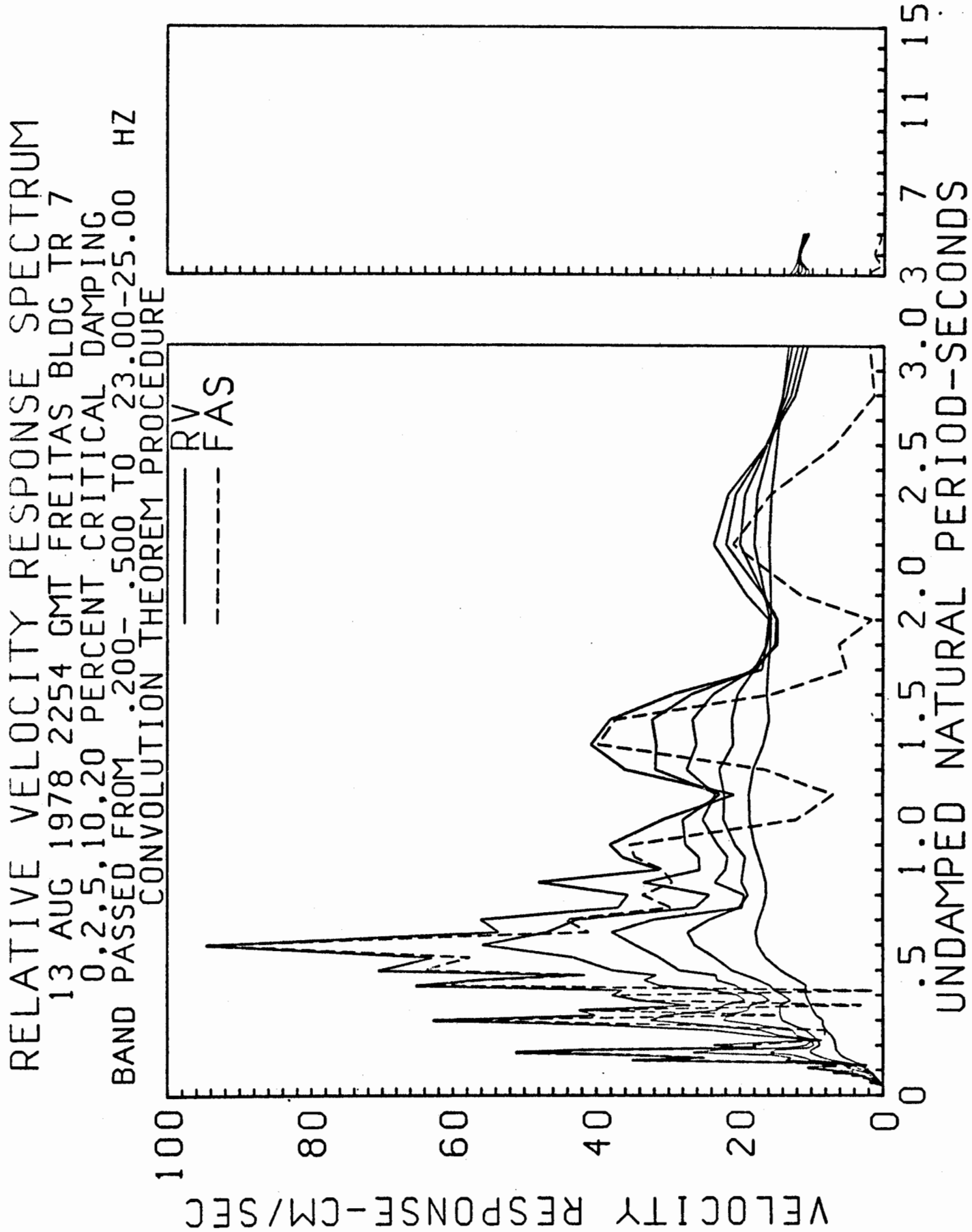

RELATIVE VELOCITY RESPONSE SPECTRUM
13 AUG 1978 2254 GMT FREITAS BLDG TR 2
0.2.5.10.20 PERCENT CRITICAL DAMPING
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
CONVOLUTION THEOREM PROCEDURE
RV
FAS
VELOCITY RESPONSE-CM/SEC
300
250
200
150
100
50
0
.5
1.0
1.5
2.0
2.5
3.0
3
7
11
15
UNDAMPED NATURAL PERIOD-SECONDS

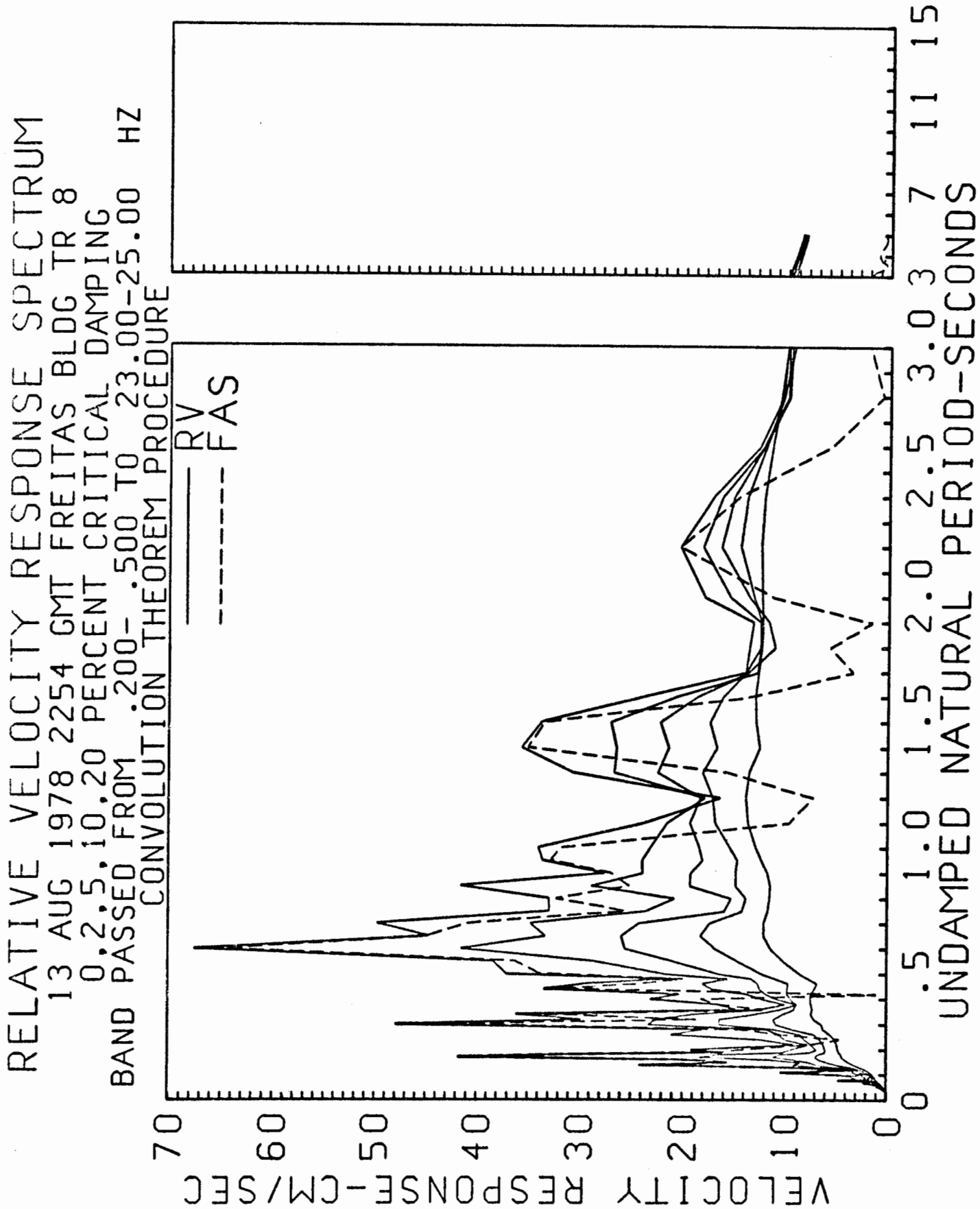

RELATIVE VELOCITY RESPONSE SPECTRUM
13 AUG 1978 2254 GMT FREITAS BLDG TR 3
0.2.5.10.20 PERCENT CRITICAL DAMPING
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
CONVOLUTION THEOREM PROCEDURE
RV
FAS
VELOCITY RESPONSE-CM/SEC
0
20
40
60
80
100
120
140
UNDAMPED NATURAL PERIOD-SECONDS
0
.5
1.0
1.5
2.0
2.5
3.0
3
7
11
15

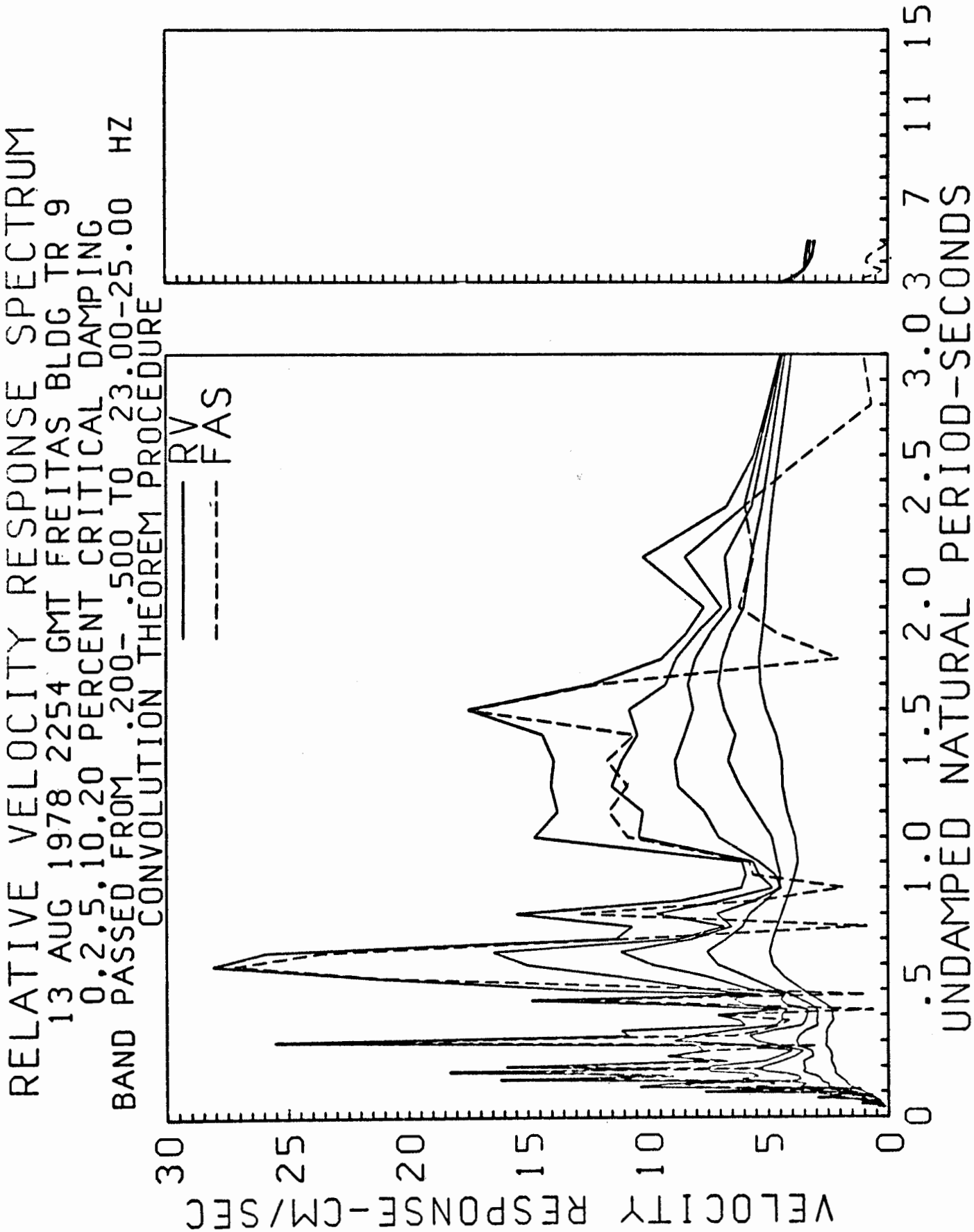

RELATIVE VELOCITY RESPONSE SPECTRUM
13 AUG 1978 2254 GMT FREITAS BLDG TR 4
0.2.5.10.20 PERCENT CRITICAL DAMPING
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
CONVOLUTION THEOREM PROCEDURE
RV
FAS
VELOCITY RESPONSE-CM/SEC
600
500
400
300
200
100
0
.5
1.0
1.5
2.0
2.5
3.0
3
7
11
15
UNDAMPED NATURAL PERIOD-SECONDS

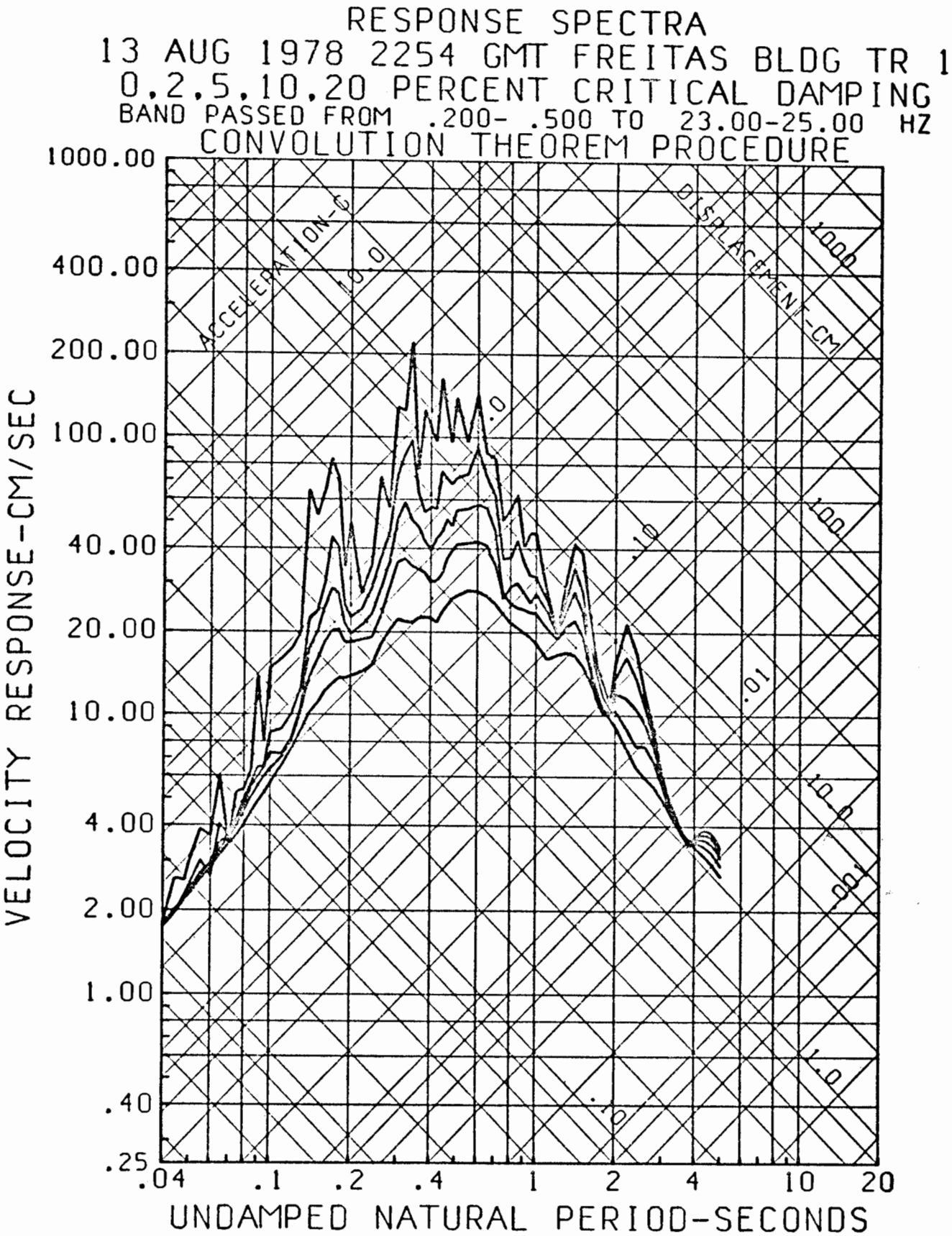

RELATIVE VELOCITY RESPONSE SPECTRUM
13 AUG 1978 2254 GMT FREITAS BLDG TR 5
0.2.5.10.20 PERCENT CRITICAL DAMPING
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
CONVOLUTION THEOREM PROCEDURE
RV
FAS
VELOCITY RESPONSE-CM/SEC
160
140
120
100
80
60
40
20
0
.5
1.0
1.5
2.0
2.5
3.0
3
7
11
15
UNDAMPED NATURAL PERIOD-SECONDS

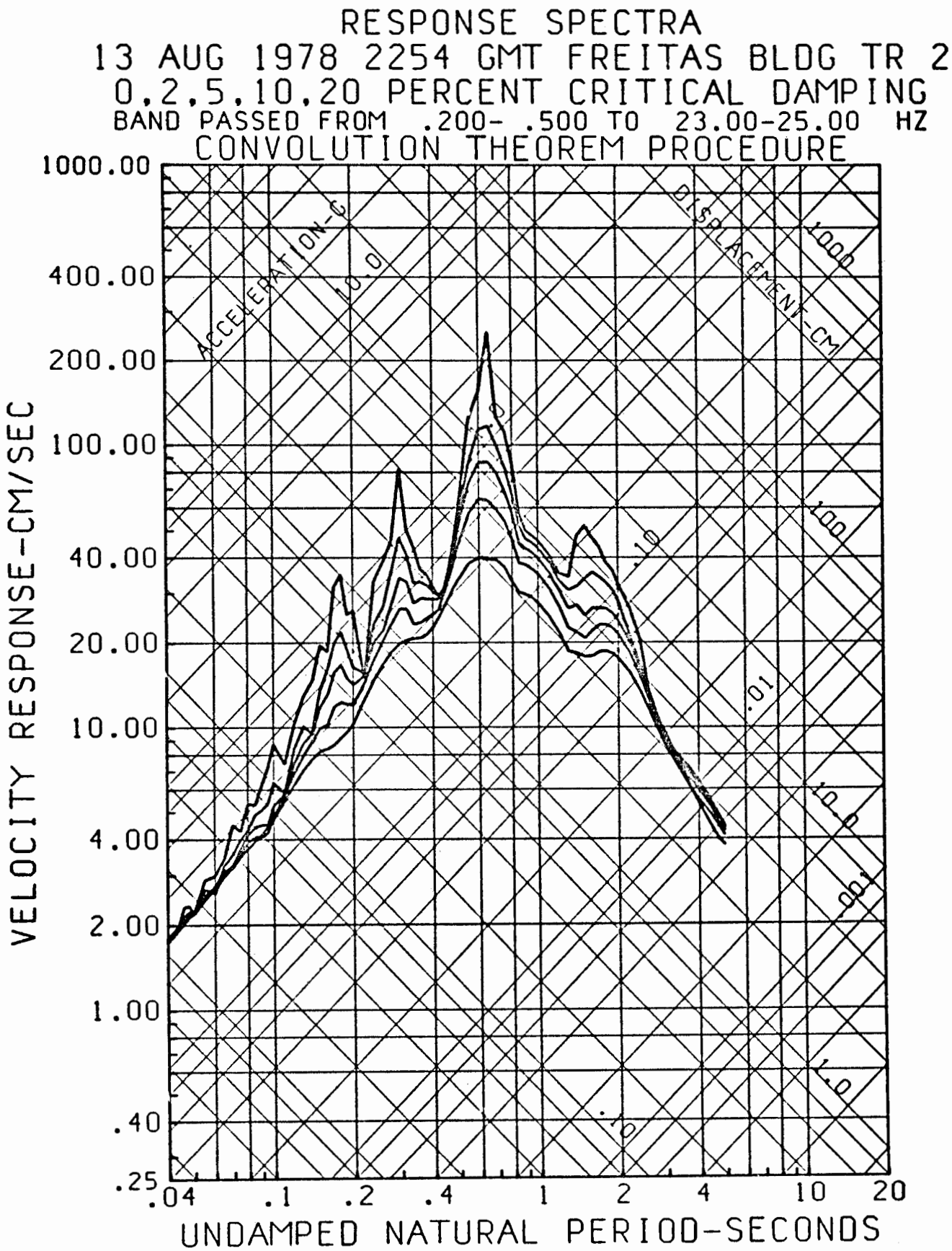

RELATIVE VELOCITY RESPONSE SPECTRUM
13 AUG 1978 2254 GMT FREITAS BLDG TR 6
0.2.5.10.20 PERCENT CRITICAL DAMPING
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
CONVOLUTION THEOREM PROCEDURE
RV
FAS
VELOCITY RESPONSE-CM/SEC
100
80
60
40
20
0
.5
1.0
1.5
2.0
2.5
3.0
3
7
11
15
UNDAMPED NATURAL PERIOD-SECONDS

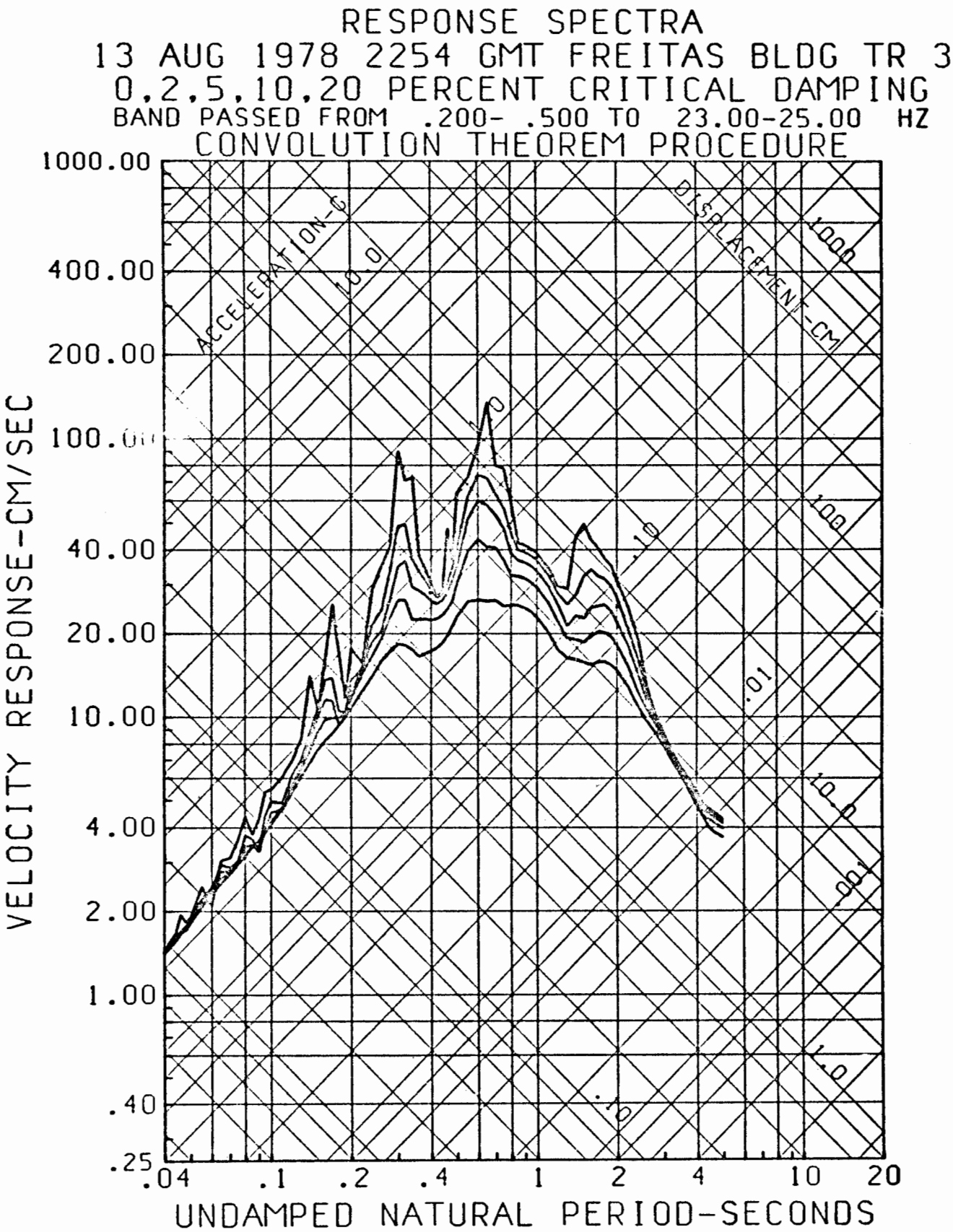

RELATIVE VELOCITY RESPONSE SPECTRUM
13 AUG 1978 2254 GMT FREITAS BLDG TR 7
0.2,5,10,20 PERCENT CRITICAL DAMPING
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
CONVOLUTION THEOREM PROCEDURE
RV
FAS
VELOCITY RESPONSE-CM/SEC
100
80
60
40
20
0
.5
1.0
1.5
2.0
2.5
3.0
3
7
11
15
UNDAMPED NATURAL PERIOD-SECONDS

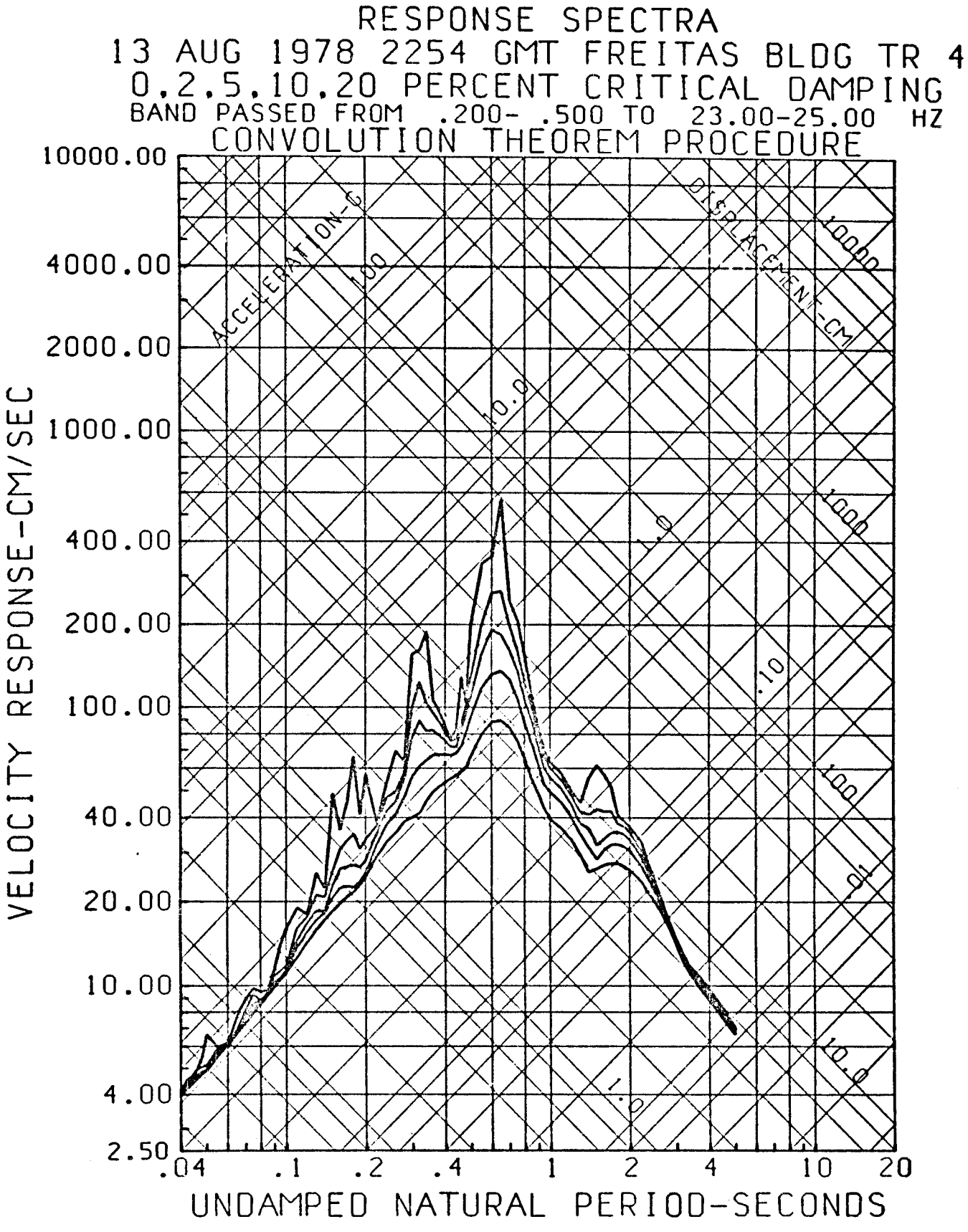

RELATIVE VELOCITY RESPONSE SPECTRUM
13 AUG 1978 2254 GMT FREITAS BLDG TR 8
0.2,5,10,20 PERCENT CRITICAL DAMPING
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
CONVOLUTION THEOREM PROCEDURE
RV
FAS
VELOCITY RESPONSE-CM/SEC
UNDAMPED NATURAL PERIOD-SECONDS
0
10
20
30
40
50
60
70
.5
1.0
1.5
2.0
2.5
3.0
3
7
11
15

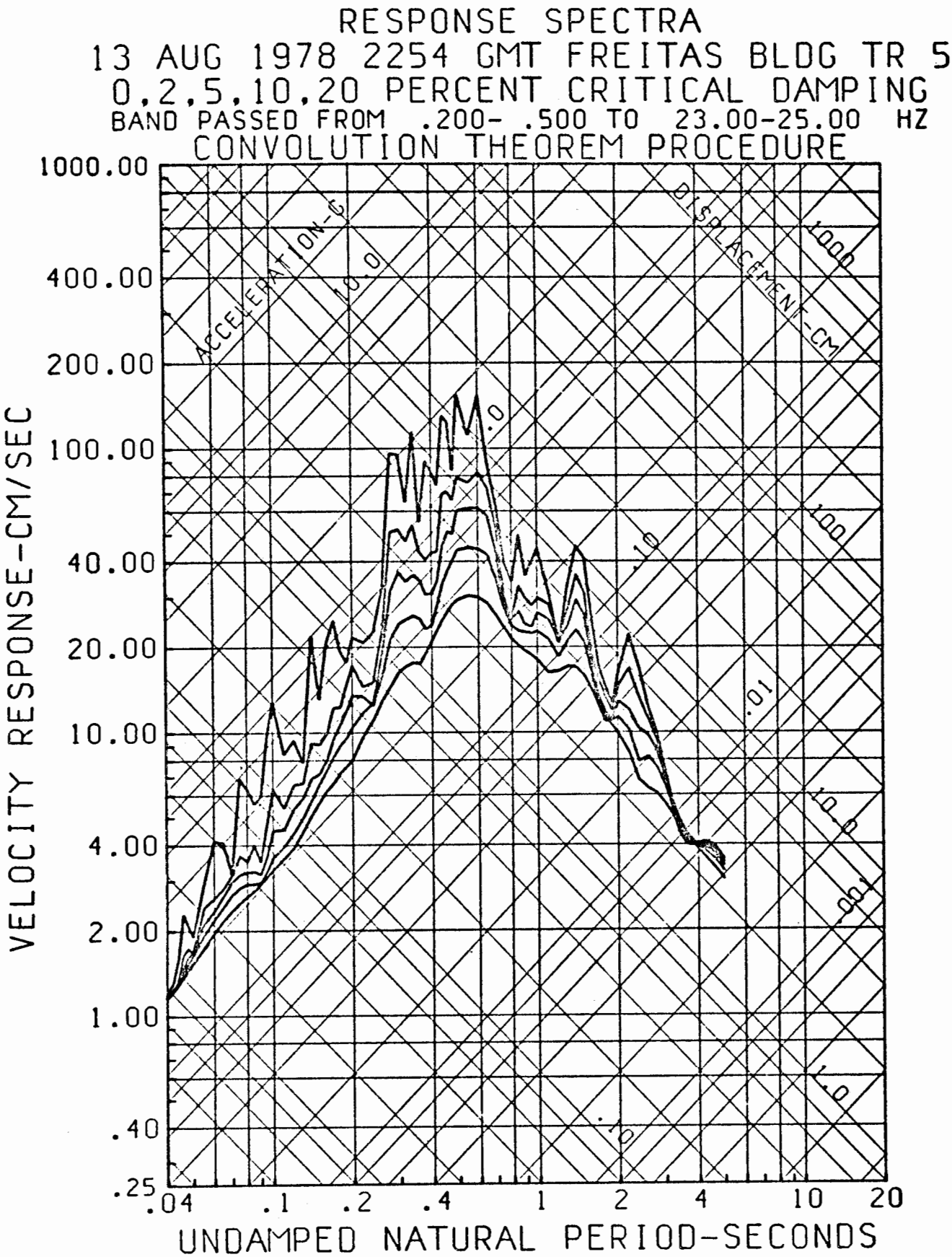

RELATIVE VELOCITY RESPONSE SPECTRUM
13 AUG 1978 2254 GMT FREITAS BLDG TR 9
0.2.5.10.20 PERCENT CRITICAL DAMPING
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
CONVOLUTION THEOREM PROCEDURE
RV
FAS
VELOCITY RESPONSE-CM/SEC
30
25
20
15
10
5
0
.5
1.0
1.5
2.0
2.5
3.0
3
7
11
15
UNDAMPED NATURAL PERIOD-SECONDS

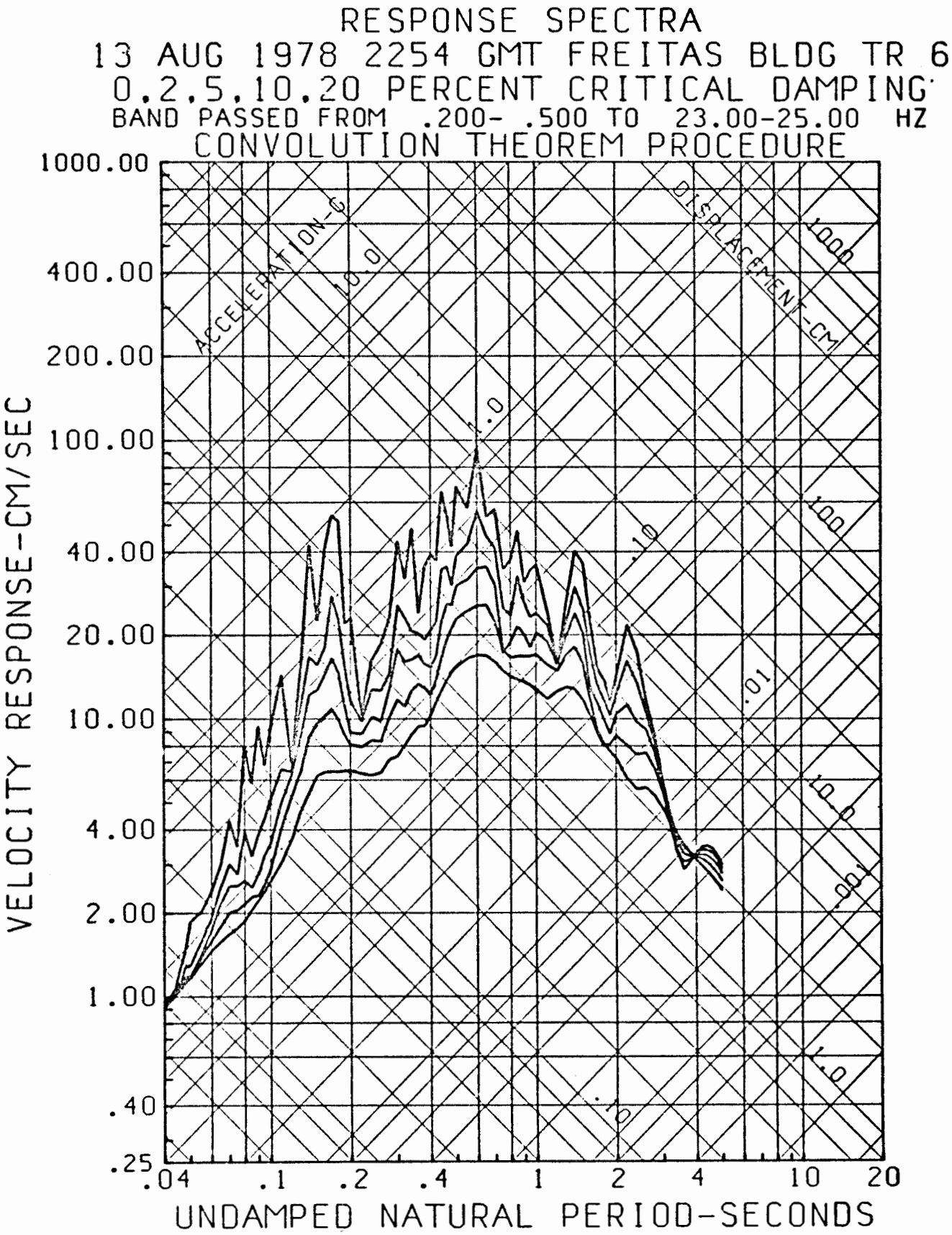

RESPONSE SPECTRA
13 AUG 1978 2254 GMT FREITAS BLDG TR 1
0,2,5,10,20 PERCENT CRITICAL DAMPING
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
CONVOLUTION THEOREM PROCEDURE
ACCELERATION-G
10.0
1.0
.10
.01
DISPLACEMENT-CM
1000
100
10.0
1.0
.10
.01
1000.00
400.00
200.00
100.00
40.00
20.00
10.00
4.00
2.00
1.00
.40
.25
VELOCITY RESPONSE-CM/SEC
.04
.1
.2
.4
1
2
4
10
20
UNDAMPED NATURAL PERIOD-SECONDS

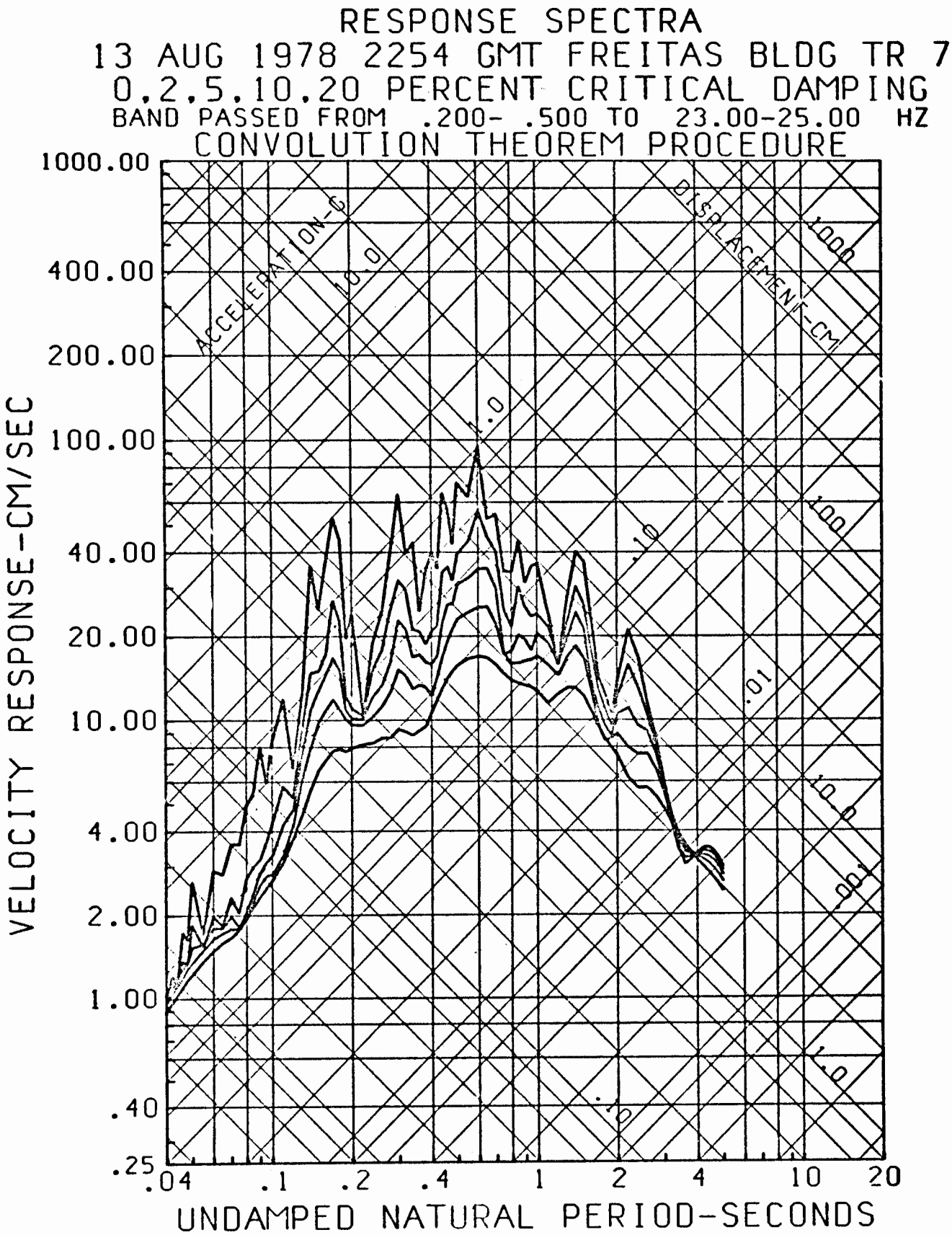

RESPONSE SPECTRA
13 AUG 1978 2254 GMT FREITAS BLDG TR 2
0,2,5,10,20 PERCENT CRITICAL DAMPING
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
CONVOLUTION THEOREM PROCEDURE
ACCELERATION-G
DISPLACEMENT-CM
VELOCITY RESPONSE-CM/SEC
UNDAMPED NATURAL PERIOD-SECONDS
1000.00
400.00
200.00
100.00
40.00
20.00
10.00
4.00
2.00
1.00
.40
.25
.04
.1
.2
.4
1
2
4
10
20

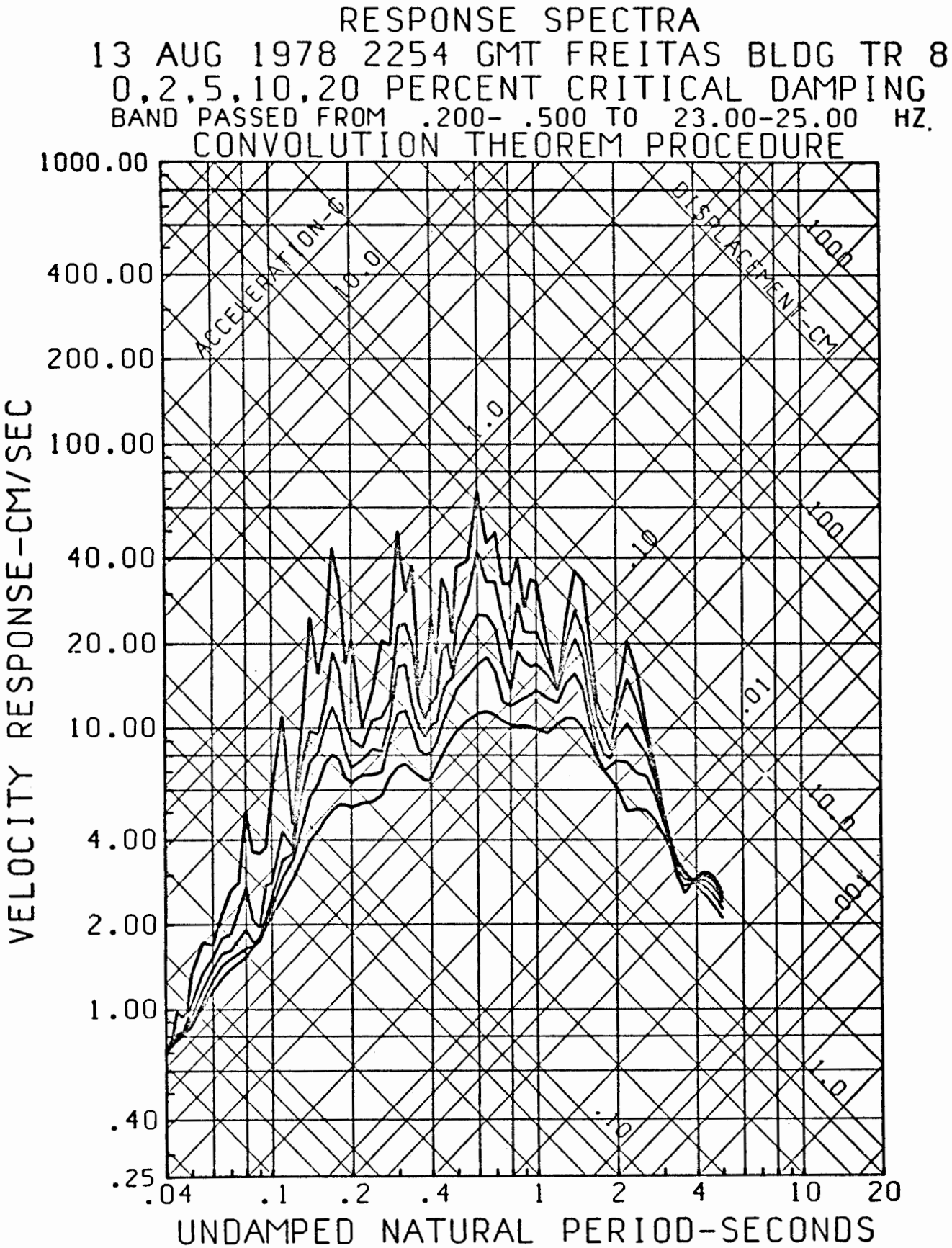

RESPONSE SPECTRA
13 AUG 1978 2254 GMT FREITAS BLDG TR 3
0,2,5,10,20 PERCENT CRITICAL DAMPING
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
CONVOLUTION THEOREM PROCEDURE
ACCELERATION-G
DISPLACEMENT-CM
VELOCITY RESPONSE-CM/SEC
UNDAMPED NATURAL PERIOD-SECONDS
1000.00
400.00
200.00
100.00
40.00
20.00
10.00
4.00
2.00
1.00
.40
.25
.04
.1
.2
.4
1
2
4
10
20

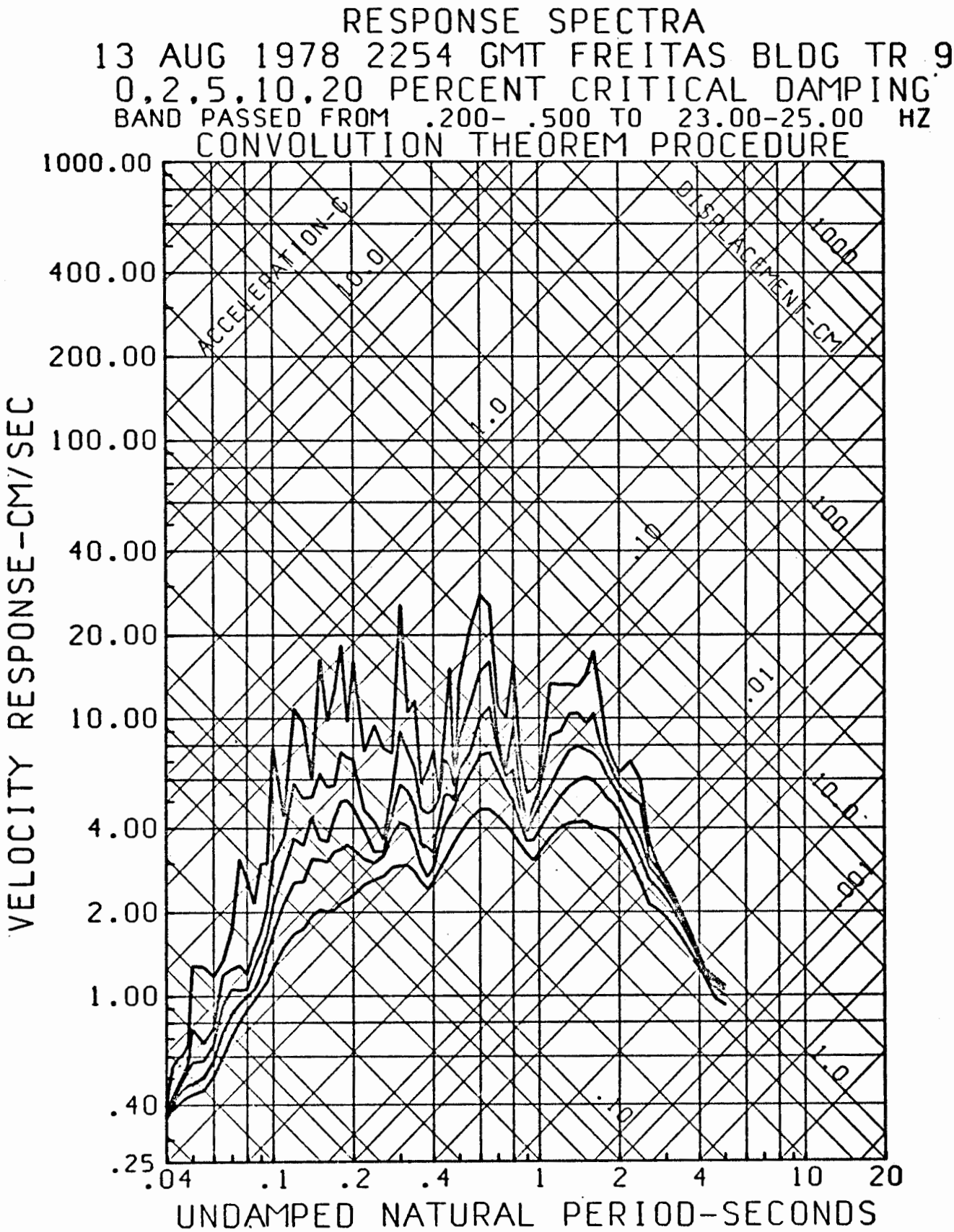

RESPONSE SPECTRA
13 AUG 1978 2254 GMT FREITAS BLDG TR 4
0,2,5,10,20 PERCENT CRITICAL DAMPING
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
CONVOLUTION THEOREM PROCEDURE
ACCELERATION-G
DISPLACEMENT-CM
VELOCITY RESPONSE-CM/SEC
UNDAMPED NATURAL PERIOD-SECONDS
10000.00
4000.00
2000.00
1000.00
400.00
200.00
100.00
40.00
20.00
10.00
4.00
2.50
.04
.1
.2
.4
1
2
4
10
20

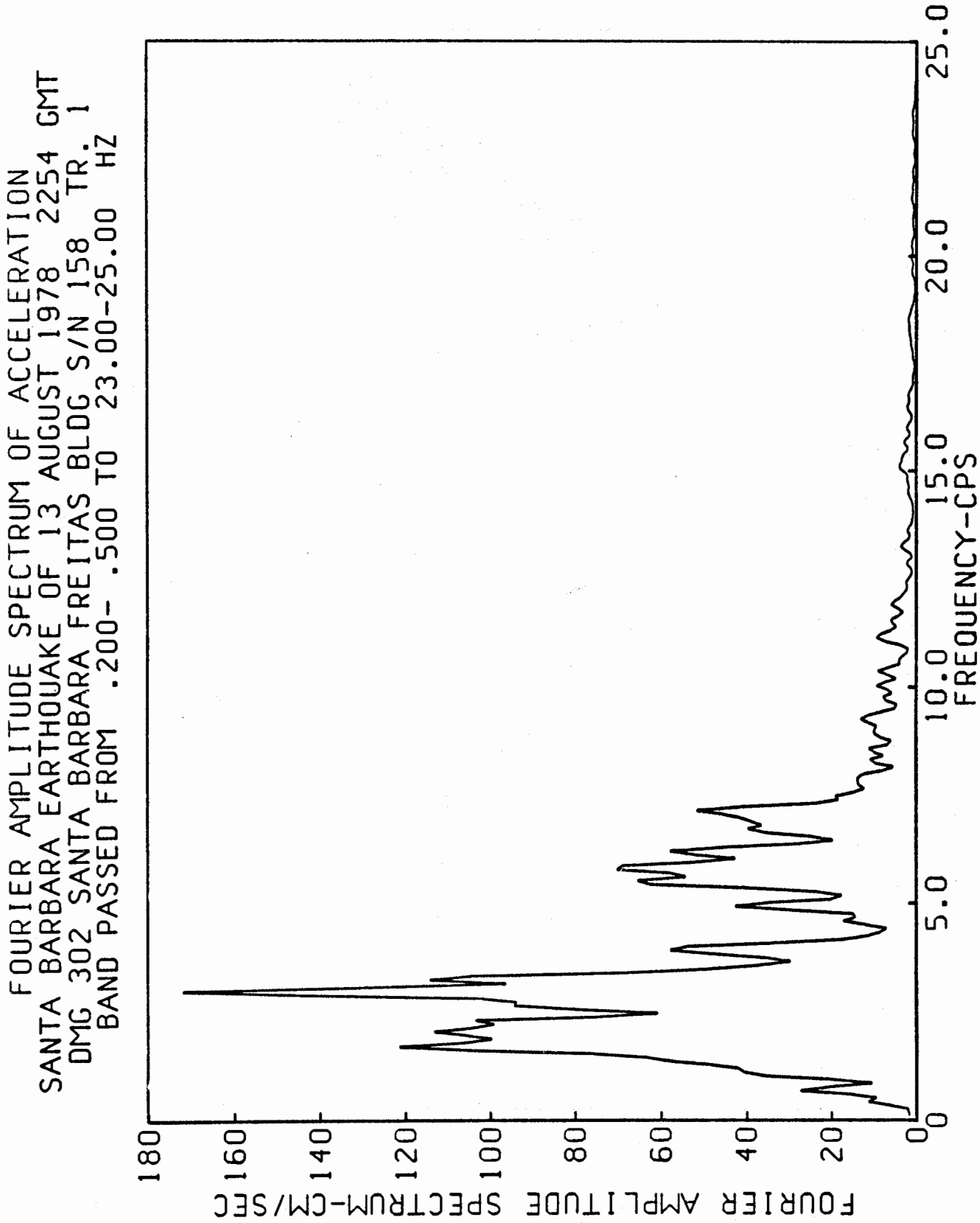

RESPONSE SPECTRA
13 AUG 1978 2254 GMT FREITAS BLDG TR 5
0,2,5,10,20 PERCENT CRITICAL DAMPING
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
CONVOLUTION THEOREM PROCEDURE
ACCELERATION-G
DISPLACEMENT-CM
VELOCITY RESPONSE-CM/SEC
UNDAMPED NATURAL PERIOD-SECONDS
1000.00
400.00
200.00
100.00
40.00
20.00
10.00
4.00
2.00
1.00
.40
.25
.04
.1
.2
.4
1
2
4
10
20

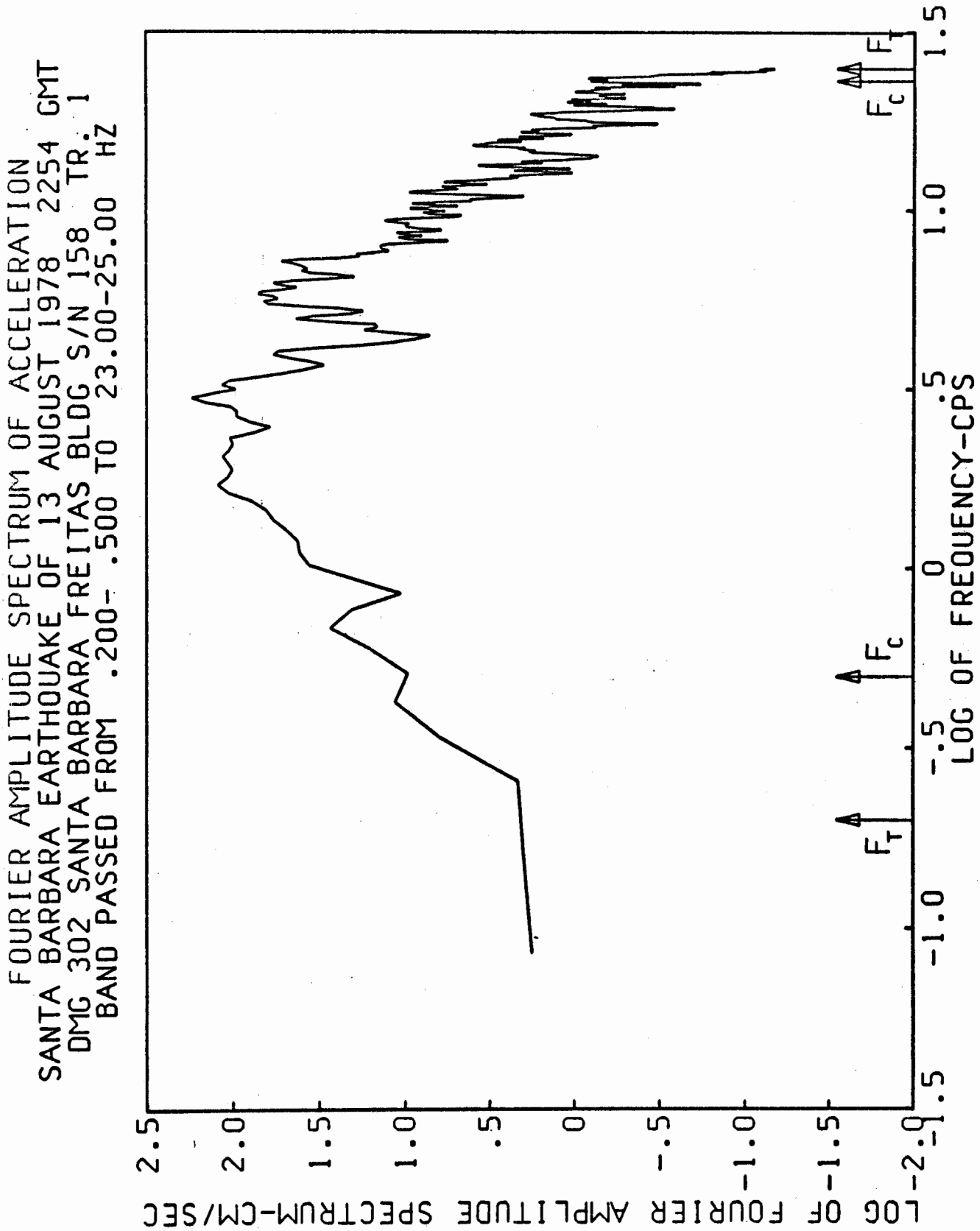

RESPONSE SPECTRA
13 AUG 1978 2254 GMT FREITAS BLDG TR 6
0,2,5,10,20 PERCENT CRITICAL DAMPING
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
CONVOLUTION THEOREM PROCEDURE
VELOCITY RESPONSE-CM/SEC
1000.00
400.00
200.00
100.00
40.00
20.00
10.00
4.00
2.00
1.00
.40
.25
.04
.1
.2
.4
1
2
4
10
20
UNDAMPED NATURAL PERIOD-SECONDS
ACCELERATION-G
DISPLACEMENT-CM
10.0
1.0
.10
.01
1000
100
10.0
1.0
.10
.001

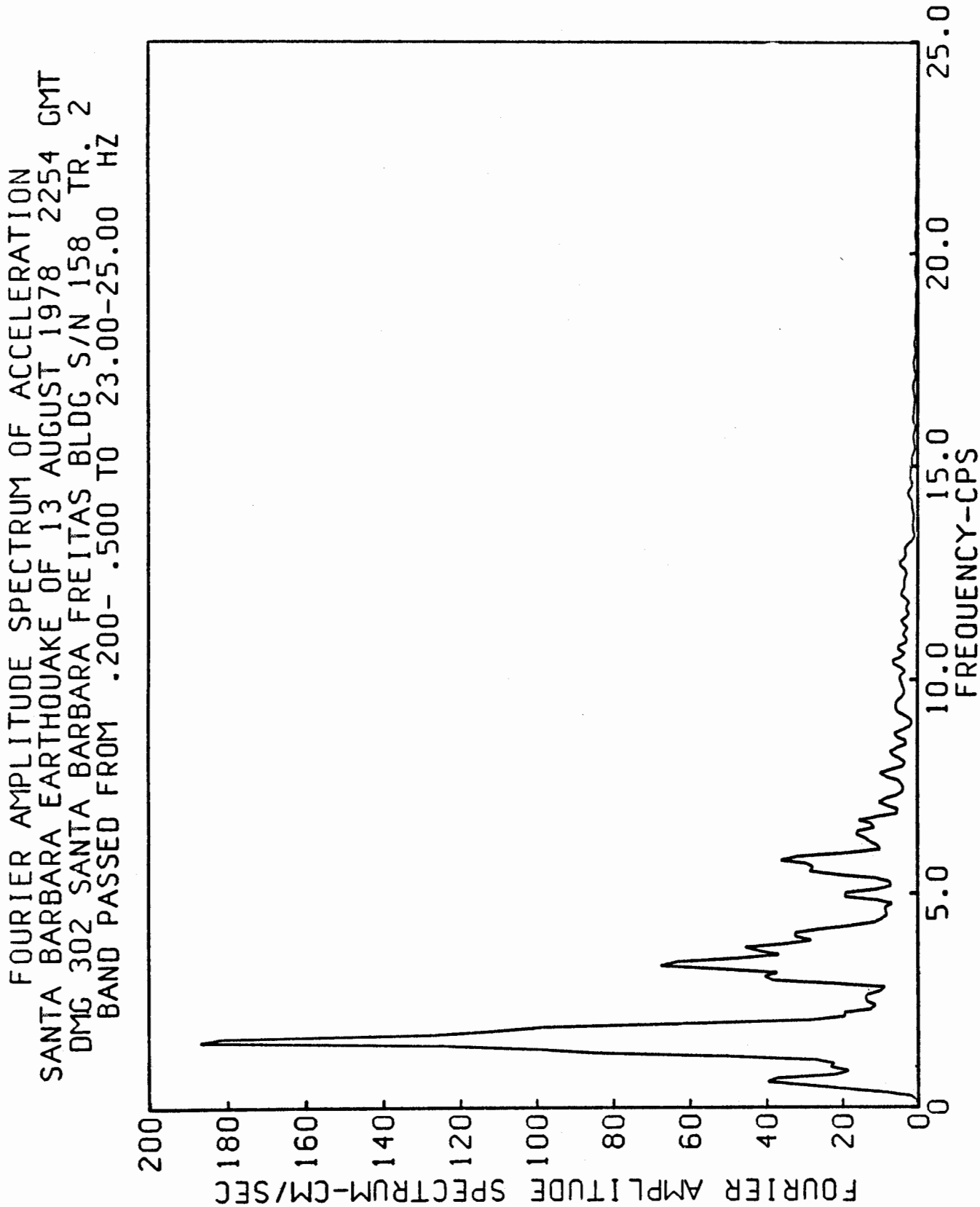

RESPONSE SPECTRA
13 AUG 1978 2254 GMT FREITAS BLDG TR 7
0,2,5,10,20 PERCENT CRITICAL DAMPING
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
CONVOLUTION THEOREM PROCEDURE
ACCELERATION-G
DISPLACEMENT-CM
VELOCITY RESPONSE-CM/SEC
UNDAMPED NATURAL PERIOD-SECONDS
1000.00
400.00
200.00
100.00
40.00
20.00
10.00
4.00
2.00
1.00
.40
.25
.04
.1
.2
.4
1
2
4
10
20

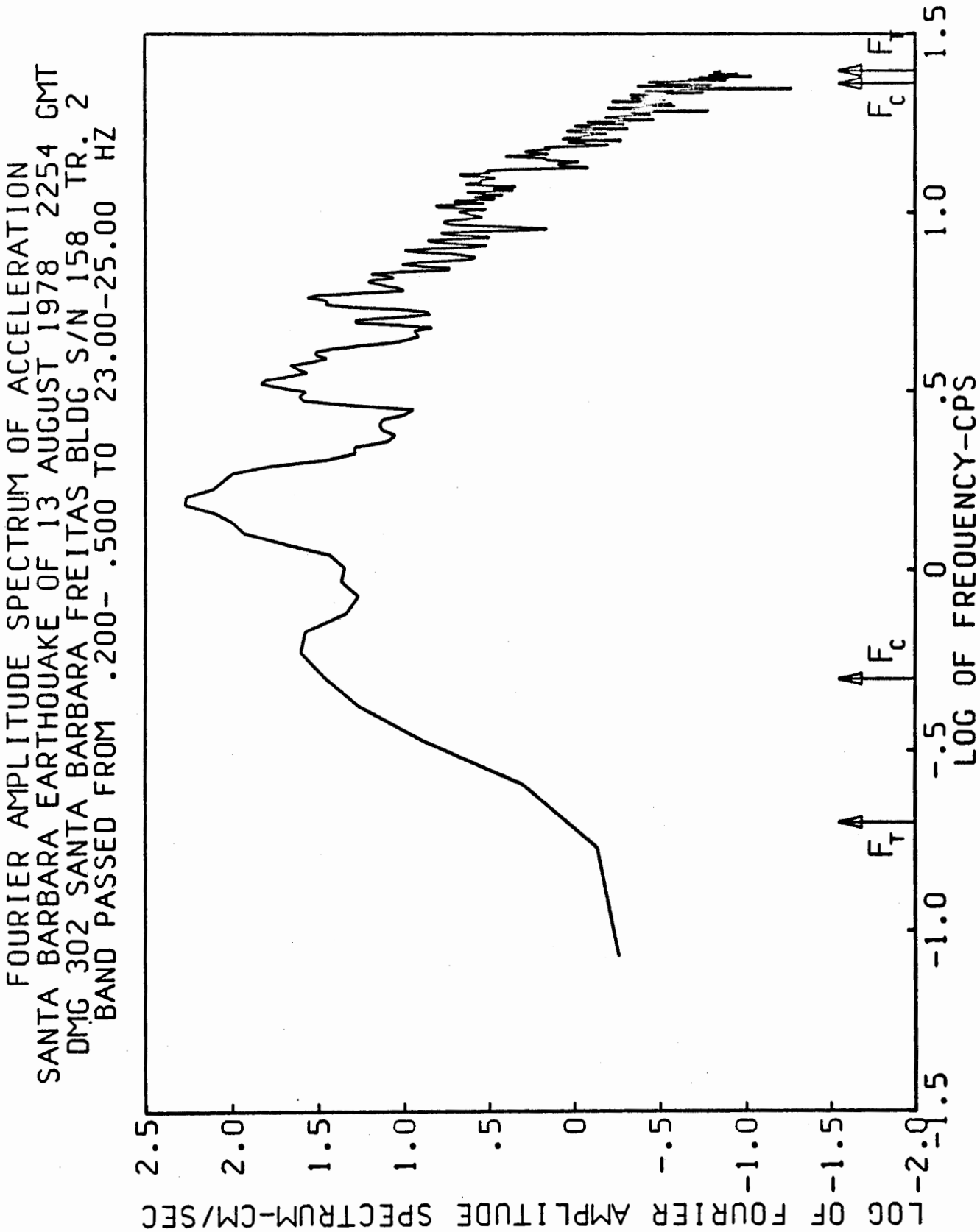

RESPONSE SPECTRA
13 AUG 1978 2254 GMT FREITAS BLDG TR 8
0,2,5,10,20 PERCENT CRITICAL DAMPING
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ.
CONVOLUTION THEOREM PROCEDURE
ACCELERATION-G
DISPLACEMENT-CM
10.0
1.0
.10
.01
.001
1000
100
10.0
1.0
.10
VELOCITY RESPONSE-CM/SEC
1000.00
400.00
200.00
100.00
40.00
20.00
10.00
4.00
2.00
1.00
.40
.25
.04
.1
.2
.4
1
2
4
10
20
UNDAMPED NATURAL PERIOD-SECONDS

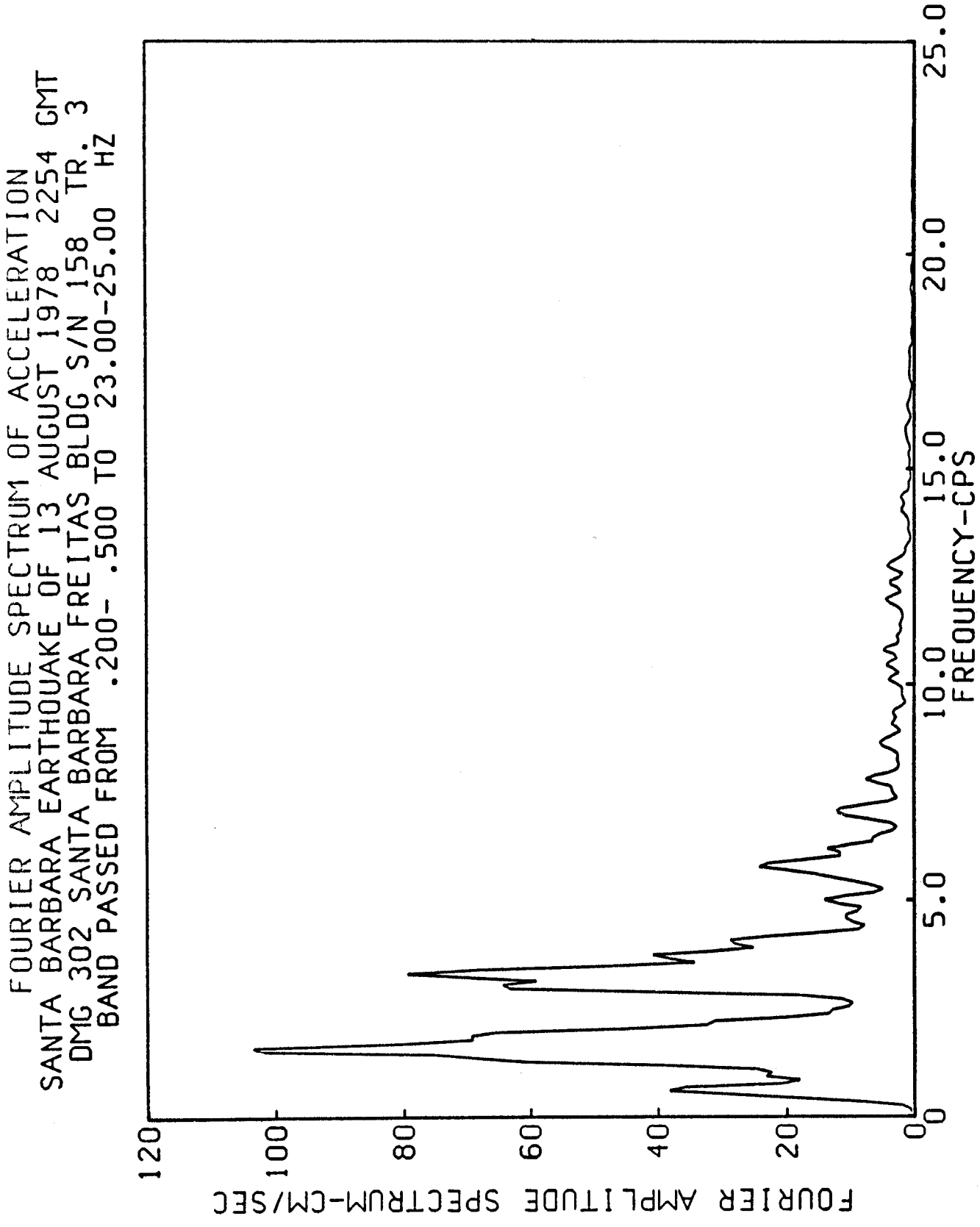

RESPONSE SPECTRA
13 AUG 1978 2254 GMT FREITAS BLDG TR 9
0,2,5,10,20 PERCENT CRITICAL DAMPING
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
CONVOLUTION THEOREM PROCEDURE
ACCELERATION-G
DISPLACEMENT-CM
VELOCITY RESPONSE-CM/SEC
UNDAMPED NATURAL PERIOD-SECONDS
1000.00
400.00
200.00
100.00
40.00
20.00
10.00
4.00
2.00
1.00
.40
.25
.04
.1
.2
.4
1
2
4
10
20

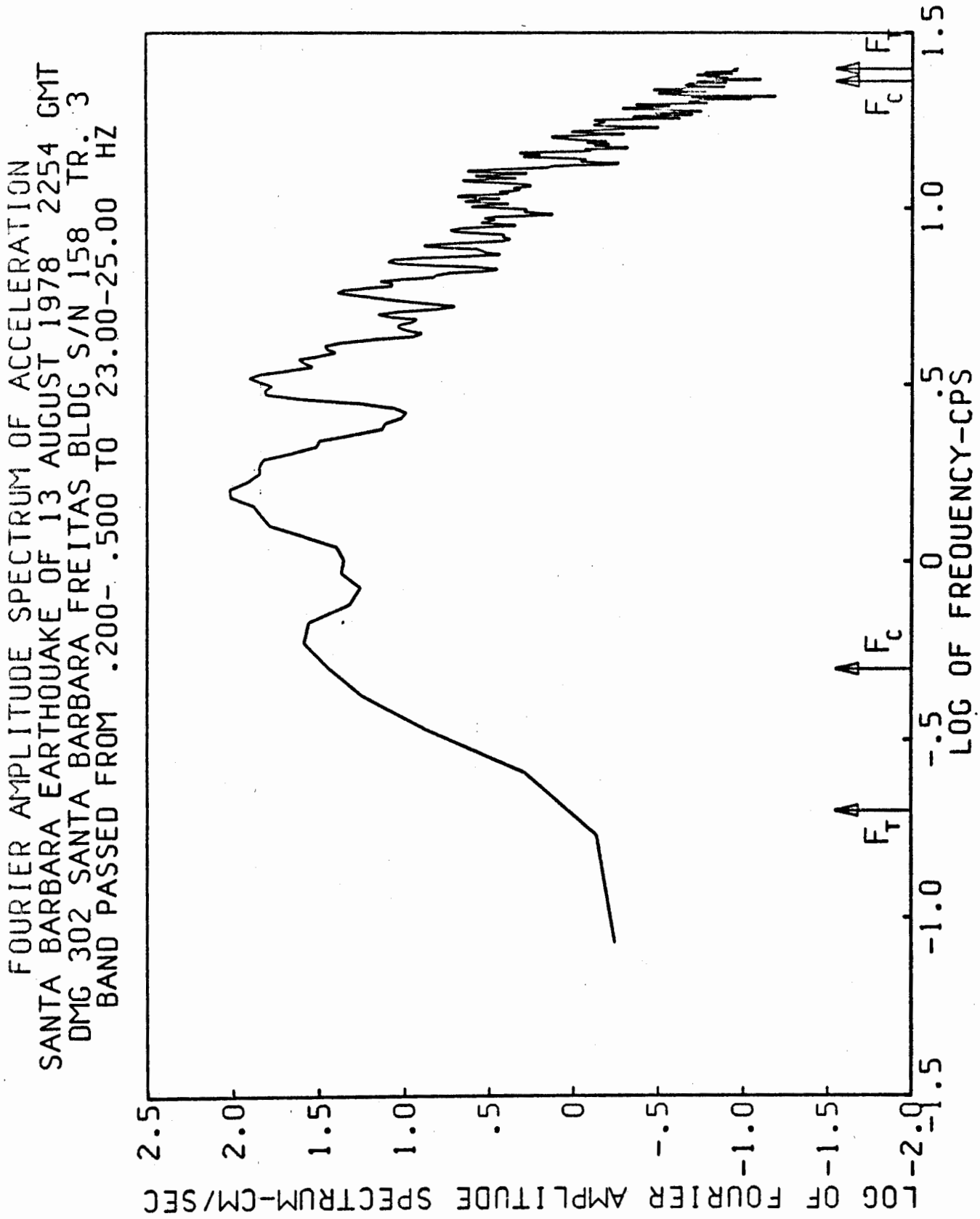

FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
SANTA BARBARA EARTHQUAKE OF 13 AUGUST 1978 2254 GMT
DMG 302 SANTA BARBARA FREITAS BLDG S/N 158 TR. 1
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
FOURIER AMPLITUDE SPECTRUM-CM/SEC
0
20
40
60
80
100
120
140
160
180
FREQUENCY-CPS
0
5.0
10.0
15.0
20.0
25.0

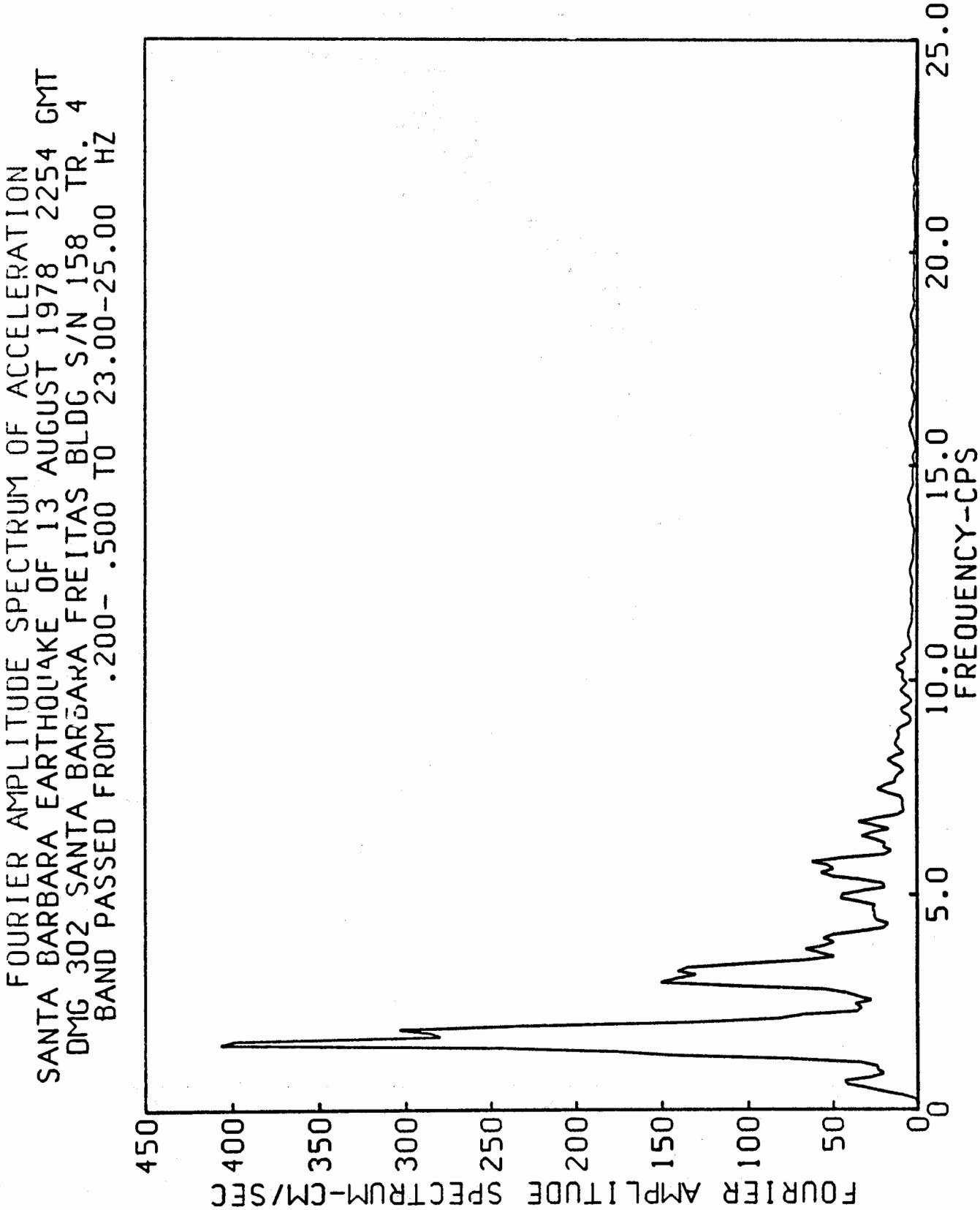

FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
SANTA BARBARA EARTHQUAKE OF 13 AUGUST 1978 2254 GMT
DMG 302 SANTA BARBARA FREITAS BLDG S/N 158 TR. 1
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
LOG OF FOURIER AMPLITUDE SPECTRUM-CM/SEC
2.5
2.0
1.5
1.0
.5
0
-.5
-1.0
-1.5
-2.0
-1.5
-1.0
-.5
0
.5
1.0
1.5
LOG OF FREQUENCY-CPS
F_T
F_c
F_c
F_T

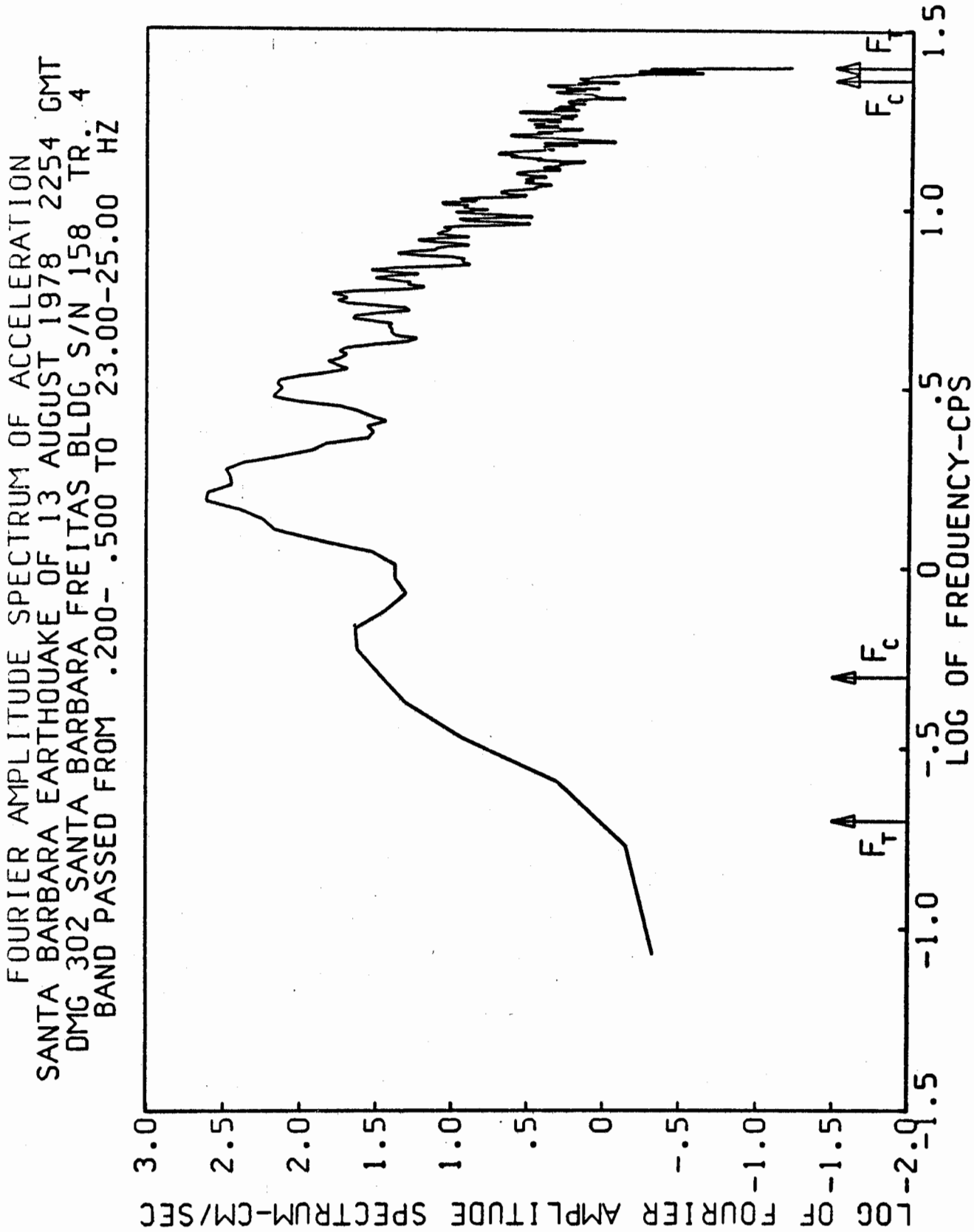

FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
SANTA BARBARA EARTHQUAKE OF 13 AUGUST 1978 2254 GMT
DMG 302 SANTA BARBARA FREITAS BLDG S/N 158 TR. 2
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
FOURIER AMPLITUDE SPECTRUM-CM/SEC
0
20
40
60
80
100
120
140
160
180
200
0
5.0
10.0
15.0
20.0
25.0
FREQUENCY-CPS

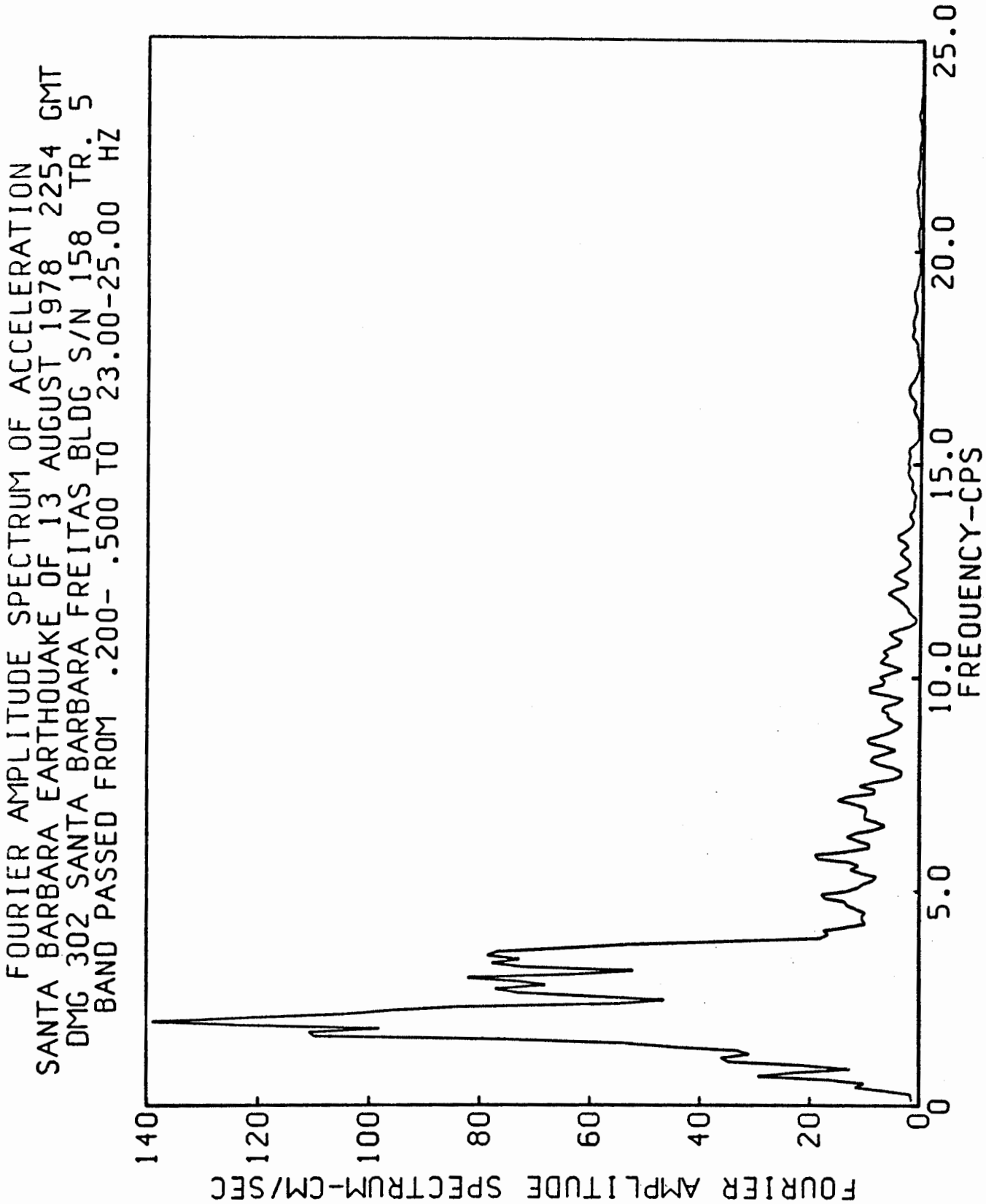

FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
SANTA BARBARA EARTHQUAKE OF 13 AUGUST 1978 2254 GMT
DMG 302 SANTA BARBARA FREITAS BLDG S/N 158 TR. 2
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
LOG OF FOURIER AMPLITUDE SPECTRUM-CM/SEC
2.5
2.0
1.5
1.0
.5
0
-.5
-1.0
-1.5
-2.0
-1.5
-1.0
-.5
0
.5
1.0
1.5
LOG OF FREQUENCY-CPS
F_T
F_c
F_c
F_T

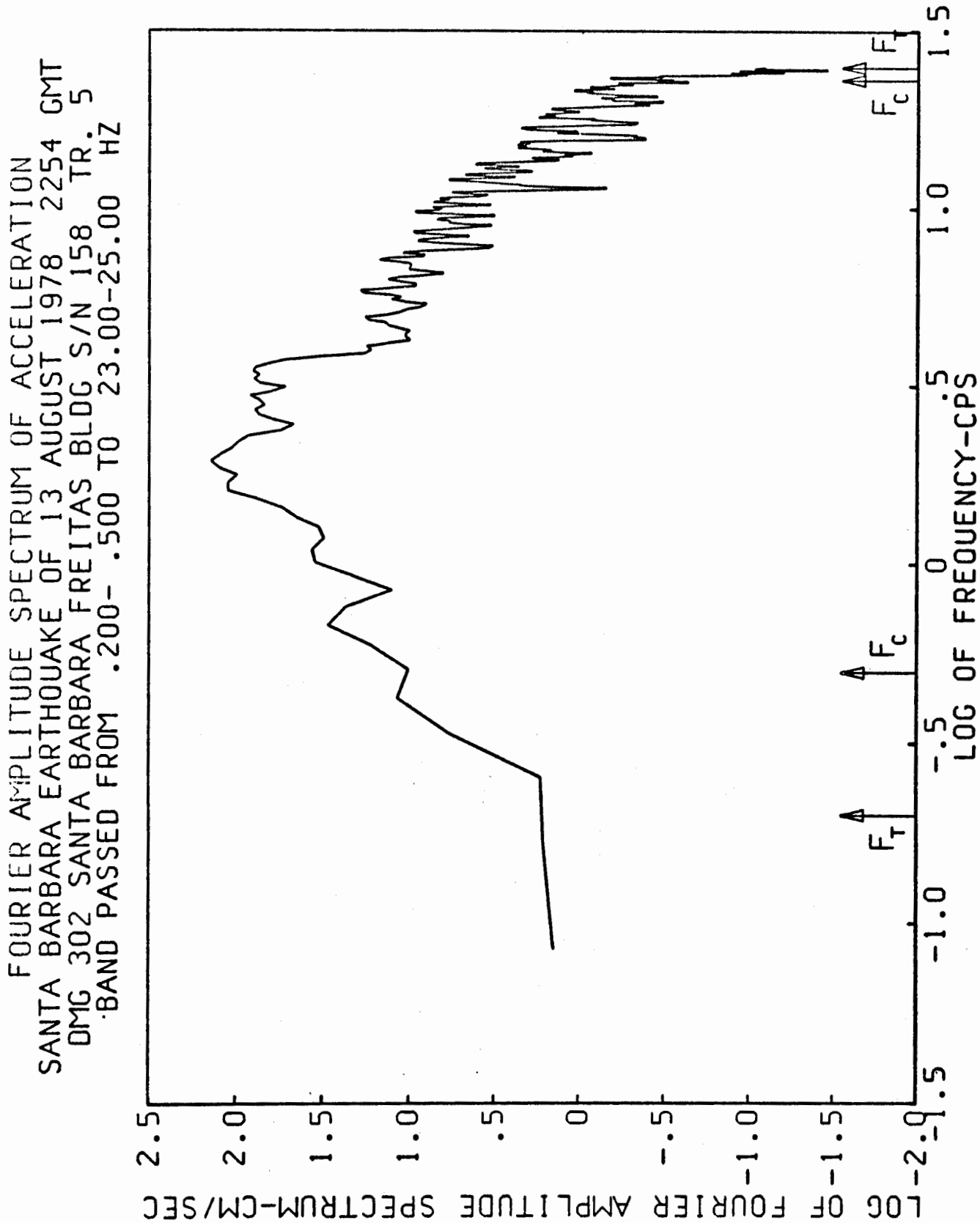

FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
SANTA BARBARA EARTHQUAKE OF 13 AUGUST 1978 2254 GMT
DMG 302 SANTA BARBARA FREITAS BLDG S/N 158 TR. 3
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
FOURIER AMPLITUDE SPECTRUM-CM/SEC
0
20
40
60
80
100
120
0
5.0
10.0
15.0
20.0
25.0
FREQUENCY-CPS

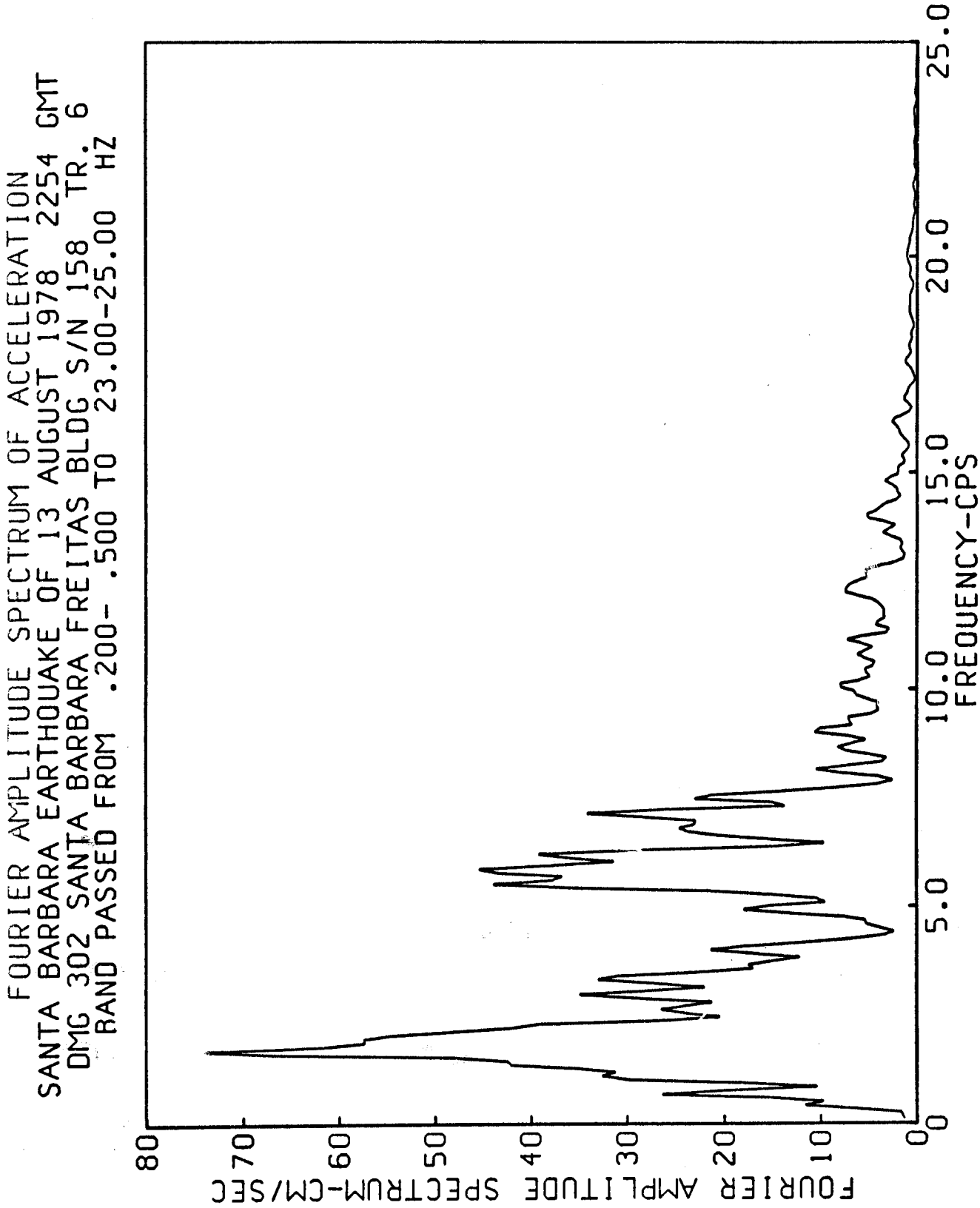

FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
SANTA BARBARA EARTHQUAKE OF 13 AUGUST 1978 2254 GMT
DMG 302 SANTA BARBARA FREITAS BLDG S/N 158 TR. 3
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
LOG OF FOURIER AMPLITUDE SPECTRUM-CM/SEC
2.5
2.0
1.5
1.0
.5
0
-.5
-1.0
-1.5
-2.0
-1.5
-1.0
-.5
0
.5
1.0
1.5
LOG OF FREQUENCY-CPS
F_T
F_c
F_c
F_T

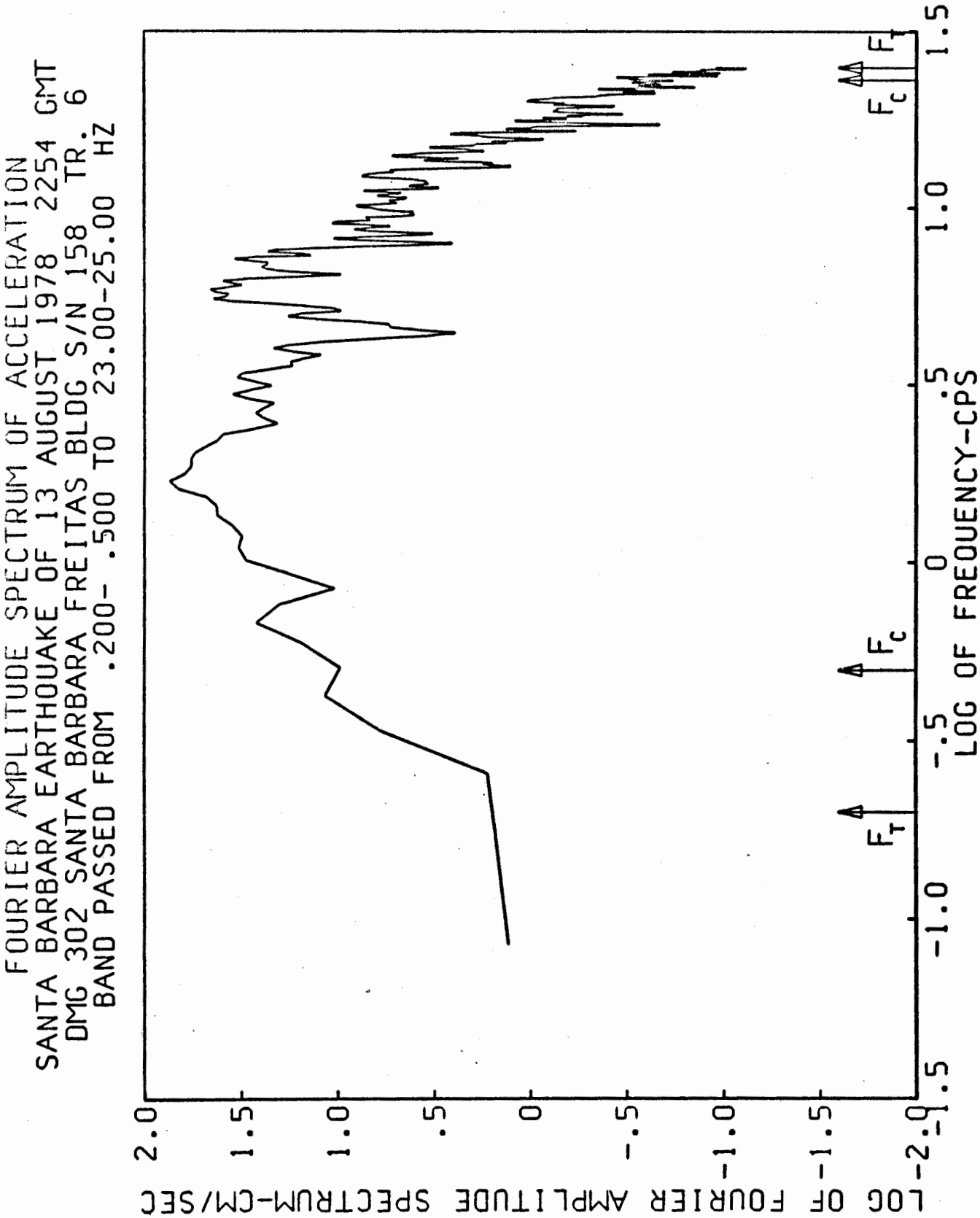

FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
SANTA BARBARA EARTHQUAKE OF 13 AUGUST 1978 2254 GMT
DMG 302 SANTA BARBARA FREITAS BLDG S/N 158 TR. 4
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
FOURIER AMPLITUDE SPECTRUM-CM/SEC
0
50
100
150
200
250
300
350
400
450
FREQUENCY-CPS
0
5.0
10.0
15.0
20.0
25.0

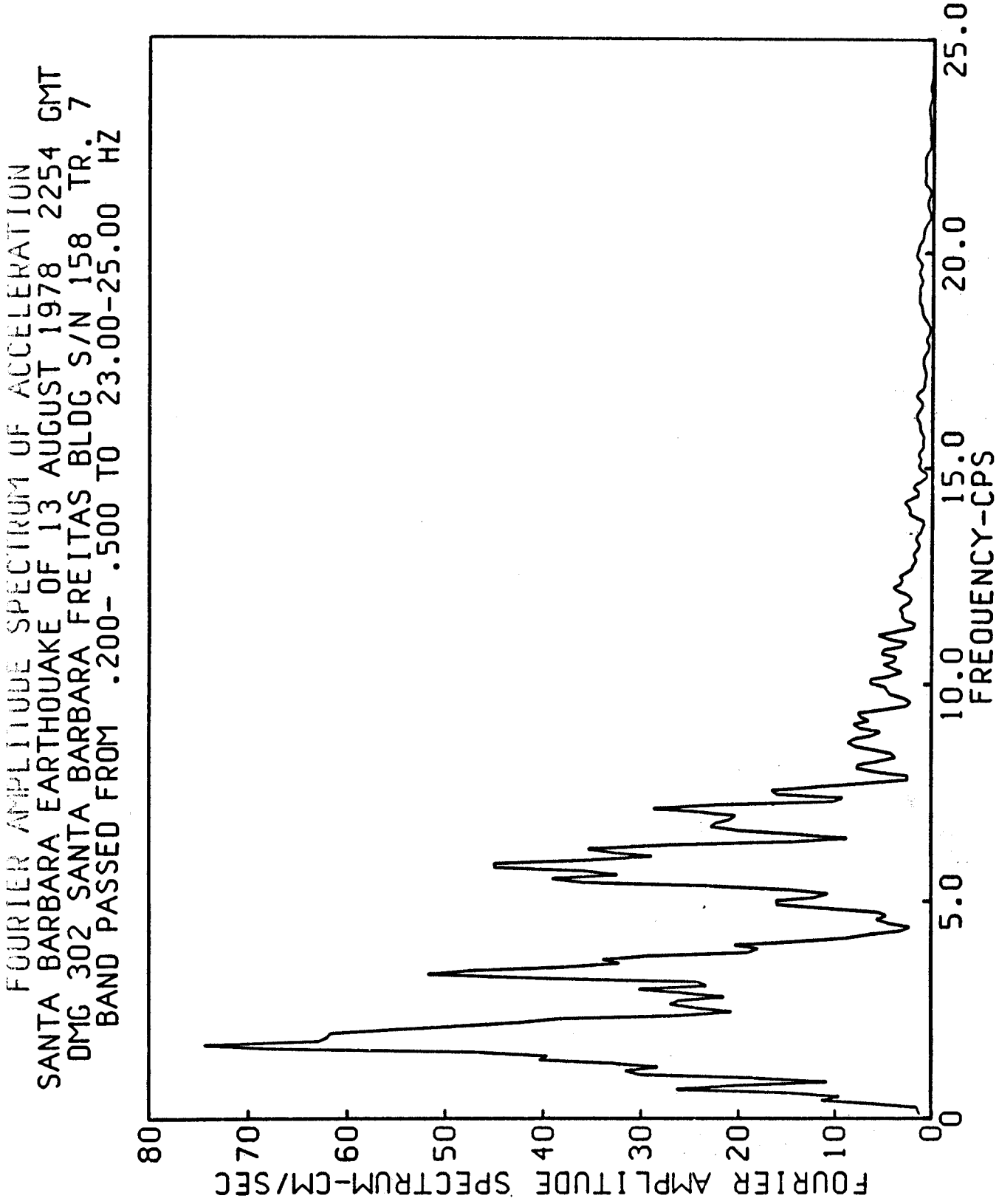

FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
SANTA BARBARA EARTHQUAKE OF 13 AUGUST 1978 2254 GMT
DMG 302 SANTA BARBARA FREITAS BLDG S/N 158 TR. 4
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
LOG OF FOURIER AMPLITUDE SPECTRUM-CM/SEC
3.0
2.5
2.0
1.5
1.0
.5
0
-.5
-1.0
-1.5
-2.0
-1.5
-1.0
-.5
0
.5
1.0
1.5
LOG OF FREQUENCY-CPS
F_T
F_c
F_c
F_T

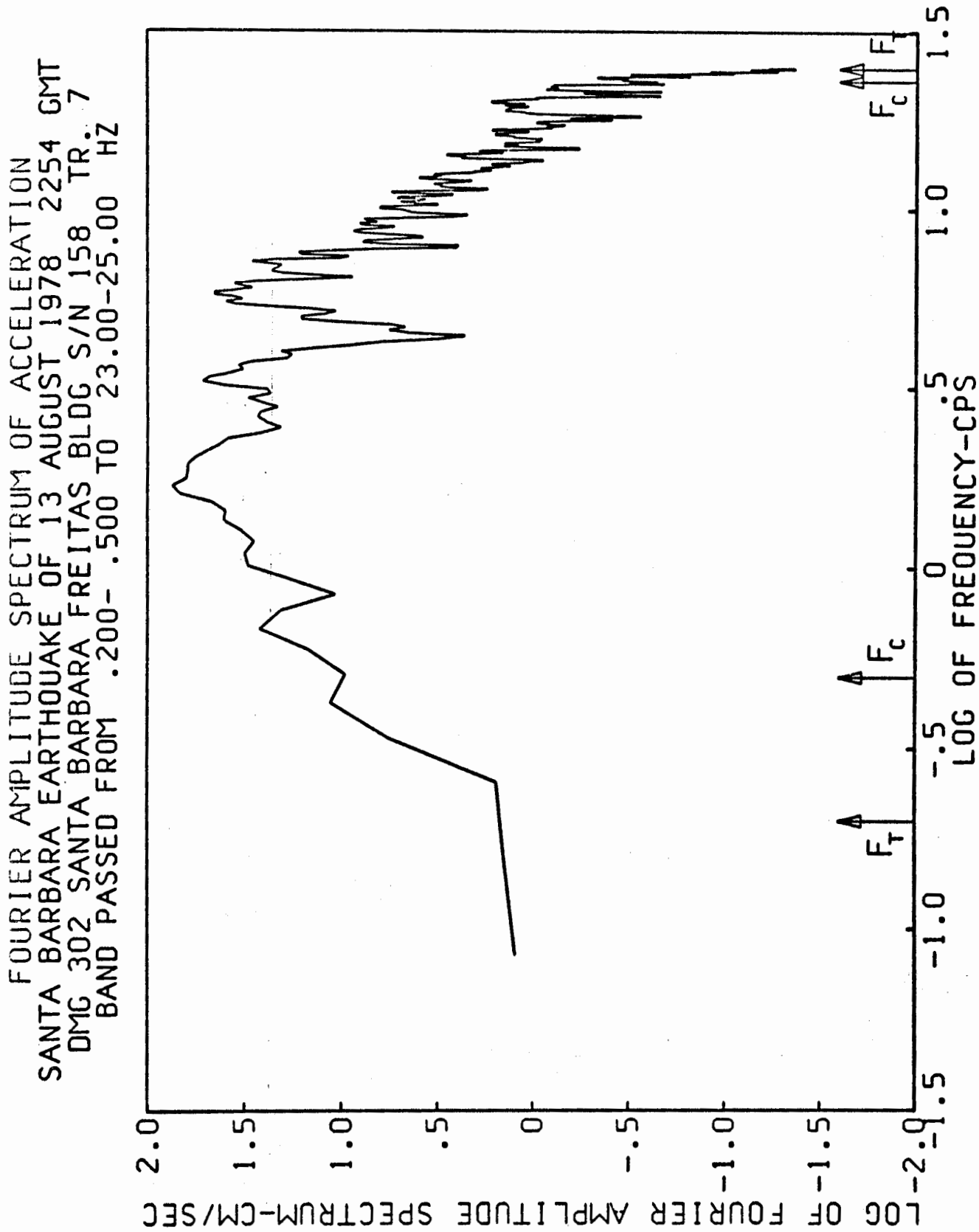

FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
SANTA BARBARA EARTHQUAKE OF 13 AUGUST 1978 2254 GMT
DMG 302 SANTA BARBARA FREITAS BLDG S/N 158 TR. 5
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
FOURIER AMPLITUDE SPECTRUM-CM/SEC
0
20
40
60
80
100
120
140
0
5.0
10.0
15.0
20.0
25.0
FREQUENCY-CPS

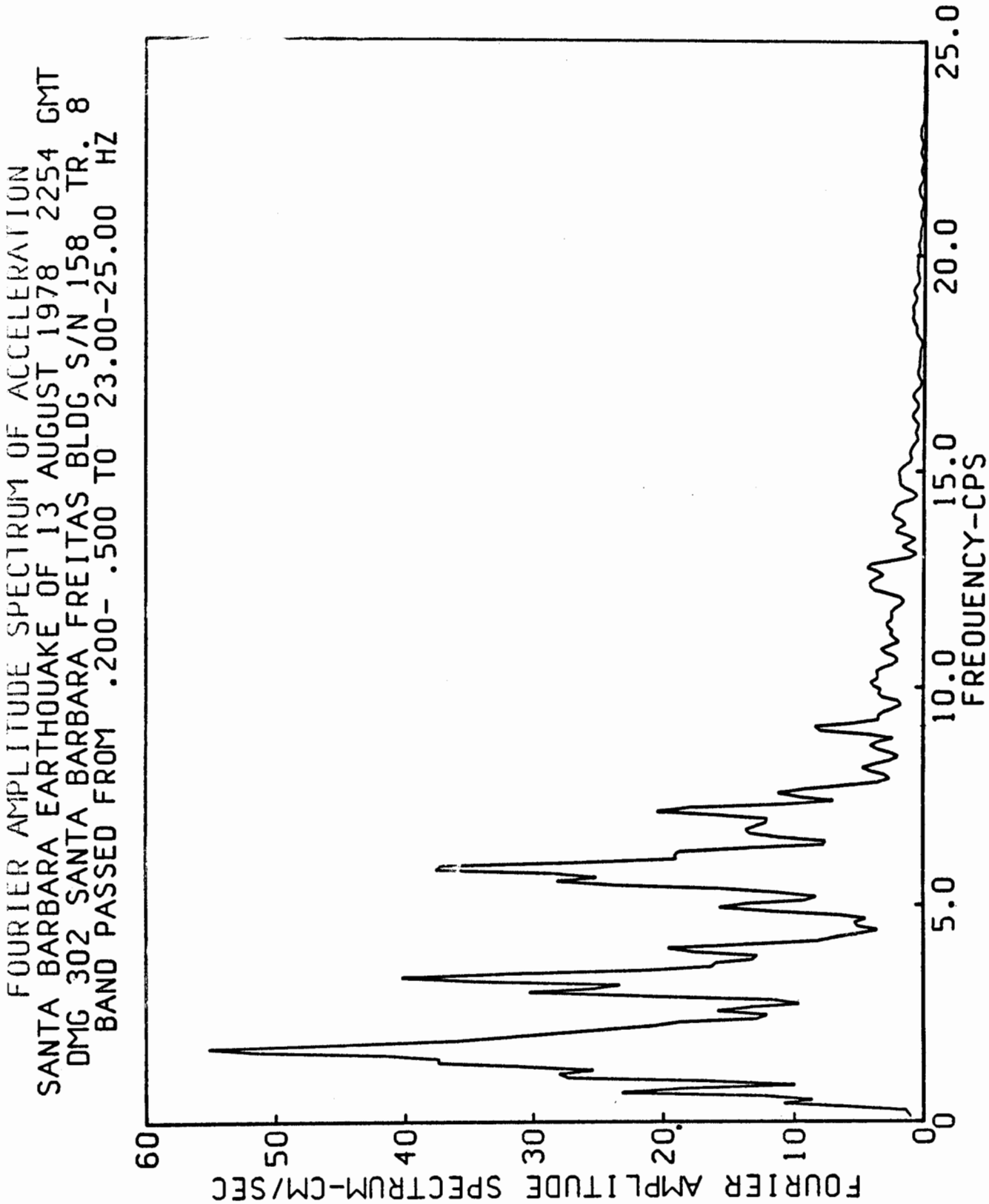

FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
SANTA BARBARA EARTHQUAKE OF 13 AUGUST 1978 2254 GMT
DMG 302 SANTA BARBARA FREITAS BLDG S/N 158 TR. 5
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
LOG OF FOURIER AMPLITUDE SPECTRUM-CM/SEC
2.5
2.0
1.5
1.0
.5
0
-.5
-1.0
-1.5
-2.0
LOG OF FREQUENCY-CPS
-1.5
-1.0
-.5
0
.5
1.0
1.5
F_T
F_c
F_c
F_T

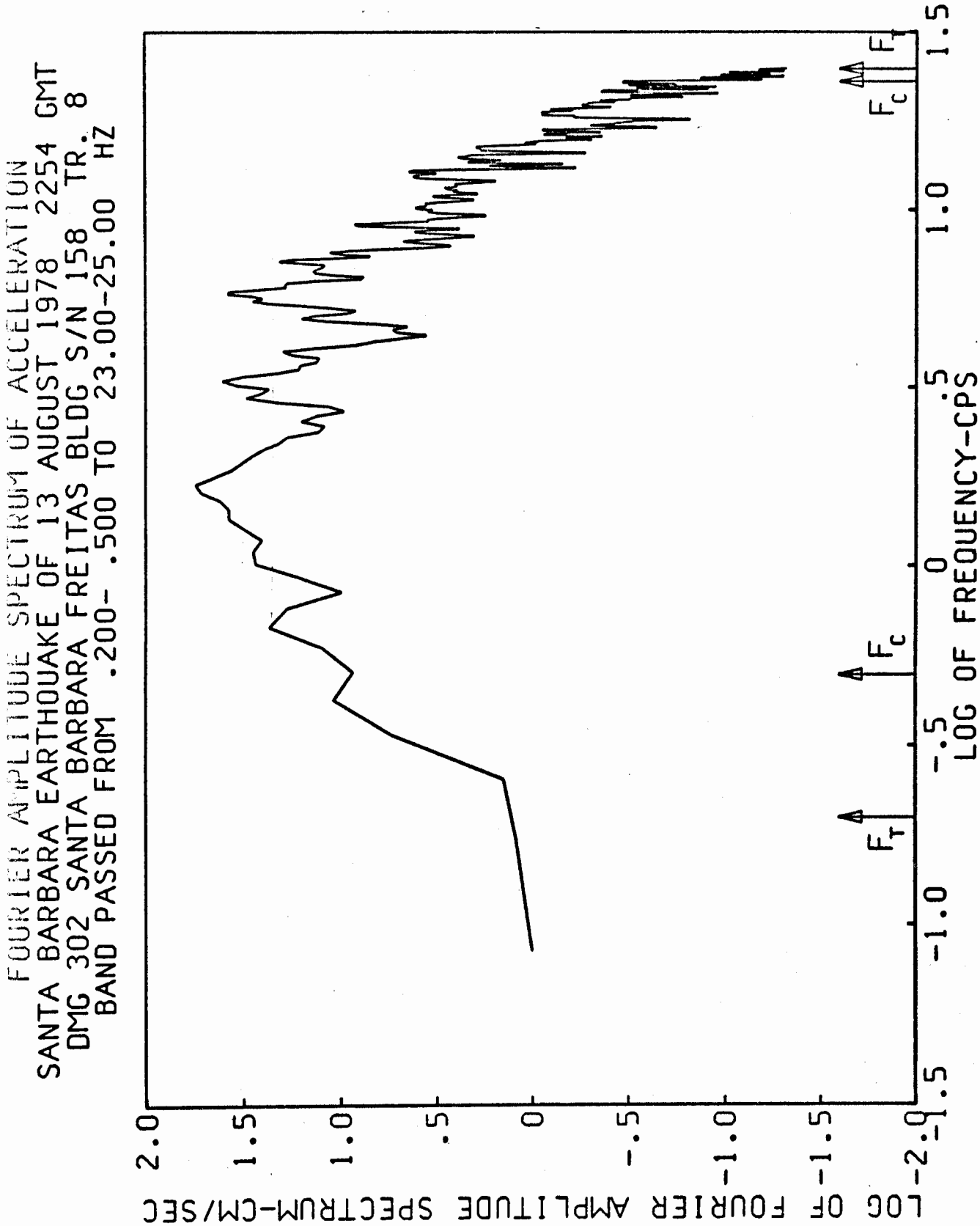

FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
SANTA BARBARA EARTHQUAKE OF 13 AUGUST 1978 2254 GMT
DMG 302 SANTA BARBARA FREITAS BLDG S/N 158 TR. 6
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
FOURIER AMPLITUDE SPECTRUM-CM/SEC
0
10
20
30
40
50
60
70
80
0
5.0
10.0
15.0
20.0
25.0
FREQUENCY-CPS

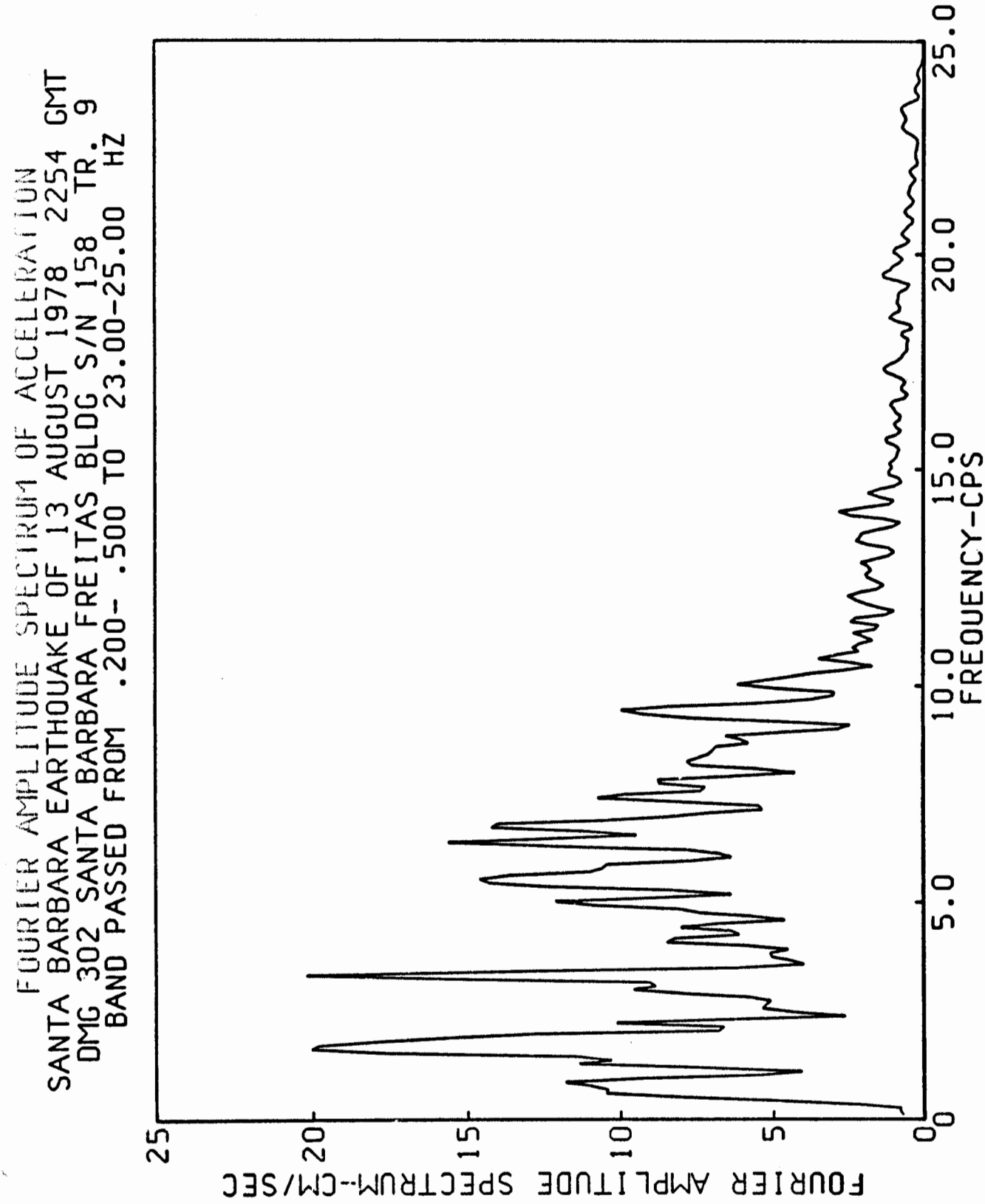

FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
SANTA BARBARA EARTHQUAKE OF 13 AUGUST 1978 2254 GMT
DMG 302 SANTA BARBARA FREITAS BLDG S/N 158 TR. 6
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
LOG OF FOURIER AMPLITUDE SPECTRUM-CM/SEC
2.0
1.5
1.0
.5
0
-.5
-1.0
-1.5
-2.0
LOG OF FREQUENCY-CPS
-1.5
-1.0
-.5
0
.5
1.0
1.5
F_T
F_c
F_c
F_T

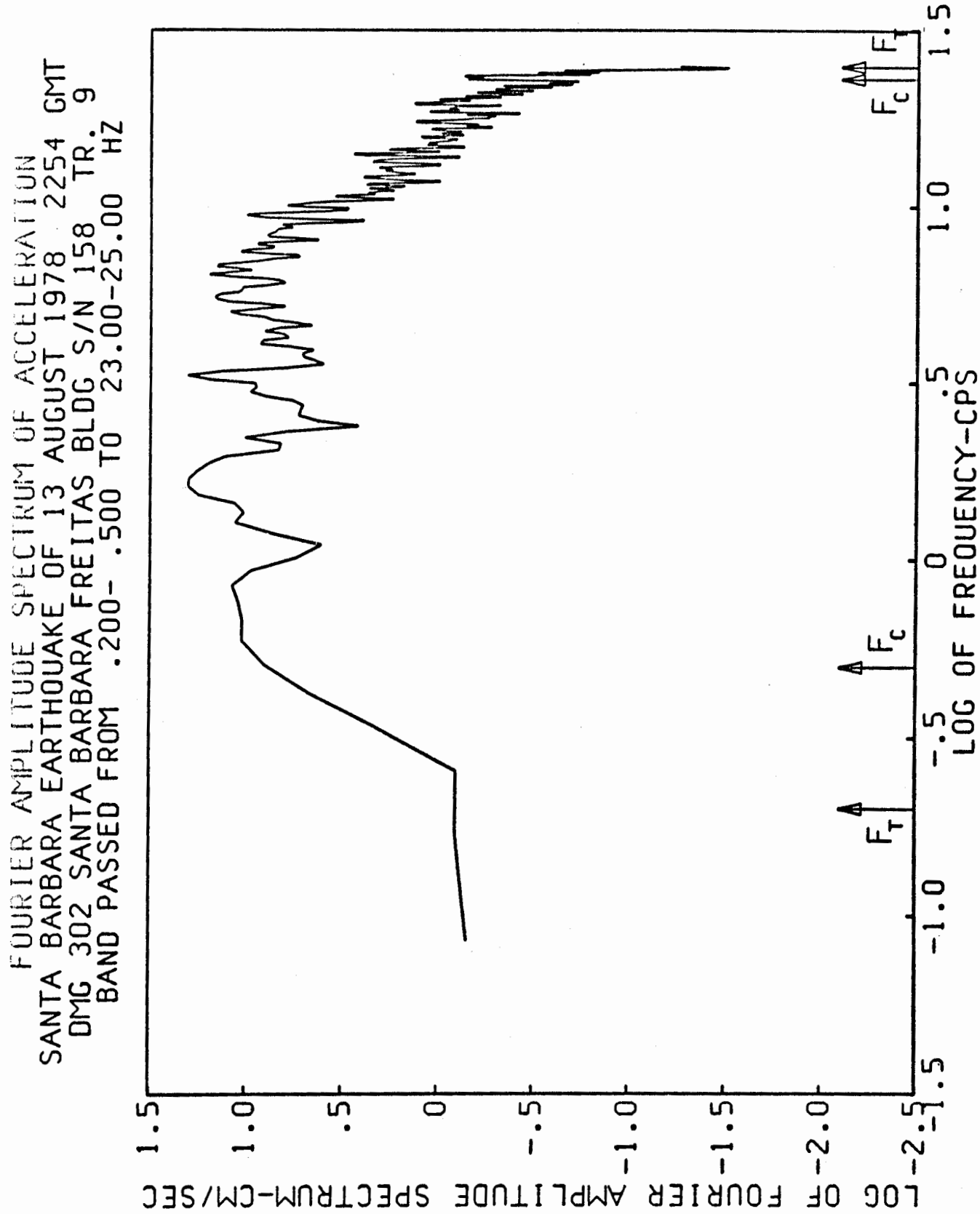

FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
SANTA BARBARA EARTHQUAKE OF 13 AUGUST 1978 2254 GMT
DMG 302 SANTA BARBARA FREITAS BLDG S/N 158 TR. 7
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
FOURIER AMPLITUDE SPECTRUM-CM/SEC
0
10
20
30
40
50
60
70
80
0
5.0
10.0
15.0
20.0
25.0
FREQUENCY-CPS

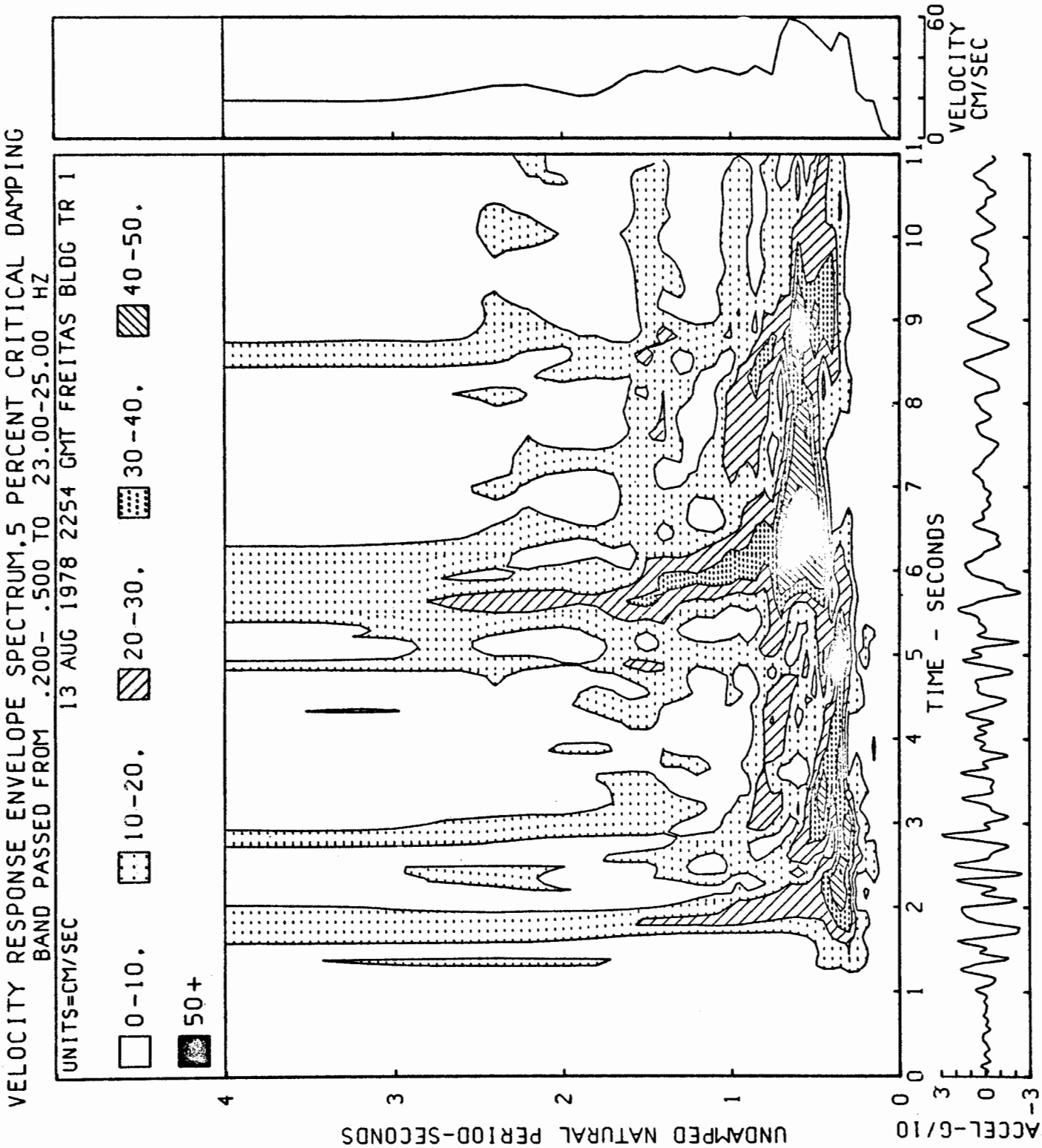

FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
SANTA BARBARA EARTHQUAKE OF 13 AUGUST 1978 2254 GMT
DMG 302 SANTA BARBARA FREITAS BLDG S/N 158 TR. 7
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
LOG OF FOURIER AMPLITUDE SPECTRUM-CM/SEC
2.0
1.5
1.0
.5
0
-.5
-1.0
-1.5
-2.0
-1.5
-1.0
-.5
0
.5
1.0
1.5
LOG OF FREQUENCY-CPS
F_T
F_C
F_C
F_T

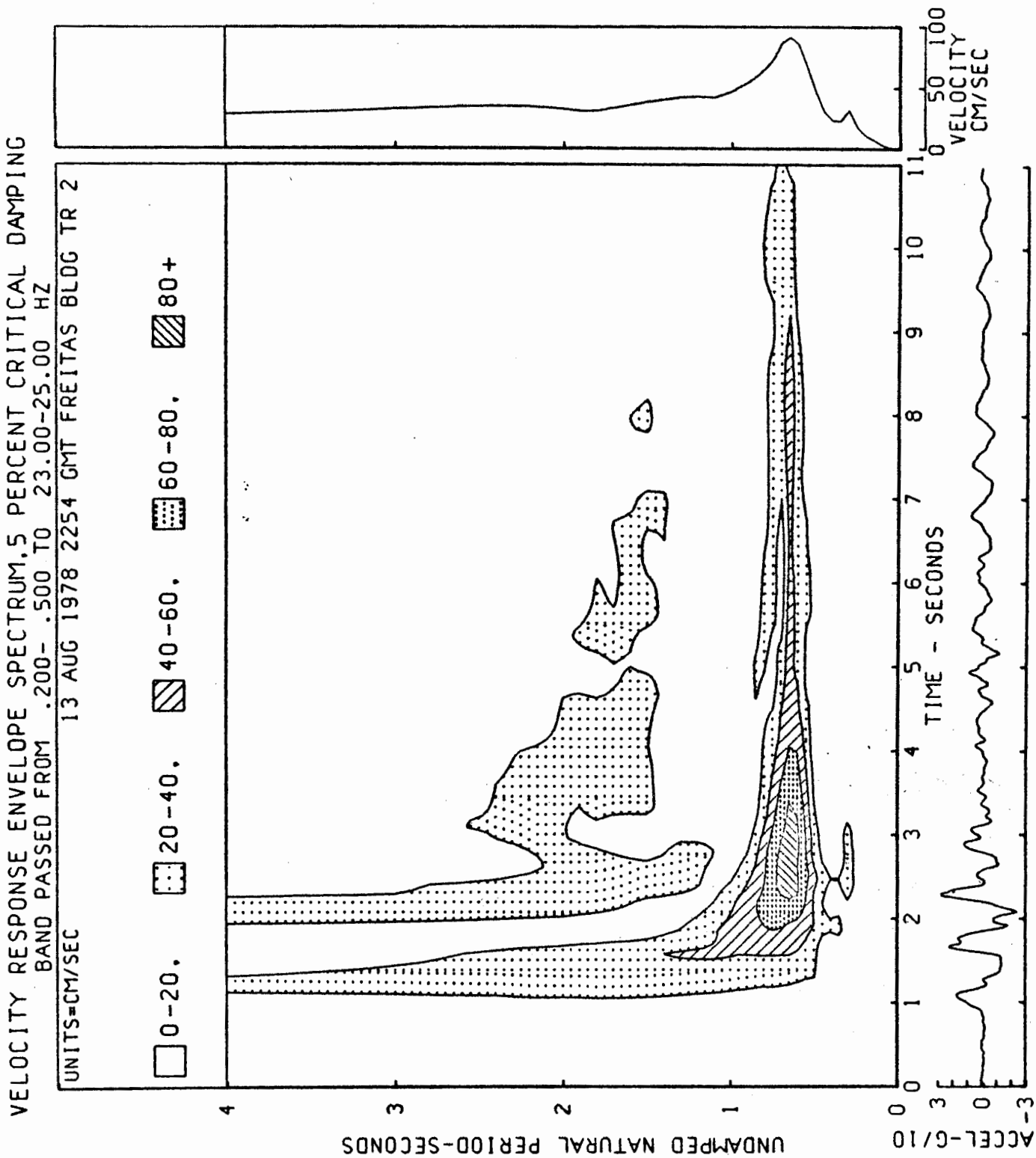

FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
SANTA BARBARA EARTHQUAKE OF 13 AUGUST 1978 2254 GMT
DMG 302 SANTA BARBARA FREITAS BLDG S/N 158 TR. 8
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
FOURIER AMPLITUDE SPECTRUM-CM/SEC
0
10
20
30
40
50
60
0
5.0
10.0
15.0
20.0
25.0
FREQUENCY-CPS

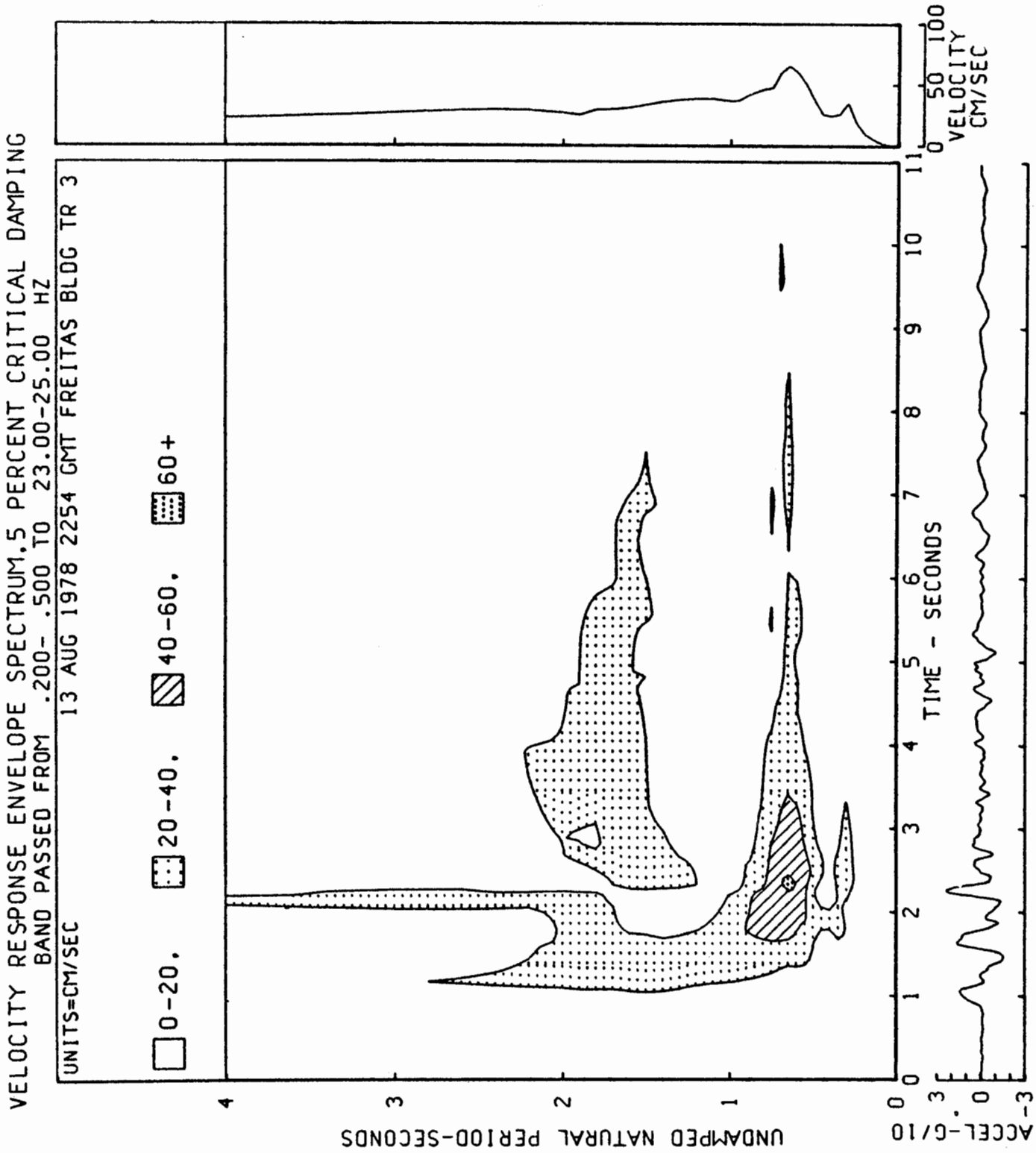

FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
SANTA BARBARA EARTHQUAKE OF 13 AUGUST 1978 2254 GMT
DMG 302 SANTA BARBARA FREITAS BLDG S/N 158 TR. 8
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
LOG OF FOURIER AMPLITUDE SPECTRUM-CM/SEC
2.0
1.5
1.0
.5
0
-.5
-1.0
-1.5
-2.0
LOG OF FREQUENCY-CPS
-1.5
-1.0
-.5
0
.5
1.0
1.5
F_T
F_c
F_c
F_T

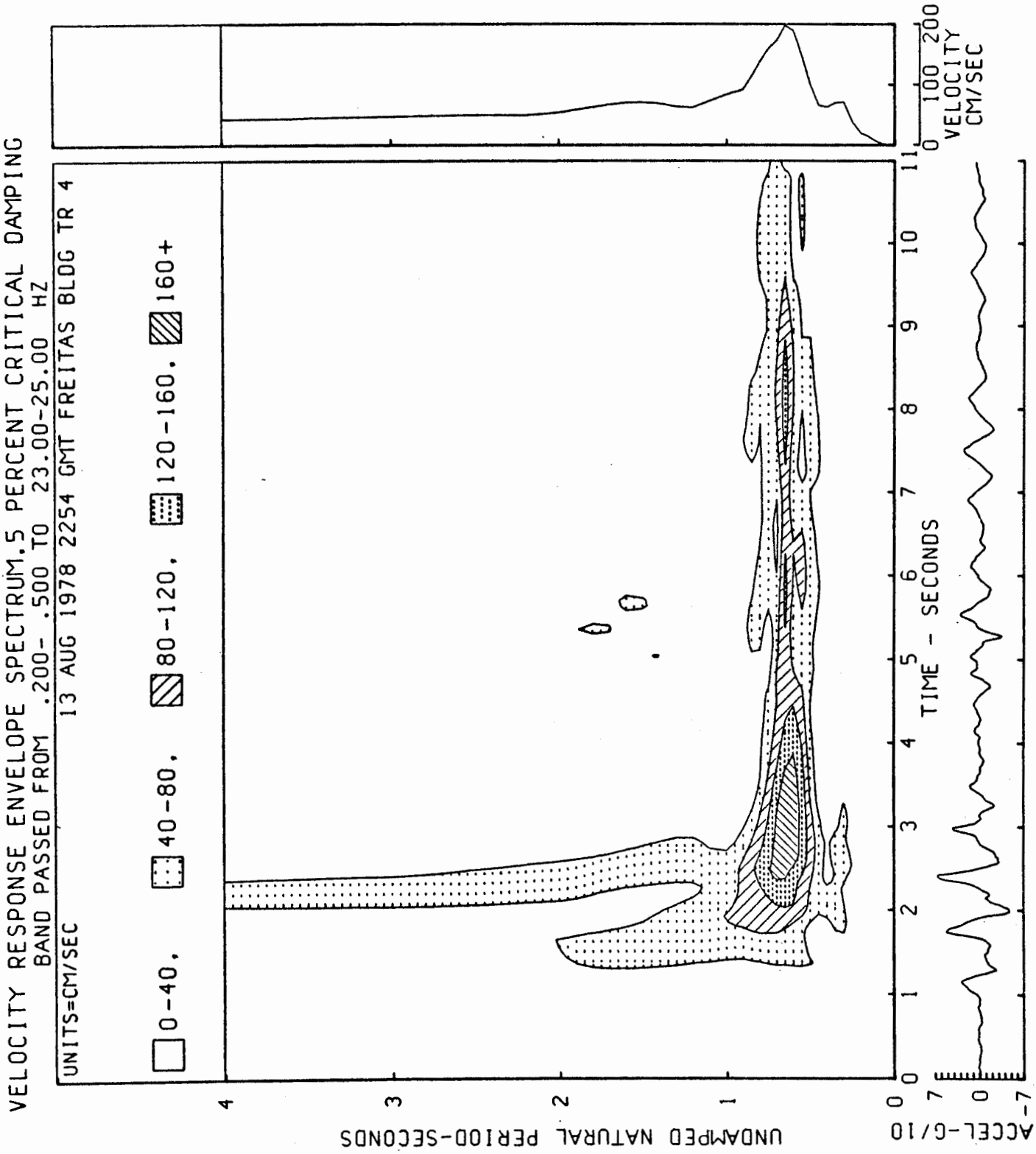

FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
SANTA BARBARA EARTHQUAKE OF 13 AUGUST 1978 2254 GMT
DMG 302 SANTA BARBARA FREITAS BLDG S/N 158 TR. 9
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
FOURIER AMPLITUDE SPECTRUM--CM/SEC
0
5
10
15
20
25
0
5.0
10.0
15.0
20.0
25.0
FREQUENCY-CPS

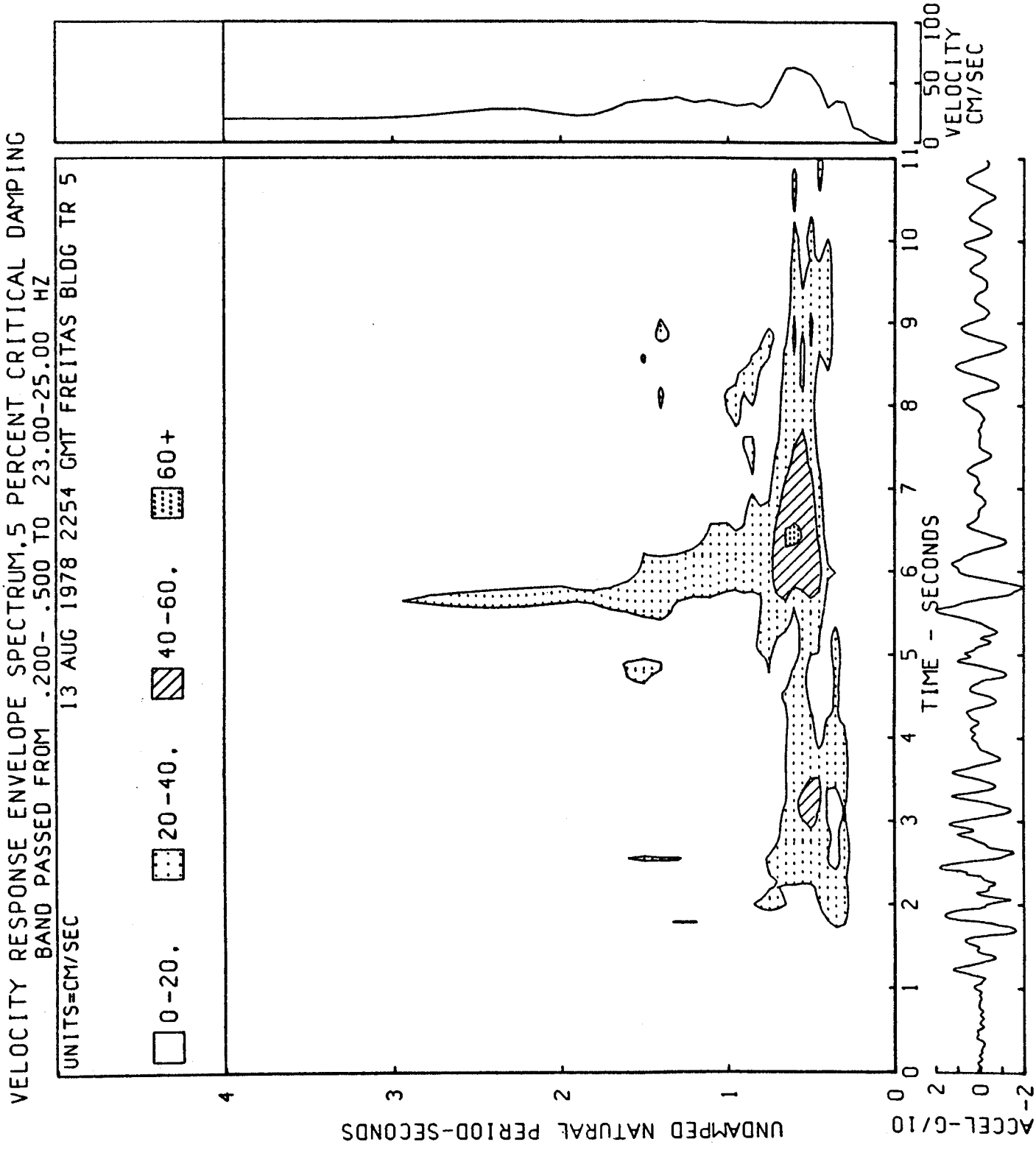

FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
SANTA BARBARA EARTHQUAKE OF 13 AUGUST 1978 2254 GMT
DMG 302 SANTA BARBARA FREITAS BLDG S/N 158 TR. 9
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
LOG OF FOURIER AMPLITUDE SPECTRUM-CM/SEC
1.5
1.0
.5
0
-.5
-1.0
-1.5
-2.0
-2.5
LOG OF FREQUENCY-CPS
-1.5
-1.0
-.5
0
.5
1.0
1.5
F_T
F_c
F_c
F_T

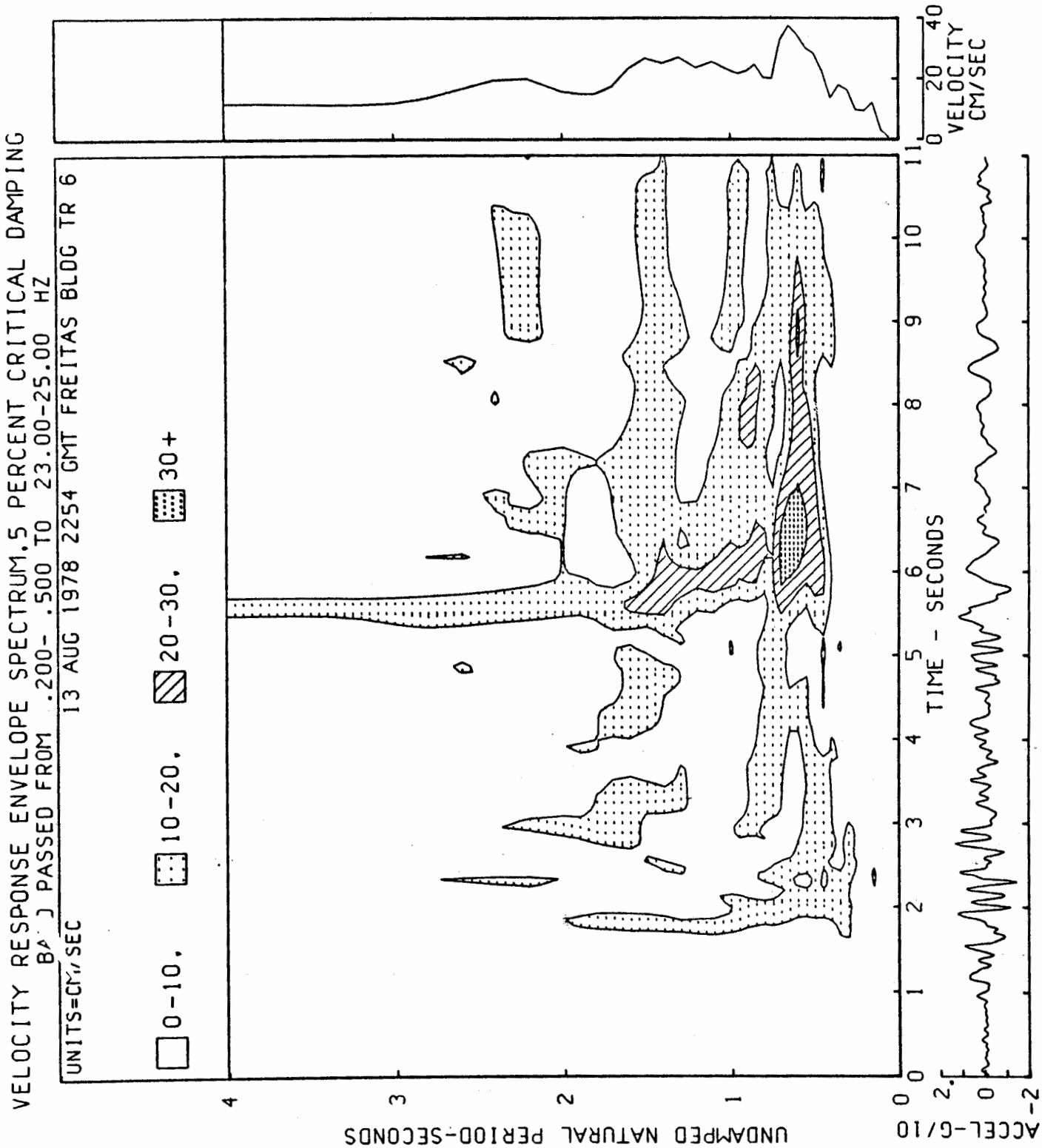

VELOCITY RESPONSE ENVELOPE SPECTRUM,5 PERCENT CRITICAL DAMPING
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
UNITS=CM/SEC
13 AUG 1978 2254 GMT FREITAS BLDG TR 1
0-10.
10-20.
20-30.
30-40.
40-50.
50+
UNDAMPED NATURAL PERIOD-SECONDS
TIME - SECONDS
VELOCITY CM/SEC
ACCEL-G/10

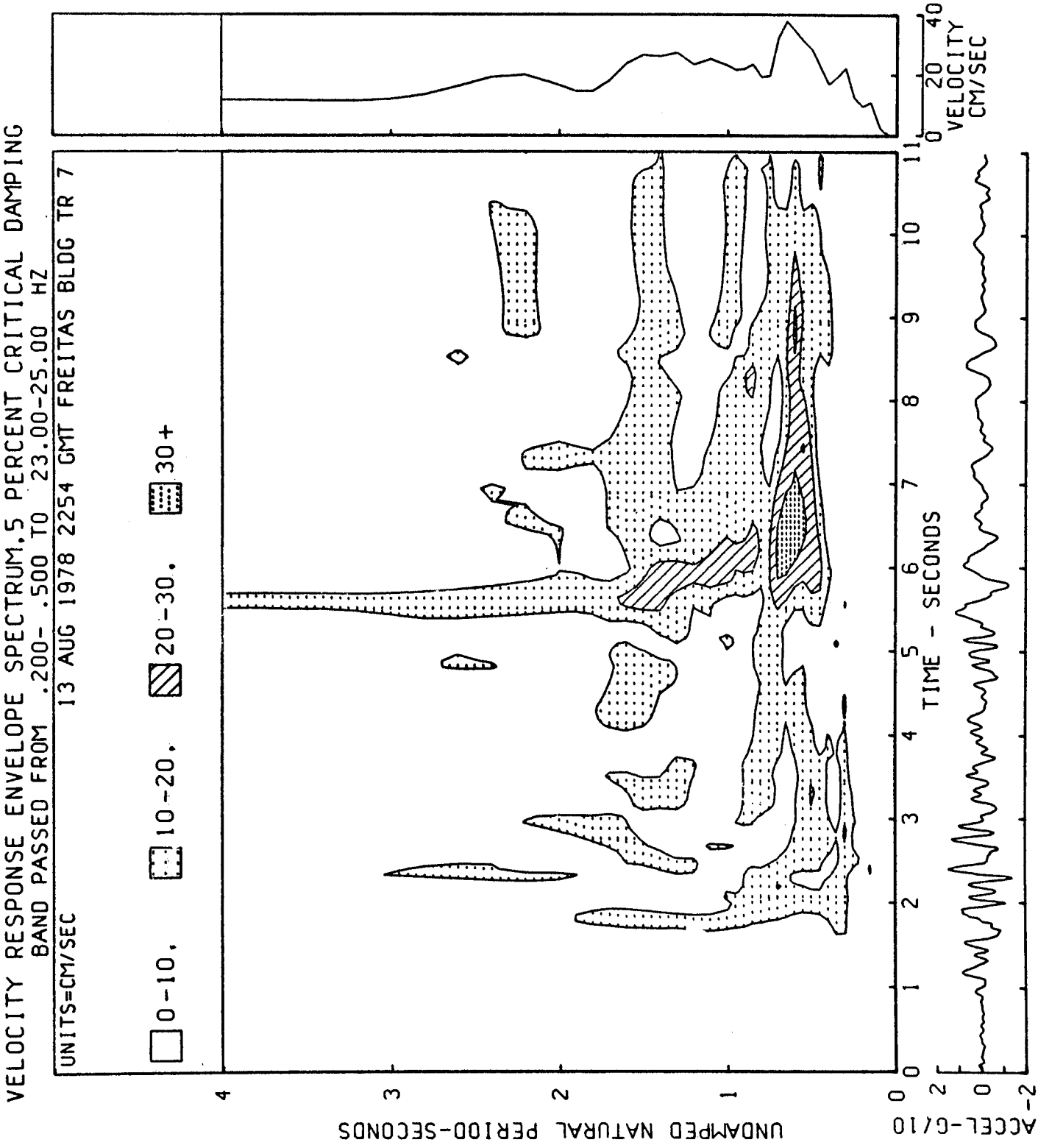

VELOCITY RESPONSE ENVELOPE SPECTRUM,5 PERCENT CRITICAL DAMPING
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
UNITS=CM/SEC
13 AUG 1978 2254 GMT FREITAS BLDG TR 2
0-20.
20-40.
40-60.
60-80.
80+
UNDAMPED NATURAL PERIOD-SECONDS
TIME - SECONDS
VELOCITY CM/SEC
ACCEL-G/10

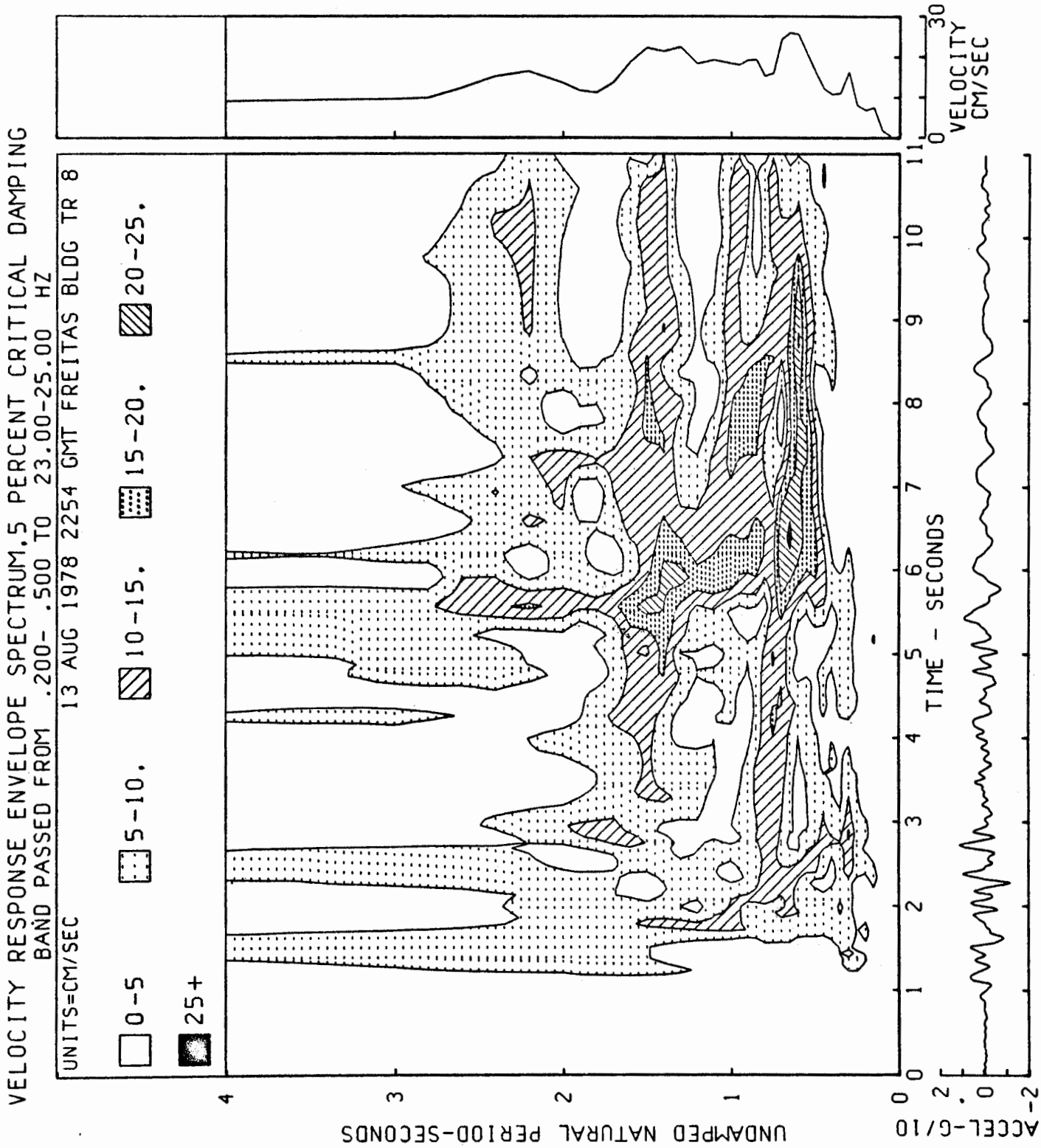

VELOCITY RESPONSE ENVELOPE SPECTRUM,5 PERCENT CRITICAL DAMPING
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
UNITS=CM/SEC
13 AUG 1978 2254 GMT FREITAS BLDG TR 3
0-20.
20-40.
40-60.
60+
UNDAMPED NATURAL PERIOD-SECONDS
TIME - SECONDS
VELOCITY CM/SEC
ACCEL-G/10

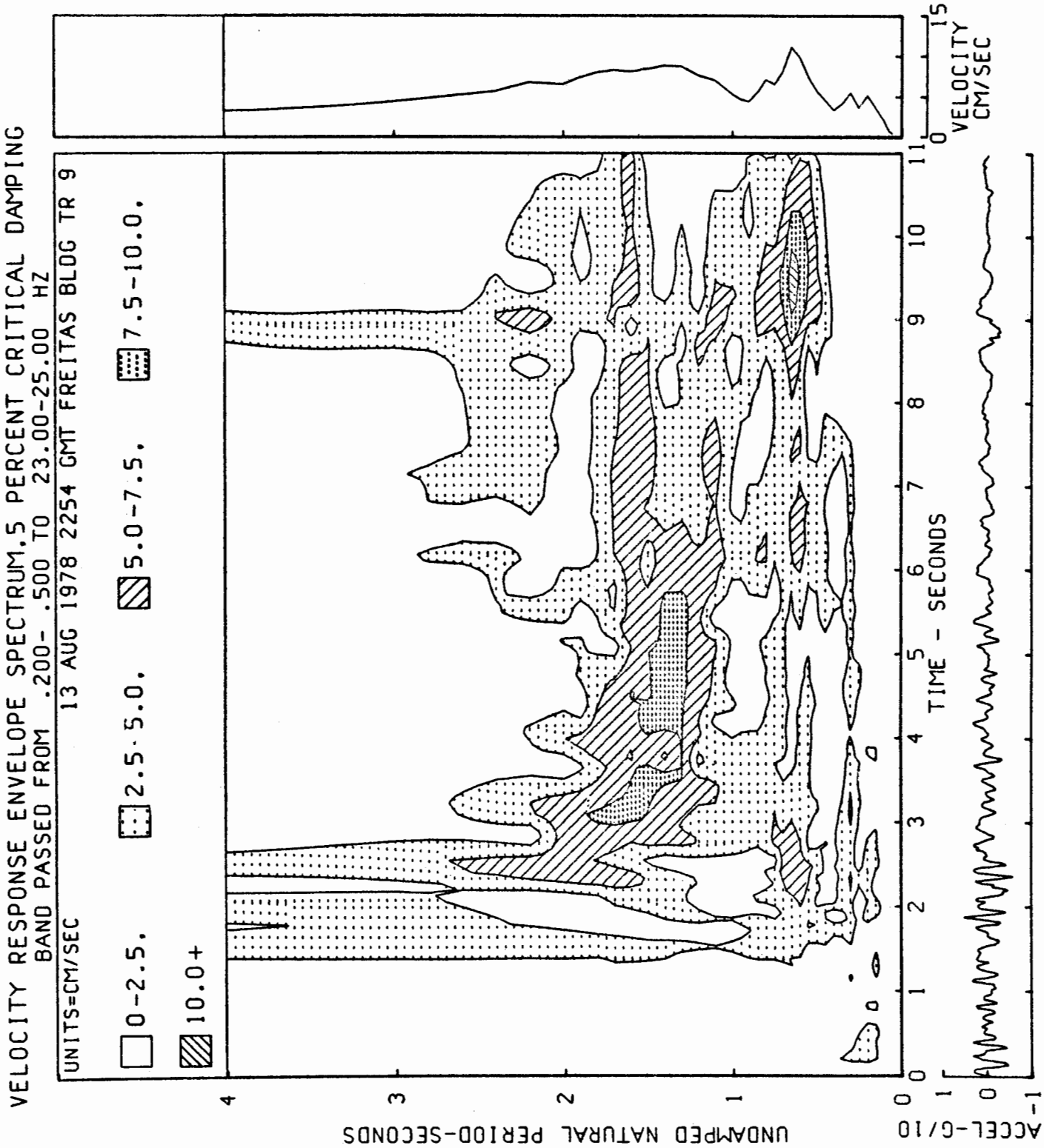

VELOCITY RESPONSE ENVELOPE SPECTRUM.5 PERCENT CRITICAL DAMPING
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
UNITS=CM/SEC
13 AUG 1978 2254 GMT FREITAS BLDG TR 4
0-40.
40-80.
80-120.
120-160.
160+
UNDAMPED NATURAL PERIOD-SECONDS
TIME - SECONDS
VELOCITY CM/SEC
ACCEL-G/10

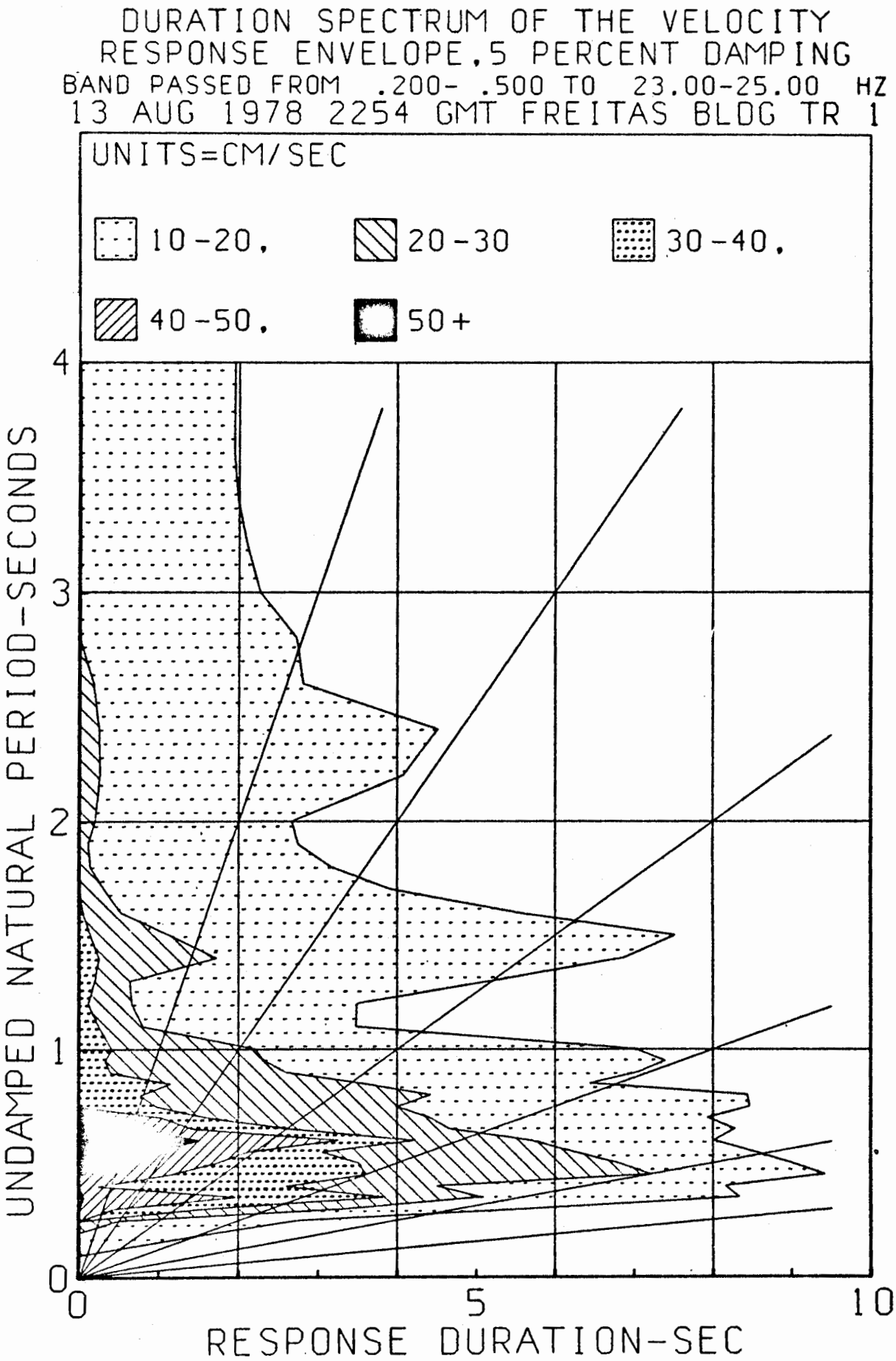

VELOCITY RESPONSE ENVELOPE SPECTRUM,5 PERCENT CRITICAL DAMPING
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
UNITS=CM/SEC
13 AUG 1978 2254 GMT FREITAS BLDG TR 5
0-20.
20-40.
40-60.
60+
UNDAMPED NATURAL PERIOD-SECONDS
TIME - SECONDS
VELOCITY CM/SEC
ACCEL-G/10

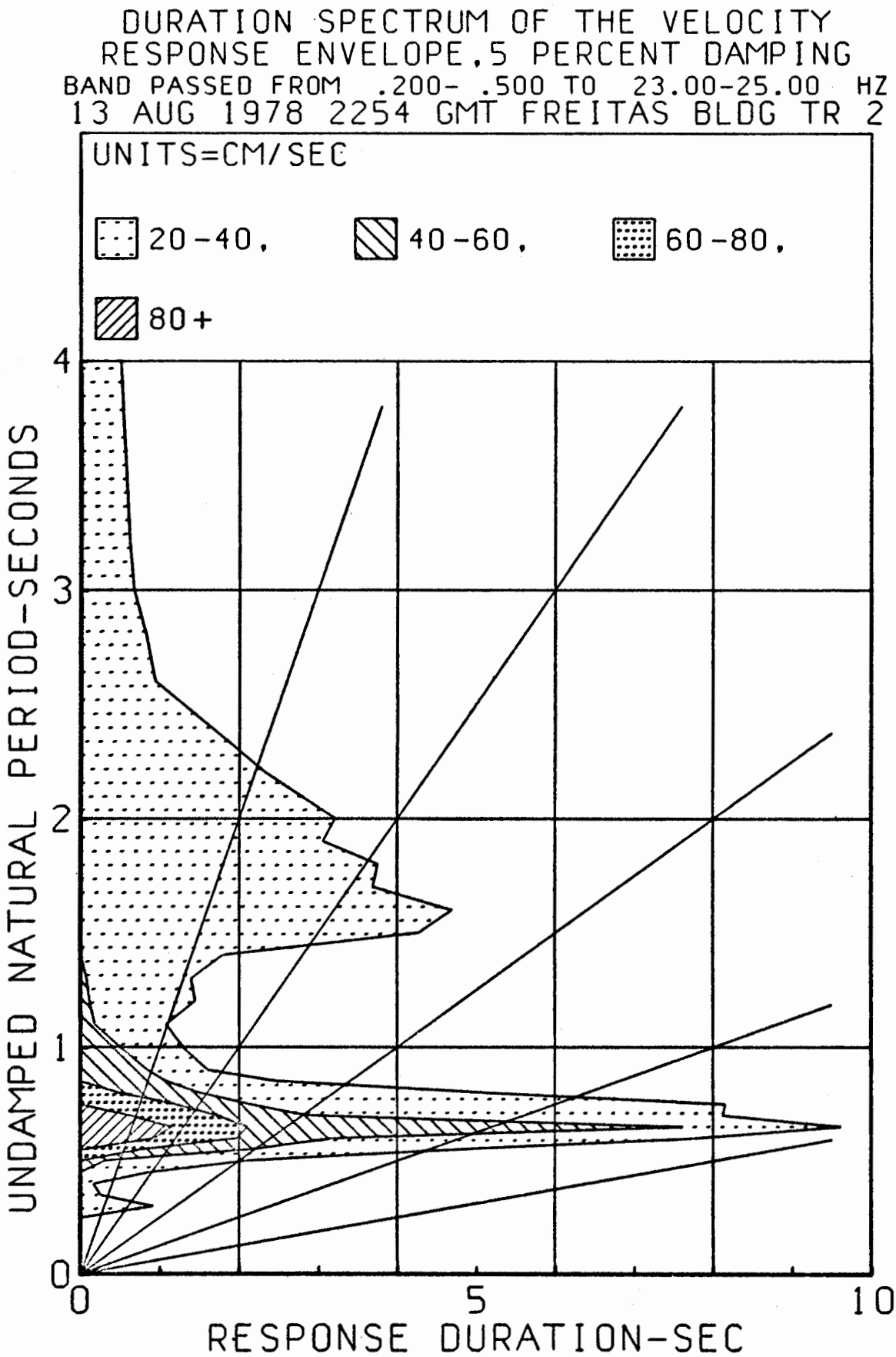

VELOCITY RESPONSE ENVELOPE SPECTRUM,5 PERCENT CRITICAL DAMPING
BA J PASSED FROM .200- .500 TO 23.00-25.00 HZ
UNITS=CM/SEC
13 AUG 1978 2254 GMT FREITAS BLDG TR 6
0-10.
10-20.
20-30.
30+
UNDAMPED NATURAL PERIOD-SECONDS
TIME - SECONDS
VELOCITY CM/SEC
ACCEL-G/10

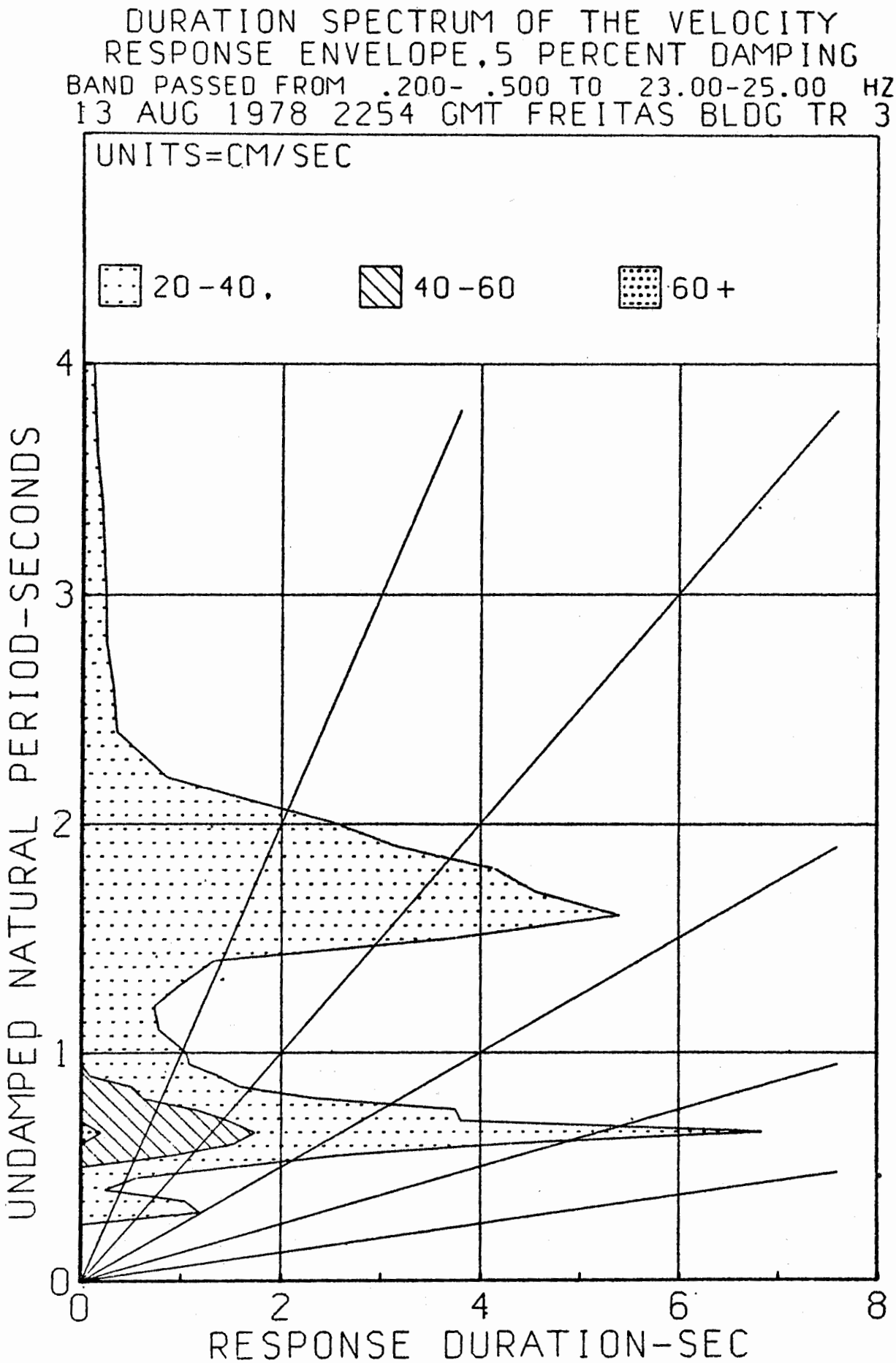

VELOCITY RESPONSE ENVELOPE SPECTRUM,5 PERCENT CRITICAL DAMPING
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
UNITS=CM/SEC
13 AUG 1978 2254 GMT FREITAS BLDG TR 7
0-10.
10-20.
20-30.
30+
UNDAMPED NATURAL PERIOD-SECONDS
TIME - SECONDS
VELOCITY CM/SEC
ACCEL-G/10

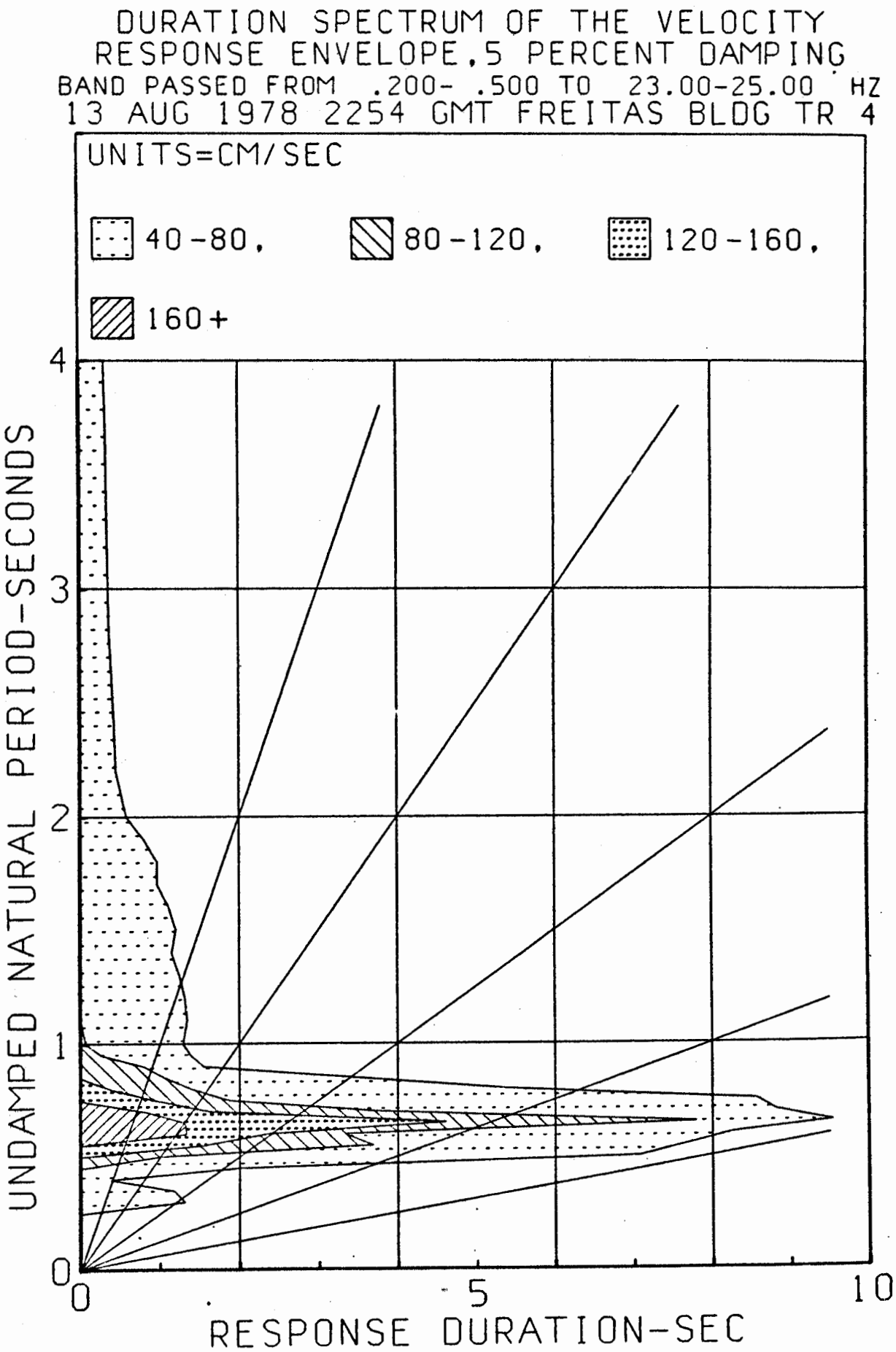

VELOCITY RESPONSE ENVELOPE SPECTRUM,5 PERCENT CRITICAL DAMPING
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
UNITS=CM/SEC
13 AUG 1978 2254 GMT FREITAS BLDG TR 8
0-5
5-10.
10-15.
15-20.
20-25.
25+
UNDAMPED NATURAL PERIOD-SECONDS
TIME - SECONDS
VELOCITY CM/SEC
ACCEL-G/10

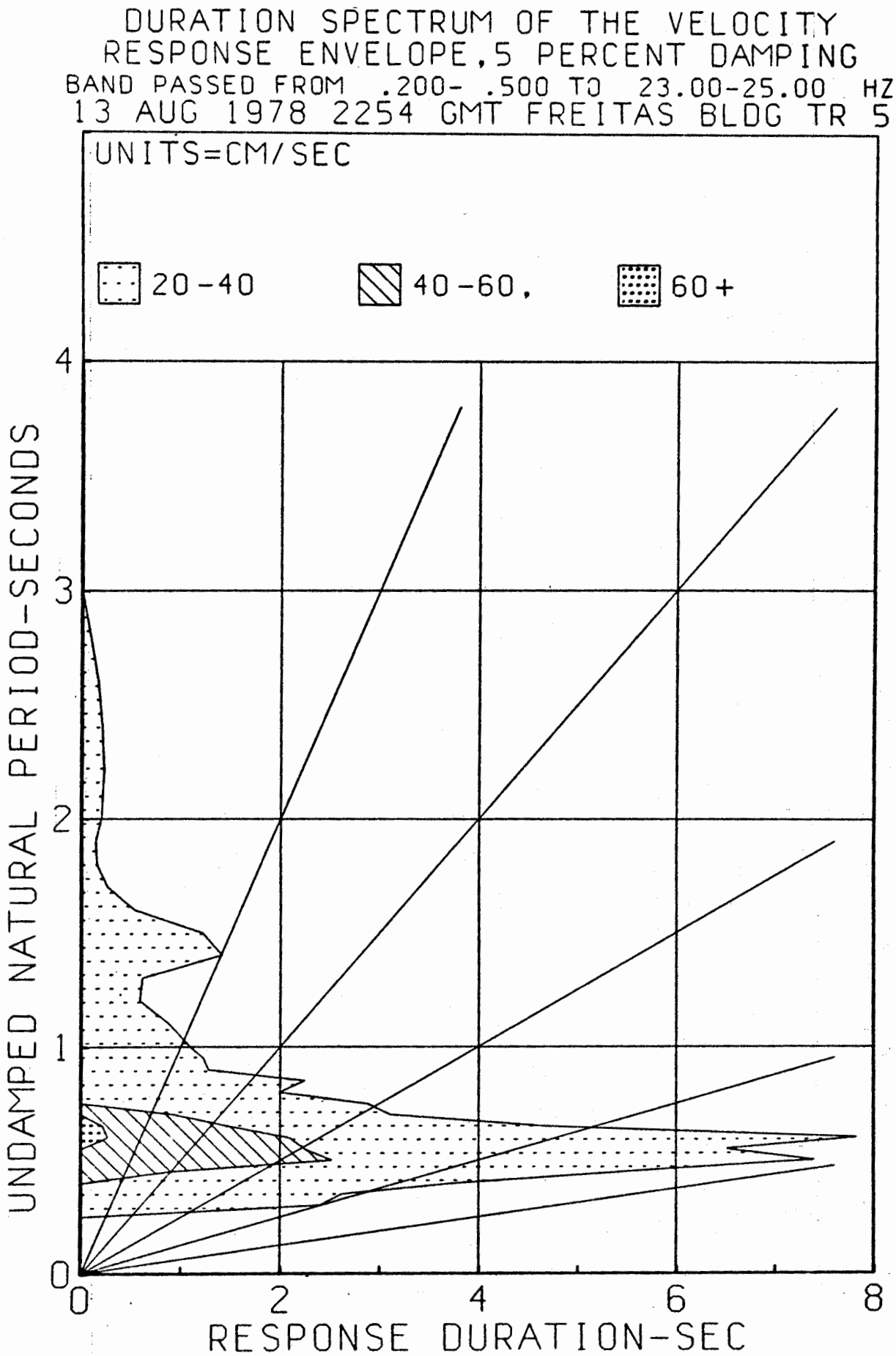

VELOCITY RESPONSE ENVELOPE SPECTRUM,5 PERCENT CRITICAL DAMPING
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
UNITS=CM/SEC
13 AUG 1978 2254 GMT FREITAS BLDG TR 9
0-2.5.
2.5-5.0.
5.0-7.5.
7.5-10.0.
10.0+
UNDAMPED NATURAL PERIOD-SECONDS
TIME - SECONDS
VELOCITY CM/SEC
ACCEL-G/10

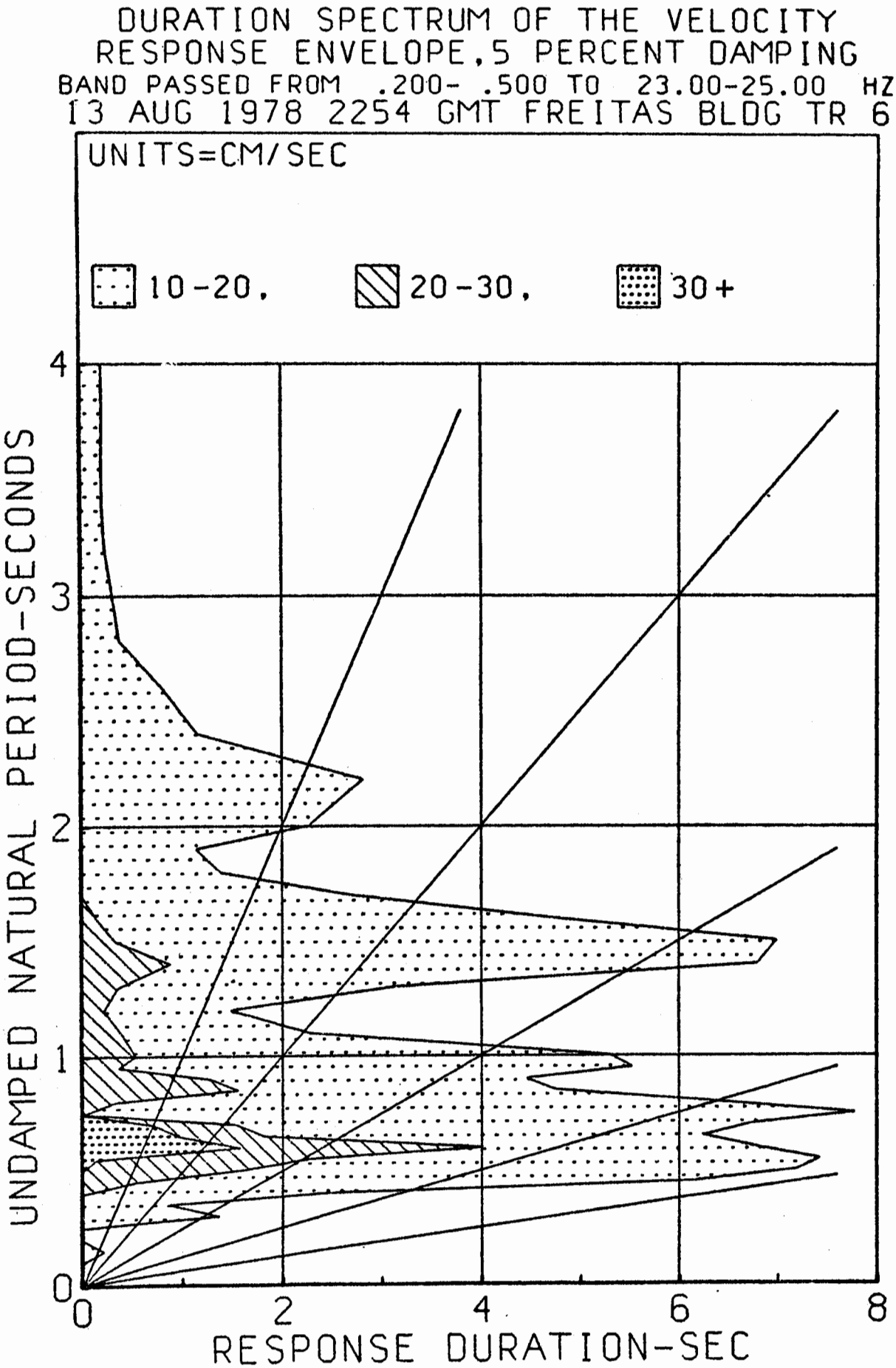

DURATION SPECTRUM OF THE VELOCITY
RESPONSE ENVELOPE,5 PERCENT DAMPING
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
13 AUG 1978 2254 GMT FREITAS BLDG TR 1
UNITS=CM/SEC
10-20.
20-30
30-40.
40-50.
50+
UNDAMPED NATURAL PERIOD-SECONDS
0
1
2
3
4
0
5
10
RESPONSE DURATION-SEC

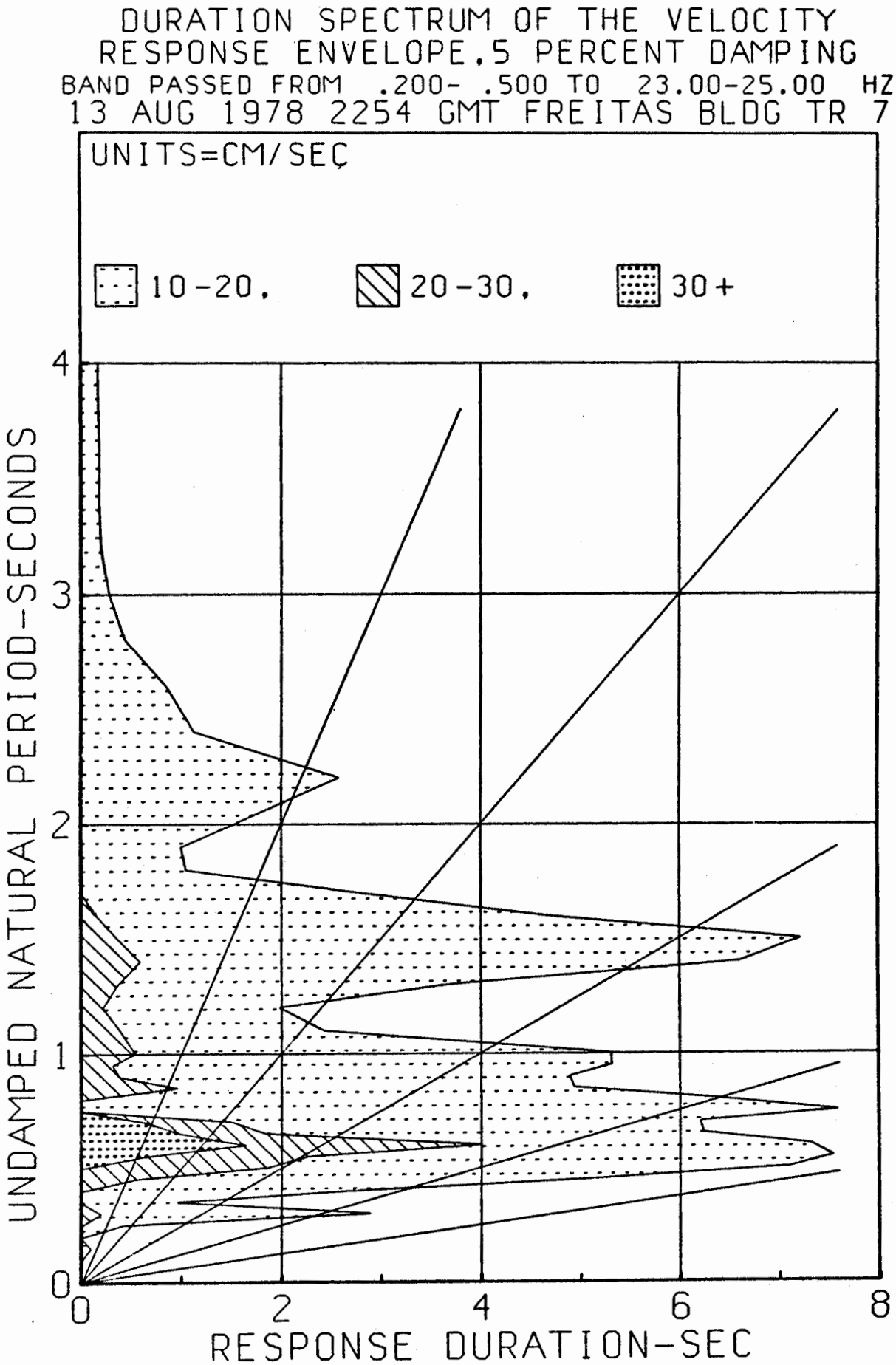

DURATION SPECTRUM OF THE VELOCITY
RESPONSE ENVELOPE,5 PERCENT DAMPING
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
13 AUG 1978 2254 GMT FREITAS BLDG TR 2
UNITS=CM/SEC
20-40,
40-60,
60-80,
80+
UNDAMPED NATURAL PERIOD-SECONDS
0
1
2
3
4
0
5
10
RESPONSE DURATION-SEC

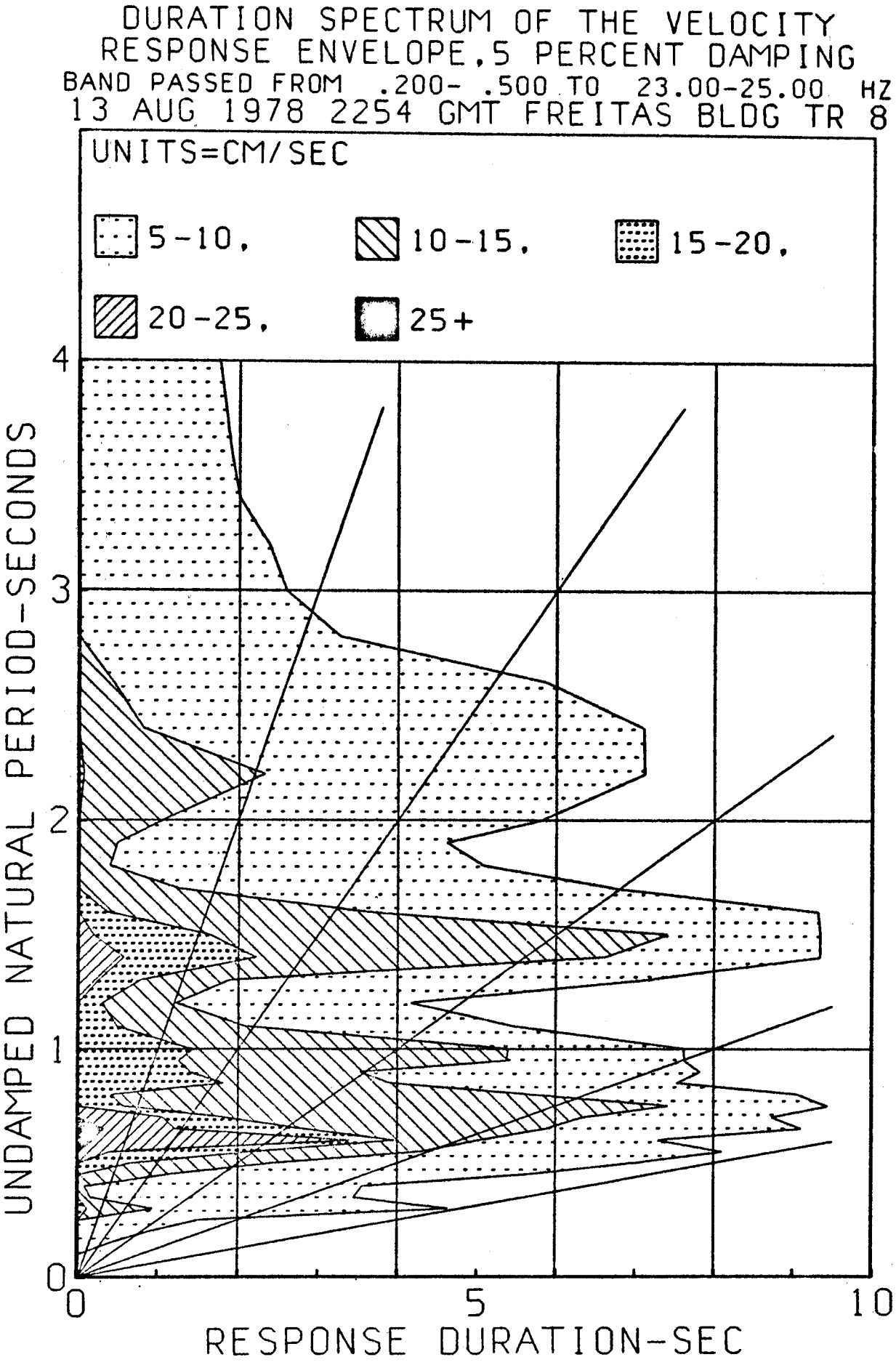

DURATION SPECTRUM OF THE VELOCITY
RESPONSE ENVELOPE,5 PERCENT DAMPING
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
13 AUG 1978 2254 GMT FREITAS BLDG TR 3
UNITS=CM/SEC
20-40,
40-60
60+
UNDAMPED NATURAL PERIOD-SECONDS
0
1
2
3
4
0
2
4
6
8
RESPONSE DURATION-SEC

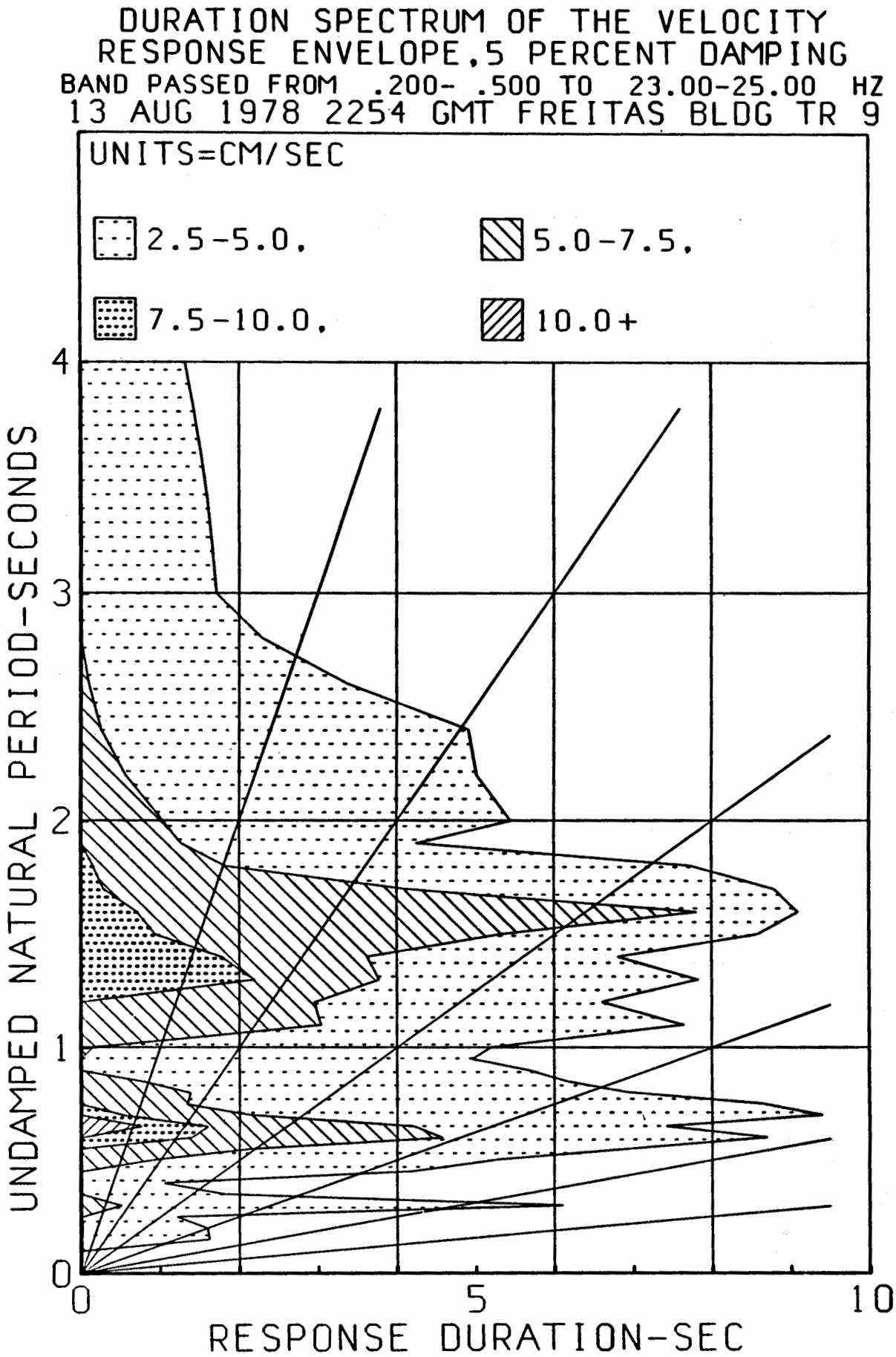

DURATION SPECTRUM OF THE VELOCITY
RESPONSE ENVELOPE,5 PERCENT DAMPING
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
13 AUG 1978 2254 GMT FREITAS BLDG TR 4
UNITS=CM/SEC
40-80,
80-120,
120-160,
160+
UNDAMPED NATURAL PERIOD-SECONDS
0
1
2
3
4
0
5
10
RESPONSE DURATION-SEC


DURATION SPECTRUM OF THE VELOCITY
RESPONSE ENVELOPE,5 PERCENT DAMPING
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
13 AUG 1978 2254 GMT FREITAS BLDG TR 5
UNITS=CM/SEC
20-40
40-60,
60+
UNDAMPED NATURAL PERIOD-SECONDS
0
1
2
3
4
0
2
4
6
8
RESPONSE DURATION-SEC


DURATION SPECTRUM OF THE VELOCITY
RESPONSE ENVELOPE,5 PERCENT DAMPING
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
13 AUG 1978 2254 GMT FREITAS BLDG TR 6
UNITS=CM/SEC
10-20.
20-30.
30+
UNDAMPED NATURAL PERIOD-SECONDS
0
1
2
3
4
0
2
4
6
8
RESPONSE DURATION-SEC


DURATION SPECTRUM OF THE VELOCITY
RESPONSE ENVELOPE,5 PERCENT DAMPING
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
13 AUG 1978 2254 GMT FREITAS BLDG TR 7
UNITS=CM/SEC
10-20,
20-30,
30+
UNDAMPED NATURAL PERIOD-SECONDS
0
1
2
3
4
0
2
4
6
8
RESPONSE DURATION-SEC


DURATION SPECTRUM OF THE VELOCITY
RESPONSE ENVELOPE,5 PERCENT DAMPING
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
13 AUG 1978 2254 GMT FREITAS BLDG TR 8
UNITS=CM/SEC
5-10.
10-15.
15-20.
20-25.
25+
UNDAMPED NATURAL PERIOD-SECONDS
0
1
2
3
4
0
5
10
RESPONSE DURATION-SEC


DURATION SPECTRUM OF THE VELOCITY
RESPONSE ENVELOPE,5 PERCENT DAMPING
BAND PASSED FROM .200- .500 TO 23.00-25.00 HZ
13 AUG 1978 2254 GMT FREITAS BLDG TR 9
UNITS=CM/SEC
2.5-5.0.
5.0-7.5.
7.5-10.0.
10.0+
UNDAMPED NATURAL PERIOD-SECONDS
0
1
2
3
4
0
5
10
RESPONSE DURATION-SEC