COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

RECORD 1961 No. 72

A.B.C. TELEVISION STUDIOS VIBRATION TESTS,

RIPPONLEA, VICTORIA 1961

by

A.M. Radeski

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CONTENTS

ILLUSTRATIONS

ABSTRACT

Vibrations due to railway traffic were measured on the site of a proposed new Australian Broadcasting Commission building at Ripponlea, Victoria.

Vibrations in the immediate vicinity of proposed foundations were found to exceed the safe limit.

1. INTRODUCTION

This Record describes a vibration investigation carried out by the Bureau of Mineral Resources, at the request of the Australian Broadcasting Commission (A.B.C.) at the Commission's television studios at Ripponlea, Victoria. The Commission plans to build a new studio alongside the existing ones.

The Melbourne-Sandringham railway line is located about 30 to 40 feet from the existing studios, in a deep cutting, and the proposed new building will be over the railway tracks (Plate 1). The purpose of this investigation was to measure and assess the vibrations caused by electric trains, because such vibrations may influence the design of the proposed building.

The investigations were carried out by A.M. Radeski, technical officer of the Bureau, on 28th April 1961.

2. INSTRUMENTS AND METHODS

The instrument used to record the vibrations was a Sprengnether Portable Blast and Vibration Seismograph, Serial No. 1577.

This instrument records 3 mutually perpendicular components of ground vibration on a moving strip of photographic paper. A record shows the ground motion magnified 100 times with timing lines at intervals of 0.02 second.

The vibrations at one location on the roof of the studio building and at three outside locations were recorded (See Plate 1). The individual tests are listed in Table 1 below :

TABLE 1

Record No.	Seismograph location		Remarks
	No.	Description	
1	1	$8\frac{1}{2}$ ft from Melb.-Sandringham line, 20 ft from Sandringham-Melb. line, approx. 1 ft below rail level.	train to Melb. passing
2	1	ditto	train from Melb. passing
3	2	approx. 2 ft from Studio building; street level	train to Melb. passing
4	2	ditto	train from Melb. passing
5	3	on the Gordon St. foot bridge	train to Melb. passing
6	3	ditto	train from Melb. passing
7	3	ditto	vibrations in absence of train
8	4	on the roof of main building, instrument placed on the central parapet	train to Melb. passing
9	4	ditto	train from Melb. passing
10	4	ditto	vibration in absence of train

3. RESULTS

Plates 2 to 4 show copies of significant parts of seismograph records. The letters L, V, and T refer to vibrations in the longitudinal, vertical, and transverse directions relative to the seismograph.

Table 2 shows the magnitude of the three components of ground displacement (taken as half the peak-to-trough amplitude) corresponding to the various locations of the seismograph. The accelerations shown in Table 2 were calculated, on the assumption that the vibrations were sinusoidal, from the equation

$$a = 4\pi^2 f^2 A$$

Where a = maximum acceleration

f = frequency

A = ground displacement

The resultant acceleration is the vector sum of the accelerations for the three components. The final column of figures shows this resultant acceleration in terms of *g*, the acceleration due to gravity (= 386 in./sec^2). All values in Table 2 were rounded off.

The accelerations computed from Records 1 and 2, taken very close to proposed foundations of the building, are 0.1 and 0.13 *g*, respectively. According to the United States Bureau of Mines (Thoenen and Windes, 1942), vibrations having accelerations smaller than 0.1 *g* are classified as "safe", whilst those between 0.1 and 1.0 *g* are described as being in a "caution zone" in which slight damage is likely to occur in normal structures. Thus vibrations on Record 2 are greater than the safe limit.

Various authorities have cited different criteria for maximum permissible ground vibration; they are shown in the Appendix. Vibrations on Record 3 and 4 are far below the "safe" limit. Frequencies found on Records 1 to 4, ranging from 29 to 54 c/s, are common in the vicinity of railway lines.

Records 5 to 7, taken on the foot-bridge, have a relatively large transverse component of low frequency (1.6 to 3.2 c/s). The accelerations, however, are practically negligible. Record 7, taken in the absence of railway traffic, indicates that these transverse movements are not associated with train movements; they are therefore probably caused by wind.

Records 8 to 10, taken on the roof of the Studio building, indicate some vibration. Record 10, taken in the absence of railway traffic, is very similar to Records 8 and 9, taken whilst trains were passing the building. This suggests that vibrations on the roof are not related to railway traffic. Traces of higher-frequency transverse vibration on Record 10 probably originated from some machinery in the building.

During the test all the trains were moving slowly. Vibration measurements conducted by the Bureau in Wangaratta (Radeski, 1961) show that amplitudes of vibrations caused by express trains are much higher than those caused by slow trains.

Vibrations recorded on the roof of the Studio building (Records 8 to 10) were much smaller than those on the ground floor level outside the building (Records 3 to 4), suggesting that the higher floors of the proposed building may be relatively free from vibrations transmitted from the ground. However, vibrations of a building are affected by so many factors such as type of foundation, design, construction, materials, etc. that it is virtually impossible to predict accurately vibrations in a proposed building.

According to Reiher and Meister (1931), as quoted by Steffens (1952) the vibrations recorded on Location 1 are classified as "annoying", but not "unpleasant".

4. CONCLUSIONS

The vibrations on the site of the proposed building are slightly greater than the "safe" level for buildings, according to the standards adopted by the U.S. Bureau of Mines.

Vibrations in the building to be erected cannot be predicted accurately.

5. REFERENCES

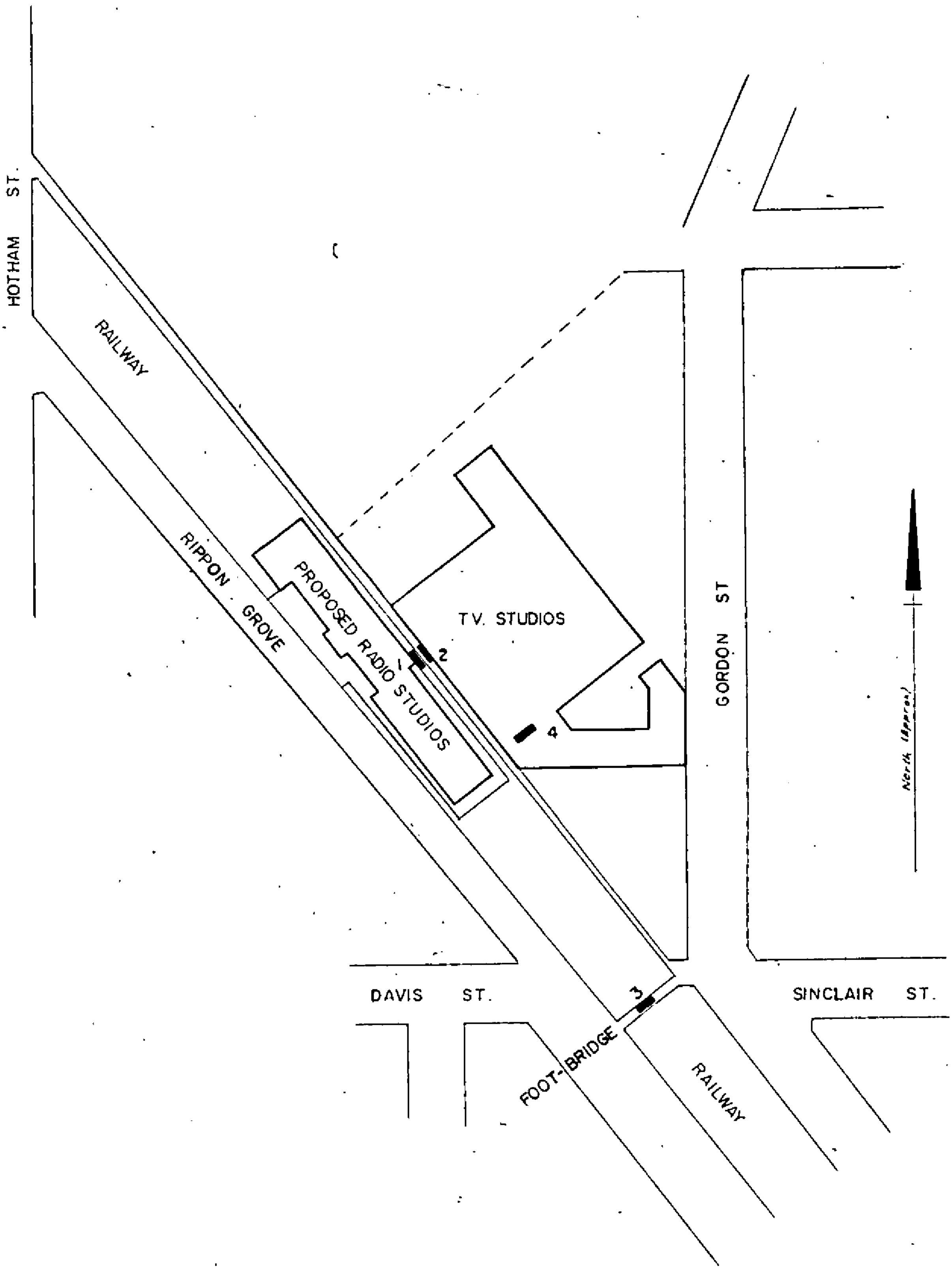
THOENEN, J.R. and WINDES, S.L.,	1942	Seismic effects of quarry blasting. <u>Bull. U.S. Bur. Min.</u> 442.
REIHER, H. and MEISTER, F.J.	1931	Die Empfindlichkeit des Menschen gegen Erschutterungen. Forschung aus dem Gebiete des Ingenieurwesen, 1931, 2(11) 381.
STEFFENS, R.J.,	1952	The assessment of vibration intensity and its application to the study of building vibrations. <u>Nat. Build. Stud. spec. Rep.</u> 19.
RADESKI, A.M.	1961	Wangaratta railway vibration tests, Victoria 1961. <u>Bur. Min. Res. Aust. Rec.</u> 1961/13.

TABLE 2

Record No.	Component	Displacement (in.)	Frequency c/s	Acceleration in./sec^2	Resultant accelerat. in./sec^2	Resultant accelerat. in terms of *g*
1	L	0.00035	33	15	39	0.10*g*
	V	0.0003	54	35		
	T	0.00025	29	8.3		
2	L	0.00025	37	14	50	0.13*g*
	V	0.00045	50	44		
	T	0.0003	40	19		
3	L	0.00015	29	5.0	13	0.03*g*
	V	0.0001	30	3.6		
	T	0.00025	33	11		
4	L	0.0001	40	6.3	15	0.04*g*
	V	0.0001	37	5.4		
	T	0.0003	33	13		
5	L	0.00005	21	0.87	3.5	0.01*g*
	V*	0.0005	1.3	0.034		
		0.0002	21	3.5		
	T	0.0019	2.6	0.51		
6	L	X			3.8	0.01*g*
	V	0.0002	22	3.8		
	T	0.00115	3.2	0.47		
7	L	X			0.1	less than 0.001*g*
	V	X				
	T	0.001	1.6	0.10		
9	L	X				
	V	X				
	T	X				
10	L	X				
	V	X				
	T	X				

X too small to be measured with the instrument used.

* Vibrations of 21 c/s are superimposed on very-low-frequency irregular movements.



ABC. TELEVISION STUDIOS VIBRATION TEST 28·4·61
RIPPONLEA, VICTORIA

SEISMOGRAPH LOCATIONS

SCALE IN FEET
160 0 160 320 480
AFTER A.B.C. PLAN

LEGEND
▬ SEISMOGRAPH LOCATION

GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS. G344-86

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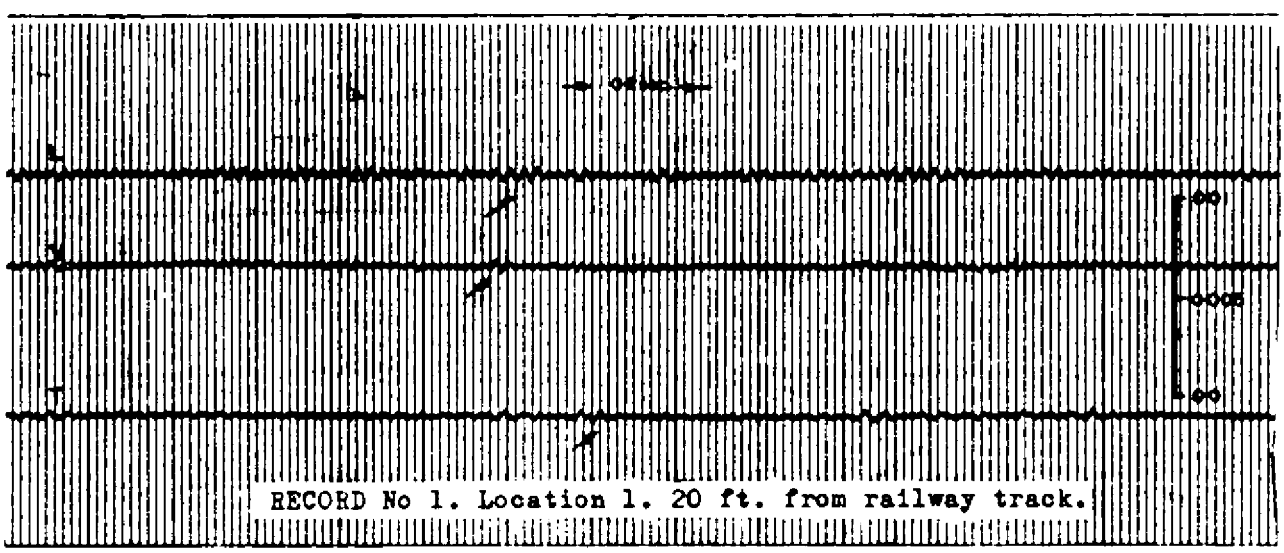
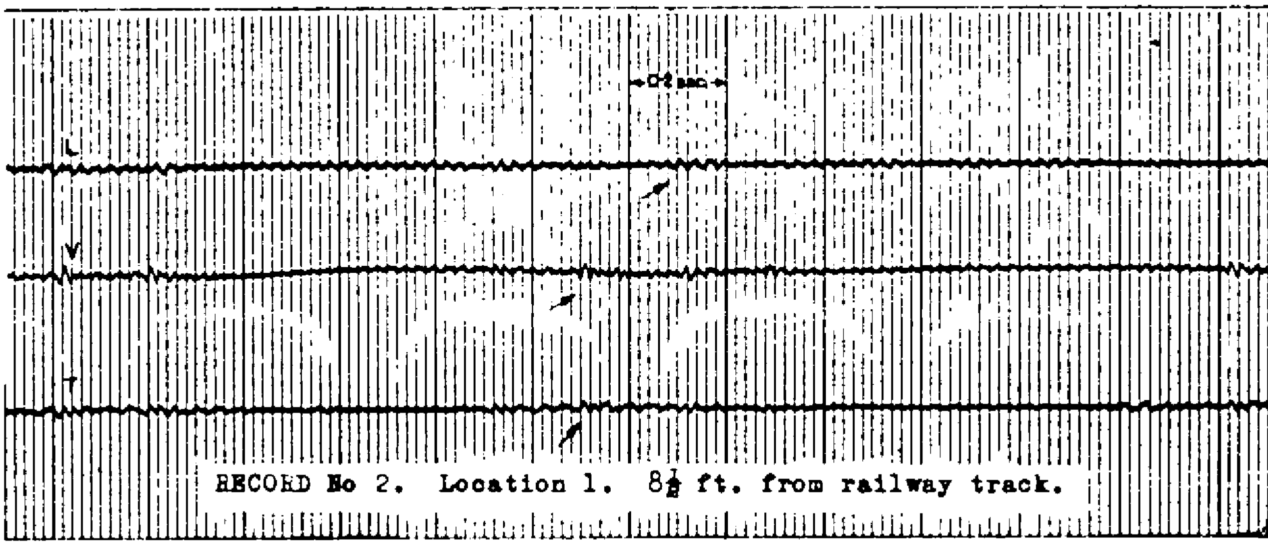
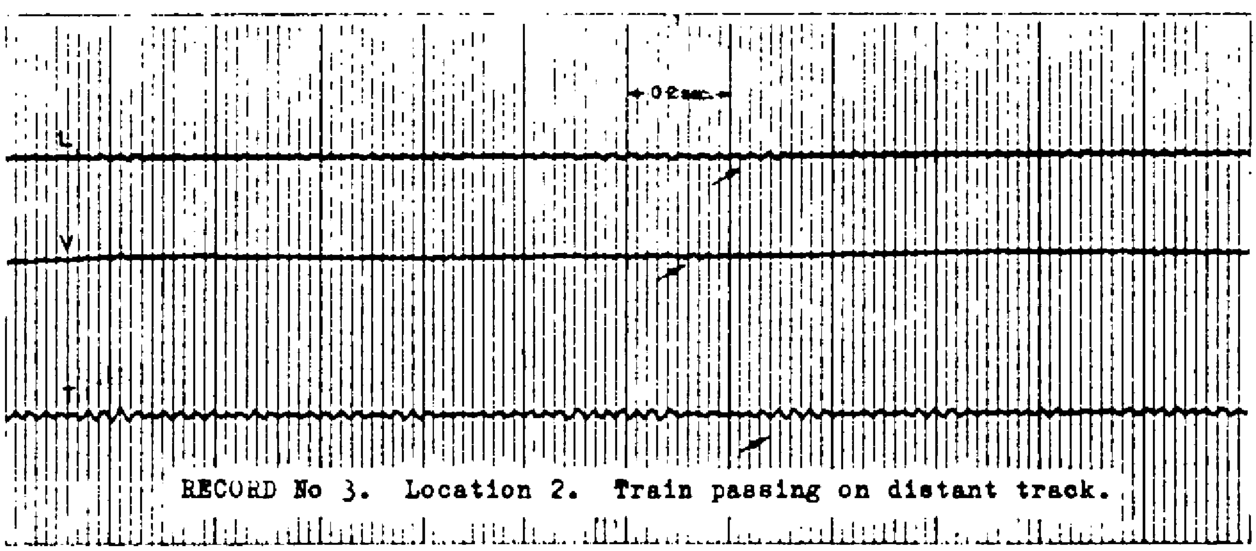
Plate 2.



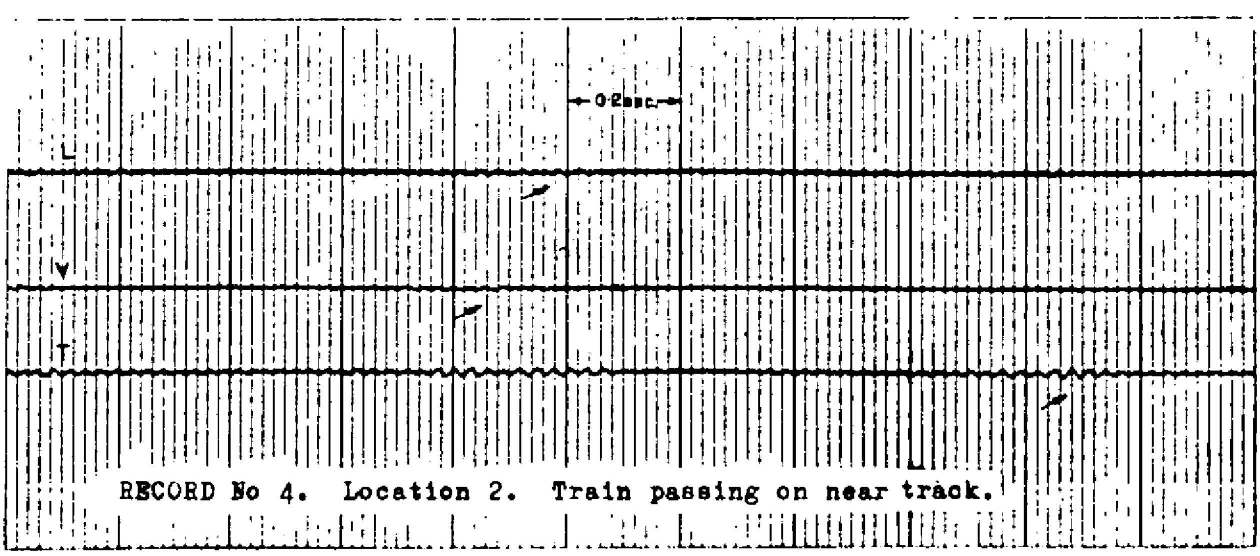
RECORD No 1. Location 1. 20 ft. from railway track.



RECORD No 2. Location 1. 8½ ft. from railway track.



RECORD No 3. Location 2. Train passing on distant track.



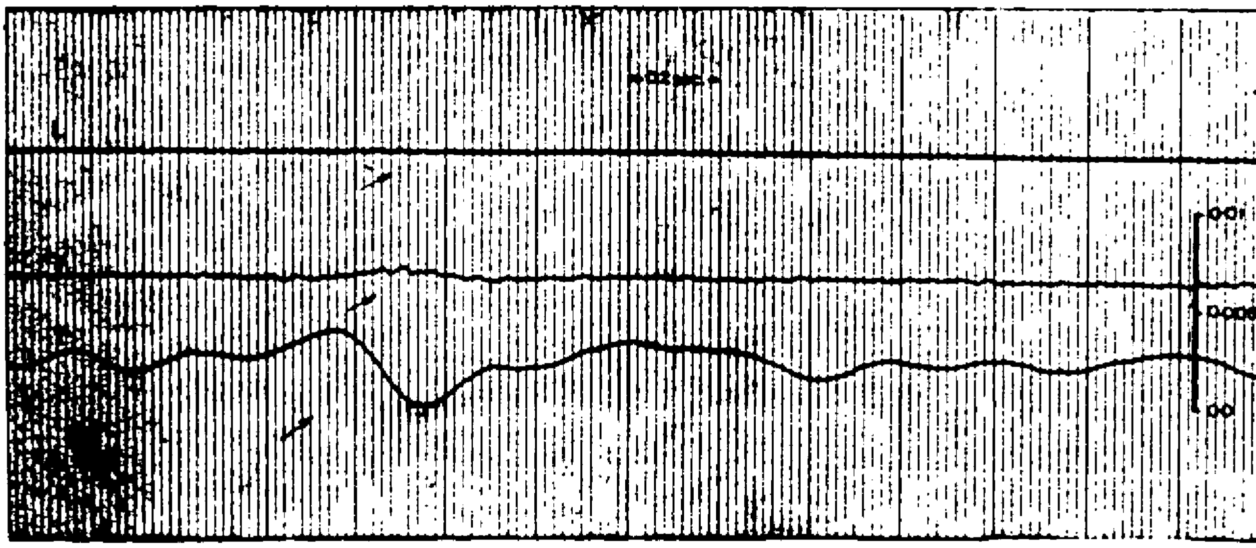
RECORD No 4. Location 2. Train passing on near track.

ABC-TV Studios Vibration Test 28-4-61.
Ripponlea, Victoria.

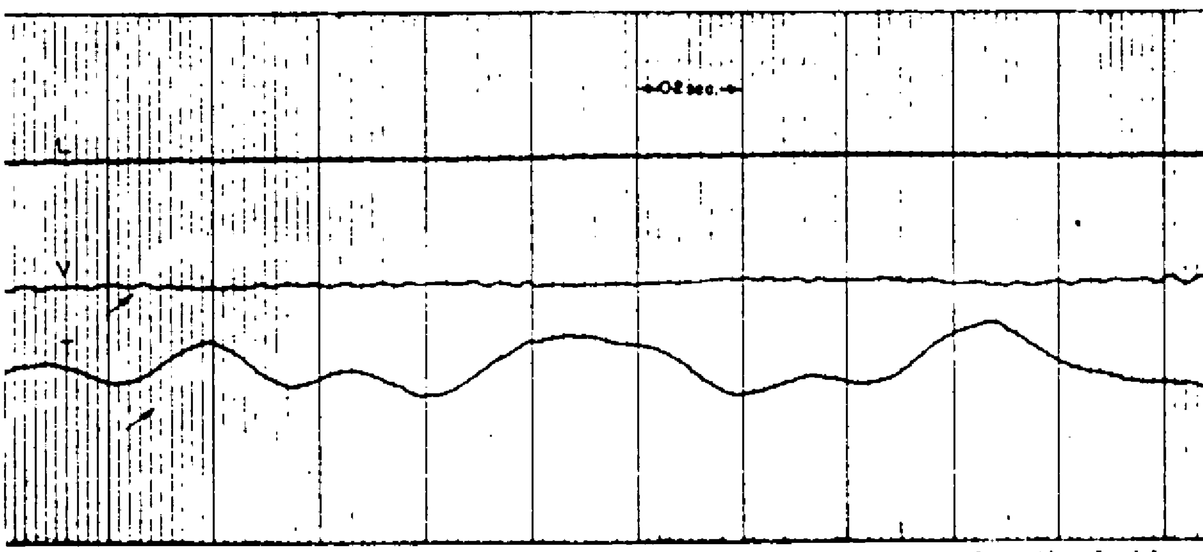
Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics.

G 544-87

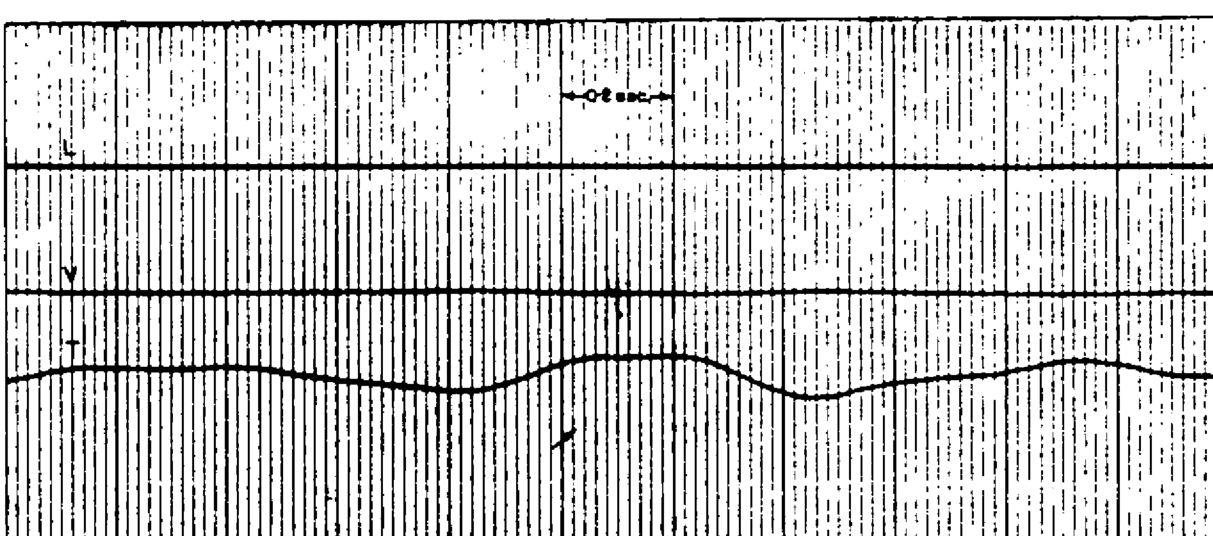
To accompany Record 1961 No 72



RECORD No 5. Location 3. Train to Melbourne passing under the bridge.



RECORD No 6. Location 3. Train from Melbourne passing under the bridge.

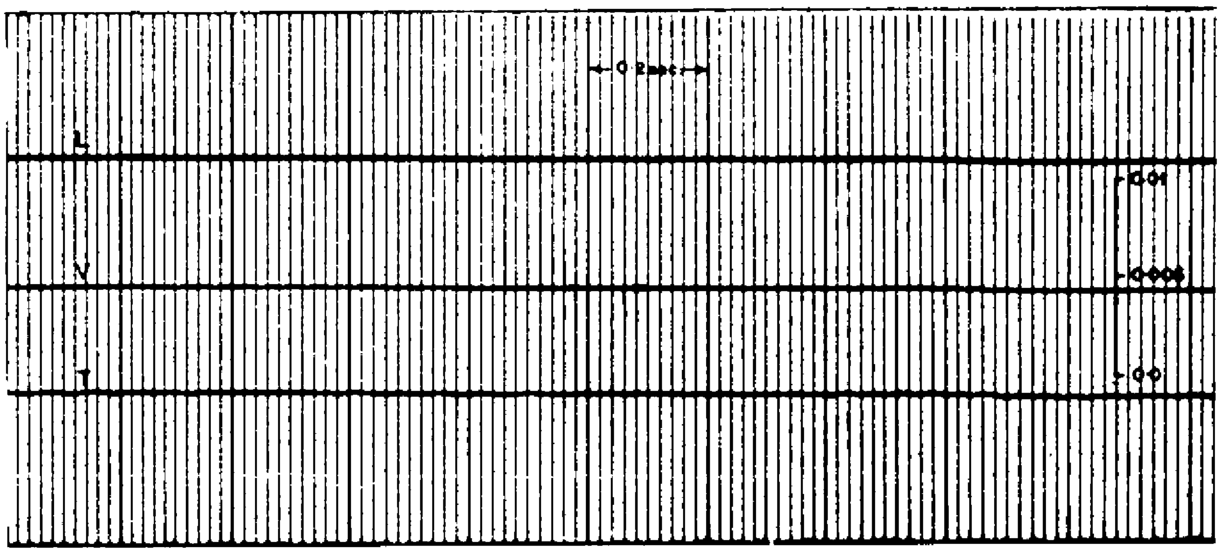


RECORD No 7. Location 3. Vibration in absence of train.

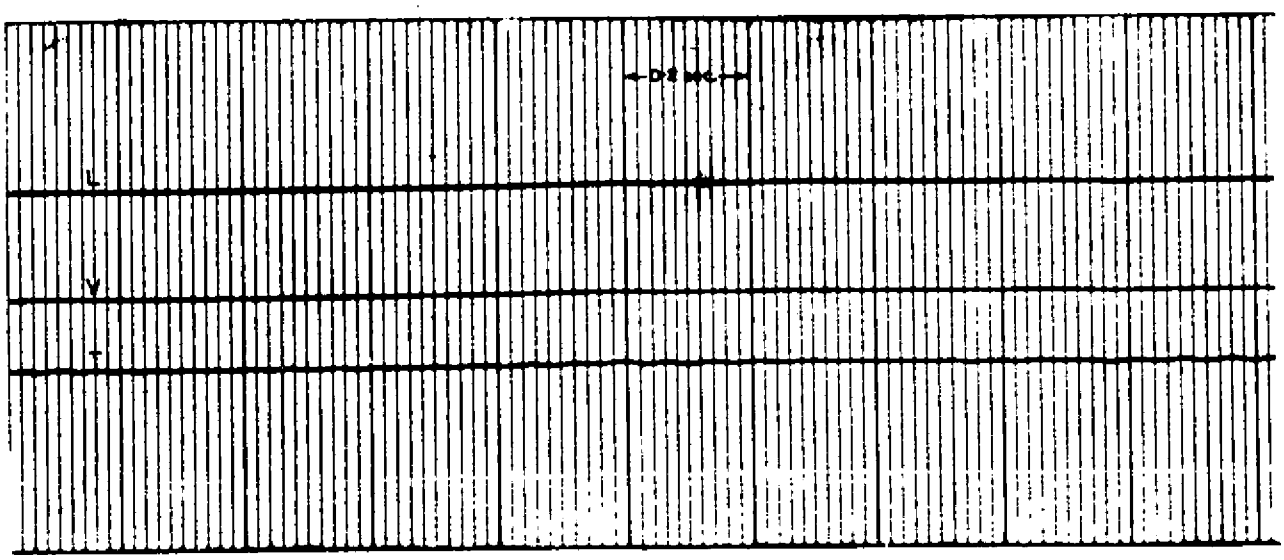
ABC-TV Studios Vibration Test 28-4-61.
Ripponlea, Victoria.

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics G 344- 98
To accompany Record 1961 No 77

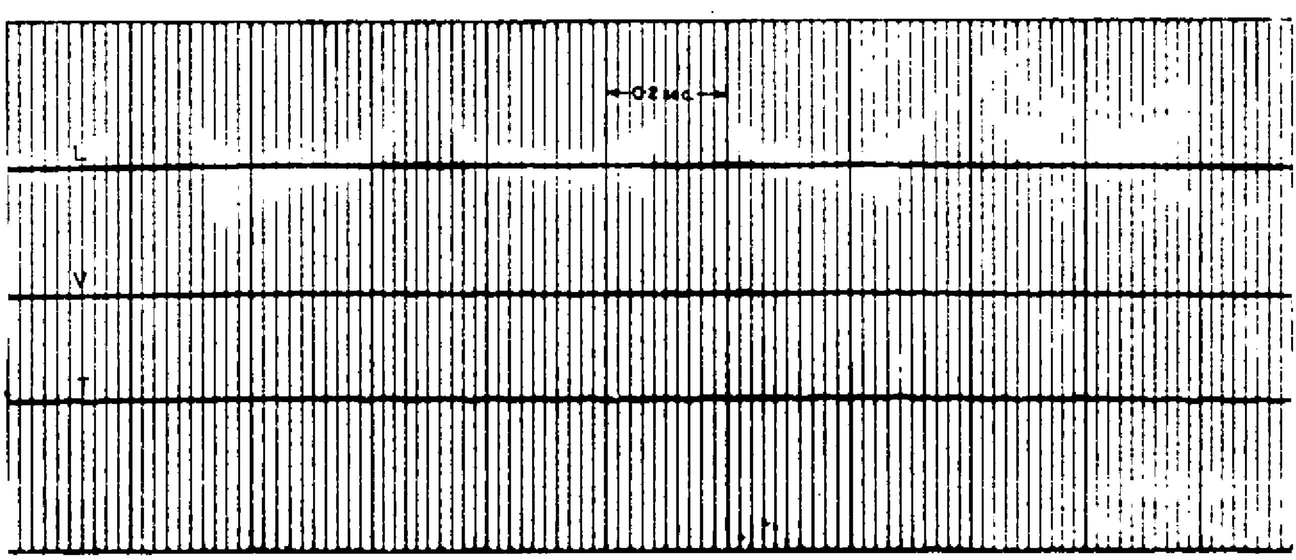
Plate 4.



RECORD No 8. Location 4. Train to Melbourne passing the building.



RECORD No 9. Location 4. Train from Melbourne passing the building.



RECORD No 10. Location 4. Vibration in absence of train.

ABC-TV Studios Vibration Test 28-4-61.
Ripponlea, Victoria.

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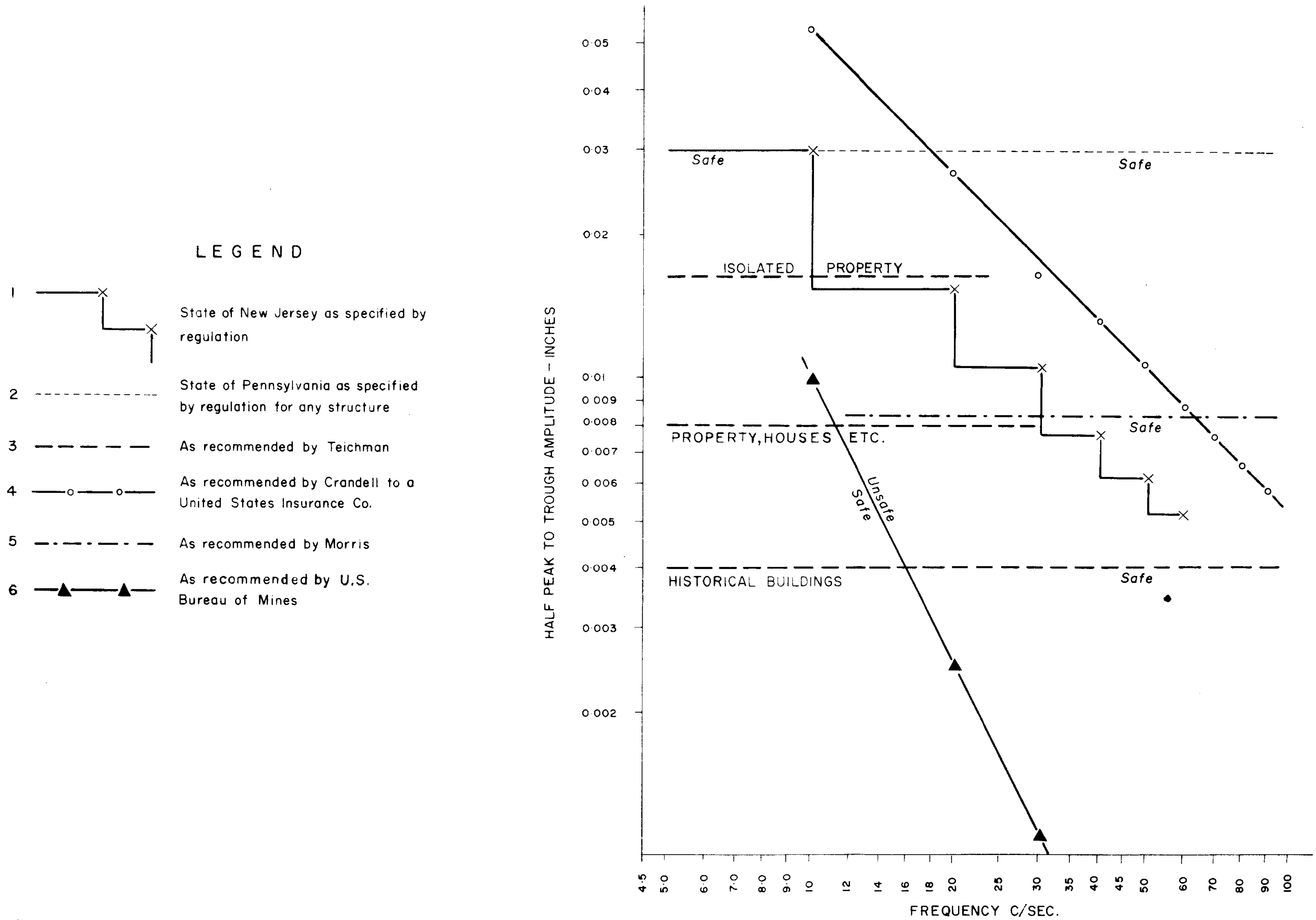
To accompany Record 1961 No [illegible].



MAXIMUM SAFE HALF PEAK TO TROUGH AMPLITUDE OF VIBRATION PLOTTED AGAINST FREQUENCY AS SPECIFIED AND RECOMMENDED BY VARIOUS U.S. GOVERMENT AUTHORITIES AND BY INDIVIDUALS