-NOISE ASSESSMENT-
FOR MIXED USE DEVELOPMENT
171-189 PARRAMATTA RD
GRANVILLE

REPORT NUMBER 4609
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PREPARED FOR

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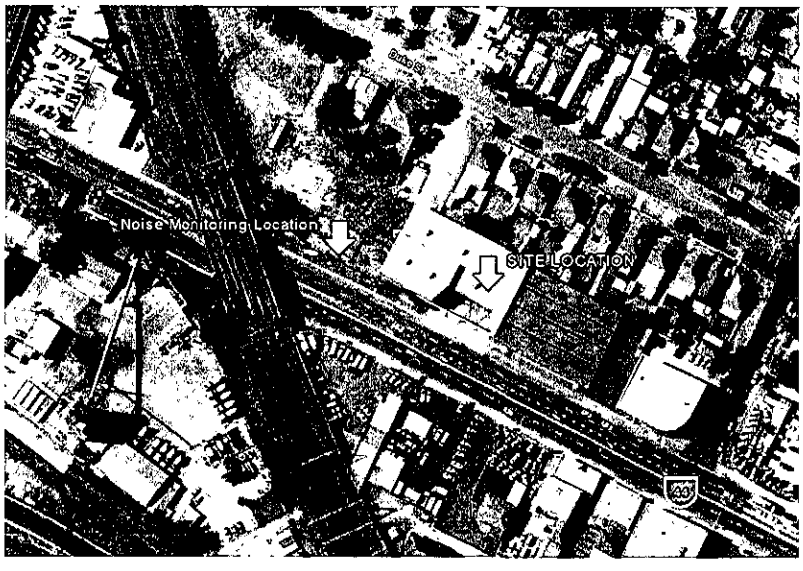
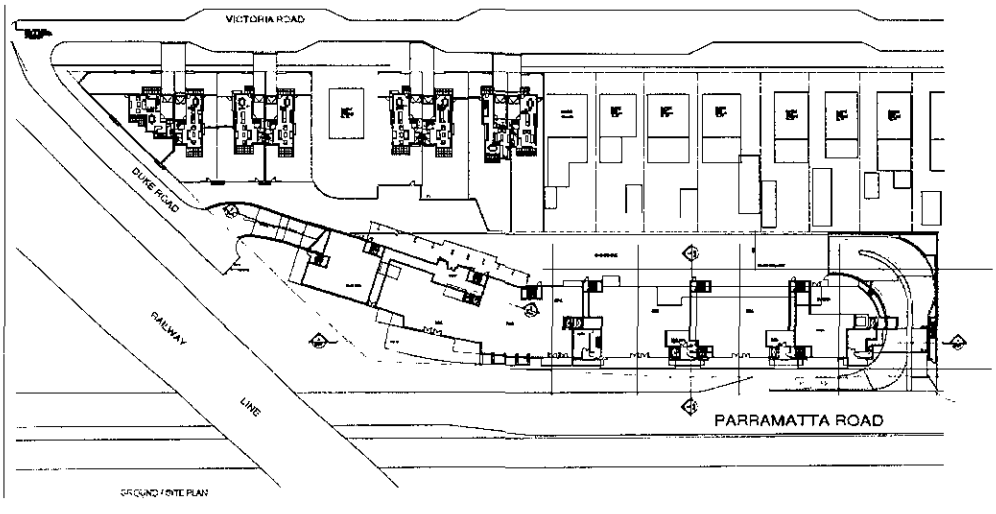
INTRODUCTION and SITE LOCATION

The site at 171-189 Parramatta Road., Granville, is to be re-developed as a mixed use development consisting of commercial/retail on the ground floor and residential premises above. The site has been identified as being affected by noise from trains on City Rail's Western Rail Line, which is approximately 15 to 20 m from the western boundary of the development. The site will also be affected by traffic on Parramatta Road and to a lesser extent from traffic on the M4 motorway. Victoria Street at the rear of the development carries very little traffic.

This report presents our assessment for the noise impact due to rail and road traffic on the building envelope, in order to satisfy the design criteria that are proposed. Sound insulation against inter-unit noise or noise from mechanical services (should this be installed) is not within the scope of this report.

Apart from the noise impact that external noise sources will have on this building development, there also exists the potential for the increase in the volume of traffic on local roads, due to the proposed building development. This aspect of noise generation due to increased traffic on local roads will also be assessed.





ASSESSMENT CRITERIA

Road Traffic Noise

The site has been identified as being affected by noise from traffic on Parramatta Road. and to a lesser extent from the M4 motorway which is on an embankment approximately 5 m high and about 110 to 140 m north of the development.

For building development impacted upon by transportation noise, it is customary to use the guidelines provided in the Australian Standards in order to control the acoustic amenity inside the development. These standards are:

- AS3671 – 1989: Acoustics - Road Traffic Noise Intrusion – Building Siting and Construction, and
- AS/NZS 2107:2000- Acoustics - Recommended Design Sound Levels and Reverberation Times for Building Interiors.

The procedure provided in AS3671 is usually adopted for the selection of building envelope construction required to achieve the internal sound levels recommended in AS2107.

The Parramatta Development Control Plan states under Section 4.3.3 Acoustic Amenity "To ensure that the siting and design of buildings minimises noise impacts from abutting major roads and other noise-generating land uses."

Section 4.3.3 requires the use of Australian Standards AS3671 and AS2107 with AS1055 Parts 1, 2 and 3 for measurement procedures.

A summary of the recommended design sound levels contained in AS2107, for residential buildings near major roads, is shown below:

TABLE I – DESIGN SOUND LEVEL FOR RESIDENTIAL BUILDINGS NEAR MAJOR ROADS

TYPE OF OCCUPANCY/ACTIVITY	SOUND LEVEL, L_{eq}, dB(A)	
	SATISFACTORY	MAXIMUM
Living areas	35	45
Sleeping areas	30	40

For the purpose of assessing the impact of traffic noise inside the proposed development, the above noise criterion will be used.

Train Noise

The site has been identified as being affected by noise from train movements on City Rail's Western Rail Service. This rail corridor consists of four tracks which are on an embankment approximately 3 to 4 m high and about 15 to 20 m southwest of the development. There is also a steel rail bridge for the tracks to cross over Parramatta Road.

The noise impact from train movements can affect nearby buildings in two ways. First, noise produced by the train may be transmitted directly to the external façade of the building through the air medium. This is known as air-borne noise.

Second, train movements may also result in ground vibration, which is propagated through the building structure, and therefore referred to as structure-borne noise. Criteria for each of these forms of noise propagation will be discussed below.

Generally when a proposed development site is located within 60 m of a rail corridor, there is a requirement by Council that an acoustic report be prepared to assess the noise impact of the nearby railway on the proposed site. This assessment is generally based on the guidelines for train noise that was proposed by the Rail Infrastructure Corporation (RIC) of the State Rail Authority.

Internal noise criteria for residential developments adjacent to rail corridors are proposed in the RIC's publication titled: "Guidelines for Councils – Consideration of Rail Noise and Vibration in the Planning Process". A summary of this criterion in respect of air borne noise is shown below:

TABLE II – NOISE CRITERIA FOR RESIDENTIAL BUILDINGS ADJACENT TO RAILWAYS

INTERNAL SPACE	TIME PERIOD	NOISE LEVEL, $L_{eq(1\ hr)}$, dB(A)
Living and sleeping areas	Day (7 am to 10 pm)	40
	Night (10 pm to 7 am)	35

If noise levels with windows or doors open exceed these noise levels by more than 10 dB(A), then an alternate form of ventilating these rooms should be considered so that occupants may leave windows closed, if they so desire.

Floor vibration level in habitable rooms should be designed to comply with the criteria in British Standard BS 6472:1992 - "Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz)".

Appropriate sections of this standard has been reproduced and shown in Appendix II of this report. Curve 2 and curve 4 are for the day-time and Curve 1.4 is the night-time criterion for continuous vibration in residential buildings. Assuming a train pass to last for 10s, and 213 trains in a 16 hour day, acceleration levels which are below 0.037m/s^2 r.m.s, are considered to have a low probability of adverse comment.

Traffic Generated by Development

When a new development is proposed for an area, there is the likelihood that the development will also generate additional traffic movements on public roads in the area. Criteria for traffic noise are contained in the "Environmental Criteria for Road Traffic Noise" (ECRTN).

Criteria for Land use developments with the potential to create additional traffic on local roads, are shown below:

$L_{eq(1hr)}$: 55 dB(A) daytime
$L_{eq(1hr)}$: 50dB(A) night-time

In all cases, traffic generated by the new development should not lead to an increase in existing noise levels by more than 2 dB.

NOISE AND VIBRATION SURVEY

A noise and vibration survey of traffic and trains was conducted at the site 9. See Figure 1 for location of monitors)

The Rail corridor is approximately 3 m above the ground level and the building will be multi-storey, therefore, the microphone of the sound level meter was located at a height of approximately 3.5 m above existing ground level.

All measurements were taken with the meter set on 'A' frequency weighting and in 'fast' time response.

Ground vibration from train movements was monitored up using a steel rod buried in the ground to a depth of about 300 mm. These vibrations were then transferred to an accelerometer which was mounted onto the steel rod using a magnetic mount.

The weather conditions at the time of the noise survey were suitable for noise measurements.

Road Traffic Noise Survey

Shown in the table below is a summary of the noise survey:

TABLE III – MEASURED NOISE LEVELS

LOCATION	Day	NOISE LEVELS, dB(A)				
		L_{max}	L_{min}	L_{10}	L_{90}	L_{eq}
Loc. 2: 8 m from Parramatta Rd. & approx. 30 m from rail bridge (17/6/05)	Thursday	99*	61	79	70	78
	Friday	87*	60	78	70	75
	Saturday	94*	60	79	70	77
Median/energy average:				79	70	77
Loc. 3: 8 m from Victoria St. (22/6/05)		57	79			64
		57	82			62
Energy average:						63

All results are rounded to the nearest whole decibel

* These noise levels are from train passes on the bridge.

Note: The L_{10} noise level is the level exceeded for 10% of the time, and is approximately the average maximum noise level. The L_{90} level is the level that is exceeded for 90% of the time, and is considered to be approximately the average of the minimum noise level recorded. This level is often referred to as the "Rated Background Noise level". The L_{eq} level represents the average noise energy during the measurement period.

Train Noise Survey

Shown in the table below is a summary of the results of the noise and vibration survey:

TABLE IV - RESULTS OF NOISE AND VIBRATION MEASUREMENTS FROM TRAINS

TRAIN NO.	LOCATION	DIRECTION	NOISE LEVEL, dB(A)		TRAIN NO.	LOCATION	DIRECTION	NOISE LEVEL, dB(A)		TRAIN NO.	LOCATION	DIRECTION	ACCELERATION LEVEL, mm/s^2
			L_{max}	SEL [3]				L_{max}	SEL [3]				
1	1 (17/6/05	Up [1]	85	93	1	2 (17/6/05)	Up [1]	88	93	1	4 (25/6/05)	Up [1]	17.4
2		Down [2]	78	86	2		Down [2]	95	97	2		Down [2]	15.1
3		Down [2]	82	86	3		Up [1]	99	101	3		Up [1]	14.1
4		Up [1]	77	85	4		Down [2]	87	89	4		Up [1]	15.0
5		Up [1]	85	90	5		Down [2]	85	91	5 (Freight – locos)		Up [1]	19.5
6		Down [2]	79	86	6		Up [1]	94	97	5 (Freight – trucks		Up [1]	18.0
7		Up [1]	88	94	7		Up [1]	88	95	5 (Freight (trucks)		Up [1]	17.6
8		Down [2]	75	83						6		Up [1]	15.3
9		Up [1]	73	82									
10 (Freight)		Down [2]	78	90									
11		Up [1]	83	91									
12		Up [1]	90	95									
Ambient:													13

All noise level results are rounded to the nearest whole decibel.

[1] Trains travelling south towards the City

[2] Trains travelling north towards Parramatta

[3] Sound Exposure Level

Detailed results for the acceleration level measured during a train pass, as well the ambient acceleration level with no train movements, has been graphed and is shown in Appendix II. In these graphs it will be seen that the acceleration level from train passes are below Curve 1.4 as defined by BS 6472: 1992, which represents the night-time criterion for continuous vibration for residential buildings.

ASSESSMENT METHODOLOGY

Noise Impact on Development from External Sources

Using the measured $L_{eq(15\ min.)}$ noise level shown in Table I, as the external noise level (or exposure level) that the envelope of the building will be subjected to, calculations were performed based on the method described in AS 3671, to determine the traffic noise attenuation (TNA_c) of the building components required to achieve the recommended internal noise criterion. From this the R_w index (weighted sound reduction index) of each component that constitute the building facades exposed to road traffic noise, can be estimated.

A similar procedure was used for train noise, except that for train noise the exposure level was calculated from the results shown in Table IV. The $L_{eq\ (1\ hr)}$ noise level is estimated to be 68 dB(A) at location 1 and 74 dB(A) at location 2. This is based on 20 train movements per hour.

Calculations are based on the plans provided from Zhinar Design dated August 2009. Based on this, building components required to achieve the recommended internal noise criterion, are shown in Section 5.

Traffic Noise Generated by Development

Using the "USFHWA" model for traffic noise prediction, calculations were performed to predict the noise impact on the surrounding environment, due to the increase in the number of vehicles on Victoria Street, from the proposed new development.

Assumptions with regard to traffic volumes, speed and distance from the road, as well as the results of the calculations are shown in the table below.

TABLE IV – CALCULATED TRAFFIC NOISE LEVELS FROM INCREASED NUMBER OF VEHICLES ON VICTORIA STEET.

DISTANCE OF VEHICLES FROM BUILDING FAÇADE (m)	TRAFFIC VOLUME PER HR.	AVERAGE SPEED (km/h)	ESTIMATED NOISE LEVEL [$L_{eq(1\ hr)}$], dB(A)
10	103 (Day)	40	53
10	68 (Night)	40	49

From the results shown above it can be seen that compliance with the recommended noise criterion discussed in Section 2.3, would be met.

RECOMMENDED CONSTRUCTION COMPONENTS

The following construction components are considered suitable in order to meet the recommended internal noise criteria.

These recommendations are based on estimates or actual laboratory test results (where available) of the acoustic performance of the building products. Where possible laboratory test data to support acoustic ratings (R_w) of building products should be requested.

However, since the performance of these products are dependent on the quality of the installation process and workmanship, it is likely that the product may perform below its acoustic rating when installed. Therefore, products recommended are meant as a guide only for the selection of building materials. No guarantees on the performance of the product can be offered post installation.

Roof/Ceiling Construction

Town Houses facing Victoria Street:

Pitched roof clad with concrete tiles or metal roof over two layers of 13 mm thick plasterboard ceiling fixed to metal furring channel attached to resilient mounts plus 120 mm thick 30 kg/m^3 Fibertex Rockwool insulation between ceiling joists, and medium duty aluminum foil sarking over the roof rafters.

If skylights, ventilators, heat extraction units or other openings into the ceiling cavity for lighting, ventilation, decoration or other purposes are to be provided, then care should be taken to ensure that such units are properly attenuated and all penetrations are properly sealed off so as not to degrade the rating of the roof/ceiling construction system.

Care should also be taken to avoid any noise paths into the ceiling cavity via the eaves.

External Wall Construction

Minimum Requirements:

Main Tower:

Equivalent to double skin cavity brick walls, minimum 270 mm thick and 13 mm internal plasterboard or cement render. All joints are to be filled solid with mortar and an air space between the leaves to be not less than 50 mm and completely free of any debris.

Town Houses:

Timber stud wall clad externally with 110 mm bricks and 13 mm plasterboard internally. Space between timber frame and bricks is to be at least 40 mm and clear of all debris.

Where the external cladding is not brick, two layers of 13 mm plasterboard to inside face, two layers of 13 mm moisture resistant plasterboard to outside face over which the external cladding is fixed. Cavity is to be filled with insulation with a minimum density of 30 kg/m^3.

Note: Penetrations into external walls for air vents, weep holes etc. must be avoided or where necessary must be properly attenuated. Should the need arise to provide mechanical ventilation or air conditioning for the units, then care should be taken to ensure that the ratings of external walls and windows are not compromised.

Window Construction

The attenuation for airborne sound insulation for windows is given in terms of a weighted sound reduction index (R_w) see AS/NZS 1276.1:1999. This is numerically similar to the previously used term - sound transmission class (STC).

Recommended glazing for windows/sliding doors are minimum requirements for acoustic purposes. In some cases thicker glass may be required for safety or other purposes.

In some instances the types of glazing systems shown on plans may have to be varied in order to achieve the recommended window ratings. Laboratory test data to support window/sliding door ratings (R_w) should be requested.

TABLE V – GLAZING REQUIREMENTS	
WINDOW/DOOR LOCATION	**MINIMUM R_w REQUIREMENTS**
Main Tower:	
Southern façade (facing Parramatta Rd.)	45
Northern façade (facing M4 motorway.)	30
Town Houses (Western Block):	
Southern façade	35
Northern façade	30
Town Houses (East Block):	
North & Southern facades	30

Mechanical Ventilation

When providing mechanical ventilation or air conditioning for the units, care should be taken to ensure that the ratings of external walls, ceilings and windows are not compromised. The use of mechanical services equipment can also introduce noise problems, and therefore the choice and location of such units is very important.

Installation

The acoustical effectiveness of the fitting out of a building with acoustic windows, doors and other products will also be dependent on the quality of the installation and associated workmanship. It is important to ensure that products are installed adequately and fully sealed to ensure that air gaps do not occur either within the products or at the perimeter and so reduce the attenuation of the building.

CONCLUSION

The noise measurements carried out at the site of the proposed development and the associated assessment indicates that the noise from trains and road traffic would have a significant impact on the development. Appropriate acoustical treatment of the units would be required to meet the recommended noise criteria. That treatment has been recommended.

The assessment also indicated that vibration levels measured from train passes generally do not exceed Curve 1.4 which is the night-time criterion for continuous vibration for residential buildings.

Rodney O. Stevens.

Rodney Stevens MAAS
Principal Consultant
RSA Acoustics

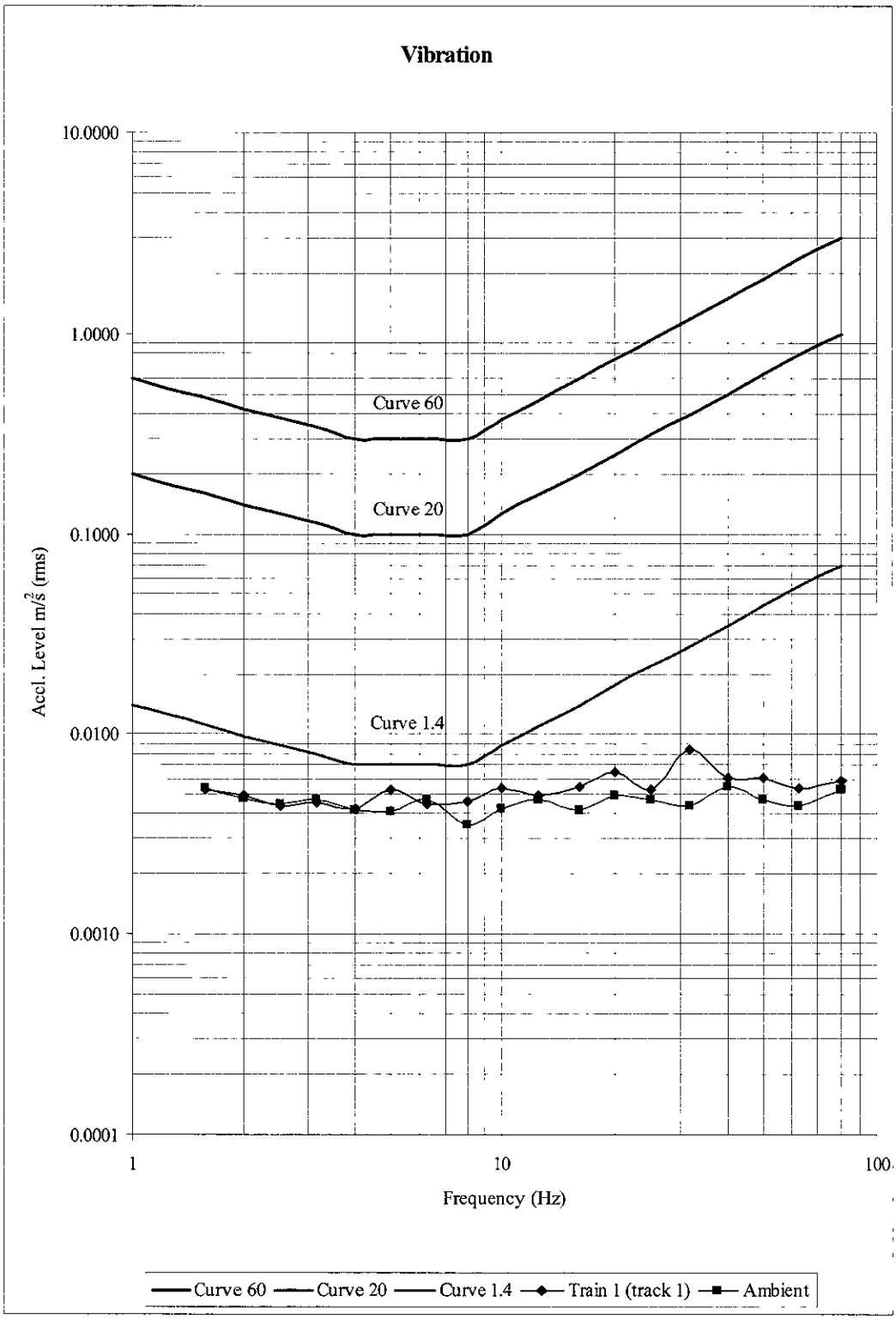
APPENDIX I

LIST OF EQUIPMENT USED FOR NOISE SURVEY		
EQUIPMENT	**MODEL/TYPE**	**SERIAL NO.**
Sound Level Meter	SVAN912	2167
	SVAN 945	4050
Pre-amplifier	SV01	1264
	SV 11	1710
Filter	1/1-1/3 Octave	2167
Microphone	SV02-C5	312
	40AN	26234
Accelerometer	B&K 4367	716569
Charge Preamp.	SV04	3053
Calibrator	B&K 4230	724711
Vibration Calibrator	IDS VC-10	3251

Calibration was checked periodically, and no significant drift in calibration was detected.

APPENDIX II

Address: 171-189 Parramatta Rd., Granville
Meas. Location: Approx.15 m from nearest track



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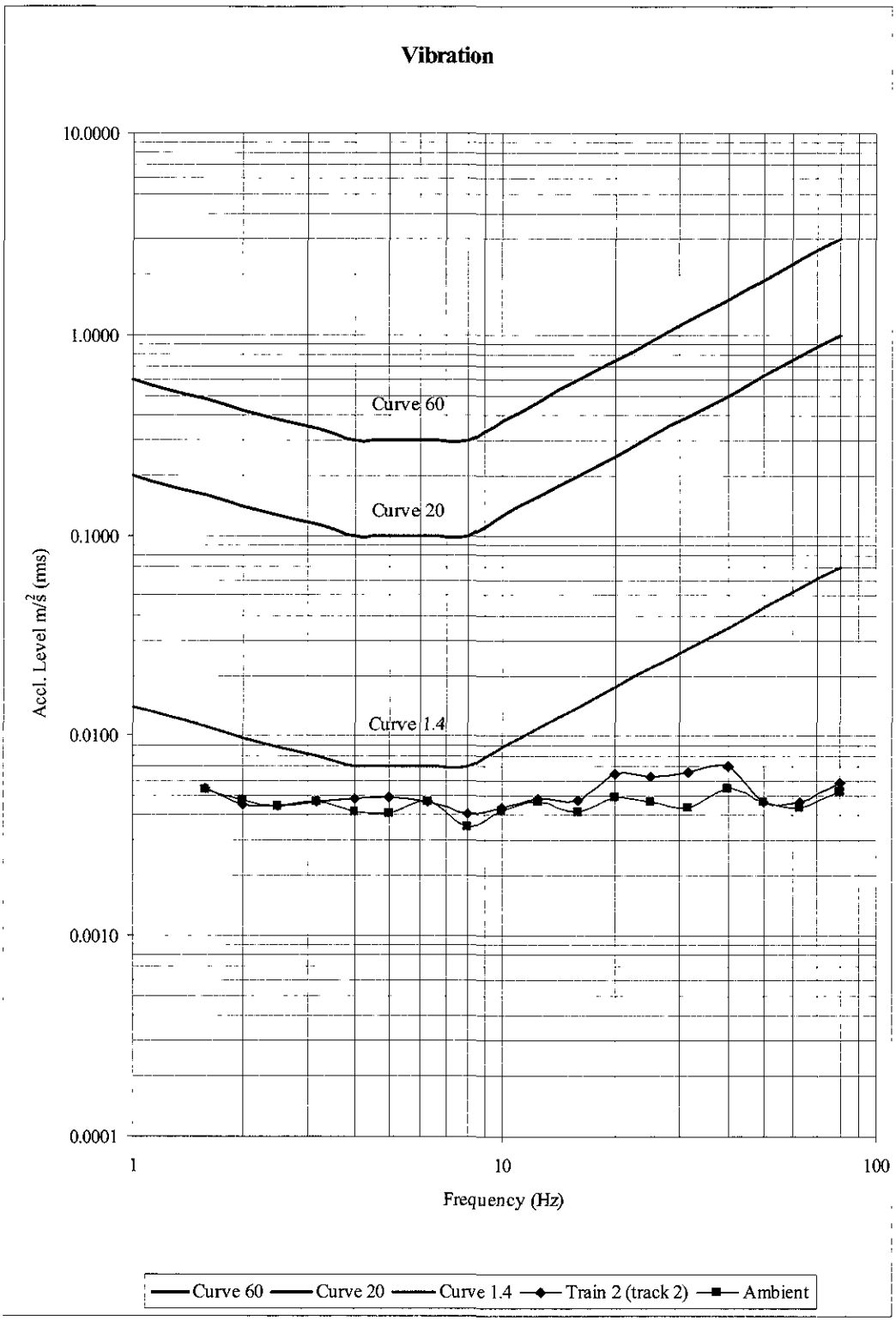

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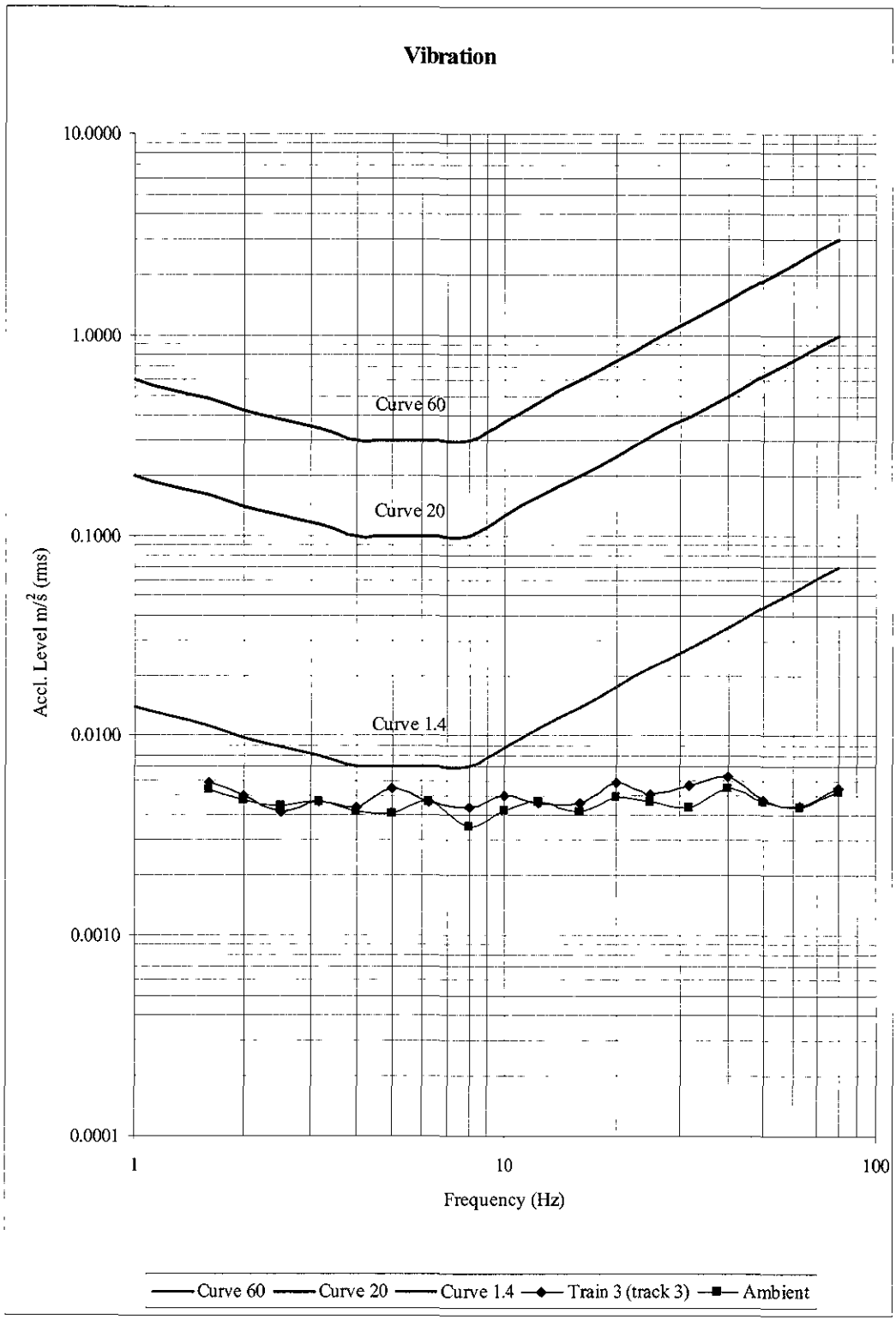

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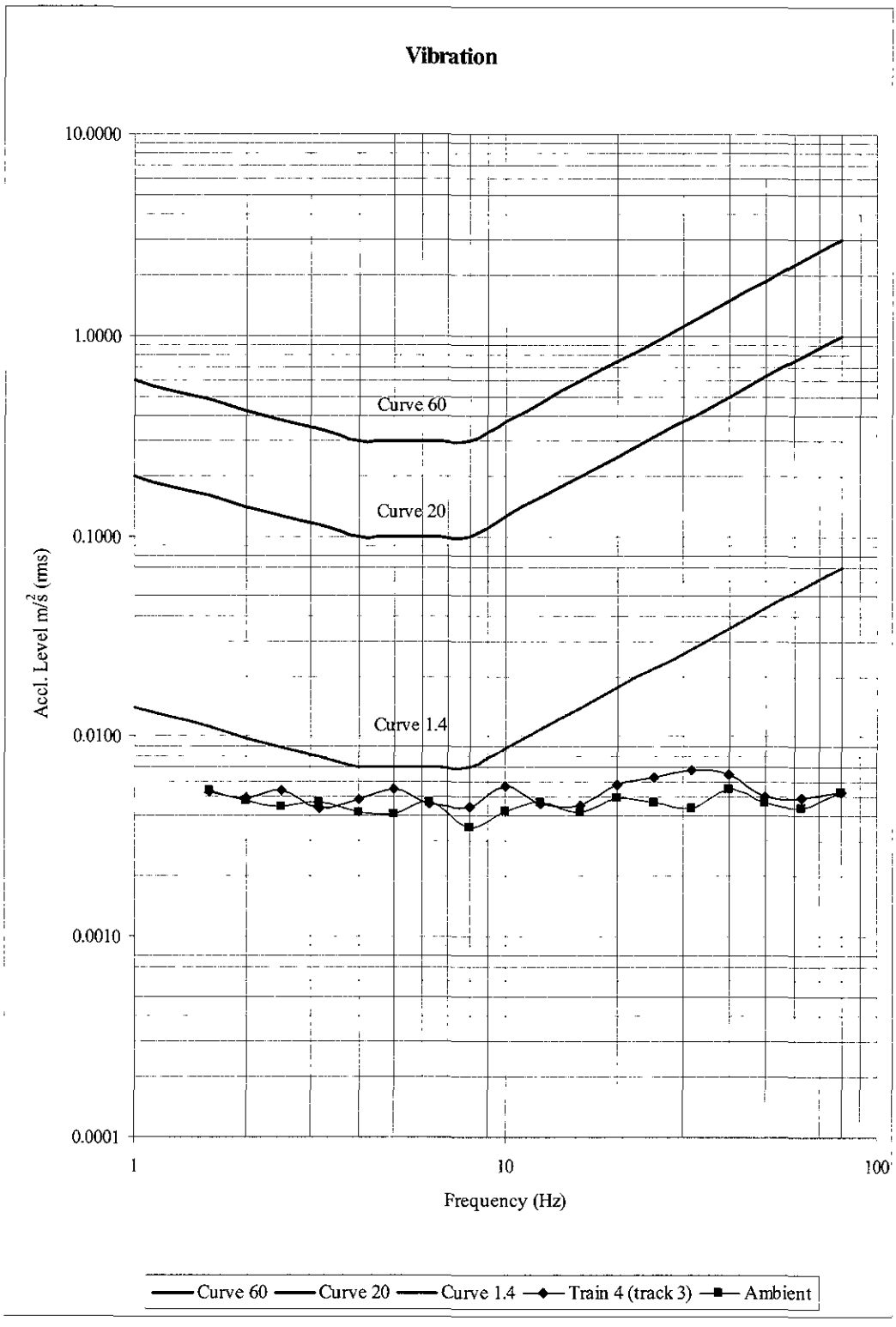

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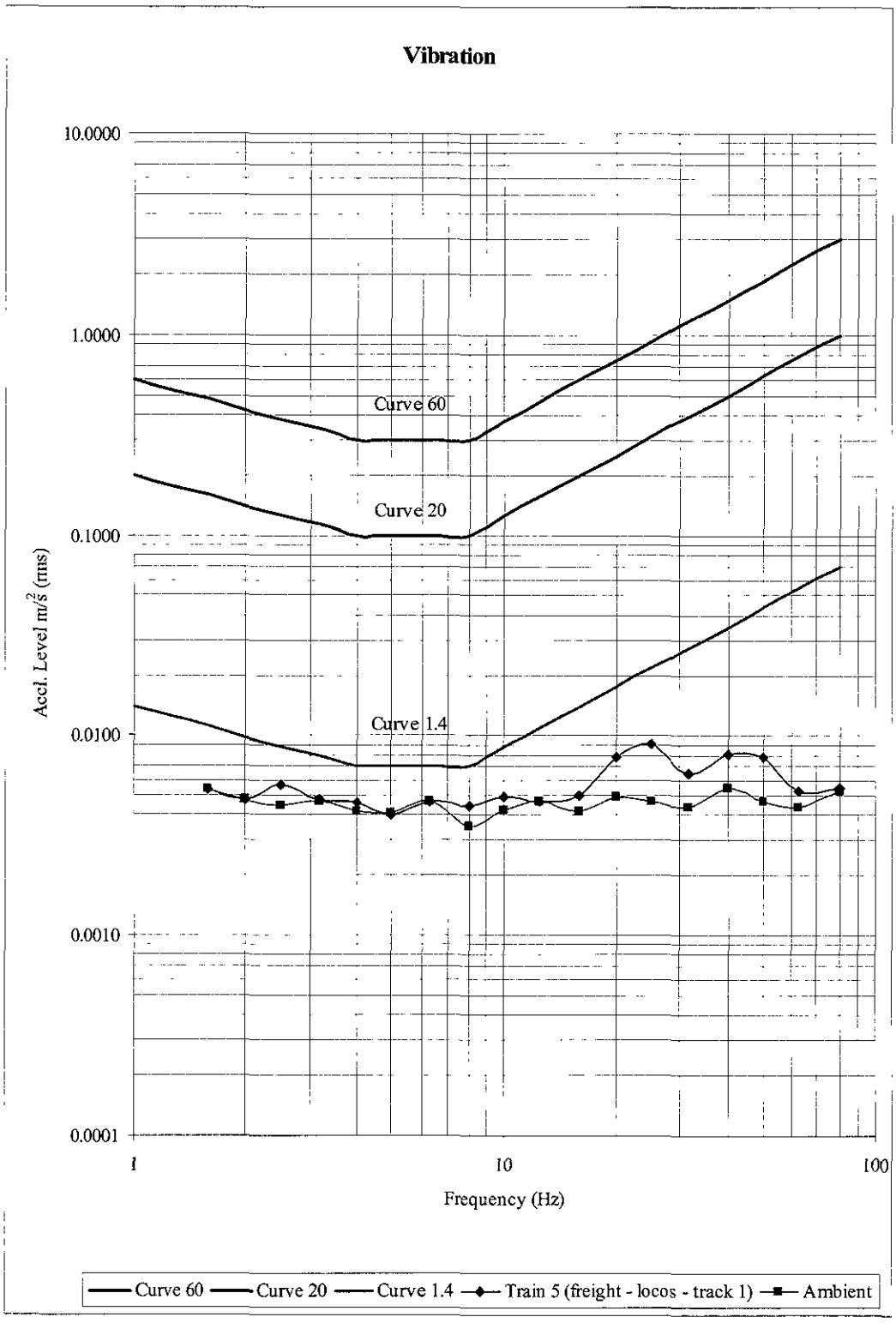

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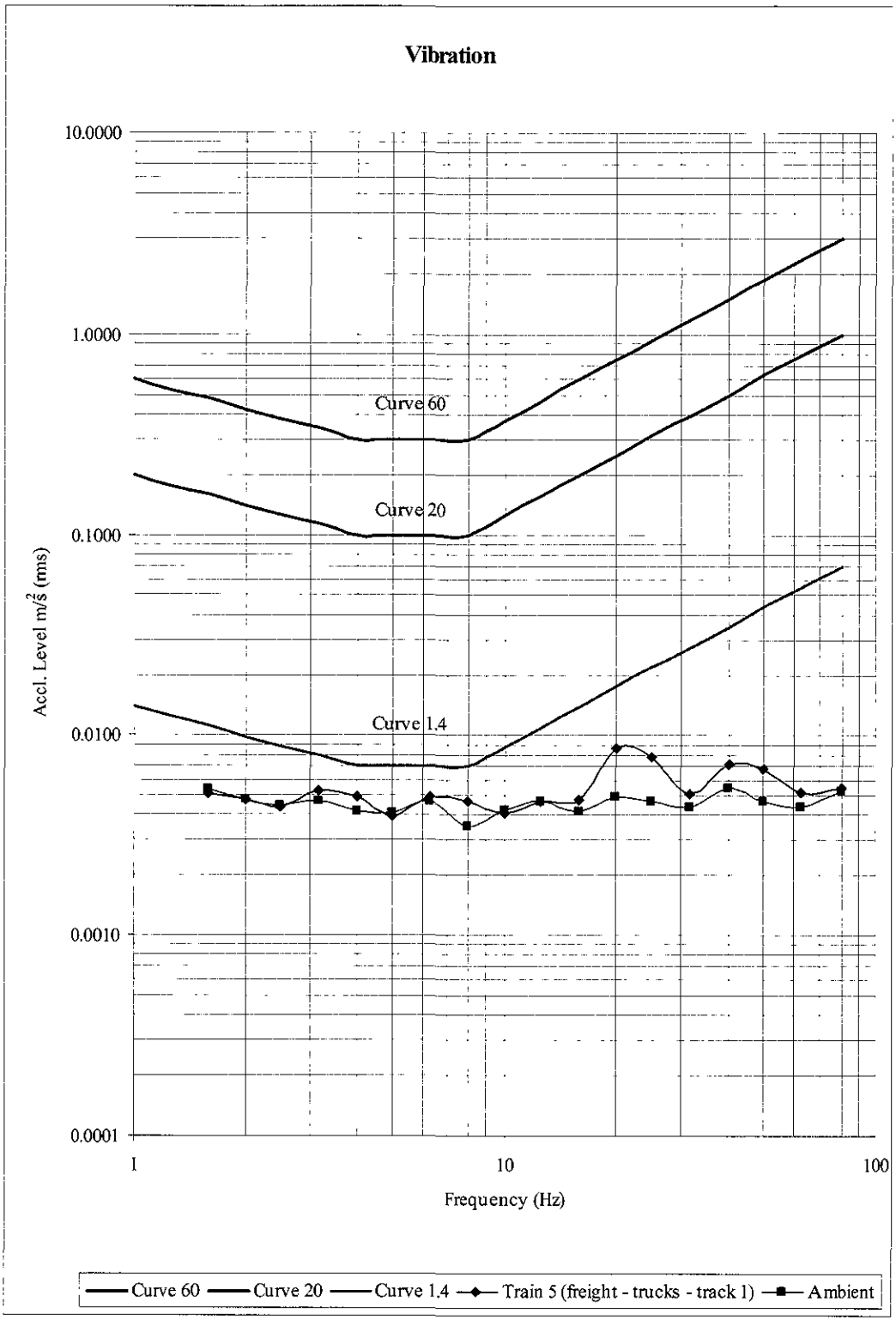

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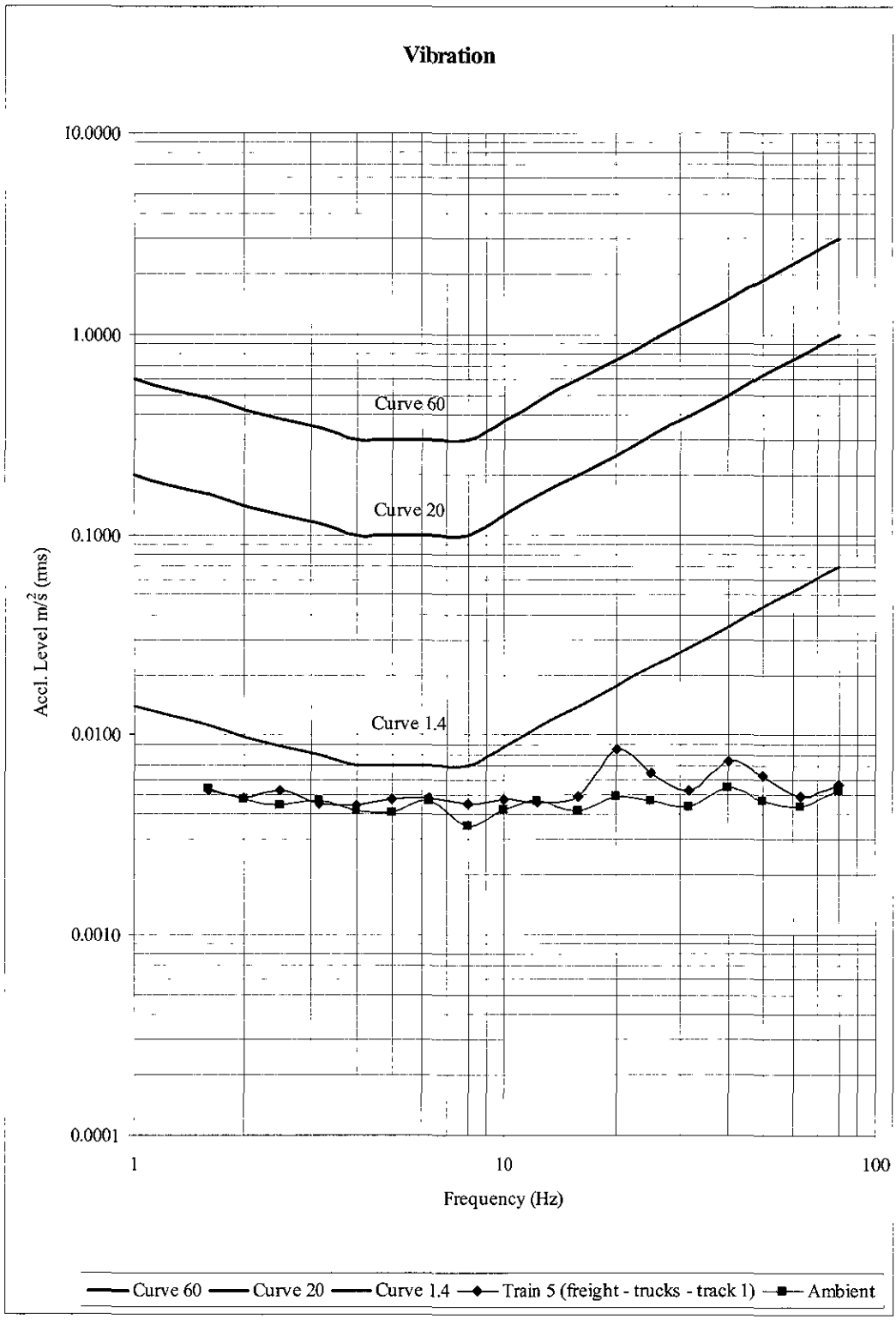

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