Raag St Pancras Ltd
Proposed Hotel and Residential Development
Britannia Street
Kings Cross
London

Local Authority Planning Requirements: Statement on Vibration Control

prepared for

RAAG St Pancras Ltd

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Proposed Tune Hotel and Housing, Britannia Street, Kings Cross
Design Strategy for Controlling Vibration

I) Introduction
The proposal envisages a mixed development comprising a Tune hotel and open market housing on a site which currently houses a car park. The vibration environment around the site is determined to a large extent by two railway lines; the London Underground Circle Line which runs in a cutting on the south-eastern edge of the site and the Thameslink Line which runs very close to it, but in a cut and cover tunnel with a vaulted brick roof and top cover. Both lines contribute to the vibration environment affecting the site.

A detailed vibration survey was carried out on the site in connection with a previous planning application. There have been no significant changes in the intervening period to the site or to the lines and operating procedures for the railways, and the original survey results and recommendations are presented along with this document.

2) Site Layout and Structural Options
The two components of the scheme are, in the main, spatially separated on the site, the housing to the south east and the hotel accommodation to the north west, with a clear patent air gap between the components to ensure effective isolation of structure-borne noise between them. One small section of the housing is accommodated adjacent to the hotel accommodation in the extreme south-east corner of the site.

The alignment of the railway lines necessitates the use of two different structural systems for the site; bored piles to the north-west, supporting the hotel accommodation and the smaller section of housing, and a raft foundation for the remainder of the housing to the south east. Some of the bored piles will be in close proximity to the Thameslink railway tunnel. Each pile will be fitted with an individually customised vibration isolating cap, to create an overall array of supports for a floating structural assembly isolated from the railway vibration below.

The avoidance of deep piles below the raft section of the foundation will mean that it will intrinsically be affected by lower levels of railway vibration, and a somewhat simpler system of isolation can be employed. Resilient mounts will be fitted between the ground and the raft above to create an overall vibration environment for the accommodation above equivalent to that in the other section of the site.

At this stage of project planning it is not possible to specify the vibration control system in great detail because there is an overriding necessity to match the compliance of each bearing or mount to the imposed mass - such details will simply not be calculable until the design has progressed significantly.

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Report No2257 - vib

Vibration Monitoring: Britannia St, London WC1.

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1.0 Object

The object of this report is to present the findings of a vibration survey carried out at the proposed development site at Britannia St, London WC1 over a 24 hour period between Wednesday 29th November & Thursday 30th 2006.[1]

It should be noted that the car park was in full operation during the survey and as such the data will not be purely train vibration although it was noted that the car park closed at 7pm opening again at 7am.

2.0 Scope

The scope of this report is as follows:

1) Presentation of survey vibration findings during a "typical" weekday period.

NOTE: It is understood that the vibration survey data is required to provide information for the design of vibration bearings for the proposed development.

A detailed triaxial assessment was undertaken of the Peak Particle Velocity levels and frequency content caused by train movements using the tunnel under the proposed development site

3.0 Survey

Vibration equipment was installed at the following positions on the dates detailed below:

Position	Description	Date of Installation / Survey
1	Approximately 2m off the centre line of the tunnel on the car park base slab	Wednesday 29th November & Thursday 30th 2006.

The fixed monitoring position enabled vibration data to be collected during the full 24 hour period.

See Photo Appendix for approximate location of monitoring equipment.

[1] NOTE: Due to adverse weather the Vibration Dosage Recordings were carried out on 8th Dec 2006..

4.0 Measurements

During the fixed monitoring histogram recordings were made which were subsequently analysed for the purpose of this report.

The following measurements were carried out:

Peak Particle Velocity (P.P.V) mm/s (1 min period).

Vibration Dosage Values (VDV) $m/s^{1.75}$ (Day time period only)

5.0 Measurement Equipment

The measurements were made using the following equipment:

1) 1 off Instantel MiniMate + Series III Tri-axial vibration analyser.

2) 1 off Vibrock V901

The Instantel monitor was set to record in stripchart mode taking the ppv & waveform measurements over the full 24hrs period. The Vibration Dosage Analyser was used during an attended survey to give an approximation to the likely foundation eVDV levels[2].

6.0 Site Operations

The site local vibration sources over the monitoring period consisted of the following:

1) Rail cutting along Western boundary of site

2) Thameslink Railway tunnel going under site (See exact position on the site plan in the Appendix.)

3) Localised vehicle movements around the car park (0700 – 1900hrs only).

The Vibration data collected from the monitor is detailed in the vibration data sheets in the Appendix for both PPV and VDV monitoring.

[2] eVDV – estimated Vibration Dosage Value

7.0 Survey Findings

The results are detailed in the Appendix and are summarised below;

MiniMate + Peak Particle Velocity (PPV) Monitoring

Position	Description	Comment
1	Approximately 2m from the Apex line of the tunnel	For the period 29th – 30th November 2006. There are regular levels of PPV Peak particle velocity in the Transverse axis above 4mm/s with the peak level recorded achieving 9.08mm/s @ 43Hz. In the vertical axis there are regular levels of PPV Peak particle velocity in the Longitudinal axis above 3mm/s with the peak level recorded achieving 5.7mm/s @ 57Hz. For the Longitudinal axis there are regular levels of PPV Peak particle velocity in the Longitudinal axis above 3mm/s with the peak level recorded achieving 7.57mm/s @ 18Hz.

Frequency Content:

The frequency content of the vibration is summarised in the PPV scatter plots in the Appendix to this report. In summary they are:

Vertical Axis: 50 – 80Hz frequency range for the higher levels of PPV.

Transverse Axis: 40 – 60Hz frequency range for the higher levels of PPV.

Longitudinal Axis: 35 – 70Hz frequency range for the higher levels of PPV.

Human Response Criteria

Vibration Dosage (VDV) Monitoring

Position	Description	Comment
1	Approximately 2m from the Apex line of the tunnel	Monitoring undertaken on the 8th December 2006 after adverse weather affected the instrumentation on 29th – 30th November 2006: 2 hourly periods were recorded between 10am – 12 noon. The predicted daytime e VDV was 0.588 $m/s^{1.75}$

The threshold levels for human response are detailed in Table 7 in BS6472: see below.

Human Response Criteria Table 7 BS6472

Place	Low probability of adverse comment	Adverse comment possible	Adverse comment probable
Residential buildings 16hrs day	0.2 to 0.4	**0.4 to 0.8**	0.8 to 1.6
Residential buildings 8hrs night	0.13	0.26	0.51

Conclusion: the peak vibration dosage levels recorded are within the "adverse comment possible" criteria : NOTE: this only takes into account the ground level vibration at the surface and will be likely to be adversely affected by foundation piles being driven to within 1m of the tunnel wall.

8.0 Conclusion

The background vibration results in the car park show that vibration levels recorded during the are relatively consistent throughout the day and night time periods and range between 4 – 6mm/s on a regular basis. This is confirmed by the attended VDV measurements just off the apex of the tunnel which provided an estimated Vibration Dosage Value of 0.588 which is in the "Adverse comment possible" banding according to BS6472.

Due to the close proximity of the rail cutting and the tunnel it is recommended that consideration is given to mitigating the vibration impact on this building based on the levels recorded.

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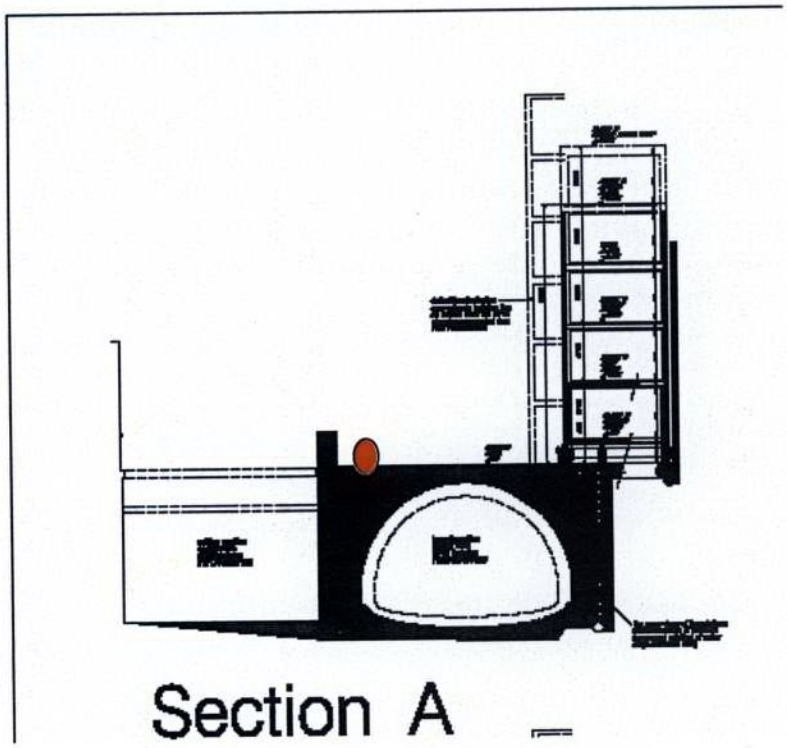
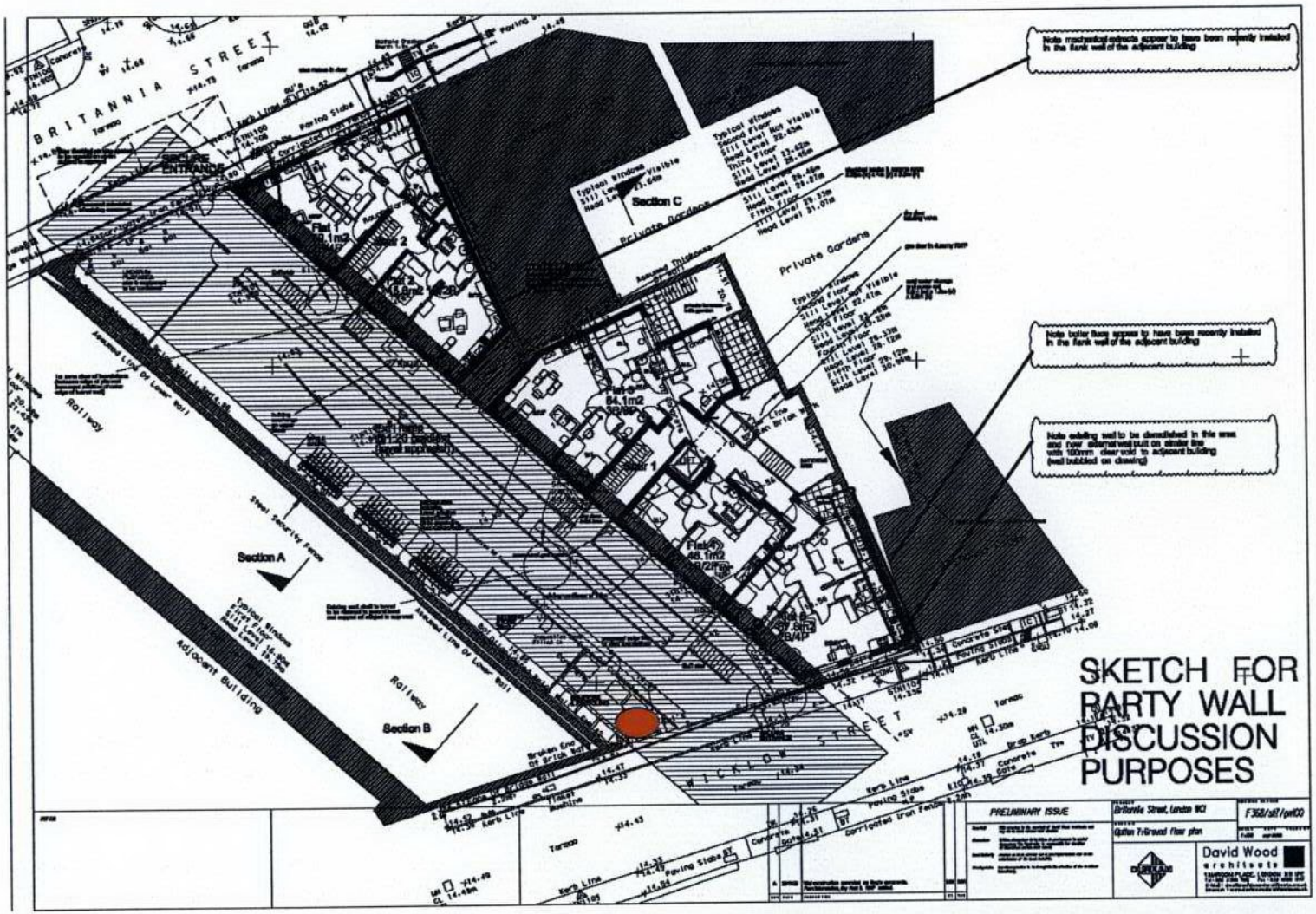
Noise & Vibration Consultant.



Vibration Monitoring Position

Section Drawing of Proposed Building Position and position of Vibration Monitor



Vibration Monitoring Position

Britannia St: Site Layout Plan – showing approximate position of vibration monitor