Appendix 9.4 – Vibration Survey Details & Summary Results

Procedure

Vibration surveys were undertaken on the following dates with the purpose of establishing the magnitude and frequency distribution of groundborne vibration levels from tram movements at various measurement locations. The duration of measurements at each position was sufficient to capture at least 10nr tram passes.

- 27 September 2023, 11:00-14:00 hrs.
- 12 October 2023, 10:00-13:00 hrs.

The key measurement positions (those used in our assessment) are described below and shown on Figure 9.2. Additional $L_{max,s}$ noise level measurements were taken within the viaduct using a Class 1 handheld sound level meter to help calibrate the analysis chain.

Position	Description
1 (A+B+C)	75-storey tower: Outdoor. Three sensor positions in the approximate location of the closest column (south-east corner) to the tram lines. Measurements taken on (A) concrete plinth in car park, (B) tarmac road surface, and (C) on the viaduct groundbearing structural slab.
2-10	75-storey tower: Indoor. Single sensors positioned at each of the remaining column positions of the proposed tower. All measurements taken on the viaduct groundbearing slab.
11	22-storey slot site: Outdoor. Single sensor positioned on road surface at a position representative of the nearest column to the tram.
12	22-storey slot site: Outdoor. Single sensor positioned on top of the viaduct near to the proposed southern tip of the building. Measurements taken on a concrete plinth on pavement next to car park access road.
13	F&B retail unit: Outdoor. Single sensor position in the approximate location of the closest columns to the elevated tramline. Measurements taken on tarmac road surface.

Instrumentation

The following instrumentation was used for the survey and subsequent analysis:

- Svantek SV106 – 6nr channel vibration meter, serial nr 69130,
- 2nr Svantek SV84 tri-axial accelerometers (X-, Y-, Z-axis),
- 2nr Svantek SV207 mounting bases,
- Svan PC++ data analysis software.

The equipment was hand calibrated before and after the survey which shown no unfavourable deviations. The equipment was factory calibrated on 18 January 2023.

The vibration was connected to the tri-axial accelerometers via extension cables. The equipment was set to log one-third octave band (1 Hz – 800 Hz) linear RMS vibration acceleration levels (m/s^2) in 1-second intervals.

The vibration measurements were undertaken with the accelerometers attached to the heavy mounting bases and sat onto the ground/surface with adjustable spiked feet to obtain true X-, Y-, Z-axis levels.

Results & Analysis

Typical measured RMS acceleration vibration levels in the dominant Z-axis for a range of selected tram passbys at the three key surveys positions (1, 12 & 13) are presented on Figures 9.3-9.5.