

Table B.14: Vibration predictions for vibration-sensitive equipment due to construction activities

Location	Vibration-sensitive Equipment	Vibration assessment reference <sup>see note e</sup>		Vibration assessment (maximum 1/3 octave vibration level (RMS) for comparison with VC curve <sup>see Note d</sup> )			Comments
		Vibration guideline target (magnitude of peak 1/3 octave band, RMS)	Baseline measurements (magnitude of peak 1/3 octave band, RMS)	Due to tunnelling activities <sup>See Note f</sup>	Due to Rockbreaking	Due to Ripping	
<b>Royal Women's Hospital</b>							
Level 1 adjacent to Grattan Street	CT Scanner	VC-A 50 µm/s	VC-B 17 µm/s	Exceeds (69 µm/s) (Up to 5 days)	Complies (4 µm/s)	Complies (1 µm/s)	Equipment was not impacted upon by construction at VCCC
	MRI	VC-C 12.5 µm/s	VC-B 17 µm/s	Exceeds (69 µm/s) (Up to 13 days)			
Level 2: Infertility	Microscopy	VC-A 50 µm/s	N/A	Minor exceedance (55 µm/s) (Up to 2 days)	Complies (3 µm/s)	Complies (1 µm/s)	
Level 3: Theatres	Typical equipment	Operating Room 100 µm/s	N/A	Complies (43 µm/s)	Complies (3 µm/s)	Complies (1 µm/s)	
<b>Royal Melbourne Hospital, Building</b>							
Ground Level	Gamma cameras, PET Scanner	VC-A 50 µm/s	N/A	Complies (13 µm/s)	Complies (21 µm/s)	Complies (6 µm/s)	Adjacent to Royal Parade RMH Nuclear medicine department
Ground Level	CT scanner	VC-A 50 µm/s	N/A	Exceeds (72 µm/s) (Up to 6 days)	Complies (12 µm/s)	Complies (4 µm/s)	Emergency Department
Level 1	MRI (1.5 T, MRI (3 T)	VC-C 12.5 µm/s	VC-B 13 µm/s	Exceeds (217 µm/s) (Up to 16 days)	Exceeds (67 µm/s) Minor exceedance (57 µm/s)	Exceeds (25 µm/s) Complies (4 µm/s)	
	CT Scanner	VC-A 50 µm/s		Exceeds (112 µm/s) (Up to 7 days)			
Level 2	Sensitive equipment	VC-A 50 µm/s	N/A	Complies (16 µm/s)	Complies (46 µm/s)	Complies (16 µm/s)	Haematology
Level 3	Operating theatres	100 µm/s	N/A	Exceeds near façade (180 µm/s) (Up to 3 days Grattan St facade)  Becomes compliant approximately 13m from facade	Complies (46 µm/s)	Complies (16 µm/s)	
Level 3	MRI	VC-C 12.5 µm/s	N/A	Exceeds (22 µm/s) (Up to 10 days)	Minor exceedance (15 µm/s)	Complies (4 µm/s)	Cardio and neurology surgery General and Angiography theatres
Level 5 (north corner)	MRIs	VC-C 12.5 µm/s	VC-B 20 µm/s	Complies (3 µm/s)	Complies (9 µm/s)	Complies (3 µm/s)	
Level 8 East Wing Main Block	Instrument Lab	VC-A 50 µm/s	N/A	Complies (6 µm/s)	Complies (5 µm/s)	Complies (1 µm/s)	Belonging to WEHI

Location	Vibration-sensitive Equipment	Vibration assessment reference <sup>see note e</sup>		Vibration assessment (maximum 1/3 octave vibration level (RMS) for comparison with VC curve <sup>see Note d</sup> )			Comments
		Vibration guideline target (magnitude of peak 1/3 octave band, RMS)	Baseline measurements (magnitude of peak 1/3 octave band, RMS)	Due to tunnelling activities <sup>See Note f</sup>	Due to Rockbreaking	Due to Ripping	
<b>Melbourne Private Hospital</b>							
Ground Level	MRI (1.5 T), MRI (3 T)	VC-C 12.5 µm/s		Complies (7 µm/s)	Complies (12 µm/s)	Complies (4 µm/s)	Private Medical Centre Radiology
	CT scanner, X-ray equipment	VC-A 50 µm/s	N/A	Complies (7 µm/s)	Complies (12 µm/s)	Complies (4 µm/s)	
	Ultra sound, Mammography	100 µm/s		Complies (72 µm/s)	Complies (12 µm/s)	Complies (4 µm/s)	
Level 2	Sensitive equipment	VC-A 50 µm/s	N/A	Complies (16 µm/s)	Complies (46 µm/s)	Complies (16 µm/s)	Micro Biology Lab
Level 7	Brain navigation systems	Operating Room 100 µm/s	N/A	Complies (3 µm/s)	Complies (3 µm/s)	Complies (1 µm/s)	Operating theatres, Cath lab, Use radiology at RMH
<b>Victorian Comprehensive Cancer Centre</b>							
Basement 2 (Haymarket corner of the building)	Cyclotron	VC-C 12.5 µm/s	N/A	Exceeds (19 µm/s) (up to 10 days)	Minor exceedance (19 µm/s)	Complies (6 µm/s)	
Basement 1 (adjacent to Grattan Street)	Linear accelerators	VC-C 12.5 µm/s	N/A	Exceeds (405 µm/s) (up to 14 days)	Exceeds ( >300 µm/s)	Exceeds ( >300 µm/s)	
Basement 1 (towards Flemington Road)	CT Scanners	VC-A 50 µm/s	N/A	Minor exceedance (51 µm/s) (Up to 1 day)	Complies (33 µm/s)	Complies (10 µm/s)	
Level 4	MRIs	VC-A 50 µm/s see note c	N/A	Complies (13 µm/s)	Complies (10 µm/s)	Complies (3 µm/s)	
Level 5	MRI,	VC-A 50 µm/s see note c	N/A	Exceeds (104 µm/s) (up to 4 days)	Exceeds (123 µm/s)	Exceeds (123 µm/s)	
	Xray, Ultrasounds	100 µm/s	N/A	Complies (85 µm/s)	Complies (58 µm/s)	Complies (56 µm/s)	
	PET, CT	VC-A 50 µm/s	N/A	Complies (13 µm/s)	Complies (8 µm/s)	Complies (2 µm/s)	
Level 6	Operating theatre Future MRI	100 µm/s VC-A 50 µm/s see note c	N/A	Complies (64 µm/s) Exceeds (58 µm/s) (up to 2 days)	Complies (47 µm/s) Complies (41 µm/s)	Complies (45 µm/s) Complies (28 µm/s)	
<b>Peter Doherty Institute</b>							
Basement	Electron microscope	VC-A 50 µm/s (on floor slab)	VC-D 6 µm/s	Exceeds (57 µm/s) (Up to 4 days)	Exceeds (178 µm/s)	Exceeds (172 µm/s)	Located on independent concrete inertia block with pneumatic isolation.  Criterion is based on information from Marshall Day Acoustics Report dated 13 February 2011 Reference SP0032010065.

Location	Vibration-sensitive Equipment	Vibration assessment reference <sup>see note e</sup>		Vibration assessment (maximum 1/3 octave vibration level (RMS) for comparison with VC curve <sup>see Note d</sup> )			Comments
		Vibration guideline target (magnitude of peak 1/3 octave band, RMS)	Baseline measurements (magnitude of peak 1/3 octave band, RMS)	Due to tunnelling activities <sup>See Note f</sup>	Due to Rockbreaking	Due to Ripping	
Ground	Auditorium	Operating Room 100 µm/s	N/A	Complies (79 µm/s)	Minor exceedance (158 µm/s)	Minor exceedance (105 µm/s)	
Level 1	Genomics room	VC-C 12.5 µm/s	N/A	Exceeds (45 µm/s) (Up to 14 days)	Exceeds (80 µm/s)	Exceeds (32 µm/s)	
Level 7	Microscopy	VC-A 50 µm/s	VC-A 48 µm/s	Complies (17 µm/s)	Complies (33 µm/s)	Complies (22 µm/s)	
Level 8	Photon	VC-C 12.5 µm/s	N/A	Minor exceedance (14 µm/s) (up to 4 days)	Exceeds (63 µm/s)	Exceeds (63 µm/s)	Located on vibration table
<b>University of Melbourne</b>							
Ground, Bio21	Electron microscope	VC-D 6 µm/s	VC-B 20 µm/s	Complies (5 µm/s)	Complies (0 µm/s)	Complies (0 µm/s)	Electron microscope isolated from structure.
Ground, Building 170	Laser diagnostics equipment	VC-A 50 µm/s	N/A	Exceeds (85 µm/s) (up to 7 days)	Complies (10 µm/s)	Complies (3 µm/s)	
Level 1, Building 170	Fluroscopes and Robotic Gantry Equipment	100 µm/s	N/A	Complies (77 µm/s)	Complies (8 µm/s)	Complies (2 µm/s)	
Ground, Building 261	Helium Ion Microscope	VC-D 6 µm/s	N/A	Minor exceedance (7 µm/s) (Up to 8 days)	Complies (2 µm/s)	Complies (1 µm/s)	
Basement, Building 175	Network Analysers and Dielectric Permittivity Probes	200 µm/s	N/A	Complies (153 µm/s)	Complies (170 µm/s)	Complies (138 µm/s)	
Ground, Building 165	Thermal Gravity Analysis	100 µm/s	N/A	Complies (5 µm/s)	Complies (2 µm/s)	Complies (1 µm/s)	
Ground, Building 165	Sorption Analyser	VC-A 50 µm/s	N/A	Complies (5 µm/s)	Complies (2 µm/s)	Complies (1 µm/s)	
Ground, Building 165	Nanomaterials Nanoindenter	VC-C 12.5 µm/s	N/A	Complies (5 µm/s)	Complies (2 µm/s)	Complies (1 µm/s)	On air isolated table
Level 1, Building 165	JPK Nanowizard	VC-C 12.5 µm/s	N/A	Complies (4 µm/s)	Complies (2 µm/s)	Complies (1 µm/s)	
Level 1, Building 165	3D Atomic Force Microscope	VC-D 6 µm/s	VC-B 15 µm/s	Complies (4 µm/s)	Complies (2 µm/s)	Complies (1 µm/s)	Located on air dampened table
Level 1, Building 165	20nm Resolution Microscope	VC-B 25 µm/s	N/A	Complies (4 µm/s)	Complies (2 µm/s)	Complies (1 µm/s)	On air isolated table
Level 1, Building 165	200nm Resolution Microscope	VC-B 25 µm/s	N/A	Complies (4 µm/s)	Complies (2 µm/s)	Complies (1 µm/s)	
Level 2, Building 165	3D Atomic Force Microscope	VC-D 6 µm/s	N/A	Complies (3 µm/s)	Complies (2 µm/s)	Complies (1 µm/s)	Located on air dampened table

Location	Vibration-sensitive Equipment	Vibration assessment reference <sup>see note e</sup>		Vibration assessment (maximum 1/3 octave vibration level (RMS) for comparison with VC curve <sup>see Note d</sup> )			Comments
		Vibration guideline target (magnitude of peak 1/3 octave band, RMS)	Baseline measurements (magnitude of peak 1/3 octave band, RMS)	Due to tunnelling activities <sup>See Note f</sup>	Due to Rockbreaking	Due to Ripping	
Level 3, Building 181	Confocal Microscope (Leica SP2)	VC-C 12.5 µm/s	VC- 24 µm/s	Exceeds (40 µm/s) (Up to 12 days)	Exceeds (51 µm/s)	Complies (21 µm/s)	Vibration limit from supplier data. On isolation table
Ground, Building 181	Confocal Microscope	314 µm/s on floor	VC- 28 µm/s	Complies (173 µm/s on floor)	Complies (178 µm/s on floor)	Complies (172 µm/s on floor)	On isolation table. Vibration limit from supplier data.
<b>Howard Florey Laboratories</b>							
Basement	MRI	VC-C 12.5 µm/s	VC-C 11 µm/s	Exceeds (31 µm/s) (Up to 14 days)	Exceeds (99 µm/s)	Exceeds (41 µm/s)	At northern end of the building
<b>Walter and Eliza Hall Institute (WEHI)</b>							
Ground Level, WEHI 1		VC-C 12.5 µm/s	N/A	Complies (7 µm/s)	Complies (6 µm/s)	Complies (2 µm/s)	Potential Crystallography facility
Level 3C WEHI 1	Laser and analysis equipment	VC-A 50 µm/s	N/A	Complies (4 µm/s)	Complies (3 µm/s)	Complies (1 µm/s)	
Level 4C WEHI 1	High sensitivity microscopes	VC-B 25 µm/s	VC-A 58 µm/s	Complies (4 µm/s)	Complies (2 µm/s)	Complies (1 µm/s)	
Level 7W WEHI 2		VC-A 50 µm/s	N/A	Complies (2 µm/s)	Complies (1 µm/s)	Complies (0 µm/s)	Structural Biology Crystal Store
<b>Kenneth Myer Building</b>							
Basement Level	Small bore MRI (4.7 T)	VC-B 25 µm/s	VC-D 5 µm/s	Complies (5 µm/s)	Complies (10 µm/s)	Complies (3 µm/s)	
Ground Level	MRI (7 T), PET CT Camera	VC-C 12.5 µm/s VC-A 50 µm/s	N/A	Complies (5 µm/s)	Complies (10 µm/s)	Complies (3 µm/s)	
All Levels	Extremely sensitive equipment	VC-C 12.5 µm/s	N/A	Complies (5 µm/s)	Complies (10 µm/s)	Complies (3 µm/s)	Equipment that is extremely sensitive to vibration
Level 1	Nano PET	VC-C 12.5 µm/s	N/A	Complies (4 µm/s)	Complies (10 µm/s)	Complies (3 µm/s)	Some equipment is pneumatically isolated
Level 2	2 photon microscopes	VC-C 12.5 µm/s	N/A	Complies (4 µm/s)	Complies (6 µm/s)	Complies (2 µm/s)	Equipment pneumatically isolated
Level 3	Advanced microscopy	VC-B 25 µm/s	N/A	Complies (3 µm/s)	Complies (5 µm/s)	Complies (1 µm/s)	Advance microscopy Equipment pneumatically isolated
Level 4	Mass spectroscopy	VC-C 12.5 µm/s	N/A	Complies (3 µm/s)	Complies (4 µm/s)	Complies (1 µm/s)	Mass spectroscopy
Level 7	Sensitive equipment	VC-A 50 µm/s	N/A	Complies (2 µm/s)	Complies (2 µm/s)	Complies (1 µm/s)	Equipment pneumatically isolated

Location	Vibration-sensitive Equipment	Vibration assessment reference <sup>see note e</sup>		Vibration assessment (maximum 1/3 octave vibration level (RMS) for comparison with VC curve <sup>see Note d</sup> )			Comments
		Vibration guideline target (magnitude of peak 1/3 octave band, RMS)	Baseline measurements (magnitude of peak 1/3 octave band, RMS)	Due to tunnelling activities <sup>See Note f</sup>	Due to Rockbreaking	Due to Ripping	
<b>University High School</b>							
<b>Gene Technology Access Centre</b>	Scanning Electron Microscope	VC-C 25 µm/s	N/A	Complies (3 µm/s)	Complies (5 µm/s)	Complies (1 µm/s)	In the Pittard Room (desk-mounted teaching resource)

- a) The list in this table is representative of the most sensitive equipment at closest proximity to the alignment. Other vibration-sensitive equipment may also be present at some sites.
- b) AHSRAE does not provide vibration guideline targets for all of the sensitive equipment that is listed in this table. The following assumptions have been made with regards to equipment that is not listed in AHSRAE:
1. Bio-resource facilities must comply with the VC curve for laboratories VC-A curve 50 µm/s
  2. X-Rays, Ultrasound, Mammography, Gamma Cameras must comply with the VC curve for laboratories VC-A curve 50 µm/s
  3. Generally sensitive equipment must comply with VC-A curve 50 µm/s
  4. PET scanners and Mass Spectroscopy machines have similar vibration requirements to MRI machines (VC-C 12.5 µm/s)
  5. CT scanners must comply with the VC-A curve 50 µm/s
  6. Hospital operating rooms are **not** used for microsurgery, eye surgery, or neurosurgery (ie they can be classified as a standard "Operating Room" 100 µm/s)
  7. Electron microscopes have a magnification of 30,000 x or greater (VC-D 6 µm/s)
  8. Photon Microscopes, Crystallography sites, Linear accelerators and Cyclotrons have similar vibration requirements to Electron microscopes and MRIs (VC-C 12.5 µm/s)
  9. General microscopes (for which the magnification is not listed are assumed) must comply with VC-A curve 50 µm/s
  10. Advanced or sensitive microscopes (for which the magnification is not listed are assumed) must comply with VC-B curve 25 µm/s
- c) MRIs located in the VCCC have a limit of 50µm/s as specified in *Victorian Comprehensive Cancer Centre Project, Volume 2, Part C, Technical Specification* (DH-PDOC-F84-C-000\_04-150525-rm.docx).
- d) For rockbreaking, PPV vibration levels were first converted in to overall RMS vibration using a crest factor of 4 (consistent with the FTA guideline). A factor of 1.5 reduction in overall vibration was used to calculate the 1/3<sup>rd</sup> Octave vibration. This factor of 1.5 reduction is intended to reflect some spread in vibration across the different frequency bands.
- e) Note that the reference for the vibration assessment is taken to be the greater of the VC-curve and baseline measurement (where available).
- f) Durations of exceedances for the tunnelling activities are for the closest alignment TBM. For some locations a second period of exceedance may occur as the other TBM passes by, however this would be reduced in both severity and duration.

Table B.15: Vibration and ground-borne noise predictions for biological resources due to construction activities

Location	Vibration target		Ground-borne noise target		Vibration assessment (maximum 1/3 octave vibration level (RMS) for comparison with VC curve <sup>see Note a)</sup>			Ground-borne Noise Assessment	
	Guideline Target (magnitude of peak 1/3 octave band, RMS)	Baseline measurements (magnitude of peak 1/3 octave band, RMS)	Guideline Target	Baseline measurements (Leq)	Due to tunnelling activities	Due to additional construction works (ripping and rockbreaking)	Approximate duration of exceedance <sup>see Note b)</sup>	Due to tunnelling activities	Due to additional construction works (ripping and rockbreaking)
<b>Royal Melbourne Hospital, Building</b>									
Basement	VC-A 50 µm/s	VC-D 6 µm/s	50 dB	78 dB	Minor exceedance (69 µm/s)	Exceeds (117 µm/s)	Up to 5 days due to tunnelling	Complies (75 dBL)	Complies (77 dBL)
Level 6	VC-A 50 µm/s	N/A	50 dB (>500Hz)	60 dB	Complies (18 µm/s)	Complies (31 µm/s)		Complies (<50 dBL)	Complies (<50 dBL)
<b>Peter Doherty Institute</b>									
Level 8	VC-A 50 µm/s	N/A	50 dB (>500Hz)	N/A	Complies (11 µm/s)	Complies (16 µm/s)		Complies (<50 dBL)	Complies (<50 dBL)
Level 9	VC-A 50 µm/s	VC-A 35 µm/s	50 dB (>500Hz)	N/A	Complies (9 µm/s)	Complies (13 µm/s)		Complies (<50 dBL)	Complies (<50 dBL)
Level 9	VC-A 50 µm/s	VC-A 35 µm/s	50 dB	70 dB	Complies (9 µm/s)	Complies (13 µm/s)		Complies (58 dBL)	Complies (58 dBL)
<b>Howard Florey Laboratories</b>									
Ground Floor	VC-A 50 µm/s	N/A	50 dB (>500Hz)	N/A	Minor exceedance (53 µm/s)	Minor exceedance (79 µm/s)	Up to 2 days due to tunnelling	Complies (<50 dBL)	Complies (<50 dBL)
Level 3	VC-A 50 µm/s	N/A	50 dB (>500Hz)	N/A	Complies (27 µm/s)	Complies (40 µm/s)		Complies (<50 dBL)	Complies (<50 dBL)
Level 4	VC-A 50 µm/s	N/A	50 dB (>100Hz)	N/A	Complies (21 µm/s)	Complies (32 µm/s)		Complies (19 dBL)	Complies (<50 dBL)
Level 5	VC-A 50 µm/s	N/A	50 dB (>100Hz)	N/A	Complies (17 µm/s)	Complies (26 µm/s)		Complies (16 dBL)	Complies (<50 dBL)
Level 7	VC-A 50 µm/s	N/A	50 dB (>500Hz)	N/A	Complies (12 µm/s)	Complies (17 µm/s)		Complies (<50 dBL)	Complies (<50 dBL)
<b>Walter and Eliza Hall Institute (WEHI)</b>									
Level 1C, WEHI 1	VC-A 50 µm/s	N/A	50 dB (>500Hz)	N/A	Complies (6 µm/s)	Complies (4 µm/s)		Complies (<50 dBL)	Complies (<50 dBL)
Level 2 WEHI 2	VC-A 50 µm/s	N/A	50 dB (>500Hz)	N/A	Complies (5 µm/s)	Complies (4 µm/s)		Complies (<50 dBL)	Complies (<50 dBL)
Level 4C WEHI 1	VC-A 50 µm/s	VC-A 43 µm/s	50 dB (>500Hz)	61 dB	Complies (4 µm/s)	Complies (1 µm/s)		Complies (<50 dBL)	Complies (<50 dBL)

Location	Vibration target		Ground-borne noise target		Vibration assessment (maximum 1/3 octave vibration level (RMS) for comparison with VC curve <sup>see Note a)</sup>			Ground-borne Noise Assessment	
	Guideline Target (magnitude of peak 1/3 octave band, RMS)	Baseline measurements (magnitude of peak 1/3 octave band, RMS)	Guideline Target	Baseline measurements (Leq)	Due to tunnelling activities	Due to additional construction works (ripping and rockbreaking)	Approximate duration of exceedance <sup>see Note b)</sup>	Due to tunnelling activities	Due to additional construction works (ripping and rockbreaking)
<b>University of Melbourne Faculty of Medicine</b>									
Level 9	VC-A 50 µm/s	VC-B 20 µm/s	50 dB (>500Hz)	49 dB	Complies (18 µm/s)	Complies (35 µm/s)		Complies (<50 dBL)	Complies (<50 dBL)
Level 9	VC-A 50 µm/s	VC-A 29 µm/s	50 dB (>500Hz)	45 dB	Complies (18 µm/s)	Complies (18 µm/s)		Complies (<50 dBL)	Complies (<50 dBL)
<b>Victorian Comprehensive Cancer Centre</b>									
Level 4	VC-A 50 µm/s	N/A	50 dB (>500Hz)	N/A	Complies (9 µm/s)	Complies (7 µm/s)	-	Complies (<50 dBL)	Complies (<50 dBL)
Level 8	VC-A 50 µm/s	N/A	50 dB (>500Hz)	N/A	Minor exceedance (63 µm/s)	Minor exceedance (63 µm/s)	Up to 7 days Up to 2 days due to tunneling	Complies (<50 dBL)	Complies (<50 dBL)

a) Note: Targets for noise and vibration are taken as the greater of the guideline target and the baseline measurement (where available).

b) Durations of exceedances for the tunnelling activities are for the closest alignment TBM. For some locations a second period of exceedance may occur as the other TBM passes by, however this would be reduced in both severity and duration.

Table B.16: Vibration and ground-borne noise predictions for Highly Sensitive areas due to construction activities

Location	Highly Sensitive Area	Noise and vibration due to tunnelling <sup>See note 1</sup>				Noise and vibration due to additional construction works (ripping and rockbreaking)				Comments
		Vibration - VDV day (m/s <sup>1.75</sup> )	Vibration - VDV Night (m/s <sup>1.75</sup> )	Ground-borne Noise (dBA)	Approximate duration of exceedance <sup>See note 4</sup>	Vibration - VDV day (m/s <sup>1.75</sup> )	Vibration - VDV Night (m/s <sup>1.75</sup> )	Ground-borne Noise (dBA)	Approximate duration of exceedance	
Trigger levels for management action:		0.4 (maximum)	0.2 (maximum)	35	Days	0.4 (maximum)	0.2 (maximum)	35	Days	
<b>Royal Women's Hospital</b>										
Level 4	Wards	Complies (0.23)	Complies (0.20)	Minor exceedance (21-37)	approx. 2 days	Complies (0.01)	Complies (0.00)	Complies (< 20)		
Level 5	Staff Accommodation	Complies (0.18)	Complies (0.16)	Complies (19-35)		Complies (0.00)	Complies (0.00)	Complies (< 20)		
Level 7	Maternity	Complies (0.12)	Complies (0.11)	Complies (15-31)		Complies (0.00)	Complies (0.00)	Complies (< 20)		
<b>Royal Melbourne Hospital</b>										
Level 2	ICU	Exceeds (0.14-0.71)	Exceeds (0.12-0.62)	Exceeds (30-50)	3 days above 45 dBA, 6 days above 35 dBA at Grattan St façade. 6 days above maximum VDV night at Grattan St façade.	Complies (0.04)	Complies (0.04)	Complies (24)		
Level 3	Ward 3S	Exceeds (0.11-0.57)	Exceeds (0.10-0.50)	Exceeds (28-48)	2 days above 45 dBA, 5 days above 35 dBA at Grattan St façade. 5 days above maximum VDV night at Grattan St façade.	Complies (0.03)	Complies (0.03)	Complies (22)		
Level 5	Ward 5S	Complies (0.37)	Exceeds (0.07-0.33)	Exceeds (24-44)	4 days above 35 dBA at Grattan St façade. 3 days above maximum VDV night at Grattan St façade.	Complies (0.02)	Complies (0.02)	Complies (< 20)		
Level 6	Ward 6S	Complies (0.30)	Exceeds (0.05-0.27)	Exceeds (22-42)	3 days above 35 dBA at Grattan St façade. 2 days above maximum VDV night at Grattan St façade.	Complies (0.02)	Complies (0.02)	Complies (< 20)		
Level 7	Ward 7S	Complies (0.25)	Exceeds (0.04-0.22)	Exceeds (20-40)	3 days above 35 dBA at Grattan St façade. 1 day above maximum VDV night at Grattan St façade.	Complies (0.01)	Complies (0.01)	Complies (< 20)		

Location	Highly Sensitive Area	Noise and vibration due to tunnelling <sup>See note 1</sup>				Noise and vibration due to additional construction works (ripping and rockbreaking)				Comments
		Vibration - VDV day (m/s <sup>1.75</sup> )	Vibration - VDV Night (m/s <sup>1.75</sup> )	Ground-borne Noise (dBA)	Approximate duration of exceedance <sup>See note 4</sup>	Vibration - VDV day (m/s <sup>1.75</sup> )	Vibration - VDV Night (m/s <sup>1.75</sup> )	Ground-borne Noise (dBA)	Approximate duration of exceedance	
Trigger levels for management action:		0.4 (maximum)	0.2 (maximum)	35	Days	0.4 (maximum)	0.2 (maximum)	35	Days	
Level 2	Cardiology ward 2b	Exceeds (0.09-0.82)	Exceeds (0.08-0.72)	Exceeds (24-51)	3 days above 45 dBA, 6 days above 35 dBA at Grattan St façade. 6 days over maximum VDV night, 4 days over maximum VDV day at Grattan St façade.	Complies (0.19)	Complies (0.16)	Minor exceedance (37)		Minor exceedance relates to the 20 tonne rockbreaker
Level 2	Ward 2W	Complies (0.07)	Complies (0.06)	Complies (22)		Complies (0.01)	Complies (0.01)	Complies (<20)		
Level 5	Ward 5E	Complies (0.04)	Complies (0.03)	Complies (15)		Complies (0.01)	Complies (0.01)	Complies (< 20)		
Level 7	Ward 7W	Complies (0.03)	Complies (0.02)	Complies (11)		Complies (0.00)	Complies (0.00)	Complies (< 20)		
Level 9	Ward 9E & 9W	Complies (0.02)	Complies (0.02)	Complies (7)		Complies (0.00)	Complies (0.00)	Complies (< 20)		
Victorian Comprehensive Cancer Centre										
Level 1	Country accommodation patient	Exceeds (0.23-0.88)	Exceeds (0.2-0.77)	Exceeds (35-52)	3 days above 45 dBA, 7 days above 35 dBA at the Grattan St façade. 7 days over maximum VDV night at Grattan St façade.	Complies (0.05)	Complies (0.05)	Complies (26)		
Level 3	Medical ward	Exceeds (0.11-0.57)	Exceeds (0.09-0.50)	Exceeds (27-48)	2 days above 45 dBA, 5 days above 35 dBA at Grattan St façade. 5 days above maximum VDV night at Grattan St façade	Complies (0.07)	Complies (0.06)	Complies (29)		
Level 5	Haematology ward	Complies (0.37)	Exceeds (0.06-0.33)	Exceeds (23-44)	4 days above 35 dBA at Grattan St façade. 3 days above maximum VDV night at Grattan St façade	Complies (0.05)	Complies (0.04)	Complies (25)		
Level 6	Surgical ward	Complies (0.30)	Exceeds (0.05-0.27)	Exceeds (21-42)	3 days above 35 dBA at Grattan St façade. 2 days above maximum VDV night at Grattan St façade	Complies (0.04)	Complies (0.03)	Complies (23)		
Peter Doherty Institute										
Ground	Auditorium	Complies (0.26) <sup>See note 2</sup>	N/A	37 <sup>See note 3</sup>		Complies (0.6) <sup>See note 2</sup>	N/A	44 <sup>See note 3</sup>		

Note 1: Some results are presented as ranges with the largest values occurring adjacent to the closest facade to the alignment. The smaller values are predicted for the regions furthest from the alignment. Where results are presented as a single figure it is the worst-case prediction for the area.

Note 2: A VDV day maximum guideline target of 0.8 applied to the Auditorium space.

Note 3: There is no guideline target for ground-borne noise for educational receivers (such as the Peter Doherty Auditorium). Predicted ground-borne noise levels of up to 44 dBA are not expected to impact on persons using the auditorium.

Note 4: Durations of exceedances for the tunnelling activities are for the closest alignment TBM. For some locations a second period of exceedance may occur as the other TBM passes by, however this would be reduced in both severity and duration.

Table B.18: Vibration predictions for vibration-sensitive equipment due to construction activities

Location	Vibration-sensitive Equipment	Vibration guideline target (magnitude of peak 1/3 octave band, RMS)	Baseline measurements (magnitude of peak 1/3 octave band, RMS)	Vibration assessment (magnitude of peak 1/3 octave band, RMS)		Approximate duration of exceedance		Comments
				Due to tunneling activities (including road header excavation of station cavern)	Due to excavation (ripping and rockbreaking)	Tunneling	Excavation	
<b>RMIT</b>								
Basement 2, Building 100	Robotics lab	100 µm/s	VC-D 3 µm/s	Exceeds (174 µm/s)	Complies (5 µm/s)	Up to 5 days (eastern alignment) plus 2 days of minor exceedance (western alignment)		
Level 7, Building 14	Electron microscope	6 µm/s	VC-B 18 µm/s	Complies (9 µm/s)	Minor exceedance (31 µm/s)			Exceedance relates to the 20 tonne rockbreaker. 19 µm/s is predicted for the ripper.
Level 5, Building 14	Confocal microscope	VC-C 12.5 µm/s	VC-B 14 µm/s	Complies (10 µm/s)	Exceeds (50 µm/s)			Exceedance relates to the 20 tonne rockbreaker as well as ripper. 32 µm/s is predicted for the ripper.
Ground Floor, Building 3	NMR Spectrometer	VC-C 12.5 µm/s	VC-D 6 µm/s	Complies (12 µm/s)	Complies (7 µm/s)			
Building 12	Acoustic Chambers	200 µm/s	N/A	Complies (149µm/s)	Complies (76 µm/s)			
Level 4, Building 7	The Fib (Ion beam manufacturing tool)	12.5 µm/s	VC-B 22 µm/s	Complies (15 µm/s)	Complies (21 µm/s)			
Level 9, Building 12	Photonics Lab	VC-C 12.5 µm/s	VC-B 19 µm/s	Exceeds (44 µm/s)	Complies (9 µm/s)	Up to 22 days occurring up to 3 times		

Note 1: Vibration has been assessed against the highest of either the guideline target level or the baseline vibration level.