Appendix 10.6 - Calculation of Construction Ground-borne Noise

From TBM

NSR No. CH2
Name Hoi Kung Court

Calculation

Item	Description	Quantity	Assumption
1	Vibration source term from graph DB320 Kwai Tsing Tunnel by Exptrapolation PPV at 5.5m	2.5 mm/s	Ref: KSL EIA Appendix 7-2-3
2	rms velocity	0.625 mm/s	
3	Vibration Velocity, ref 10^ -6 mm/s	116 dB	
4	Ro R Distance attenuation	5.5 m 60 m -21 dB	Reference distance of TBM cutter head to the measurement point Distance between TBM to foundation of Hoi Kung Court
5	Soil Damping	0 dB	Assume no soil damping and vibration transfer from rock to foundation
6	Building Coupling Loss	0 dB	
7	Coupling Loss from bed rock to pile	0 dB	
8	Floor to floor attenuation	-2 dB	2 dB reduction per floor Assume the worst affected NSR is on 1/F.
9	Conversion from Vibration to noise	-27 dB	Ref: KSL EIA report Appendix 7-1
10	Conversion to A-weighted Noise	-20 dB	Ref: Transit Noise and Vibration Impact Assessment, FTA, Table 10-1
11	Predicted Groundborne noise	**46 dB(A)**	

Appendix 10.6 - Calculation of Construction Ground-borne Noise

From TBM

NSR No. CH3
Name Elizabeth House, Block C

Calculation

Item	Description	Quantity	Assumption
1	Vibration source term from graph DB320 Kwai Tsing Tunnel by Exptrapolation PPV at 5.5m	2.5 mm/s	Ref: KSL EIA Appendix 7-2-3
2	rms velocity	0.625 mm/s	
3	Vibration Velocity, ref 10^ -6 mm/s	116 dB	
4	Ro R Distance attenuation	5.5 m 60 m -21 dB	Reference distance of TBM cutter head to the measurement point Distance between TBM to foundation of Elizabeth House, Block C
5	Soil Damping	0 dB	Assume no soil damping and vibration transfer from rock to foundation
6	Building Coupling Loss	0 dB	
7	Coupling Loss from bed rock to pile	0 dB	
8	Floor to floor attenuation	-16 dB	2 dB reduction per floor Assume the worst affected NSR is on 8/F.
9	Conversion from Vibration to noise	-27 dB	Ref: KSL EIA report Appendix 7-1
10	Conversion to A-weighted Noise	-20 dB	Ref: Transit Noise and Vibration Impact Assessment, FTA, Table 10-1
11	Predicted Groundborne noise	**32 dB(A)**	

Appendix 10.6 - Calculation of Construction Ground-borne Noise

From TBM

NSR No. EX4
Name Hong Kong Academy for Performing Arts

Calculation

Item	Description	Quantity	Assumption
1	Vibration source term from graph DB320 Kwai Tsing Tunnel by Exptrapolation PPV at 5.5m	2.5 mm/s	Ref: KSL EIA Appendix 7-2-3
2	rms velocity	0.625 mm/s	
3	Vibration Velocity, ref 10^ -6 mm/s	116 dB	
4	Ro R Distance attenuation	5.5 m 40 m -17 dB	Reference distance of TBM cutter head to the measurement point Distance between TBM to foundation of HKAPA
5	Soil Damping	0 dB	Assume no soil damping and vibration transfer from rock to foundation
6	Building Coupling Loss	0 dB	
7	Coupling Loss from bed rock to pile	0 dB	
8	Floor to floor attenuation	0 dB	2 dB reduction per floor Assume the worst affected NSR is on G/F.
9	Conversion from Vibration to noise	-27 dB	Ref: KSL EIA report Appendix 7-1
10	Conversion to A-weighted Noise	-20 dB	Ref: Transit Noise and Vibration Impact Assessment, FTA, Table 10-1
11	Predicted Groundborne noise	**52 dB(A)**	

Appendix 10.6 - Calculation of Construction Ground-borne Noise

From PME

NSR No. **HH9**
Name **Harbourfront Horizon**

Calculation

PME Hydraulic Breaker

Item	Description								Assumption
	Octave Band Frequency	16	31.5	63	125	250	500	Hz	
	rms velocity	0.06	0.07	0.06	0.05	0.062	0.12	mm/s	Adopted from KSL EIA Appendix 7-1, Site Vibration Measurement
1	Vibration Velocity, ref 10^ -6 mm/s	95	97	96	94	96	102	dB(V)	
2	Ro	5.5	5.5	5.5	5.5	5.5	5.5	m	Site measurement of breaker operation at distance = 5.5m
	R	220	220	220	220	220	220	m	Shortest distance from the site to the NSR
	Distance Attenuation	-32	-32	-32	-32	-32	-32	dB	
3	Soil / Rock Damping	0	0	0	0	0	0	dB	The whole transmission path is assumed to be rock and no damping applied
4	Building Coupling Loss	0	0	0	0	0	0	dB	
5	Floor to Floor Attenuation	-2	-2	-2	-2	-2	-2	dB	Assume -2 dB per floor Assume the worst affected NSR is on 1/F.
6	Conversion from Vibration to Noise	-27	-27	-27	-27	-27	-27	dB	Adopted from KSL EIA Report Appendix 7-1
7	Conversion to A-weighted Noise	-56.7	-39.4	-26.2	-16.1	-8.6	-3.2	dB(A)	Standard acoustic principal
	Individual Groundborne Noise	-22	-4	9	17	26	37	dB(A)	Standard acoustic principal
	Predicted Groundborne Noise for ONE Hydraulic Breaker Operation						38	dB(A)	

PME Drill Rig

	Using the calculated hydraulic breaker noise to correct to Rock Drill Noise	5.1	dB(A)	20log(0.536/0.298) Site measurement in KSL EIA Appendix 7-1
	Predicted Groundborne Noise for ONE drill rig operation	43	dB(A)	

PME Hand-held Breaker

	Using the calculated hydraulic breaker noise to correct to Hand-held Breaker Noise	-0.6	dB(A)	20log(0.279/0.298) Site measurement in KSL EIA Appendix 7-1
	Predicted Groundborne Noise for ONE Hand-held breaker operation	37	dB(A)	

Predicted Ground-borne Noise Level

Scenario	Type of PME	No. of PME	Predicted Ground-borne Noise Level	Construction Activities
1	Hydraulic Breaker	2	41	Demolition of freight building
2	Hydraulic Breaker	2	45	Demolition of freight building and construction of cofferdam wall for HUH Landfall
	Drill Rig	1		
3	Hydraulic Breaker	5	49	Excavation for HUH Landfall
	Hand-held Breaker	11		
4	Rock Drill	2	46	Piling construction

Appendix 10.6 - Calculation of Construction Ground-borne Noise

From PME

NSR No. **CH2**
Name **Hoi Kung Court**

Calculation

PME Hydraulic Breaker

Item	Description								Assumption
	Octave Band Frequency	16	31.5	63	125	250	500	Hz	
	rms velocity	0.06	0.07	0.06	0.05	0.062	0.12	mm/s	Adopted from KSL EIA Appendix 7-1, Site Vibration Measurement
1	Vibration Velocity, ref 10^ -6 mm/s	95	97	96	94	96	102	dB(V)	
2	Ro	5.5	5.5	5.5	5.5	5.5	5.5	m	Site measurement of breaker operation at distance = 5.5m
	R	48	48	48	48	48	48	m	Shortest distance from the site to the NSR
	Distance Attenuation	-19	-19	-19	-19	-19	-19	dB	
3	Soil / Rock Damping	0	0	0	0	0	0	dB	The whole transmission path is assumed to be rock and no damping applied
4	Building Coupling Loss	0	0	0	0	0	0	dB	
5	Floor to Floor Attenuation	-2	-2	-2	-2	-2	-2	dB	Assume -2 dB per floor Assume the worst affected NSR is on 1/F.
6	Conversion from Vibration to Noise	-27	-27	-27	-27	-27	-27	dB	Adopted from KSL EIA Report Appendix 7-1
7	Conversion to A-weighted Noise	-56.7	-39.4	-26.2	-16.1	-8.6	-3.2	dB(A)	Standard acoustic principal
	Individual Groundborne Noise	-9	9	22	30	39	51	dB(A)	Standard acoustic principal
	Predicted Groundborne Noise for ONE Hydraulic Breaker Operation						51	dB(A)	

PME Drill Rig

	Using the calculated hydraulic breaker noise to correct to Rock Drill Noise	5.1	dB(A)	20log(0.536/0.298)	Site measurement in KSL EIA Appendix 7-1
	Predicted Groundborne Noise for ONE drill rig operation	56	dB(A)		

PME Pile Rig

	Using the calculated hydraulic breaker noise to correct to pipepile noise	6.6	dB(A)	20log(0.638/0.298)	Site measurement in KSL EIA Appendix 7-1
	Predicted Groundborne Noise for ONE pile rig operation	58	dB(A)		

Predicted Ground-borne Noise Level

Scenario	Type of PME	No. of PME	Predicted Ground-borne Noise Level	Construction Activities
1	Drill Rig	4	63	Tunnel Excavation
	Pile Rig	1		

Appendix 10.6 - Calculation of Construction Ground-borne Noise

From PME

NSR No. **EX2**
Name **Renaissance Harbour View Hotel**

PME Hydraulic Breaker

Item	Description								Assumption
	Octave Band Frequency	16	31.5	63	125	250	500	Hz	
	rms velocity	0.06	0.07	0.06	0.05	0.062	0.12	mm/s	Adopted from KSL EIA Appendix 7-1, Site Vibration Measurement
1	Vibration Velocity, ref 10^ -6 mm/s	95	97	96	94	96	102	dB(V)	
2	Ro	5.5	5.5	5.5	5.5	5.5	5.5	m	Site measurement of breaker operation at distance = 5.5m
	R	30	30	30	30	30	30	m	Shortest distance from the site to the NSR
	Distance Attenuation	-15	-15	-15	-15	-15	-15	dB	
3	Soil / Rock Damping	0	0	0	0	0	0	dB	The whole transmission path is assumed to be rock and no damping applied
4	Building Coupling Loss	0	0	0	0	0	0	dB	
5	Floor to Floor Attenuation	-8	-8	-8	-8	-8	-8	dB	Assume -2 dB per floor Assume the worst affected NSR is on 4/F.
6	Conversion from Vibration to Noise	-27	-27	-27	-27	-27	-27	dB	Adopted from KSL EIA Report Appendix 7-1
7	Conversion to A-weighted Noise	-56.7	-39.4	-26.2	-16.1	-8.6	-3.2	dB(A)	Standard acoustic principal
	Individual Groundborne Noise	-11	8	20	28	38	49	dB(A)	Standard acoustic principal
	Predicted Groundborne Noise for ONE Hydraulic Breaker Operation						49	dB(A)	

PME Hand-held Breaker

	Using the calculated hydraulic breaker noise to correct to Hand-held breaker noise	-0.6	dB(A)	20log(0.279/0.298) Site measurement in KSL EIA Appendix 7-1
	Predicted Groundborne Noise for ONE hand-held breaker operation	49	dB(A)	

Predicted Ground-borne Noise Level

Scenario	Type of PME	No. of PME	Predicted Ground-borne Noise Level	Construction Activities
1	Hydraulic Breaker	1	52	Tunnel Excavation
	Hand-held Breaker	1		

Appendix 10.6 - Calculation of Construction Ground-borne Noise

From PME

NSR No. **EX3**
Name **Grand Hyatt Hotel**

PME Hydraulic Breaker

Item	Description								Assumption
	Octave Band Frequency	16	31.5	63	125	250	500	Hz	
	rms velocity	0.06	0.07	0.06	0.05	0.0623	0.12	mm/s	Adopted from KSL EIA Appendix 7-1, Site Vibration Measurement
1	Vibration Velocity, ref 10^ -6 mm/s	95	97	96	94	96	102	dB(V)	
2	Ro	5.5	5.5	5.5	5.5	5.5	5.5	m	Site measurement of breaker operation at distance = 5.5m
	R	30	30	30	30	30	30	m	Shortest distance from the site to the NSR
	Distance Attenuation	-15	-15	-15	-15	-15	-15	dB	
3	Soil / Rock Damping	0	0	0	0	0	0	dB	The whole transmission path is assumed to be rock and no damping applied
4	Building Coupling Loss	0	0	0	0	0	0	dB	
5	Floor to Floor Attenuation	-8	-8	-8	-8	-8	-8	dB	Assume -2 dB per floor Assume the worst affected NSR is on 4/F.
6	Conversion from Vibration to Noise	-27	-27	-27	-27	-27	-27	dB	Adopted from KSL EIA Report Appendix 7-1
7	Conversion to A-weighted Noise	-56.7	-39.4	-26.2	-16.1	-8.6	-3.2	dB(A)	Standard acoustic principal
	Individual Groundborne Noise	-11	8	20	28	38	49	dB(A)	Standard acoustic principal
	Predicted Groundborne Noise for ONE Hydraulic Breaker Operation						49	dB(A)	

PME Hand-held Breaker

	Using the calculated hydraulic breaker noise to correct to Hand-held breaker noise	-0.6	dB(A)	20log(0.279/0.298) Site measurement in KSL EIA Appendix 7-1
	Predicted Groundborne Noise for ONE hand-held breaker operation	49	dB(A)	

Predicted Ground-borne Noise Level

Scenario	Type of PME	No. of PME	Predicted Ground-borne Noise Level	Construction Activities
1	Hydraulic Breaker	1	52	Tunnel Excavation
	Hand-held Breaker	1		

Appendix 10.6 - Calculation of Construction Ground-borne Noise

From PME

NSR No. **AD4**
Name **Island Shangri-La Hotel**

PME Hydraulic Breaker

Item	Description								Assumption
	Octave Band Frequency	16	31.5	63	125	250	500	Hz	
	rms velocity	0.06	0.068	0.06	0.05	0.06	0.12	mm/s	
1	Vibration Velocity, ref 10^ -6 mm/s	95	97	96	94	96	102	dB(V)	
2	Ro	5.5	5.5	5.5	5.5	5.5	5.5	m	Site measurement of breaker operation at distance = 5.5m
	R	48	48	48	48	48	48	m	Shortest distance from the site to the NSR
	Distance Attenuation	-19	-19	-19	-19	-19	-19	dB	
3	Soil / Rock Damping	0	0	0	0	0	0	dB	The whole transmission path is assumed to be rock and no damping applied
4	Building Coupling Loss	0	0	0	0	0	0	dB	
5	Floor to Floor Attenuation	-10	-10	-10	-10	-10	-10	dB	Assume -2 dB per floor and the worst affected NSR is located on 5th floor.
6	Conversion from Vibration to Noise	-27	-27	-27	-27	-27	-27	dB	Adopted from KSL EIA Table 7-4
7	Conversion to A-weighted Noise	-56.7	-39.4	-26.2	-16.1	-8.6	-3.2	dB(A)	Standard acoustic principal
	Individual Groundborne Noise	-17	1	14	22	31	43	dB(A)	Standard acoustic principal
	Predicted Groundborne Noise for ONE hydraulic breaker Operation						43	dB(A)	

PME Drill Rig

	Using the calculated hydraulic breaker noise to correct to rock drill noise	5.1	dB(A)	20log(0.638/0.298) Site measurement in KSL EIA Appendix 7-1
	Predicted Groundborne Noise for rock drill operation	48	dB(A)	

PME Hand-held Breaker

	Using the calculated hydraulic breaker noise to correct to Hand-held breaker noise	-0.6	dB(A)	20log(0.279/0.298) Site measurement in KSL EIA Appendix 7-1
	Predicted Groundborne Noise for ONE hand-held breaker operation	42	dB(A)	

Predicted Ground-borne Noise Level

Scenario	Type of PME	No. of PME	Predicted Ground-borne Noise Level	Construction Activities
1	Hydraulic breaker	2	46	Overrun Tunnel Excavation
	Drill Rig	3	53	Overrun Tunnel Excavation
	Hand held breaker	4	48	Overrun Tunnel Excavation
			55	