Appendix 5.12: Sample Calculation for Operational Ground-borne Railway Noise (Base Case Scenario)

Project:	NOL Rail Operational GBN Assessment				
NSR:	AUT-G10		Horizontal Dist, m	Vertical Dist, m	Slant Dist, m	Train Speed. Km/h
Location:	York International Kindergarten	Up Track	17	0	17	95
Assessed Floor:	G/F	Down Track	32	0	32	103

		Frequency (Hz)														
Description	Unit	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 $N/m^{0.5}$	56.7	60.7	59.7	57.7	56.7	60.7	63.7	64.7	64.7	60.7	59.7	58.7	55.7	56.7	53.7
TIL BCT (Alt1)	dB	-1.0	-1.0	3.0	6.8	-2.0	-6.5	-6.5	-5.1	-5.5	-7.0	-7.6	-6.8	-5.5	-1.0	-1.8
TCF Bored Tunnel in Soil	dB	-7.0	-8.0	-8.0	-8.5	-8.5	-8.5	-8.0	-7.5	-7.0	-4.5	-5.5	-5.0	-5.0	-5.0	-5.0
TOC	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LSR NOL-Soil	dB re 10^{-9}(m/s)/($N/m^{0.5}$)	47.1	40.9	36.1	28.0	31.2	32.5	24.2	23.4	15.9	21.5	11.7	8.5	7.1	2.8	2.9
Up Track Vib. Level	dB re 10^{-9}m/s	95.8	92.6	90.7	84.0	77.4	78.2	73.4	75.4	68.1	70.7	58.3	55.4	52.3	53.5	49.7
Down Track Calculation																
FDL	dB re 1 $N/m^{0.5}$	57.4	61.4	60.4	58.4	57.4	61.4	64.4	65.4	65.4	61.4	60.4	59.4	56.4	57.4	54.4
TIL BCT (Alt1)	dB	-1.0	-1.0	3.0	6.8	-2.0	-6.5	-6.5	-5.1	-5.5	-7.0	-7.6	-6.8	-5.5	-1.0	-1.8
TCF Bored Tunnel in Soil	dB	-7.0	-8.0	-8.0	-8.5	-8.5	-8.5	-8.0	-7.5	-7.0	-4.5	-5.5	-5.0	-5.0	-5.0	-5.0
TOC	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LSR NOL-Soil	dB re 10^{-9}(m/s)/($N/m^{0.5}$)	30.5	26.4	26.3	22.2	22.0	19.0	13.8	13.1	8.7	10.8	-2.8	-5.1	-10.3	-9.9	-11.1
Down Track Vib. Level	dB re 10^{-9}m/s	79.9	78.7	81.6	78.9	68.9	65.4	63.7	65.9	61.6	60.7	44.4	42.4	35.6	41.5	36.4
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		95.9	92.8	91.2	85.2	77.9	78.4	73.8	75.9	69.0	71.1	58.4	55.6	52.3	53.8	49.9
BCF	dB Large masonry bldgs	-6.7	-7.3	-8.0	-9.0	-10.1	-11.1	-12.0	-12.9	-13.6	-14.1	-14.3	-14.2	-12.6	-11.5	-11.5
BVR-up	dB Floor G/F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BVR - Resonance	dB	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7	0.7
CTN	dB	-27	-27	-27	-27	-27	-27	-27	-27	-27	-27	-27	-27	-27	-27	-27
SAF	dB	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5

Predicted Noise Level	**1/3 Oct, dB**	**73.2**	**69.5**	**67.2**	**60.2**	**51.6**	**50.7**	**45.0**	**46.0**	**38.2**	**39.0**	**25.1**	**21.4**	**18.7**	**21.0**	**17.1**
A-weighting	**dB**	**-50.5**	**-44.7**	**-39.4**	**-34.6**	**-30.2**	**-26.2**	**-22.5**	**-19.1**	**-16.1**	**-13.4**	**-10.9**	**-8.6**	**-6.6**	**-4.8**	**-3.2**
A-weighted Noise Level	**1/3 Oct, dB(A)**	**22.7**	**24.8**	**27.8**	**25.6**	**21.4**	**24.5**	**22.5**	**26.9**	**22.1**	**25.6**	**14.2**	**12.8**	**12.1**	**16.2**	**13.9**
L_{max}	**dB(A)**	**35**														
Passby duration	**sec**	**7.6**														
Train Frequency (Day)	**per 30min per direction**	**15**														
$L_{eq,30mins}$ (Day)	**dB(A)**	**23**														

Notes: [1] FDL based on SP1900 8-car 60kph data (See Appendix 5.2) and adjusted by the speed correction factor of 20log(V/Vref), in line with FTA manual.

[2] $L_{eq,30mins} = L_{max} + 10*log(Passby\ duration\ in\ sec) + 10*log(no.\ of\ events\ in\ 30mins\ per\ direction) - 10*log(1800\ secounds)dB(A)$

(3dB(A) correction is added to $L_{eq,30mins}$ for leading and trailing effect for conservative approaches.)

[3] The adopted LSR data is based on interpolation of the relevant measured LSR data

[4] Passby duration = Train length / train speed. Train length is 200m. The direction, where the train speed is lower, was adopted for calculation.

[5] The train type, number of car and peak train frequencies were provided and confirmed by MTRCL.

Appendix 5.12: Sample Calculation for Operational Ground-borne Railway Noise (Base Case Scenario)

			Horizontal Dist, m	Vertical Dist, m	Slant Dist, m	Train Speed. Km/h
Project:	NOL Rail Operational GBN Assessment					
NSR:	KSR-G04					
Location:	No.297-298 Kut Hing Wai	Up Track	41	23	47	87
Assessed Floor:	G/F	Down Track	22	23	31	78

		Frequency (Hz)														
Description	Unit	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 $N/m^{0.5}$	55.9	59.9	58.9	56.9	55.9	59.9	62.9	63.9	63.9	59.9	58.9	57.9	54.9	55.9	52.9
TIL BCT (Alt1)	dB	-1.0	-1.0	3.0	6.8	-2.0	-6.5	-6.5	-5.1	-5.5	-7.0	-7.6	-6.8	-5.5	-1.0	-1.8
TCF Tunnel in Rock	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOC	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LSR NOL-Rock	dB re 10^{-9}(m/s)/($N/m^{0.5}$)	17.8	22.3	19.9	12.2	11.5	13.6	11.9	2.4	3.1	10.1	13.1	11.1	-5.4	-12.6	-20.8
Up Track Vib. Level	dB re 10^{-9}m/s	72.7	81.2	81.8	75.9	65.4	67.0	68.3	61.2	61.5	63.0	64.4	62.2	44.0	42.3	30.3
Down Track Calculation																
FDL	dB re 1 $N/m^{0.5}$	55.0	59.0	58.0	56.0	55.0	59.0	62.0	63.0	63.0	59.0	58.0	57.0	54.0	55.0	52.0
TIL BCT (Alt1)	dB	-1.0	-1.0	3.0	6.8	-2.0	-6.5	-6.5	-5.1	-5.5	-7.0	-7.6	-6.8	-5.5	-1.0	-1.8
TCF Tunnel in Rock	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOC	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LSR NOL-Rock	dB re 10^{-9}(m/s)/($N/m^{0.5}$)	19.2	23.1	20.8	13.9	13.2	15.3	13.6	4.7	5.4	11.8	14.5	11.9	-4.5	-11.3	-18.6
Down Track Vib. Level	dB re 10^{-9}m/s	73.2	81.0	81.7	76.6	66.2	67.7	69.1	62.5	62.8	63.7	64.9	62.1	44.0	42.7	31.6
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		75.9	84.1	84.8	79.3	68.8	70.4	71.7	64.9	65.2	66.4	67.7	65.2	47.0	45.5	34.0
BCF	dB 2-4 storey masonry blo	-10.8	-11.5	-12.0	-12.3	-12.4	-12.3	-12.1	-11.6	-11.1	-10.3	-9.3	-8.1	-6.7	-4.7	-4.7
BVR-up	dB Floor G/F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BVR - Resonance	dB	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7	0.0
CTN	dB	-27	-27	-27	-27	-27	-27	-27	-27	-27	-27	-27	-27	-27	-27	-27
SAF	dB	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5

Predicted Noise Level	**1/3 Oct, dB**	**49.1**	**56.6**	**56.8**	**51.0**	**40.2**	**41.5**	**42.8**	**36.3**	**36.9**	**38.1**	**39.4**	**37.1**	**19.3**	**19.5**	**7.3**
A-weighting	**dB**	**-50.5**	**-44.7**	**-39.4**	**-34.6**	**-30.2**	**-26.2**	**-22.5**	**-19.1**	**-16.1**	**-13.4**	**-10.9**	**-8.6**	**-6.6**	**-4.8**	**-3.2**
A-weighted Noise Level	**1/3 Oct, dB(A)**	**-1.4**	**11.9**	**17.4**	**16.4**	**10.0**	**15.3**	**20.3**	**17.2**	**20.8**	**24.7**	**28.5**	**28.5**	**12.7**	**14.7**	**4.1**
L_{max}	**dB(A)**	**33**														
Passby duration	**sec**	**9.2**														
Train Frequency (Day)	**per 30min per direction**	**15**														
$L_{eq,30mins}$ (Day)	**dB(A)**	**22**														

Notes: [1] FDL based on SP1900 8-car 60kph data (See Appendix 5.2) and adjusted by the speed correction factor of 20log(V/Vref), in line with FTA manual.

[2] $L_{eq,30mins} = L_{max}$ + 10*log(Passby duration in sec) + 10*log(no. of events in 30mins per direction) - 10*log(1800 secounds)dB(A)
(3dB(A) correction is added to $L_{eq,30mins}$ for leading and trailing effect for conservative approaches.)

[3] The adopted LSR data is based on interpolation of the relevant measured LSR data

[4] Passby duration = Train length / train speed. Train length is 200m. The direction, where the train speed is lower, was adopted for calculation.

[5] The train type, number of car and peak train frequencies were provided and confirmed by MTRCL.

Appendix 5.12: Sample Calculation for Operational Ground-borne Railway Noise (Base Case Scenario)

Project:	NOL Rail Operational GBN Assessment				
NSR:	KTU-G02		Horizontal Dist, m	Vertical Dist, m	Slant Dist, m	Train Speed. Km/h
Location:	Village House in Chau Tau Tsue	Up Track	38	11	40	72
Assessed Floor:	G/F	Down Track	17	12	21	93

		Frequency (Hz)														
Description	Unit	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 $N/m^{0.5}$	54.3	58.3	57.3	55.3	54.3	58.3	61.3	62.3	62.3	58.3	57.3	56.3	53.3	54.3	51.3
TIL BCT (Alt1)	dB	-1.0	-1.0	3.0	6.8	-2.0	-6.5	-6.5	-5.1	-5.5	-7.0	-7.6	-6.8	-5.5	-1.0	-1.8
TCF Bored Tunnel in Soi	dB	-7.0	-8.0	-8.0	-8.5	-8.5	-8.5	-8.0	-7.5	-7.0	-4.5	-5.5	-5.0	-5.0	-5.0	-5.0
TOC	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LSR NOL-Soil	dB re 10^{-9}(m/s)/($N/m^{0.5}$)	24.6	21.2	22.8	20.1	18.8	14.3	10.2	9.5	6.1	7.0	-8.0	-10.0	-16.4	-14.4	-16.1
Up Track Vib. Level	dB re 10^{-9}m/s	70.9	70.5	75.0	73.6	62.5	57.5	56.9	59.1	55.9	53.8	36.2	34.5	26.3	33.9	28.4
Down Track Calculation																
FDL	dB re 1 $N/m^{0.5}$	56.5	60.5	59.5	57.5	56.5	60.5	63.5	64.5	64.5	60.5	59.5	58.5	55.5	56.5	53.5
TIL BCT (Alt1)	dB	-1.0	-1.0	3.0	6.8	-2.0	-6.5	-6.5	-5.1	-5.5	-7.0	-7.6	-6.8	-5.5	-1.0	-1.8
TCF Bored Tunnel in Soi	dB	-7.0	-8.0	-8.0	-8.5	-8.5	-8.5	-8.0	-7.5	-7.0	-4.5	-5.5	-5.0	-5.0	-5.0	-5.0
TOC	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LSR NOL-Soil	dB re 10^{-9}(m/s)/($N/m^{0.5}$)	41.2	35.7	32.6	26.0	27.9	27.7	20.5	19.7	13.4	17.7	6.5	3.7	0.9	-1.7	-2.1
Down Track Vib. Level	dB re 10^{-9}m/s	89.7	87.2	87.1	81.7	73.9	73.2	69.5	71.6	65.4	66.7	52.9	50.4	45.9	48.8	44.6
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		89.8	87.3	87.3	82.4	74.2	73.3	69.7	71.8	65.8	66.9	53.0	50.5	45.9	48.9	44.7
BCF	dB Single family residenc	-4.4	-4.8	-5.0	-5.0	-5.0	-5.0	-4.8	-4.5	-4.2	-3.8	-3.4	-2.9	-2.0	-0.5	-0.5
BVR-up	dB Floor G/F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BVR - Resonance	dB	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7	0.0
CTN	dB	-27	-27	-27	-27	-27	-27	-27	-27	-27	-27	-27	-27	-27	-27	-27
SAF	dB	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5

Predicted Noise Level	**1/3 Oct, dB**	**69.4**	**66.5**	**66.3**	**61.4**	**53.0**	**51.7**	**48.1**	**50.3**	**44.4**	**45.1**	**30.6**	**27.6**	**22.9**	**27.1**	**22.2**
A-weighting	**dB**	**-50.5**	**-44.7**	**-39.4**	**-34.6**	**-30.2**	**-26.2**	**-22.5**	**-19.1**	**-16.1**	**-13.4**	**-10.9**	**-8.6**	**-6.6**	**-4.8**	**-3.2**
A-weighted Noise Level	**1/3 Oct, dB(A)**	**18.9**	**21.8**	**26.9**	**26.8**	**22.8**	**25.5**	**25.6**	**31.2**	**28.3**	**31.7**	**19.7**	**19.0**	**16.3**	**22.3**	**19.0**
L_{max}	**dB(A)**	**38**														
Passby duration	**sec**	**10.0**														
Train Frequency (Day)	**per 30min per direction**	**15**														
$L_{eq,30mins}$ (Day)	**dB(A)**	**27**														

Notes: [1] FDL based on SP1900 8-car 60kph data (See Appendix 5.2) and adjusted by the speed correction factor of 20log(V/Vref), in line with FTA manual.

[2] $L_{eq,30mins} = L_{max}$ + 10*log(Passby duration in sec) + 10*log(no. of events in 30mins per direction) - 10*log(1800 secounds)dB(A)
(3dB(A) correction is added to $L_{eq,30mins}$ for leading and trailing effect for conservative approaches.)

[3] The adopted LSR data is based on interpolation of the relevant measured LSR data

[4] Passby duration = Train length / train speed. Train length is 200m. The direction, where the train speed is lower, was adopted for calculation.

[5] The train type, number of car and peak train frequencies were provided and confirmed by MTRCL.