Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	DIH-1-1
Location:	Tsui Chuk Garden Block 5
Assessed Floor	1
Item:	1

Train Speed: 95 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	0	75	75
Down Track	0	75	75

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D064	15	67	75[1]
Down Track	D064	15	67	75[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	38.0	42.0	41.0	39.0	38.0	42.0	45.0	46.0	46.0	42.0	41.0	40.0	37.0	38.0	35.0
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-0.2	1.3	0.4	-2.3	-7.9	-10.8	-20.6	-19.2	-22.7	-20.1	-11.1	-5.7	-2.1	3.4	-5.4
Up Track Vib. Level	dB re 10^{-6}in/sec	37.8	43.3	41.4	36.7	30.1	31.2	24.4	26.8	23.3	21.9	29.9	34.3	34.9	41.4	29.6
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	38.0	42.0	41.0	39.0	38.0	42.0	45.0	46.0	46.0	42.0	41.0	40.0	37.0	38.0	35.0
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-0.2	1.3	0.4	-2.3	-7.9	-10.8	-20.6	-19.2	-22.7	-20.1	-11.1	-5.7	-2.1	3.4	-5.4
Down Track Vib. Level	dB re 10^{-6}in/sec	37.8	43.3	41.4	36.7	30.1	31.2	24.4	26.8	23.3	21.9	29.9	34.3	34.9	41.4	29.6
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		40.8	46.3	44.4	39.7	33.1	34.2	27.4	29.8	26.3	24.9	32.9	37.3	37.9	44.4	32.6
BCF	dB Y/N 0															
BVR-up	dB Floor 1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**56.8**	**62.3**	**60.4**	**55.7**	**48.9**	**49.6**	**42.6**	**44.8**	**41.1**	**38.9**	**45.9**	**49.3**	**48.9**	**55.1**	**43.3**
Predicted Noise Level	**Oct, dB**			**65.0**			**52.7**			**47.1**			**53.0**			**55.4**
L_{max}	**dB(A)**	**52.7**														
$L_{eq,30mins}$	**dB(A)**	**39.5**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project: Shatin Central Link Rail Operational GBN Assessment **Train Speed:** 90 kph
NSR Ref.: DIH 2-1
Location: Pak Yuen House
Assessed Floor 1
Item: 2

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	295	65	302
Down Track	290	65	297

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D049	19	60	302[1]
Down Track	D049	19	60	297[1]

		Frequency (Hz)														
Description	Unit	20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	37.5	41.5	40.5	38.5	37.5	41.5	44.5	45.5	45.5	41.5	40.5	39.5	36.5	37.5	34.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-0.2	1.3	0.4	-2.3	-7.9	-10.8	-20.6	-19.2	-22.7	-20.1	-11.1	-5.7	-2.1	3.4	-5.4
Up Track Vib. Level	dB re 10^{-6}in/sec	37.3	42.8	40.9	36.2	29.6	30.7	23.9	26.3	22.8	21.4	29.4	33.8	34.4	40.9	29.1
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	37.5	41.5	40.5	38.5	37.5	41.5	44.5	45.5	45.5	41.5	40.5	39.5	36.5	37.5	34.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-0.2	1.3	0.4	-2.3	-7.9	-10.8	-20.6	-19.2	-22.7	-20.1	-11.1	-5.7	-2.1	3.4	-5.4
Down Track Vib. Level	dB re 10^{-6}in/sec	37.3	42.8	40.9	36.2	29.6	30.7	23.9	26.3	22.8	21.4	29.4	33.8	34.4	40.9	29.1
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		40.3	45.8	43.9	39.2	32.6	33.7	26.9	29.3	25.8	24.4	32.4	36.8	37.4	43.9	32.1
BCF	dB Y/N 0															
BVR-up	dB Floor 1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**56.3**	**61.8**	**59.9**	**55.2**	**48.4**	**49.1**	**42.1**	**44.3**	**40.6**	**38.4**	**45.4**	**48.8**	**48.4**	**54.6**	**42.8**
Predicted Noise Level	**Oct, dB**			**64.5**			**52.3**			**46.6**			**52.6**			**54.9**
L_{max}	**dB(A)**	**52.3**														
$L_{eq,30mins}$	**dB(A)**	**39.3**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.
[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.
[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.
[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.
[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(
(3dB(A) correction is added to $L_{eq,30mins}$ for leading and trailing effect for conservative approaches.)
[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.
[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project: Shatin Central Link Rail Operational GBN Assessment **Train Speed:** 90 kph
NSR Ref.: DIH-3-1
Location: Wah Yuen House
Assessed Floor 1
Item: 3

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	102	50	114
Down Track	100	50	112

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D028	22	44	114[1]
Down Track	D028	22	44	112[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	37.5	41.5	40.5	38.5	37.5	41.5	44.5	45.5	45.5	41.5	40.5	39.5	36.5	37.5	34.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-0.2	1.3	0.4	-2.3	-7.9	-10.8	-20.6	-19.2	-22.7	-20.1	-11.1	-5.7	-2.1	3.4	-5.4
Up Track Vib. Level	dB re 10^{-6}in/sec	37.3	42.8	40.9	36.2	29.6	30.7	23.9	26.3	22.8	21.4	29.4	33.8	34.4	40.9	29.1
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	37.5	41.5	40.5	38.5	37.5	41.5	44.5	45.5	45.5	41.5	40.5	39.5	36.5	37.5	34.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-0.2	1.3	0.4	-2.3	-7.9	-10.8	-20.6	-19.2	-22.7	-20.1	-11.1	-5.7	-2.1	3.4	-5.4
Down Track Vib. Level	dB re 10^{-6}in/sec	37.3	42.8	40.9	36.2	29.6	30.7	23.9	26.3	22.8	21.4	29.4	33.8	34.4	40.9	29.1
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		40.3	45.8	43.9	39.2	32.6	33.7	26.9	29.3	25.8	24.4	32.4	36.8	37.4	43.9	32.1
BCF	dB Y/N 0															
BVR-up	dB Floor 1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**56.3**	**61.8**	**59.9**	**55.2**	**48.4**	**49.1**	**42.1**	**44.3**	**40.6**	**38.4**	**45.4**	**48.8**	**48.4**	**54.6**	**42.8**
Predicted Noise Level	**Oct, dB**			**64.5**			**52.3**			**46.6**			**52.6**			**54.9**
L_{max}	**dB(A)**	**52.3**														
$L_{eq,30mins}$	**dB(A)**	**39.3**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.
[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.
[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.
[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.
[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(
(3dB(A) correction is added to $L_{eq,30mins}$ for leading and trailing effect for conservative approaches.)
[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.
[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project: Shatin Central Link Rail Operational GBN Assessment
NSR Ref.: DIH-3-2
Location: Nga Yuen House
Assessed Floor 1
Item: 4

Train Speed: 80 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	135	45	142
Down Track	120	45	128

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D028	22	44	142[1]
Down Track	D028	22	44	128[1]

		Frequency (Hz)														
Description	Unit	20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	36.5	40.5	39.5	37.5	36.5	40.5	43.5	44.5	44.5	40.5	39.5	38.5	35.5	36.5	33.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-0.2	1.3	0.4	-2.3	-7.9	-10.8	-20.6	-19.2	-22.7	-20.1	-11.1	-5.7	-2.1	3.4	-5.4
Up Track Vib. Level	dB re 10^{-6}in/sec	36.3	41.8	39.9	35.2	28.6	29.7	22.9	25.3	21.8	20.4	28.4	32.8	33.4	39.9	28.1
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	36.5	40.5	39.5	37.5	36.5	40.5	43.5	44.5	44.5	40.5	39.5	38.5	35.5	36.5	33.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-0.2	1.3	0.4	-2.3	-7.9	-10.8	-20.6	-19.2	-22.7	-20.1	-11.1	-5.7	-2.1	3.4	-5.4
Down Track Vib. Level	dB re 10^{-6}in/sec	36.3	41.8	39.9	35.2	28.6	29.7	22.9	25.3	21.8	20.4	28.4	32.8	33.4	39.9	28.1
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		39.3	44.8	42.9	38.2	31.6	32.7	25.9	28.3	24.8	23.4	31.4	35.8	36.4	42.9	31.1
BCF	dB Y/N 0															
BVR-up	dB Floor 1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**55.3**	**60.8**	**58.9**	**54.2**	**47.4**	**48.1**	**41.1**	**43.3**	**39.6**	**37.4**	**44.4**	**47.8**	**47.4**	**53.6**	**41.8**
Predicted Noise Level	**Oct, dB**			**63.5**			**51.2**			**45.6**			**51.6**			**53.9**
L_{max}	**dB(A)**	**51.2**														
$L_{eq,30mins}$	**dB(A)**	**38.8**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.
[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.
[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.
[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.
[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(
(3dB(A) correction is added to $L_{eq,30mins}$ for leading and trailing effect for conservative approaches.)
[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.
[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project: Shatin Central Link Rail Operational GBN Assessment **Train Speed:** 90 kph
NSR Ref.: DIH-3-3
Location: Kwai Yuen House
Assessed Floor 1
Item: 5

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	5	35	35
Down Track	15	35	38

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D002	24	34	35[1]
Down Track	D002	24	34	38[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	37.5	41.5	40.5	38.5	37.5	41.5	44.5	45.5	45.5	41.5	40.5	39.5	36.5	37.5	34.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-1.0	3.0	3.0	6.8	10.1	6.9	6.1	3.5	2.0	1.4	0.4	-0.1	0.0	-0.8	-3.7
Up Track Vib. Level	dB re 10^{-6}in/sec	36.5	44.5	43.5	45.3	47.6	48.4	50.6	49.0	47.5	42.9	40.9	39.4	36.5	36.7	30.9
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	37.5	41.5	40.5	38.5	37.5	41.5	44.5	45.5	45.5	41.5	40.5	39.5	36.5	37.5	34.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-4.0	-0.2	0.5	4.3	7.3	2.4	1.2	-1.5	-4.4	-5.8	-4.8	-5.5	-5.0	-8.2	-11.7
Down Track Vib. Level	dB re 10^{-6}in/sec	33.6	41.3	41.0	42.8	44.8	43.9	45.7	44.0	41.1	35.7	35.8	34.0	31.5	29.3	22.9
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		38.3	46.2	45.4	47.2	49.4	49.7	51.8	50.2	48.4	43.7	42.1	40.5	37.7	37.4	31.5
BCF	dB Y/N 0															
BVR-up	dB Floor 1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**54.3**	**62.2**	**61.4**	**63.2**	**65.2**	**65.1**	**67.0**	**65.2**	**63.2**	**57.7**	**55.1**	**52.5**	**48.7**	**48.1**	**42.2**
Predicted Noise Level	**Oct, dB**			**67.1**			**70.7**			**67.8**			**57.6**			**49.1**
L_{max}	**dB(A)**	**54.6**														
$L_{eq,30mins}$	**dB(A)**	**41.7**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.
[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.
[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.
[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.
[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(
(3dB(A) correction is added to $L_{eq,30mins}$ for leading and trailing effect for conservative approaches.)
[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.
[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project: Shatin Central Link Rail Operational GBN Assessment
NSR Ref.: DIH-3-4
Location: Chui Yuen House
Assessed Floor 1
Item: 6

Train Speed: 80 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	55	45	71
Down Track	50	45	67

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D028	22	44	71[1]
Down Track	D028	22	44	67[1]

		Frequency (Hz)														
Description	Unit	20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	36.5	40.5	39.5	37.5	36.5	40.5	43.5	44.5	44.5	40.5	39.5	38.5	35.5	36.5	33.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-0.2	1.3	0.4	-2.3	-7.9	-10.8	-20.6	-19.2	-22.7	-20.1	-11.1	-5.7	-2.1	3.4	-5.4
Up Track Vib. Level	dB re 10^{-6}in/sec	36.3	41.8	39.9	35.2	28.6	29.7	22.9	25.3	21.8	20.4	28.4	32.8	33.4	39.9	28.1
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	36.5	40.5	39.5	37.5	36.5	40.5	43.5	44.5	44.5	40.5	39.5	38.5	35.5	36.5	33.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-0.2	1.3	0.4	-2.3	-7.9	-10.8	-20.6	-19.2	-22.7	-20.1	-11.1	-5.7	-2.1	3.4	-5.4
Down Track Vib. Level	dB re 10^{-6}in/sec	36.3	41.8	39.9	35.2	28.6	29.7	22.9	25.3	21.8	20.4	28.4	32.8	33.4	39.9	28.1
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		39.3	44.8	42.9	38.2	31.6	32.7	25.9	28.3	24.8	23.4	31.4	35.8	36.4	42.9	31.1
BCF	dB Y/N 0															
BVR-up	dB Floor 1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**55.3**	**60.8**	**58.9**	**54.2**	**47.4**	**48.1**	**41.1**	**43.3**	**39.6**	**37.4**	**44.4**	**47.8**	**47.4**	**53.6**	**41.8**
Predicted Noise Level	**Oct, dB**			**63.5**			**51.2**			**45.6**			**51.6**			**53.9**
L_{max}	**dB(A)**	**51.2**														
$L_{eq,30mins}$	**dB(A)**	**38.8**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.
[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.
[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.
[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.
[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(
(3dB(A) correction is added to $L_{eq,30mins}$ for leading and trailing effect for conservative approaches.)
[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.
[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project: Shatin Central Link Rail Operational GBN Assessment
NSR Ref.: DIH-4-1
Location: Pang Ching Court
Assessed Floor 1
Item: 7

Train Speed: 90 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	210	70	221
Down Track	195	70	207

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D064	15	67	221[1]
Down Track	D064	15	67	207[1]

		Frequency (Hz)														
Description	Unit	20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	37.5	41.5	40.5	38.5	37.5	41.5	44.5	45.5	45.5	41.5	40.5	39.5	36.5	37.5	34.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-0.2	1.3	0.4	-2.3	-7.9	-10.8	-20.6	-19.2	-22.7	-20.1	-11.1	-5.7	-2.1	3.4	-5.4
Up Track Vib. Level	dB re 10^{-6}in/sec	37.3	42.8	40.9	36.2	29.6	30.7	23.9	26.3	22.8	21.4	29.4	33.8	34.4	40.9	29.1
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	37.5	41.5	40.5	38.5	37.5	41.5	44.5	45.5	45.5	41.5	40.5	39.5	36.5	37.5	34.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-0.2	1.3	0.4	-2.3	-7.9	-10.8	-20.6	-19.2	-22.7	-20.1	-11.1	-5.7	-2.1	3.4	-5.4
Down Track Vib. Level	dB re 10^{-6}in/sec	37.3	42.8	40.9	36.2	29.6	30.7	23.9	26.3	22.8	21.4	29.4	33.8	34.4	40.9	29.1
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		40.3	45.8	43.9	39.2	32.6	33.7	26.9	29.3	25.8	24.4	32.4	36.8	37.4	43.9	32.1
BCF	dB Y/N 0															
BVR-up	dB Floor 1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**56.3**	**61.8**	**59.9**	**55.2**	**48.4**	**49.1**	**42.1**	**44.3**	**40.6**	**38.4**	**45.4**	**48.8**	**48.4**	**54.6**	**42.8**
Predicted Noise Level	**Oct, dB**			**64.5**			**52.3**			**46.6**			**52.6**			**54.9**
L_{max}	**dB(A)**	**52.3**														
$L_{eq,30mins}$	**dB(A)**	**39.3**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.
[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.
[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.
[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.
[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(
(3dB(A) correction is added to $L_{eq,30mins}$ for leading and trailing effect for conservative approaches.)
[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.
[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	DIH-4-2
Location:	Carbo Anglo-Chinese Kindergarden
Assessed Floor	0
Item:	8

Train Speed: 90 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	130	75	150
Down Track	115	75	137

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D064	15	67	150[1]
Down Track	D064	15	67	137[1]

		Frequency (Hz)														
Description	Unit	20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	37.5	41.5	40.5	38.5	37.5	41.5	44.5	45.5	45.5	41.5	40.5	39.5	36.5	37.5	34.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-0.2	1.3	0.4	-2.3	-7.9	-10.8	-20.6	-19.2	-22.7	-20.1	-11.1	-5.7	-2.1	3.4	-5.4
Up Track Vib. Level	dB re 10^{-6}in/sec	37.3	42.8	40.9	36.2	29.6	30.7	23.9	26.3	22.8	21.4	29.4	33.8	34.4	40.9	29.1
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	37.5	41.5	40.5	38.5	37.5	41.5	44.5	45.5	45.5	41.5	40.5	39.5	36.5	37.5	34.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-0.2	1.3	0.4	-2.3	-7.9	-10.8	-20.6	-19.2	-22.7	-20.1	-11.1	-5.7	-2.1	3.4	-5.4
Down Track Vib. Level	dB re 10^{-6}in/sec	37.3	42.8	40.9	36.2	29.6	30.7	23.9	26.3	22.8	21.4	29.4	33.8	34.4	40.9	29.1
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		40.3	45.8	43.9	39.2	32.6	33.7	26.9	29.3	25.8	24.4	32.4	36.8	37.4	43.9	32.1
BCF	dB Y/N 0															
BVR-up	dB Floor 0	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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**58.3**	**63.8**	**61.9**	**57.2**	**50.4**	**51.1**	**44.1**	**46.3**	**42.6**	**40.4**	**47.4**	**50.8**	**50.4**	**56.6**	**44.8**
Predicted Noise Level	**Oct, dB**			**66.5**			**54.3**			**48.6**			**54.6**			**56.9**
L_{max}	**dB(A)**	**54.3**														
$L_{eq,30mins}$	**dB(A)**	**44[8]**														
Noise Criteria	**dB(A)**	**55[9]**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

[8] A 3dB(A) upward adjustment is made to account for the daytime headway of 22 EMU trains within a 30 minutes period.

[9] Daytime criteria are used for educational buildings, church and temple.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	DIH-5-1
Location:	Rainbow Home
Assessed Floor	0
Item:	9

Train Speed: 80 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	60	35	69
Down Track	25	35	43

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D002	24	34	69[1]
Down Track	D002	24	34	43[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	36.5	40.5	39.5	37.5	36.5	40.5	43.5	44.5	44.5	40.5	39.5	38.5	35.5	36.5	33.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-9.0	-9.8	-13.7	-15.2	-8.6	-18.7	-20.2	-11.6	-24.0	-23.5	-21.3	-13.0	-15.4	-14.9	-16.6
Up Track Vib. Level	dB re 10^{-6}in/sec	27.5	30.7	25.8	22.3	27.9	21.8	23.3	32.9	20.5	17.0	18.2	25.5	20.1	21.6	16.9
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	36.5	40.5	39.5	37.5	36.5	40.5	43.5	44.5	44.5	40.5	39.5	38.5	35.5	36.5	33.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-5.5	-1.7	-1.5	2.5	4.6	-1.1	-3.0	-4.5	-8.9	-10.7	-8.9	-7.3	-6.0	-9.6	-12.8
Down Track Vib. Level	dB re 10^{-6}in/sec	31.0	38.8	38.0	40.0	41.0	39.4	40.5	40.0	35.6	29.8	30.6	31.2	29.5	26.9	20.7
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		32.6	39.5	38.2	40.1	41.3	39.5	40.6	40.8	35.7	30.1	30.9	32.2	30.0	28.0	22.2
BCF	dB Y/N 0															
BVR-up	dB Floor 0	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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**50.6**	**57.5**	**56.2**	**58.1**	**59.1**	**56.9**	**57.8**	**57.8**	**52.5**	**46.1**	**45.9**	**46.2**	**43.0**	**40.7**	**34.9**
Predicted Noise Level	**Oct, dB**			**62.1**			**62.8**			**59.1**			**50.0**			**41.7**
L_{max}	**dB(A)**	**46.3**														
$L_{eq,30mins}$	**dB(A)**	**33.9**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	DIH-5-2
Location:	Residential premises
Assessed Floor	1
Item:	10

Train Speed: 80 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	45	30	54
Down Track	10	30	32

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D002	24	20	54[1]
Down Track	D002	24	20	32[1]

		Frequency (Hz)														
Description	Unit	20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	36.5	40.5	39.5	37.5	36.5	40.5	43.5	44.5	44.5	40.5	39.5	38.5	35.5	36.5	33.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	2.0	-2.0	-5.5	-5.8	-1.3	-10.4	-12.2	-6.6	-21.3	-22.1	-14.0	-10.8	-12.5	-12.2	-15.1
Up Track Vib. Level	dB re 10^{-6}in/sec	38.5	38.5	34.0	31.7	35.2	30.1	31.3	37.9	23.2	18.4	25.5	27.7	23.0	24.3	18.4
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	36.5	40.5	39.5	37.5	36.5	40.5	43.5	44.5	44.5	40.5	39.5	38.5	35.5	36.5	33.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	8.5	3.1	5.5	8.6	8.8	1.1	3.5	1.3	-5.9	-13.6	-7.3	-7.0	-6.6	-9.8	-10.8
Down Track Vib. Level	dB re 10^{-6}in/sec	45.0	43.6	45.0	46.1	45.3	41.6	47.0	45.8	38.6	26.9	32.2	31.5	28.9	26.7	22.7
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		45.9	44.8	45.3	46.3	45.7	41.9	47.1	46.4	38.7	27.5	33.0	33.0	29.9	28.7	24.1
BCF	dB Y/N 0															
BVR-up	dB Floor 1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**61.9**	**60.8**	**61.3**	**62.3**	**61.5**	**57.3**	**62.3**	**61.4**	**53.5**	**41.5**	**46.0**	**45.0**	**40.9**	**39.4**	**34.8**
Predicted Noise Level	**Oct, dB**			**66.3**			**65.6**			**62.1**			**49.3**			**40.7**
L_{max}	**dB(A)**	**47.6**														
$L_{eq,30mins}$	**dB(A)**	**35.2**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	DIH-5-5
Location:	Our Lady's Kindergarden
Assessed Floor	0
Item:	11

Train Speed: 80 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	110	40	117
Down Track	85	40	94

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D018	28	40	117[1]
Down Track	D018	28	40	94[1]

		Frequency (Hz)														
Description	Unit	20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	36.5	40.5	39.5	37.5	36.5	40.5	43.5	44.5	44.5	40.5	39.5	38.5	35.5	36.5	33.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	1.3	-4.7	-5.1	-7.1	-4.2	-7.0	-2.5	-16.1	-14.8	-15.6	-19.2	-13.0	-13.8	-18.8	-17.8
Up Track Vib. Level	dB re 10^{-6}in/sec	37.8	35.8	34.4	30.4	32.3	33.5	41.0	28.4	29.7	24.9	20.3	25.5	21.7	17.7	15.7
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	36.5	40.5	39.5	37.5	36.5	40.5	43.5	44.5	44.5	40.5	39.5	38.5	35.5	36.5	33.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	1.3	-4.7	-5.1	-7.1	-4.2	-7.0	-2.5	-16.1	-14.8	-15.6	-19.2	-13.0	-13.8	-18.8	-17.8
Down Track Vib. Level	dB re 10^{-6}in/sec	37.8	35.8	34.4	30.4	32.3	33.5	41.0	28.4	29.7	24.9	20.3	25.5	21.7	17.7	15.7
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		40.8	38.8	37.4	33.4	35.3	36.5	44.0	31.4	32.7	27.9	23.3	28.5	24.7	20.7	18.7
BCF	dB Y/N 0															
BVR-up	dB Floor 0	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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**58.8**	**56.8**	**55.4**	**51.4**	**53.1**	**53.9**	**61.2**	**48.4**	**49.5**	**43.9**	**38.3**	**42.5**	**37.7**	**33.4**	**31.4**
Predicted Noise Level	**Oct, dB**			**59.8**			**62.5**			**52.6**			**44.8**			**35.5**
L_{max}	**dB(A)**	**43.1**														
$L_{eq,30mins}$	**dB(A)**	**34[8]**														
Noise Criteria	**dB(A)**	**55[9]**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

[8] A 3dB(A) upward adjustment is made to account for the daytime headway of 22 EMU trains within a 30 minutes period.

[9] Daytime criteria are used for educational buildings, church and temple.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project: Shatin Central Link Rail Operational GBN Assessment
NSR Ref.: DIH 6-1
Location: WTS Fire Station and Quarters Block A
Assessed Floor 1
Item: 12

Train Speed: 85 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	5	30	30
Down Track	5	30	30

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D002	24	20	30[1]
Down Track	D002	24	20	30[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	37.0	41.0	40.0	38.0	37.0	41.0	44.0	45.0	45.0	41.0	40.0	39.0	36.0	37.0	34.0
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	9.1	4.8	7.0	9.1	9.2	2.5	4.2	2.5	-4.6	-11.6	-5.8	-6.4	-6.2	-9.3	-10.4
Up Track Vib. Level	dB re 10^{-6}in/sec	46.1	45.9	47.1	47.1	46.2	43.5	48.2	47.5	40.5	29.4	34.3	32.7	29.8	27.8	23.6
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	37.0	41.0	40.0	38.0	37.0	41.0	44.0	45.0	45.0	41.0	40.0	39.0	36.0	37.0	34.0
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	9.1	4.8	7.0	9.1	9.2	2.5	4.2	2.5	-4.6	-11.6	-5.8	-6.4	-6.2	-9.3	-10.4
Down Track Vib. Level	dB re 10^{-6}in/sec	46.1	45.9	47.1	47.1	46.2	43.5	48.2	47.5	40.5	29.4	34.3	32.7	29.8	27.8	23.6
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		49.1	48.9	50.1	50.1	49.2	46.5	51.2	50.5	43.5	32.4	37.3	35.7	32.8	30.8	26.6
BCF	dB Y/N 0															
BVR-up	dB Floor 1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**65.1**	**64.9**	**66.1**	**66.1**	**65.0**	**61.9**	**66.4**	**65.5**	**58.3**	**46.4**	**50.3**	**47.7**	**43.8**	**41.5**	**37.3**
Predicted Noise Level	**Oct, dB**			**70.5**			**69.6**			**66.3**			**52.8**			**42.9**
L_{max}	**dB(A)**	**51.5**														
$L_{eq,30mins}$	**dB(A)**	**38.8**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.
[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.
[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.
[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.
[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(
(3dB(A) correction is added to $L_{eq,30mins}$ for leading and trailing effect for conservative approaches.)
[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.
[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project: Shatin Central Link Rail Operational GBN Assessment
NSR Ref.: DIH-7-1
Location: Tropicana Gardens Block 2
Assessed Floor 4
Item: 13

Train Speed: 85 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	14	40	42
Down Track	58	40	70

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D018	28	40	42[1]
Down Track	D018	28	40	70[1]

		Frequency (Hz)														
Description	Unit	20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	37.0	41.0	40.0	38.0	37.0	41.0	44.0	45.0	45.0	41.0	40.0	39.0	36.0	37.0	34.0
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	3.9	1.0	0.8	1.3	2.9	1.0	2.4	-2.5	-3.7	-2.6	1.7	4.6	5.8	7.2	9.2
Up Track Vib. Level	dB re 10^{-6}in/sec	38.0	39.1	37.8	36.4	36.9	39.1	43.4	39.6	38.3	35.5	38.8	40.6	38.8	41.2	40.3
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	37.0	41.0	40.0	38.0	37.0	41.0	44.0	45.0	45.0	41.0	40.0	39.0	36.0	37.0	34.0
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	2.2	-3.3	-3.8	-5.6	-2.8	-5.7	-1.9	-14.3	-13.2	-14.1	-17.5	-11.4	-12.3	-17.1	-16.2
Down Track Vib. Level	dB re 10^{-6}in/sec	36.3	34.7	33.2	29.4	31.2	32.3	39.1	27.8	28.8	23.9	19.5	24.6	20.7	17.0	14.8
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		40.2	40.4	39.1	37.2	37.9	39.9	44.8	39.8	38.8	35.8	38.8	40.7	38.9	41.2	40.3
BCF	dB Y/N 0															
BVR-up	dB Floor 4	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**50.2**	**50.4**	**49.1**	**47.2**	**47.7**	**49.3**	**54.0**	**48.8**	**47.6**	**43.8**	**45.8**	**46.7**	**43.9**	**45.9**	**45.0**
Predicted Noise Level	**Oct, dB**			**53.9**			**55.9**			**52.0**			**50.4**			**48.5**
L_{max}	**dB(A)**	**47.5**														
$L_{eq,30mins}$	**dB(A)**	**34.8**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.
[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.
[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.
[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.
[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(
(3dB(A) correction is added to $L_{eq,30mins}$ for leading and trailing effect for conservative approaches.)
[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.
[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project: Shatin Central Link Rail Operational GBN Assessment
NSR Ref.: DIH-7-2
Location: Tropicana Gardens Block 3
Assessed Floor 4
Item: 14

Train Speed: 85 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	10	40	41
Down Track	48	40	62

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D018	28	40	41[1]
Down Track	D018	28	40	62[1]

		Frequency (Hz)														
Description	Unit	20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	37.0	41.0	40.0	38.0	37.0	41.0	44.0	45.0	45.0	41.0	40.0	39.0	36.0	37.0	34.0
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	4.0	1.5	1.1	2.5	4.0	3.0	3.7	0.8	-0.9	-0.9	4.3	6.6	7.7	9.0	10.4
Up Track Vib. Level	dB re 10^{-6}in/sec	38.0	39.5	38.2	37.5	38.1	41.0	44.8	42.8	41.1	37.1	41.3	42.7	40.7	43.0	41.4
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	37.0	41.0	40.0	38.0	37.0	41.0	44.0	45.0	45.0	41.0	40.0	39.0	36.0	37.0	34.0
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	2.9	-2.3	-2.9	-4.6	-1.8	-4.7	-1.5	-12.9	-12.1	-13.0	-16.3	-10.2	-11.2	-15.8	-15.0
Down Track Vib. Level	dB re 10^{-6}in/sec	37.0	35.7	34.1	30.5	32.2	33.3	39.5	29.1	29.9	25.0	20.7	25.8	21.8	18.2	16.0
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		40.5	41.0	39.6	38.3	39.1	41.7	45.9	43.0	41.4	37.4	41.3	42.7	40.8	43.0	41.4
BCF	dB Y/N 0															
BVR-up	dB Floor 4	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**50.5**	**51.0**	**49.6**	**48.3**	**48.9**	**51.1**	**55.1**	**52.0**	**50.2**	**45.4**	**48.3**	**48.7**	**45.8**	**47.7**	**46.1**
Predicted Noise Level	**Oct, dB**			**54.5**			**57.2**			**54.7**			**52.6**			**50.0**
L_{max}	**dB(A)**	**49.2**														
$L_{eq,30mins}$	**dB(A)**	**36.5**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.
[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.
[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.
[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.
[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(
(3dB(A) correction is added to $L_{eq,30mins}$ for leading and trailing effect for conservative approaches.)
[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.
[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	DIH-8-1
Location:	Redemption Lutheran Church
Assessed Floor	0
Item:	15

Train Speed: 85 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	116	20	118
Down Track	163	20	164

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D002	24	20	118[1]
Down Track	D002	24	20	164[1]

		Frequency (Hz)														
Description	Unit	20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	37.0	41.0	40.0	38.0	37.0	41.0	44.0	45.0	45.0	41.0	40.0	39.0	36.0	37.0	34.0
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-4.0	-7.2	-12.3	-15.3	-8.1	-21.5	-19.5	-11.7	-25.6	-26.9	-17.4	-14.3	-17.0	-15.4	-18.4
Up Track Vib. Level	dB re 10^{-6}in/sec	30.0	30.8	24.7	19.7	25.9	16.5	21.5	30.3	16.4	11.1	19.6	21.7	16.0	18.6	12.6
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	37.0	41.0	40.0	38.0	37.0	41.0	44.0	45.0	45.0	41.0	40.0	39.0	36.0	37.0	34.0
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-4.0	-7.2	-12.3	-15.3	-8.1	-21.5	-19.5	-11.7	-25.6	-26.9	-17.4	-14.3	-17.0	-15.4	-18.4
Down Track Vib. Level	dB re 10^{-6}in/sec	30.0	30.8	24.7	19.7	25.9	16.5	21.5	30.3	16.4	11.1	19.6	21.7	16.0	18.6	12.6
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		33.0	33.8	27.7	22.7	28.9	19.5	24.5	33.3	19.4	14.1	22.6	24.7	19.0	21.6	15.6
BCF	dB Y/N 0															
BVR-up	dB Floor 0	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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**51.0**	**51.8**	**45.7**	**40.7**	**46.7**	**36.9**	**41.7**	**50.3**	**36.2**	**30.1**	**37.6**	**38.7**	**32.0**	**34.3**	**28.3**
Predicted Noise Level	**Oct, dB**			**53.1**			**48.3**			**50.5**			**41.7**			**35.3**
L_{max}	**dB(A)**	**37.4**														
$L_{eq,30mins}$	**dB(A)**	**24.6**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project: Shatin Central Link Rail Operational GBN Assessment
NSR Ref.: DIH-9-1
Location: Shek On Building
Assessed Floor 0
Item: 16

Train Speed: 80 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	118	25	121
Down Track	156	25	158

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D002	24	20	121[1]
Down Track	D002	24	20	158[1]

		Frequency (Hz)														
Description	Unit	20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	36.5	40.5	39.5	37.5	36.5	40.5	43.5	44.5	44.5	40.5	39.5	38.5	35.5	36.5	33.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-4.0	-7.2	-12.3	-15.3	-8.1	-21.5	-19.5	-11.7	-25.6	-26.9	-17.4	-14.3	-17.0	-15.4	-18.4
Up Track Vib. Level	dB re 10^{-6}in/sec	29.5	30.3	24.2	19.2	25.4	16.0	21.0	29.8	15.9	10.6	19.1	21.2	15.5	18.1	12.1
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	36.5	40.5	39.5	37.5	36.5	40.5	43.5	44.5	44.5	40.5	39.5	38.5	35.5	36.5	33.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-4.0	-7.2	-12.3	-15.3	-8.1	-21.5	-19.5	-11.7	-25.6	-26.9	-17.4	-14.3	-17.0	-15.4	-18.4
Down Track Vib. Level	dB re 10^{-6}in/sec	29.5	30.3	24.2	19.2	25.4	16.0	21.0	29.8	15.9	10.6	19.1	21.2	15.5	18.1	12.1
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		32.5	33.3	27.2	22.2	28.4	19.0	24.0	32.8	18.9	13.6	22.1	24.2	18.5	21.1	15.1
BCF	dB Y/N 0															
BVR-up	dB Floor 0	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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**50.5**	**51.3**	**45.2**	**40.2**	**46.2**	**36.4**	**41.2**	**49.8**	**35.7**	**29.6**	**37.1**	**38.2**	**31.5**	**33.8**	**27.8**
Predicted Noise Level	**Oct, dB**			**52.5**			**47.7**			**50.0**			**41.2**			**34.8**
L_{max}	**dB(A)**	**36.8**														
$L_{eq,30mins}$	**dB(A)**	**27[8]**														
Noise Criteria	**dB(A)**	**55[9]**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.
[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.
[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.
[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.
[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(
(3dB(A) correction is added to $L_{eq,30mins}$ for leading and trailing effect for conservative approaches.)
[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.
[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.
[8] A 3dB(A) upward adjustment is made to account for the daytime headway of 22 EMU trains within a 30 minutes period.
[9] Daytime criteria are used for educational buildings, church and temple.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project: Shatin Central Link Rail Operational GBN Assessment
NSR Ref.: DIH-10-1
Location: Hong Kong Sheung Keung Hui Nursing Home
Assessed Floor 1
Item: 17

Train Speed: 80 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	160	25	162
Down Track	188	25	190

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D002	24	20	162[1]
Down Track	D002	24	20	190[1]

				Frequency (Hz)															
Description	Unit			20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																			
FDL	dB re 1 lb/in$^{0.5}$			36.5	40.5	39.5	37.5	36.5	40.5	43.5	44.5	44.5	40.5	39.5	38.5	35.5	36.5	33.5
CCF	dB	Y/N	N																
TIL	dB	Type	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB			-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3
TOC	dB	Type	0																
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb			-4.0	-7.2	-12.3	-15.3	-8.1	-21.5	-19.5	-11.7	-25.6	-26.9	-17.4	-14.3	-17.0	-15.4	-18.4	
Up Track Vib. Level	dB re 10^{-6}in/sec			29.5	30.3	24.2	19.2	25.4	16.0	21.0	29.8	15.9	10.6	19.1	21.2	15.5	18.1	12.1	
Down Track Calculation																			
FDL	dB re 1 lb/in$^{0.5}$			36.5	40.5	39.5	37.5	36.5	40.5	43.5	44.5	44.5	40.5	39.5	38.5	35.5	36.5	33.5	
CCF	dB	Y/N	N																
TIL	dB	Type	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB			-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3
TOC	dB	Type	0																
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb			-4.0	-7.2	-12.3	-15.3	-8.1	-21.5	-19.5	-11.7	-25.6	-26.9	-17.4	-14.3	-17.0	-15.4	-18.4	
Down Track Vib. Level	dB re 10^{-6}in/sec			29.5	30.3	24.2	19.2	25.4	16.0	21.0	29.8	15.9	10.6	19.1	21.2	15.5	18.1	12.1	
Total of Up and Down Tracks Calculation																			
Total Vibration Level Outside Building				32.5	33.3	27.2	22.2	28.4	19.0	24.0	32.8	18.9	13.6	22.1	24.2	18.5	21.1	15.1	
BCF	dB	Y/N	0																
BVR-up	dB	Floor	1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	
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			2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
SAF	dB			10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	

Predicted Noise Level	**1/3 Oct, dB**	**48.5**	**49.3**	**43.2**	**38.2**	**44.2**	**34.4**	**39.2**	**47.8**	**33.7**	**27.6**	**35.1**	**36.2**	**29.5**	**31.8**	**25.8**
Predicted Noise Level	**Oct, dB**			**50.5**			**45.7**			**48.0**			**39.2**			**32.8**
L_{max}	**dB(A)**	**34.8**														
$L_{eq,30mins}$	**dB(A)**	**22.4**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.
[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.
[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.
[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.
[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(
(3dB(A) correction is added to $L_{eq,30mins}$ for leading and trailing effect for conservative approaches.)
[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.
[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	DIH-11-1
Location:	Lung Wan House
Assessed Floor	1
Item:	18

Train Speed: 35 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	75	25	79
Down Track	60	25	65

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D002	24	20	79[1]
Down Track	D002	24	20	65[1]

				Frequency (Hz)														
Description	Unit			20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																		
FDL	dB re 1 lb/in$^{0.5}$			29.3	33.3	32.3	30.3	29.3	33.3	36.3	37.3	37.3	33.3	32.3	31.3	28.3	29.3	26.3
CCF	dB	Y/N	N															
TIL	dB	Type	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB			-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB	Type	0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb			-4.0	-7.2	-12.3	-15.3	-8.1	-21.5	-19.5	-11.7	-25.6	-26.9	-17.4	-14.3	-17.0	-15.4	-18.4
Up Track Vib. Level	dB re 10^{-6}in/sec			20.3	21.1	15.0	10.0	16.2	6.8	11.8	20.6	6.7	1.4	9.9	12.0	6.3	8.9	2.9
Down Track Calculation																		
FDL	dB re 1 lb/in$^{0.5}$			29.3	33.3	32.3	30.3	29.3	33.3	36.3	37.3	37.3	33.3	32.3	31.3	28.3	29.3	26.3
CCF	dB	Y/N	N															
TIL	dB	Type	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB			-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB	Type	0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb			-1.7	-4.8	-9.6	-13.3	-6.3	-16.9	-16.4	-9.1	-23.4	-24.6	-15.6	-12.3	-14.7	-13.6	-16.6
Down Track Vib. Level	dB re 10^{-6}in/sec			22.6	23.5	17.8	12.0	18.0	11.4	14.9	23.2	8.9	3.7	11.8	14.0	8.6	10.8	4.8
Total of Up and Down Tracks Calculation																		
Total Vibration Level Outside Building				24.6	25.5	19.6	14.2	20.2	12.7	16.6	25.1	11.0	5.7	13.9	16.1	10.6	12.9	6.9
BCF	dB	Y/N	0															
BVR-up	dB	Floor	1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
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			2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB			10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**40.6**	**41.5**	**35.6**	**30.2**	**36.0**	**28.1**	**31.8**	**40.1**	**25.8**	**19.7**	**26.9**	**28.1**	**21.6**	**23.6**	**17.6**
Predicted Noise Level	**Oct, dB**			**42.7**			**37.9**			**40.3**			**31.1**			**24.6**
L_{max}	**dB(A)**	**26.9**														
$L_{eq,30mins}$	**dB(A)**	**<20**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	DIH-12-1
Location:	Galaxia Tower B
Assessed Floor	5
Item:	19

Train Speed: 55 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	195	30	197
Down Track	180	30	182

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D002	24	20	197[1]
Down Track	D002	24	20	182[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	33.2	37.2	36.2	34.2	33.2	37.2	40.2	41.2	41.2	37.2	36.2	35.2	32.2	33.2	30.2
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-4.0	-7.2	-12.3	-15.3	-8.1	-21.5	-19.5	-11.7	-25.6	-26.9	-17.4	-14.3	-17.0	-15.4	-18.4
Up Track Vib. Level	dB re 10^{-6}in/sec	24.2	25.0	18.9	13.9	20.1	10.7	15.7	24.5	10.6	5.3	13.8	15.9	10.2	12.8	6.8
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	33.2	37.2	36.2	34.2	33.2	37.2	40.2	41.2	41.2	37.2	36.2	35.2	32.2	33.2	30.2
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-4.0	-7.2	-12.3	-15.3	-8.1	-21.5	-19.5	-11.7	-25.6	-26.9	-17.4	-14.3	-17.0	-15.4	-18.4
Down Track Vib. Level	dB re 10^{-6}in/sec	24.2	25.0	18.9	13.9	20.1	10.7	15.7	24.5	10.6	5.3	13.8	15.9	10.2	12.8	6.8
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		27.3	28.1	22.0	17.0	23.2	13.8	18.8	27.6	13.7	8.4	16.9	19.0	13.3	15.9	9.9
BCF	dB Y/N 0															
BVR-up	dB Floor 5	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**35.3**	**36.1**	**30.0**	**25.0**	**31.0**	**21.2**	**26.0**	**34.6**	**20.5**	**14.4**	**21.9**	**23.0**	**16.3**	**18.6**	**12.6**
Predicted Noise Level	**Oct, dB**			**37.3**			**32.5**			**34.8**			**25.9**			**19.6**
L_{max}	**dB(A)**	**21.6**														
$L_{eq,30mins}$	**dB(A)**	**<20**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	DIH-12-2
Location:	Galaxia Tower E
Assessed Floor	5
Item:	20

Train Speed: 45 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	180	30	182
Down Track	160	30	163

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D002	24	20	182[1]
Down Track	D002	24	20	163[1]

				Frequency (Hz)															
Description	Unit			20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																			
FDL	dB re 1 lb/in$^{0.5}$			31.5	35.5	34.5	32.5	31.5	35.5	38.5	39.5	39.5	35.5	34.5	33.5	30.5	31.5	28.5
CCF	dB	Y/N	N																
TIL	dB	Type	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB			-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB	Type	0																
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb			-4.0	-7.2	-12.3	-15.3	-8.1	-21.5	-19.5	-11.7	-25.6	-26.9	-17.4	-14.3	-17.0	-15.4	-18.4	
Up Track Vib. Level	dB re 10^{-6}in/sec			22.5	23.3	17.2	12.2	18.4	9.0	14.0	22.8	8.9	3.6	12.1	14.2	8.5	11.1	5.1	
Down Track Calculation																			
FDL	dB re 1 lb/in$^{0.5}$			31.5	35.5	34.5	32.5	31.5	35.5	38.5	39.5	39.5	35.5	34.5	33.5	30.5	31.5	28.5	
CCF	dB	Y/N	N																
TIL	dB	Type	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB			-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB	Type	0																
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb			-4.0	-7.2	-12.3	-15.3	-8.1	-21.5	-19.5	-11.7	-25.6	-26.9	-17.4	-14.3	-17.0	-15.4	-18.4	
Down Track Vib. Level	dB re 10^{-6}in/sec			22.5	23.3	17.2	12.2	18.4	9.0	14.0	22.8	8.9	3.6	12.1	14.2	8.5	11.1	5.1	
Total of Up and Down Tracks Calculation																			
Total Vibration Level Outside Building				25.5	26.3	20.2	15.2	21.4	12.0	17.0	25.8	11.9	6.6	15.1	17.2	11.5	14.1	8.1	
BCF	dB	Y/N	0																
BVR-up	dB	Floor	5	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	
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			2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
SAF	dB			10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	

Predicted Noise Level	**1/3 Oct, dB**	**33.5**	**34.3**	**28.2**	**23.2**	**29.2**	**19.4**	**24.2**	**32.8**	**18.7**	**12.6**	**20.1**	**21.2**	**14.5**	**16.8**	**10.8**
Predicted Noise Level	**Oct, dB**			**35.5**			**30.7**			**33.0**			**24.2**			**17.9**
L_{max}	**dB(A)**	**19.8**														
$L_{eq,30mins}$	**dB(A)**	**<20**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	DIH-13-1
Location:	Canossa Primary School
Assessed Floor	0
Item:	21

Train Speed: 85 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	160	25	162
Down Track	200	25	202

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D002	24	20	162[1]
Down Track	D002	24	20	202[1]

		Frequency (Hz)														
Description	Unit	20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	37.0	41.0	40.0	38.0	37.0	41.0	44.0	45.0	45.0	41.0	40.0	39.0	36.0	37.0	34.0
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-4.0	-7.2	-12.3	-15.3	-8.1	-21.5	-19.5	-11.7	-25.6	-26.9	-17.4	-14.3	-17.0	-15.4	-18.4
Up Track Vib. Level	dB re 10^{-6}in/sec	30.0	30.8	24.7	19.7	25.9	16.5	21.5	30.3	16.4	11.1	19.6	21.7	16.0	18.6	12.6
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	37.0	41.0	40.0	38.0	37.0	41.0	44.0	45.0	45.0	41.0	40.0	39.0	36.0	37.0	34.0
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-4.0	-7.2	-12.3	-15.3	-8.1	-21.5	-19.5	-11.7	-25.6	-26.9	-17.4	-14.3	-17.0	-15.4	-18.4
Down Track Vib. Level	dB re 10^{-6}in/sec	30.0	30.8	24.7	19.7	25.9	16.5	21.5	30.3	16.4	11.1	19.6	21.7	16.0	18.6	12.6
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		33.0	33.8	27.7	22.7	28.9	19.5	24.5	33.3	19.4	14.1	22.6	24.7	19.0	21.6	15.6
BCF	dB Y/N 0															
BVR-up	dB Floor 0	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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**51.0**	**51.8**	**45.7**	**40.7**	**46.7**	**36.9**	**41.7**	**50.3**	**36.2**	**30.1**	**37.6**	**38.7**	**32.0**	**34.3**	**28.3**
Predicted Noise Level	**Oct, dB**			**53.1**			**48.3**			**50.5**			**41.7**			**35.3**
L_{max}	**dB(A)**	**37.4**														
$L_{eq,30mins}$	**dB(A)**	**28[8]**														
Noise Criteria	**dB(A)**	**55[9]**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

[8] A 3dB(A) upward adjustment is made to account for the daytime headway of 22 EMU trains within a 30 minutes period.

[9] Daytime criteria are used for educational buildings, church and temple.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project: Shatin Central Link Rail Operational GBN Assessment **Train Speed:** 60 kph
NSR Ref.: DIH-14-1
Location: Rhythm Garden Block 2
Assessed Floor 1
Item: 22

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	45	25	51
Down Track	60	25	65

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D002	24	20	51[1]
Down Track	D002	24	20	65[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.0	38.0	37.0	35.0	34.0	38.0	41.0	42.0	42.0	38.0	37.0	36.0	33.0	34.0	31.0
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	3.6	-1.0	-3.8	-1.1	1.6	-7.6	-10.5	-6.1	-20.8	-21.3	-13.6	-10.6	-12.0	-12.1	-14.9
Up Track Vib. Level	dB re 10^{-6}in/sec	37.6	37.0	33.2	33.9	35.6	30.4	30.5	35.9	21.2	16.7	23.4	25.4	21.0	21.9	16.1
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.0	38.0	37.0	35.0	34.0	38.0	41.0	42.0	42.0	38.0	37.0	36.0	33.0	34.0	31.0
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-1.7	-4.8	-9.6	-13.3	-6.3	-16.9	-16.4	-9.1	-23.4	-24.6	-15.6	-12.3	-14.7	-13.6	-16.6
Down Track Vib. Level	dB re 10^{-6}in/sec	32.3	33.2	27.5	21.7	27.7	21.1	24.6	32.9	18.6	13.4	21.4	23.7	18.3	20.4	14.4
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		38.7	38.5	34.3	34.1	36.3	30.9	31.5	37.7	23.1	18.4	25.5	27.6	22.9	24.2	18.4
BCF	dB Y/N 0															
BVR-up	dB Floor 1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**54.7**	**54.5**	**50.3**	**50.1**	**52.1**	**46.3**	**46.7**	**52.7**	**37.9**	**32.4**	**38.5**	**39.6**	**33.9**	**34.9**	**29.1**
Predicted Noise Level	**Oct, dB**			**56.9**			**54.0**			**52.9**			**42.7**			**35.9**
L_{max}	**dB(A)**	**39.0**														
$L_{eq,30mins}$	**dB(A)**	**27.8**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.
[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.
[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.
[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.
[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(
(3dB(A) correction is added to $L_{eq,30mins}$ for leading and trailing effect for conservative approaches.)
[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.
[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	DIH-14-2
Location:	Rhythm Garden Block 5
Assessed Floor	1
Item:	23

Train Speed: 60 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	35	25	43
Down Track	50	25	56

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D002	24	20	43[1]
Down Track	D002	24	20	56[1]

		Frequency (Hz)														
Description	Unit	20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.0	38.0	37.0	35.0	34.0	38.0	41.0	42.0	42.0	38.0	37.0	36.0	33.0	34.0	31.0
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	6.0	0.6	-0.5	5.1	5.8	-3.3	-4.6	-4.4	-18.4	-19.6	-12.7	-10.0	-9.8	-11.5	-13.6
Up Track Vib. Level	dB re 10^{-6}in/sec	40.0	38.6	36.5	40.1	39.8	34.7	36.4	37.6	23.6	18.4	24.3	26.0	23.2	22.5	17.4
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.0	38.0	37.0	35.0	34.0	38.0	41.0	42.0	42.0	38.0	37.0	36.0	33.0	34.0	31.0
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	0.9	-2.7	-6.6	-8.9	-3.2	-12.2	-13.4	-7.0	-21.6	-22.6	-14.2	-11.0	-12.8	-12.3	-15.2
Down Track Vib. Level	dB re 10^{-6}in/sec	34.9	35.3	30.4	26.1	30.8	25.8	27.6	35.0	20.4	15.4	22.8	25.0	20.2	21.7	15.8
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		41.2	40.3	37.4	40.2	40.3	35.2	36.9	39.5	25.3	20.2	26.6	28.5	24.9	25.1	19.7
BCF	dB Y/N 0															
BVR-up	dB Floor 1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**57.2**	**56.3**	**53.4**	**56.2**	**56.1**	**50.6**	**52.1**	**54.5**	**40.1**	**34.2**	**39.6**	**40.5**	**35.9**	**35.8**	**30.4**
Predicted Noise Level	**Oct, dB**			**60.3**			**58.4**			**54.7**			**43.9**			**36.9**
L_{max}	**dB(A)**	**40.8**														
$L_{eq,30mins}$	**dB(A)**	**29.6**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	DIH-14-3
Location:	Rhythm Garden Block 8
Assessed Floor	1
Item:	24

Train Speed: 60 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	175	25	177
Down Track	185	25	187

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D002	24	20	177[1]
Down Track	D002	24	20	187[1]

		Frequency (Hz)														
Description	Unit	20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.0	38.0	37.0	35.0	34.0	38.0	41.0	42.0	42.0	38.0	37.0	36.0	33.0	34.0	31.0
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-4.0	-7.2	-12.3	-15.3	-8.1	-21.5	-19.5	-11.7	-25.6	-26.9	-17.4	-14.3	-17.0	-15.4	-18.4
Up Track Vib. Level	dB re 10^{-6}in/sec	30.0	30.8	24.7	19.7	25.9	16.5	21.5	30.3	16.4	11.1	19.6	21.7	16.0	18.6	12.6
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.0	38.0	37.0	35.0	34.0	38.0	41.0	42.0	42.0	38.0	37.0	36.0	33.0	34.0	31.0
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-4.0	-7.2	-12.3	-15.3	-8.1	-21.5	-19.5	-11.7	-25.6	-26.9	-17.4	-14.3	-17.0	-15.4	-18.4
Down Track Vib. Level	dB re 10^{-6}in/sec	30.0	30.8	24.7	19.7	25.9	16.5	21.5	30.3	16.4	11.1	19.6	21.7	16.0	18.6	12.6
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		33.0	33.8	27.7	22.7	28.9	19.5	24.5	33.3	19.4	14.1	22.6	24.7	19.0	21.6	15.6
BCF	dB Y/N 0															
BVR-up	dB Floor 1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**49.0**	**49.8**	**43.7**	**38.7**	**44.7**	**34.9**	**39.7**	**48.3**	**34.2**	**28.1**	**35.6**	**36.7**	**30.0**	**32.3**	**26.3**
Predicted Noise Level	**Oct, dB**			**51.0**			**46.2**			**48.5**			**39.7**			**33.3**
L_{max}	**dB(A)**	**35.3**														
$L_{eq,30mins}$	**dB(A)**	**24.1**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project: Shatin Central Link Rail Operational GBN Assessment
NSR Ref.: DIH-14-4
Location: Canossa Primary School (San Po Kong)
Assessed Floor 1
Item: 25

Train Speed: 60 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	145	25	147
Down Track	160	25	162

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D002	24	20	147[1]
Down Track	D002	24	20	162[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.0	38.0	37.0	35.0	34.0	38.0	41.0	42.0	42.0	38.0	37.0	36.0	33.0	34.0	31.0
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-4.0	-7.2	-12.3	-15.3	-8.1	-21.5	-19.5	-11.7	-25.6	-26.9	-17.4	-14.3	-17.0	-15.4	-18.4
Up Track Vib. Level	dB re 10^{-6}in/sec	25.0	25.8	19.7	14.7	20.9	11.5	16.5	25.3	11.4	6.1	14.6	16.7	11.0	13.6	7.6
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.0	38.0	37.0	35.0	34.0	38.0	41.0	42.0	42.0	38.0	37.0	36.0	33.0	34.0	31.0
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-4.0	-7.2	-12.3	-15.3	-8.1	-21.5	-19.5	-11.7	-25.6	-26.9	-17.4	-14.3	-17.0	-15.4	-18.4
Down Track Vib. Level	dB re 10^{-6}in/sec	25.0	25.8	19.7	14.7	20.9	11.5	16.5	25.3	11.4	6.1	14.6	16.7	11.0	13.6	7.6
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		28.0	28.8	22.7	17.7	23.9	14.5	19.5	28.3	14.4	9.1	17.6	19.7	14.0	16.6	10.6
BCF	dB Y/N 0															
BVR-up	dB Floor 1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**44.0**	**44.8**	**38.7**	**33.7**	**39.7**	**29.9**	**34.7**	**43.3**	**29.2**	**23.1**	**30.6**	**31.7**	**25.0**	**27.3**	**21.3**
Predicted Noise Level	**Oct, dB**			**46.0**			**41.2**			**43.5**			**34.7**			**28.3**
L_{max}	**dB(A)**	**30.3**														
$L_{eq,30mins}$	**dB(A)**	**<20[8]**														
Noise Criteria	**dB(A)**	**55[9]**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.
[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.
[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.
[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.
[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(
(3dB(A) correction is added to $L_{eq,30mins}$ for leading and trailing effect for conservative approaches.)
[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.
[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.
[8] A 3dB(A) upward adjustment is made to account for the daytime headway of 22 EMU trains within a 30 minutes period.
[9] Daytime criteria are used for educational buildings, church and temple.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project: Shatin Central Link Rail Operational GBN Assessment
NSR Ref.: DIH-14-5
Location: Rhythm Garden Block 1
Assessed Floor 1
Item: 26

Train Speed: 55 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	40	25	47
Down Track	50	25	56

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D002	24	20	47[1]
Down Track	D002	24	20	56[1]

		Frequency (Hz)														
Description	Unit	20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	33.2	37.2	36.2	34.2	33.2	37.2	40.2	41.2	41.2	37.2	36.2	35.2	32.2	33.2	30.2
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	5.1	-0.1	-1.9	3.0	4.3	-5.0	-7.8	-5.3	-19.7	-20.4	-13.2	-10.3	-11.0	-11.8	-14.3
Up Track Vib. Level	dB re 10^{-6}in/sec	38.4	37.2	34.3	37.3	37.6	32.3	32.4	36.0	21.5	16.8	23.1	24.9	21.2	21.4	15.9
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	33.2	37.2	36.2	34.2	33.2	37.2	40.2	41.2	41.2	37.2	36.2	35.2	32.2	33.2	30.2
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	0.9	-2.7	-6.6	-8.9	-3.2	-12.2	-13.4	-7.0	-21.6	-22.6	-14.2	-11.0	-12.8	-12.3	-15.2
Down Track Vib. Level	dB re 10^{-6}in/sec	34.1	34.6	29.6	25.4	30.0	25.1	26.9	34.2	19.6	14.7	22.1	24.3	19.4	20.9	15.0
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		39.8	39.1	35.6	37.5	38.3	33.0	33.5	38.2	23.7	18.9	25.6	27.6	23.4	24.2	18.5
BCF	dB Y/N 0															
BVR-up	dB Floor 1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**55.8**	**55.1**	**51.6**	**53.5**	**54.1**	**48.4**	**48.7**	**53.2**	**38.5**	**32.9**	**38.6**	**39.6**	**34.4**	**34.9**	**29.2**
Predicted Noise Level	**Oct, dB**			**58.4**			**56.0**			**53.4**			**42.8**			**35.9**
L_{max}	**dB(A)**	**39.4**														
$L_{eq,30mins}$	**dB(A)**	**28.6**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.
[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.
[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.
[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.
[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(
(3dB(A) correction is added to $L_{eq,30mins}$ for leading and trailing effect for conservative approaches.)
[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.
[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	DIH-14-6
Location:	Rhythm Garden Block 3
Assessed Floor	1
Item:	27

Train Speed: 60 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	45	25	51
Down Track	60	25	65

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D002	24	20	51[1]
Down Track	D002	24	20	65[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.0	38.0	37.0	35.0	34.0	38.0	41.0	42.0	42.0	38.0	37.0	36.0	33.0	34.0	31.0
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	3.6	-1.0	-3.8	-1.1	1.6	-7.6	-10.5	-6.1	-20.8	-21.3	-13.6	-10.6	-12.0	-12.1	-14.9
Up Track Vib. Level	dB re 10^{-6}in/sec	37.6	37.0	33.2	33.9	35.6	30.4	30.5	35.9	21.2	16.7	23.4	25.4	21.0	21.9	16.1
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.0	38.0	37.0	35.0	34.0	38.0	41.0	42.0	42.0	38.0	37.0	36.0	33.0	34.0	31.0
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-1.7	-4.8	-9.6	-13.3	-6.3	-16.9	-16.4	-9.1	-23.4	-24.6	-15.6	-12.3	-14.7	-13.6	-16.6
Down Track Vib. Level	dB re 10^{-6}in/sec	32.3	33.2	27.5	21.7	27.7	21.1	24.6	32.9	18.6	13.4	21.4	23.7	18.3	20.4	14.4
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		38.7	38.5	34.3	34.1	36.3	30.9	31.5	37.7	23.1	18.4	25.5	27.6	22.9	24.2	18.4
BCF	dB Y/N 0															
BVR-up	dB Floor 1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**54.7**	**54.5**	**50.3**	**50.1**	**52.1**	**46.3**	**46.7**	**52.7**	**37.9**	**32.4**	**38.5**	**39.6**	**33.9**	**34.9**	**29.1**
Predicted Noise Level	**Oct, dB**			**56.9**			**54.0**			**52.9**			**42.7**			**35.9**
L_{max}	**dB(A)**	**39.0**														
$L_{eq,30mins}$	**dB(A)**	**27.8**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	DIH-15-1
Location:	Kam Wan House
Assessed Floor	0
Item:	28

Train Speed: 60 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	100	25	103
Down Track	85	25	89

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D002	24	20	103[1]
Down Track	D002	24	20	89[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.0	38.0	37.0	35.0	34.0	38.0	41.0	42.0	42.0	38.0	37.0	36.0	33.0	34.0	31.0
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-4.0	-7.2	-12.3	-15.3	-8.1	-21.5	-19.5	-11.7	-25.6	-26.9	-17.4	-14.3	-17.0	-15.4	-18.4
Up Track Vib. Level	dB re 10^{-6}in/sec	30.0	30.8	24.7	19.7	25.9	16.5	21.5	30.3	16.4	11.1	19.6	21.7	16.0	18.6	12.6
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.0	38.0	37.0	35.0	34.0	38.0	41.0	42.0	42.0	38.0	37.0	36.0	33.0	34.0	31.0
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-4.0	-7.2	-12.3	-15.3	-8.1	-21.5	-19.5	-11.7	-25.6	-26.9	-17.4	-14.3	-17.0	-15.4	-18.4
Down Track Vib. Level	dB re 10^{-6}in/sec	30.0	30.8	24.7	19.7	25.9	16.5	21.5	30.3	16.4	11.1	19.6	21.7	16.0	18.6	12.6
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		33.0	33.8	27.7	22.7	28.9	19.5	24.5	33.3	19.4	14.1	22.6	24.7	19.0	21.6	15.6
BCF	dB Y/N 0															
BVR-up	dB Floor 0	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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**51.0**	**51.8**	**45.7**	**40.7**	**46.7**	**36.9**	**41.7**	**50.3**	**36.2**	**30.1**	**37.6**	**38.7**	**32.0**	**34.3**	**28.3**
Predicted Noise Level	**Oct, dB**			**53.0**			**48.2**			**50.5**			**41.7**			**35.3**
L_{max}	**dB(A)**	**37.3**														
$L_{eq,30mins}$	**dB(A)**	**26.1**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	DIH-15-2
Location:	Pik Hoi House
Assessed Floor	0
Item:	29

Train Speed: 55 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	75	25	79
Down Track	65	25	70

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D002	24	20	79[1]
Down Track	D002	24	20	70[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	33.2	37.2	36.2	34.2	33.2	37.2	40.2	41.2	41.2	37.2	36.2	35.2	32.2	33.2	30.2
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-4.0	-7.2	-12.3	-15.3	-8.1	-21.5	-19.5	-11.7	-25.6	-26.9	-17.4	-14.3	-17.0	-15.4	-18.4
Up Track Vib. Level	dB re 10^{-6}in/sec	29.2	30.0	23.9	18.9	25.1	15.7	20.7	29.5	15.6	10.3	18.8	20.9	15.2	17.8	11.8
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	33.2	37.2	36.2	34.2	33.2	37.2	40.2	41.2	41.2	37.2	36.2	35.2	32.2	33.2	30.2
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-2.7	-5.9	-10.8	-14.2	-7.1	-19.0	-17.8	-10.3	-24.4	-25.6	-16.4	-13.2	-15.7	-14.4	-17.4
Down Track Vib. Level	dB re 10^{-6}in/sec	30.5	31.3	25.4	20.0	26.1	18.2	22.4	31.0	16.8	11.6	19.8	22.0	16.5	18.8	12.8
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		32.9	33.8	27.8	22.5	28.7	20.2	24.7	33.3	19.3	14.0	22.4	24.5	18.9	21.4	15.4
BCF	dB Y/N 0															
BVR-up	dB Floor 0	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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**50.9**	**51.8**	**45.8**	**40.5**	**46.5**	**37.6**	**41.9**	**50.3**	**36.1**	**30.0**	**37.4**	**38.5**	**31.9**	**34.1**	**28.1**
Predicted Noise Level	**Oct, dB**			**53.0**			**48.2**			**50.5**			**41.5**			**35.1**
L_{max}	**dB(A)**	**37.2**														
$L_{eq,30mins}$	**dB(A)**	**26.4**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project: Shatin Central Link Rail Operational GBN Assessment **Train Speed:** 85 kph
NSR Ref.: DIH-16-1
Location: Wong Tai Sin Temple
Assessed Floor 0
Item: 30

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	22	35	41
Down Track	35	35	49

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D002	24	34	41[1]
Down Track	D002	24	34	49[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	37.0	41.0	40.0	38.0	37.0	41.0	44.0	45.0	45.0	41.0	40.0	39.0	36.0	37.0	34.0
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-5.0	-1.0	-0.6	3.3	5.6	0.2	-1.6	-3.4	-7.0	-8.9	-6.8	-6.6	-5.5	-9.0	-12.4
Up Track Vib. Level	dB re 10^{-6}in/sec	32.1	40.1	39.4	41.3	42.6	41.2	42.4	41.6	38.0	32.1	33.2	32.5	30.6	28.0	21.7
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	37.0	41.0	40.0	38.0	37.0	41.0	44.0	45.0	45.0	41.0	40.0	39.0	36.0	37.0	34.0
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-6.4	-4.4	-4.7	-0.3	1.6	-4.4	-6.1	-7.2	-14.5	-15.0	-16.0	-9.6	-8.5	-11.4	-14.1
Down Track Vib. Level	dB re 10^{-6}in/sec	30.6	36.7	35.3	37.8	38.7	36.6	38.0	37.8	30.5	26.1	24.0	29.4	27.5	25.6	19.9
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		34.4	41.7	40.8	42.9	44.1	42.5	43.8	43.1	38.7	33.1	33.7	34.2	32.3	30.0	23.9
BCF	dB Y/N 0															
BVR-up	dB Floor 0	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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**52.4**	**59.7**	**58.8**	**60.9**	**61.9**	**59.9**	**61.0**	**60.1**	**55.5**	**49.1**	**48.7**	**48.2**	**45.3**	**42.7**	**36.6**
Predicted Noise Level	**Oct, dB**			**64.7**			**65.8**			**61.7**			**52.4**			**43.6**
L_{max}	**dB(A)**	**48.8**														
$L_{eq,30mins}$	**dB(A)**	**36.1**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.
[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.
[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.
[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.
[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(
(3dB(A) correction is added to $L_{eq,30mins}$ for leading and trailing effect for conservative approaches.)
[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.
[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	DIH-17-1
Location:	Chuk Yuen United Village
Assessed Floor	0
Item:	31

Train Speed: 85 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	15	30	34
Down Track	50	30	58

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D002	24	20	34[1]
Down Track	D002	24	20	58[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	37.0	41.0	40.0	38.0	37.0	41.0	44.0	45.0	45.0	41.0	40.0	39.0	36.0	37.0	34.0
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	8.0	2.6	4.2	8.2	8.4	0.3	2.1	-0.1	-9.1	-15.1	-8.7	-7.8	-7.2	-10.2	-11.4
Up Track Vib. Level	dB re 10^{-6}in/sec	45.1	43.6	44.2	46.2	45.4	41.4	46.1	45.0	36.0	25.9	31.3	31.3	28.9	26.8	22.6
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	37.0	41.0	40.0	38.0	37.0	41.0	44.0	45.0	45.0	41.0	40.0	39.0	36.0	37.0	34.0
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-0.2	-3.3	-7.8	-12.0	-5.2	-14.0	-14.5	-7.4	-22.0	-23.1	-14.4	-11.1	-13.2	-12.4	-15.4
Down Track Vib. Level	dB re 10^{-6}in/sec	36.8	37.7	32.2	26.0	31.8	27.0	29.5	37.6	23.0	17.9	25.6	27.9	22.8	24.6	18.6
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		45.7	44.6	44.5	46.2	45.6	41.5	46.2	45.7	36.2	26.6	32.3	32.9	29.8	28.9	24.1
BCF	dB Y/N 0															
BVR-up	dB Floor 0	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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**63.7**	**62.6**	**62.5**	**64.2**	**63.4**	**58.9**	**63.4**	**62.7**	**53.0**	**42.6**	**47.3**	**46.9**	**42.8**	**41.6**	**36.8**
Predicted Noise Level	**Oct, dB**			**68.0**			**67.1**			**63.2**			**50.9**			**42.8**
L_{max}	**dB(A)**	**48.9**														
$L_{eq,30mins}$	**dB(A)**	**36.2**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project: Shatin Central Link Rail Operational GBN Assessment
NSR Ref.: DIH-18-1
Location: Upper Wong Tai Sin Estate Po Sin House
Assessed Floor 1
Item: 32

Train Speed: 85 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	25	40	47
Down Track	30	40	50

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D018	28	40	47[1]
Down Track	D018	28	40	50[1]

		Frequency (Hz)														
Description	Unit	20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	37.0	41.0	40.0	38.0	37.0	41.0	44.0	45.0	45.0	41.0	40.0	39.0	36.0	37.0	34.0
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	3.1	-0.8	-1.5	-3.0	-0.7	-3.4	-0.3	-10.8	-10.6	-10.8	-8.9	-5.9	-2.4	-1.7	4.2
Up Track Vib. Level	dB re 10^{-6}in/sec	40.1	40.2	38.5	35.0	36.3	37.6	43.7	34.2	34.4	30.2	31.1	33.1	33.6	35.3	38.2
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	37.0	41.0	40.0	38.0	37.0	41.0	44.0	45.0	45.0	41.0	40.0	39.0	36.0	37.0	34.0
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	3.3	-1.2	-2.0	-3.6	-1.2	-4.0	-0.9	-11.7	-11.2	-11.7	-11.8	-8.5	-7.6	-7.4	-5.2
Down Track Vib. Level	dB re 10^{-6}in/sec	40.3	39.9	38.0	34.4	35.8	37.0	43.1	33.3	33.8	29.3	28.3	30.6	28.5	29.6	28.9
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		43.2	43.1	41.3	37.7	39.1	40.3	46.4	36.8	37.1	32.8	32.9	35.0	34.8	36.4	38.7
BCF	dB Y/N 0															
BVR-up	dB Floor 1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**59.2**	**59.1**	**57.3**	**53.7**	**54.9**	**55.7**	**61.6**	**51.8**	**51.9**	**46.8**	**45.9**	**47.0**	**45.8**	**47.1**	**49.4**
Predicted Noise Level	**Oct, dB**			**62.0**			**63.3**			**55.5**			**51.1**			**51.4**
L_{max}	**dB(A)**	**50.4**														
$L_{eq,30mins}$	**dB(A)**	**37.7**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.
[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.
[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.
[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.
[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(
(3dB(A) correction is added to $L_{eq,30mins}$ for leading and trailing effect for conservative approaches.)
[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.
[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	DIH-18-2
Location:	Upper Wong Tai Sin Estate Tat Sin House
Assessed Floor	1
Item:	33

Train Speed: 90 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	35	45	57
Down Track	37	45	58

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D028	22	44	57[1]
Down Track	D028	22	44	58[1]

		Frequency (Hz)														
Description	Unit	20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	37.5	41.5	40.5	38.5	37.5	41.5	44.5	45.5	45.5	41.5	40.5	39.5	36.5	37.5	34.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	0.5	1.6	0.8	-1.7	-7.4	-9.0	-16.8	-17.5	-18.3	-17.1	-9.0	-3.9	0.0	5.3	0.1
Up Track Vib. Level	dB re 10^{-6}in/sec	38.0	43.1	41.3	36.8	30.1	32.5	27.7	28.1	27.2	24.4	31.6	35.6	36.5	42.8	34.6
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	37.5	41.5	40.5	38.5	37.5	41.5	44.5	45.5	45.5	41.5	40.5	39.5	36.5	37.5	34.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	0.4	1.5	0.7	-1.8	-7.5	-9.3	-17.4	-17.8	-19.0	-17.6	-9.3	-4.2	-0.4	5.0	-0.8
Down Track Vib. Level	dB re 10^{-6}in/sec	37.9	43.0	41.3	36.7	30.0	32.2	27.1	27.8	26.5	23.9	31.2	35.3	36.1	42.5	33.7
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		40.9	46.1	44.3	39.8	33.1	35.4	30.4	30.9	29.9	27.2	34.4	38.5	39.3	45.6	37.2
BCF	dB Y/N 0															
BVR-up	dB Floor 1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**56.9**	**62.1**	**60.3**	**55.8**	**48.9**	**50.8**	**45.6**	**45.9**	**44.7**	**41.2**	**47.4**	**50.5**	**50.3**	**56.3**	**47.9**
Predicted Noise Level	**Oct, dB**			**64.9**			**53.7**			**49.1**			**54.4**			**56.9**
		6.444	**17.4**	**20.9**	**21.2**	**18.7**	**24.58**	**23.1**	**26.8**	**28.6**	**27.8**	**36.5**	**41.9**	**43.7**	**52.146**	**44.7**
		4.409	**54.7**	**123**	**131**	**73.5**	**287.4**	**205**	**481**	**721**	**601**	**4458**	**####**	**####**	**163909**	**####**
L_{max}	**dB(A)**	**54.3**														
$L_{eq,30mins}$	**dB(A)**	**41.3**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	DIH-19-1
Location:	Lung Cheung Gov. Secondary School
Assessed Floor	0
Item:	34

Train Speed: 90 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	40	45	60
Down Track	55	45	71

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D028	22	44	60[1]
Down Track	D028	22	44	71[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	37.5	41.5	40.5	38.5	37.5	41.5	44.5	45.5	45.5	41.5	40.5	39.5	36.5	37.5	34.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	0.1	1.4	0.6	-2.0	-7.7	-9.9	-18.7	-18.3	-20.5	-18.6	-10.0	-4.8	-1.1	4.3	-2.7
Up Track Vib. Level	dB re 10^{-6}in/sec	37.7	43.0	41.1	36.5	29.9	31.6	25.8	27.2	25.0	22.9	30.5	34.7	35.5	41.9	31.9
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	37.5	41.5	40.5	38.5	37.5	41.5	44.5	45.5	45.5	41.5	40.5	39.5	36.5	37.5	34.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-0.2	1.3	0.4	-2.3	-7.9	-10.8	-20.6	-19.2	-22.7	-20.1	-11.1	-5.7	-2.1	3.4	-5.4
Down Track Vib. Level	dB re 10^{-6}in/sec	37.3	42.8	40.9	36.2	29.6	30.7	23.9	26.3	22.8	21.4	29.4	33.8	34.4	40.9	29.1
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		40.5	45.9	44.0	39.4	32.8	34.2	28.0	29.8	27.1	25.2	33.0	37.3	38.0	44.4	33.7
BCF	dB Y/N 0															
BVR-up	dB Floor 0	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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**58.5**	**63.9**	**62.0**	**57.4**	**50.6**	**51.6**	**45.2**	**46.8**	**43.9**	**41.2**	**48.0**	**51.3**	**51.0**	**57.1**	**46.4**
Predicted Noise Level	**Oct, dB**			**66.6**			**54.6**			**49.3**			**55.1**			**57.5**
L_{max}	**dB(A)**	**54.8**														
$L_{eq,30mins}$	**dB(A)**	**45[8]**														
Noise Criteria	**dB(A)**	**55[9]**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

[8] A 3dB(A) upward adjustment is made to account for the daytime headway of 22 EMU trains within a 30 minutes period.

[9] Daytime criteria are used for educational buildings, church and temple.

Project: Shatin Central Link Rail Operational GBN Assessment
NSR Ref.: DIH-20-1
Location: Baptist Rainbow Primary School
Assessed Floor 0
Item: 35

Train Speed: 90 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	95	45	105
Down Track	80	45	92

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D028	22	44	105[1]
Down Track	D028	22	44	92[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	37.5	41.5	40.5	38.5	37.5	41.5	44.5	45.5	45.5	41.5	40.5	39.5	36.5	37.5	34.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-0.2	1.3	0.4	-2.3	-7.9	-10.8	-20.6	-19.2	-22.7	-20.1	-11.1	-5.7	-2.1	3.4	-5.4
Up Track Vib. Level	dB re 10^{-6}in/sec	37.3	42.8	40.9	36.2	29.6	30.7	23.9	26.3	22.8	21.4	29.4	33.8	34.4	40.9	29.1
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	37.5	41.5	40.5	38.5	37.5	41.5	44.5	45.5	45.5	41.5	40.5	39.5	36.5	37.5	34.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-0.2	1.3	0.4	-2.3	-7.9	-10.8	-20.6	-19.2	-22.7	-20.1	-11.1	-5.7	-2.1	3.4	-5.4
Down Track Vib. Level	dB re 10^{-6}in/sec	37.3	42.8	40.9	36.2	29.6	30.7	23.9	26.3	22.8	21.4	29.4	33.8	34.4	40.9	29.1
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		40.3	45.8	43.9	39.2	32.6	33.7	26.9	29.3	25.8	24.4	32.4	36.8	37.4	43.9	32.1
BCF	dB Y/N 0															
BVR-up	dB Floor 0	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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**58.3**	**63.8**	**61.9**	**57.2**	**50.4**	**51.1**	**44.1**	**46.3**	**42.6**	**40.4**	**47.4**	**50.8**	**50.4**	**56.6**	**44.8**
Predicted Noise Level	**Oct, dB**			**66.5**			**54.3**			**48.6**			**54.6**			**56.9**
L_{max}	**dB(A)**	**54.3**														
$L_{eq,30mins}$	**dB(A)**	**44[8]**														
Noise Criteria	**dB(A)**	**55[9]**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.
[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.
[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.
[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.
[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(
(3dB(A) correction is added to $L_{eq,30mins}$ for leading and trailing effect for conservative approaches.)
[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.
[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.
[8] A 3dB(A) upward adjustment is made to account for the daytime headway of 22 EMU trains within a 30 minutes period.

[9] Daytime criteria are used for educational buildings, church and temple.

Project: Shatin Central Link Rail Operational GBN Assessment
NSR Ref.: DIH-21-1
Location: Tin Wang Court Wang King House
Assessed Floor 1
Item: 36

Train Speed: 90 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	30	40	50
Down Track	40	40	57

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D018	28	40	50[1]
Down Track	D018	28	40	57[1]

		Frequency (Hz)														
Description	Unit	20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	37.5	41.5	40.5	38.5	37.5	41.5	44.5	45.5	45.5	41.5	40.5	39.5	36.5	37.5	34.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	3.3	-1.2	-2.0	-3.6	-1.2	-4.0	-0.9	-11.7	-11.2	-11.7	-11.8	-8.5	-7.6	-7.4	-5.2
Up Track Vib. Level	dB re 10^{-6}in/sec	40.8	40.3	38.5	34.9	36.3	37.5	43.6	33.8	34.3	29.8	28.8	31.1	28.9	30.1	29.3
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	37.5	41.5	40.5	38.5	37.5	41.5	44.5	45.5	45.5	41.5	40.5	39.5	36.5	37.5	34.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	3.2	-1.8	-2.5	-4.1	-1.5	-4.4	-1.3	-12.4	-11.7	-12.5	-14.9	-9.7	-10.4	-13.4	-12.6
Down Track Vib. Level	dB re 10^{-6}in/sec	40.7	39.7	38.0	34.4	36.0	37.1	43.2	33.1	33.9	29.1	25.6	29.8	26.2	24.1	22.0
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		43.7	43.0	41.3	37.7	39.2	40.3	46.4	36.5	37.1	32.5	30.5	33.5	30.8	31.1	30.1
BCF	dB Y/N 0															
BVR-up	dB Floor 1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**59.7**	**59.0**	**57.3**	**53.7**	**55.0**	**55.7**	**61.6**	**51.5**	**51.9**	**46.5**	**43.5**	**45.5**	**41.8**	**41.8**	**40.8**
Predicted Noise Level	**Oct, dB**			**62.0**			**63.3**			**55.3**			**48.6**			**44.3**
L_{max}	**dB(A)**	**46.4**														
$L_{eq,30mins}$	**dB(A)**	**33.4**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.
[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.
[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.
[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.
[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(
(3dB(A) correction is added to $L_{eq,30mins}$ for leading and trailing effect for conservative approaches.)
[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.
[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	DIH-22-1
Location:	Price Memorial Catholic Primary School
Assessed Floor	0
Item:	37

Train Speed: 90 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	80	40	89
Down Track	95	40	103

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D018	28	40	89[1]
Down Track	D018	28	40	103[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	37.5	41.5	40.5	38.5	37.5	41.5	44.5	45.5	45.5	41.5	40.5	39.5	36.5	37.5	34.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	1.3	-4.7	-5.1	-7.1	-4.2	-7.0	-2.5	-16.1	-14.8	-15.6	-19.2	-13.0	-13.8	-18.8	-17.8
Up Track Vib. Level	dB re 10^{-6}in/sec	38.8	36.8	35.4	31.4	33.3	34.5	42.0	29.4	30.7	25.9	21.3	26.5	22.7	18.7	16.7
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	37.5	41.5	40.5	38.5	37.5	41.5	44.5	45.5	45.5	41.5	40.5	39.5	36.5	37.5	34.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	1.3	-4.7	-5.1	-7.1	-4.2	-7.0	-2.5	-16.1	-14.8	-15.6	-19.2	-13.0	-13.8	-18.8	-17.8
Down Track Vib. Level	dB re 10^{-6}in/sec	38.8	36.8	35.4	31.4	33.3	34.5	42.0	29.4	30.7	25.9	21.3	26.5	22.7	18.7	16.7
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		41.8	39.8	38.4	34.4	36.3	37.5	45.0	32.4	33.7	28.9	24.3	29.5	25.7	21.7	19.7
BCF	dB Y/N 0															
BVR-up	dB Floor 0	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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**59.8**	**57.8**	**56.4**	**52.4**	**54.1**	**54.9**	**62.2**	**49.4**	**50.5**	**44.9**	**39.3**	**43.5**	**38.7**	**34.4**	**32.4**
Predicted Noise Level	**Oct, dB**			**60.9**			**63.5**			**53.7**			**45.9**			**36.6**
L_{max}	**dB(A)**	**44.1**														
$L_{eq,30mins}$	**dB(A)**	**34[8]**														
Noise Criteria	**dB(A)**	**55[9]**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

[8] A 3dB(A) upward adjustment is made to account for the daytime headway of 22 EMU trains within a 30 minutes period.

[9] Daytime criteria are used for educational buildings, church and temple.

Project: Shatin Central Link Rail Operational GBN Assessment
NSR Ref.: DIH-23-1
Location: Tin Ma Court Chun On House
Assessed Floor 1
Item: 38

Train Speed: 90 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	100	40	108
Down Track	115	40	122

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D018	28	40	108[1]
Down Track	D018	28	40	122[1]

		Frequency (Hz)														
Description	Unit	20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	37.5	41.5	40.5	38.5	37.5	41.5	44.5	45.5	45.5	41.5	40.5	39.5	36.5	37.5	34.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	1.3	-4.7	-5.1	-7.1	-4.2	-7.0	-2.5	-16.1	-14.8	-15.6	-19.2	-13.0	-13.8	-18.8	-17.8
Up Track Vib. Level	dB re 10^{-6}in/sec	38.8	36.8	35.4	31.4	33.3	34.5	42.0	29.4	30.7	25.9	21.3	26.5	22.7	18.7	16.7
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	37.5	41.5	40.5	38.5	37.5	41.5	44.5	45.5	45.5	41.5	40.5	39.5	36.5	37.5	34.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	1.3	-4.7	-5.1	-7.1	-4.2	-7.0	-2.5	-16.1	-14.8	-15.6	-19.2	-13.0	-13.8	-18.8	-17.8
Down Track Vib. Level	dB re 10^{-6}in/sec	38.8	36.8	35.4	31.4	33.3	34.5	42.0	29.4	30.7	25.9	21.3	26.5	22.7	18.7	16.7
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		41.8	39.8	38.4	34.4	36.3	37.5	45.0	32.4	33.7	28.9	24.3	29.5	25.7	21.7	19.7
BCF	dB Y/N 0															
BVR-up	dB Floor 1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**57.8**	**55.8**	**54.4**	**50.4**	**52.1**	**52.9**	**60.2**	**47.4**	**48.5**	**42.9**	**37.3**	**41.5**	**36.7**	**32.4**	**30.4**
Predicted Noise Level	**Oct, dB**			**58.9**			**61.5**			**51.7**			**43.9**			**34.6**
L_{max}	**dB(A)**	**42.1**														
$L_{eq,30mins}$	**dB(A)**	**29.2**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.
[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.
[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.
[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.
[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(
(3dB(A) correction is added to $L_{eq,30mins}$ for leading and trailing effect for conservative approaches.)
[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.
[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	DIH-24-1
Location:	Shing Wong Temple
Assessed Floor	1
Item:	39

Train Speed: 90 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	0	35	35
Down Track	5	35	35

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D002	24	34	35[1]
Down Track	D002	24	34	35[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	37.5	41.5	40.5	38.5	37.5	41.5	44.5	45.5	45.5	41.5	40.5	39.5	36.5	37.5	34.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-1.0	3.0	3.0	6.8	10.1	6.9	6.1	3.5	2.0	1.4	0.4	-0.1	0.0	-0.8	-3.7
Up Track Vib. Level	dB re 10^{-6}in/sec	36.5	44.5	43.5	45.3	47.6	48.4	50.6	49.0	47.5	42.9	40.9	39.4	36.5	36.7	30.9
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	37.5	41.5	40.5	38.5	37.5	41.5	44.5	45.5	45.5	41.5	40.5	39.5	36.5	37.5	34.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-1.0	3.0	3.0	6.8	10.1	6.9	6.1	3.5	2.0	1.4	0.4	-0.1	0.0	-0.8	-3.7
Down Track Vib. Level	dB re 10^{-6}in/sec	36.5	44.5	43.5	45.3	47.6	48.4	50.6	49.0	47.5	42.9	40.9	39.4	36.5	36.7	30.9
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		39.5	47.5	46.5	48.3	50.6	51.4	53.6	52.0	50.5	45.9	43.9	42.4	39.5	39.7	33.9
BCF	dB Y/N 0															
BVR-up	dB Floor 1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**55.5**	**63.5**	**62.5**	**64.3**	**66.4**	**66.8**	**68.8**	**67.0**	**65.3**	**59.9**	**56.9**	**54.4**	**50.5**	**50.4**	**44.6**
Predicted Noise Level	**Oct, dB**			**68.3**			**72.3**			**69.7**			**59.4**			**51.4**
L_{max}	**dB(A)**	**56.6**														
$L_{eq,30mins}$	**dB(A)**	**43.6**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	DIH-P1-1
Location:	Upper Wong Tai Sin Estate Phase 3
Assessed Floor	2
Item:	40

Train Speed: 90 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	0	37	37
Down Track	5	28	28

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D002	24	34	37[1]
Down Track	D002	24	20	28[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	37.5	41.5	40.5	38.5	37.5	41.5	44.5	45.5	45.5	41.5	40.5	39.5	36.5	37.5	34.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-3.6	0.1	0.8	4.7	7.8	3.1	2.1	-0.9	-3.6	-4.8	-4.1	-5.2	-4.9	-8.0	-11.4
Up Track Vib. Level	dB re 10^{-6}in/sec	28.9	36.6	36.4	38.2	40.4	39.6	41.6	39.6	37.0	31.7	31.4	29.4	26.7	24.6	18.1
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	37.5	41.5	40.5	38.5	37.5	41.5	44.5	45.5	45.5	41.5	40.5	39.5	36.5	37.5	34.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	9.7	6.6	8.6	9.6	9.6	3.9	4.9	3.7	-3.2	-9.7	-4.2	-5.7	-5.8	-8.8	-10.0
Down Track Vib. Level	dB re 10^{-6}in/sec	42.2	43.1	44.1	43.1	42.1	40.4	44.4	44.2	37.3	26.9	31.3	28.8	25.7	23.8	19.5
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		42.4	43.9	44.8	44.3	44.3	43.0	46.2	45.5	40.2	32.9	34.4	32.1	29.2	27.2	21.9
BCF	dB Y/N 0															
BVR-up	dB Floor 2	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**56.4**	**57.9**	**58.8**	**58.3**	**58.1**	**56.4**	**59.4**	**58.5**	**53.0**	**44.9**	**45.4**	**42.1**	**38.2**	**35.9**	**30.6**
Predicted Noise Level	**Oct, dB**			**63.1**			**62.9**			**59.7**			**47.6**			**37.0**
L_{max}	**dB(A)**	**45.3**														
$L_{eq,30mins}$	**dB(A)**	**32.4**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	DIH-P2-1
Location:	TBA
Assessed Floor	2
Item:	41

Train Speed: 70 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	75	20	78
Down Track	95	20	97

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D002	24	20	78[1]
Down Track	D002	24	20	97[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	35.3	39.3	38.3	36.3	35.3	39.3	42.3	43.3	43.3	39.3	38.3	37.3	34.3	35.3	32.3
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-4.0	-7.2	-12.3	-15.3	-8.1	-21.5	-19.5	-11.7	-25.6	-26.9	-17.4	-14.3	-17.0	-15.4	-18.4
Up Track Vib. Level	dB re 10^{-6}in/sec	26.3	27.1	21.0	16.0	22.2	12.8	17.8	26.6	12.7	7.4	15.9	18.0	12.3	14.9	8.9
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	35.3	39.3	38.3	36.3	35.3	39.3	42.3	43.3	43.3	39.3	38.3	37.3	34.3	35.3	32.3
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-4.0	-7.2	-12.3	-15.3	-8.1	-21.5	-19.5	-11.7	-25.6	-26.9	-17.4	-14.3	-17.0	-15.4	-18.4
Down Track Vib. Level	dB re 10^{-6}in/sec	26.3	27.1	21.0	16.0	22.2	12.8	17.8	26.6	12.7	7.4	15.9	18.0	12.3	14.9	8.9
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		29.3	30.1	24.0	19.0	25.2	15.8	20.8	29.6	15.7	10.4	18.9	21.0	15.3	17.9	11.9
BCF	dB Y/N 0															
BVR-up	dB Floor 2	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**43.3**	**44.1**	**38.0**	**33.0**	**39.0**	**29.2**	**34.0**	**42.6**	**28.5**	**22.4**	**29.9**	**31.0**	**24.3**	**26.6**	**20.6**
Predicted Noise Level	**Oct, dB**			**45.4**			**40.6**			**42.9**			**34.0**			**27.6**
L_{max}	**dB(A)**	**29.7**														
$L_{eq,30mins}$	**dB(A)**	**<20**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	DIH-P2-2
Location:	TBA
Assessed Floor	2
Item:	42

Train Speed: 45 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	0	20	20
Down Track	0	20	20

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D002	24	20	20[1]
Down Track	D002	24	20	20[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	31.5	35.5	34.5	32.5	31.5	35.5	38.5	39.5	39.5	35.5	34.5	33.5	30.5	31.5	28.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	14.6	12.9	14.2	14.1	14.6	15.1	16.5	15.8	14.2	8.3	8.7	4.7	2.3	5.0	5.1
Up Track Vib. Level	dB re 10^{-6}in/sec	41.1	43.4	43.7	41.6	41.1	45.6	50.0	50.3	48.7	38.8	38.2	33.2	27.8	31.5	28.6
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	31.5	35.5	34.5	32.5	31.5	35.5	38.5	39.5	39.5	35.5	34.5	33.5	30.5	31.5	28.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	14.6	12.9	14.2	14.1	14.6	15.1	16.5	15.8	14.2	8.3	8.7	4.7	2.3	5.0	5.1
Down Track Vib. Level	dB re 10^{-6}in/sec	41.1	43.4	43.7	41.6	41.1	45.6	50.0	50.3	48.7	38.8	38.2	33.2	27.8	31.5	28.6
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		44.1	46.4	46.7	44.6	44.1	48.6	53.0	53.3	51.7	41.8	41.2	36.2	30.8	34.5	31.6
BCF	dB Y/N 0															
BVR-up	dB Floor 2	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**58.1**	**60.4**	**60.7**	**58.6**	**57.9**	**62.0**	**66.2**	**66.3**	**64.5**	**53.8**	**52.2**	**46.2**	**39.8**	**43.2**	**40.3**
Predicted Noise Level	**Oct, dB**			**64.8**			**68.1**			**68.7**			**53.4**			**45.0**
L_{max}	**dB(A)**	**53.4**														
$L_{eq,30mins}$	**dB(A)**	**43.5**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	DIH-P2-3
Location:	TBA
Assessed Floor	2
Item:	43

Train Speed: 60 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	0	20	20
Down Track	0	20	20

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D002	24	20	20[1]
Down Track	D002	24	20	20[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.0	38.0	37.0	35.0	34.0	38.0	41.0	42.0	42.0	38.0	37.0	36.0	33.0	34.0	31.0
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	14.6	12.9	14.2	14.1	14.6	15.1	16.5	15.8	14.2	8.3	8.7	4.7	2.3	5.0	5.1
Up Track Vib. Level	dB re 10^{-6}in/sec	43.6	45.9	46.2	44.1	43.6	48.1	52.5	52.8	51.2	41.3	40.7	35.7	30.3	34.0	31.1
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.0	38.0	37.0	35.0	34.0	38.0	41.0	42.0	42.0	38.0	37.0	36.0	33.0	34.0	31.0
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	14.6	12.9	14.2	14.1	14.6	15.1	16.5	15.8	14.2	8.3	8.7	4.7	2.3	5.0	5.1
Down Track Vib. Level	dB re 10^{-6}in/sec	43.6	45.9	46.2	44.1	43.6	48.1	52.5	52.8	51.2	41.3	40.7	35.7	30.3	34.0	31.1
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		46.6	48.9	49.2	47.1	46.6	51.1	55.5	55.8	54.2	44.3	43.7	38.7	33.3	37.0	34.1
BCF	dB Y/N 0															
BVR-up	dB Floor 2	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**60.6**	**62.9**	**63.2**	**61.1**	**60.4**	**64.5**	**68.7**	**68.8**	**67.0**	**56.3**	**54.7**	**48.7**	**42.3**	**45.7**	**42.8**
Predicted Noise Level	**Oct, dB**			**67.3**			**70.6**			**71.2**			**55.9**			**47.5**
L_{max}	**dB(A)**	**55.9**														
$L_{eq,30mins}$	**dB(A)**	**44.7**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	DIH-P2-4
Location:	TBA
Assessed Floor	2
Item:	44

Train Speed: 60 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	30	20	36
Down Track	45	20	49

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D002	24	20	36[1]
Down Track	D002	24	20	49[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.0	38.0	37.0	35.0	34.0	38.0	41.0	42.0	42.0	38.0	37.0	36.0	33.0	34.0	31.0
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	7.6	2.1	2.9	7.7	7.9	-0.4	0.7	-1.4	-12.2	-16.6	-10.2	-8.5	-7.7	-10.6	-12.0
Up Track Vib. Level	dB re 10^{-6}in/sec	36.6	35.1	34.9	37.7	36.9	32.6	36.7	35.6	24.8	16.4	21.8	22.5	20.3	18.4	14.0
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.0	38.0	37.0	35.0	34.0	38.0	41.0	42.0	42.0	38.0	37.0	36.0	33.0	34.0	31.0
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	4.7	-0.4	-2.6	2.0	3.6	-5.8	-9.4	-5.7	-20.4	-20.8	-13.4	-10.5	-11.6	-12.0	-14.7
Down Track Vib. Level	dB re 10^{-6}in/sec	33.7	32.6	29.4	32.0	32.6	27.2	26.6	31.3	16.6	12.2	18.6	20.5	16.4	17.0	11.3
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		38.4	37.0	36.0	38.8	38.3	33.7	37.1	36.9	25.4	17.8	23.5	24.6	21.8	20.8	15.9
BCF	dB Y/N 0															
BVR-up	dB Floor 2	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**52.4**	**51.0**	**50.0**	**52.8**	**52.1**	**47.1**	**50.3**	**49.9**	**38.2**	**29.8**	**34.5**	**34.6**	**30.8**	**29.5**	**24.6**
Predicted Noise Level	**Oct, dB**			**56.2**			**55.1**			**50.3**			**38.4**			**30.7**
L_{max}	**dB(A)**	**36.2**														
$L_{eq,30mins}$	**dB(A)**	**25.0**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	KAT-P1-1
Location:	Residential premises near Kai Tak Station
Assessed Floor	2
Item:	45

Train Speed: 35 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	75	15	76
Down Track	90	17	92

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D018	28	15	76[1]
Down Track	D018	28	15	92[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	29.3	33.3	32.3	30.3	29.3	33.3	36.3	37.3	37.3	33.3	32.3	31.3	28.3	29.3	26.3
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 1	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	15.8	13.8	8.6	1.9	-5.3	-8.4	-13.2	-15.0	-18.4	-17.3	-18.1	-16.2	-16.3	-19.4	-19.6
Up Track Vib. Level	dB re 10^{-6}in/sec	50.1	52.1	45.9	37.2	29.0	29.9	28.1	27.3	23.9	21.0	19.2	20.1	17.0	14.9	11.7
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	29.3	33.3	32.3	30.3	29.3	33.3	36.3	37.3	37.3	33.3	32.3	31.3	28.3	29.3	26.3
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	15.8	13.8	8.6	1.9	-5.3	-8.4	-13.2	-15.0	-18.4	-17.3	-18.1	-16.2	-16.3	-19.4	-19.6
Down Track Vib. Level	dB re 10^{-6}in/sec	40.1	42.1	35.9	27.2	19.0	19.9	18.1	17.3	13.9	11.0	9.2	10.1	7.0	4.9	1.7
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		50.5	52.5	46.3	37.6	29.4	30.3	28.5	27.7	24.3	21.4	19.6	20.5	17.4	15.3	12.1
BCF	dB Y/N 0															
BVR-up	dB Floor 2	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**64.5**	**66.5**	**60.3**	**51.6**	**43.2**	**43.7**	**41.7**	**40.7**	**37.1**	**33.4**	**30.6**	**30.5**	**26.4**	**24.0**	**20.8**
Predicted Noise Level	**Oct, dB**			**67.6**			**47.8**			**42.8**			**34.4**			**25.7**
L_{max}	**dB(A)**	**31.9**														
$L_{eq,30mins}$	**dB(A)**	**23.1**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	KAT-P1-2
Location:	Residential premises near Kai Tak Station
Assessed Floor	2
Item:	46

Train Speed: 50 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	75	15	76
Down Track	90	17	92

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D018	28	15	76[1]
Down Track	D018	28	15	92[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	32.4	36.4	35.4	33.4	32.4	36.4	39.4	40.4	40.4	36.4	35.4	34.4	31.4	32.4	29.4
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	15.8	13.8	8.6	1.9	-5.3	-8.4	-13.2	-15.0	-18.4	-17.3	-18.1	-16.2	-16.3	-19.4	-19.6
Up Track Vib. Level	dB re 10^{-6}in/sec	43.2	45.2	39.0	30.3	22.1	23.0	21.2	20.4	17.0	14.1	12.3	13.2	10.1	8.0	4.8
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	32.4	36.4	35.4	33.4	32.4	36.4	39.4	40.4	40.4	36.4	35.4	34.4	31.4	32.4	29.4
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 1	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	15.8	13.8	8.6	1.9	-5.3	-8.4	-13.2	-15.0	-18.4	-17.3	-18.1	-16.2	-16.3	-19.4	-19.6
Down Track Vib. Level	dB re 10^{-6}in/sec	53.2	55.2	49.0	40.3	32.1	33.0	31.2	30.4	27.0	24.1	22.3	23.2	20.1	18.0	14.8
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		53.6	55.6	49.4	40.7	32.5	33.4	31.6	30.8	27.4	24.5	22.7	23.6	20.5	18.4	15.2
BCF	dB Y/N 0															
BVR-up	dB Floor 2	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**67.6**	**69.6**	**63.4**	**54.7**	**46.3**	**46.8**	**44.8**	**43.8**	**40.2**	**36.5**	**33.7**	**33.6**	**29.5**	**27.1**	**23.9**
Predicted Noise Level	**Oct, dB**			**70.7**			**50.8**			**45.9**			**37.5**			**28.8**
L_{max}	**dB(A)**	**35.0**														
$L_{eq,30mins}$	**dB(A)**	**24.6**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	KAT-P1-3
Location:	Residential premises near Kai Tak Station
Assessed Floor	2
Item:	47

Train Speed: 70 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	55	15	57
Down Track	70	17	72

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D018	28	15	57[1]
Down Track	D018	28	15	72[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	35.3	39.3	38.3	36.3	35.3	39.3	42.3	43.3	43.3	39.3	38.3	37.3	34.3	35.3	32.3
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3
TOC	dB Type 1	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	17.9	15.6	10.0	4.3	-2.1	-6.1	-9.9	-12.3	-15.4	-14.2	-15.2	-12.6	-12.5	-15.9	-16.3
Up Track Vib. Level	dB re 10^{-6}in/sec	60.2	61.9	55.3	47.6	40.2	40.2	39.4	38.0	34.9	32.1	30.1	31.7	28.8	26.4	23.0
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	35.3	39.3	38.3	36.3	35.3	39.3	42.3	43.3	43.3	39.3	38.3	37.3	34.3	35.3	32.3
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	15.8	13.8	8.6	1.9	-5.3	-8.4	-13.2	-15.0	-18.4	-17.3	-18.1	-16.2	-16.3	-19.4	-19.6
Down Track Vib. Level	dB re 10^{-6}in/sec	48.1	50.1	43.9	35.2	27.0	27.9	26.1	25.3	21.9	19.0	17.2	18.1	15.0	12.9	9.7
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		60.5	62.2	55.6	47.9	40.4	40.5	39.6	38.3	35.2	32.3	30.4	31.9	29.0	26.6	23.2
BCF	dB Y/N 0															
BVR-up	dB Floor 2	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**74.5**	**76.2**	**69.6**	**61.9**	**54.2**	**53.9**	**52.8**	**51.3**	**48.0**	**44.3**	**41.4**	**41.9**	**38.0**	**35.3**	**31.9**
Predicted Noise Level	**Oct, dB**			**77.2**			**58.5**			**53.5**			**45.5**			**37.0**
L_{max}	**dB(A)**	**42.6**														
$L_{eq,30mins}$	**dB(A)**	**30.7**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	KAT-P1-4
Location:	Residential premises near Kai Tak Station
Assessed Floor	2
Item:	48

Train Speed: 65 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	80	15	81
Down Track	65	17	67

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D018	28	15	81[1]
Down Track	D018	28	15	67[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.7	38.7	37.7	35.7	34.7	38.7	41.7	42.7	42.7	38.7	37.7	36.7	33.7	34.7	31.7
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	15.8	13.8	8.6	1.9	-5.3	-8.4	-13.2	-15.0	-18.4	-17.3	-18.1	-16.2	-16.3	-19.4	-19.6
Up Track Vib. Level	dB re 10^{-6}in/sec	45.5	47.5	41.3	32.6	24.4	25.3	23.5	22.7	19.3	16.4	14.6	15.5	12.4	10.3	7.1
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.7	38.7	37.7	35.7	34.7	38.7	41.7	42.7	42.7	38.7	37.7	36.7	33.7	34.7	31.7
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	16.5	14.4	9.1	2.7	-4.2	-7.6	-12.1	-14.1	-17.4	-16.3	-17.1	-15.0	-15.0	-18.2	-18.5
Down Track Vib. Level	dB re 10^{-6}in/sec	46.2	48.1	41.8	33.4	25.5	26.1	24.6	23.6	20.3	17.4	15.6	16.7	13.7	11.5	8.2
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		48.9	50.8	44.5	36.0	28.0	28.7	27.1	26.2	22.8	20.0	18.1	19.1	16.1	13.9	10.7
BCF	dB Y/N 0															
BVR-up	dB Floor 2	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**62.9**	**64.8**	**58.5**	**50.0**	**41.8**	**42.1**	**40.3**	**39.2**	**35.6**	**32.0**	**29.1**	**29.1**	**25.1**	**22.6**	**19.4**
Predicted Noise Level	**Oct, dB**			**65.9**			**46.2**			**41.3**			**32.9**			**24.3**
L_{max}	**dB(A)**	**30.4**														
$L_{eq,30mins}$	**dB(A)**	**<20**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	KAT-P1-5
Location:	Residential premises near Kai Tak Station Site 1
Assessed Floor	2
Item:	49

Train Speed: 60 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	10	15	18
Down Track	20	17	26

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D018	28	15	18[1]
Down Track	D018	28	15	26[1]

		Frequency (Hz)														
Description	Unit	20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.0	38.0	37.0	35.0	34.0	38.0	41.0	42.0	42.0	38.0	37.0	36.0	33.0	34.0	31.0
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	20.7	20.8	20.5	21.1	19.3	13.8	11.2	8.9	5.4	1.6	3.0	6.5	4.2	7.2	6.4
Up Track Vib. Level	dB re 10^{-6}in/sec	51.7	55.8	54.5	53.1	50.3	48.8	49.2	47.9	44.4	36.6	37.0	39.5	34.2	38.2	34.4
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.0	38.0	37.0	35.0	34.0	38.0	41.0	42.0	42.0	38.0	37.0	36.0	33.0	34.0	31.0
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	19.4	19.3	17.9	18.3	12.5	2.5	-2.1	-5.3	-8.7	-6.0	-7.5	-2.4	-3.6	-2.9	-6.9
Down Track Vib. Level	dB re 10^{-6}in/sec	50.4	54.3	51.9	50.3	43.5	37.5	35.9	33.7	30.4	29.1	26.5	30.6	26.4	28.1	21.1
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		54.1	58.1	56.4	55.0	51.1	49.1	49.4	48.0	44.5	37.3	37.4	40.0	34.9	38.6	34.6
BCF	dB Y/N 0															
BVR-up	dB Floor 2	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**68.1**	**72.1**	**70.4**	**69.0**	**64.9**	**62.5**	**62.6**	**61.0**	**57.3**	**49.3**	**48.4**	**50.0**	**43.9**	**47.3**	**43.3**
Predicted Noise Level	**Oct, dB**			**75.5**			**68.3**			**62.8**			**52.8**			**48.8**
L_{max}	**dB(A)**	**50.9**														
$L_{eq,30mins}$	**dB(A)**	**39.7**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	KAT-P1-6
Location:	Residential premises near Kai Tak Station Site 1
Assessed Floor	2
Item:	50

Train Speed: 55 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	180	15	181
Down Track	165	17	166

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D018	28	15	181[1]
Down Track	D018	28	15	166[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	33.2	37.2	36.2	34.2	33.2	37.2	40.2	41.2	41.2	37.2	36.2	35.2	32.2	33.2	30.2
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 1	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	15.8	13.8	8.6	1.9	-5.3	-8.4	-13.2	-15.0	-18.4	-17.3	-18.1	-16.2	-16.3	-19.4	-19.6
Up Track Vib. Level	dB re 10^{-6}in/sec	54.0	56.0	49.8	41.1	32.9	33.8	32.0	31.2	27.8	24.9	23.1	24.0	20.9	18.8	15.6
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	33.2	37.2	36.2	34.2	33.2	37.2	40.2	41.2	41.2	37.2	36.2	35.2	32.2	33.2	30.2
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	15.8	13.8	8.6	1.9	-5.3	-8.4	-13.2	-15.0	-18.4	-17.3	-18.1	-16.2	-16.3	-19.4	-19.6
Down Track Vib. Level	dB re 10^{-6}in/sec	44.0	46.0	39.8	31.1	22.9	23.8	22.0	21.2	17.8	14.9	13.1	14.0	10.9	8.8	5.6
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		54.5	56.5	50.3	41.6	33.4	34.3	32.5	31.7	28.3	25.4	23.6	24.5	21.4	19.3	16.1
BCF	dB Y/N 0															
BVR-up	dB Floor 2	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**68.5**	**70.5**	**64.3**	**55.6**	**47.2**	**47.7**	**45.7**	**44.7**	**41.1**	**37.4**	**34.6**	**34.5**	**30.4**	**28.0**	**24.8**
Predicted Noise Level	**Oct, dB**			**71.5**			**51.7**			**46.8**			**38.3**			**29.7**
L_{max}	**dB(A)**	**35.8**														
$L_{eq,30mins}$	**dB(A)**	**25.0**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	KAT-P1-7
Location:	Residential premises near Kai Tak Station
Assessed Floor	2
Item:	51

Train Speed: 75 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	0	15	15
Down Track	0	17	17

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D018	28	15	15[1]
Down Track	D018	28	15	17[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	35.9	39.9	38.9	36.9	35.9	39.9	42.9	43.9	43.9	39.9	38.9	37.9	34.9	35.9	32.9
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	21.1	21.2	20.9	21.5	20.4	15.8	16.0	14.4	10.9	4.8	7.1	9.3	7.2	10.7	12.0
Up Track Vib. Level	dB re 10^{-6}in/sec	52.0	56.1	54.8	53.4	51.3	50.7	53.9	53.3	49.8	39.7	41.0	42.2	37.1	41.6	39.9
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	35.9	39.9	38.9	36.9	35.9	39.9	42.9	43.9	43.9	39.9	38.9	37.9	34.9	35.9	32.9
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	20.9	21.0	20.7	21.3	19.8	14.8	13.6	11.6	8.1	3.2	5.0	7.9	5.7	9.0	9.2
Down Track Vib. Level	dB re 10^{-6}in/sec	51.8	56.0	54.6	53.3	50.8	49.7	51.6	50.6	47.1	38.1	39.0	40.8	35.7	39.9	37.1
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		54.9	59.1	57.7	56.4	54.1	53.3	55.9	55.2	51.7	42.0	43.1	44.6	39.5	43.9	41.8
BCF	dB Y/N 0															
BVR-up	dB Floor 2	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**68.9**	**73.1**	**71.7**	**70.4**	**67.9**	**66.7**	**69.1**	**68.2**	**64.5**	**54.0**	**54.1**	**54.6**	**48.5**	**52.6**	**50.5**
Predicted Noise Level	**Oct, dB**			**76.6**			**72.8**			**69.8**			**57.9**			**54.7**
L_{max}	**dB(A)**	**56.8**														
$L_{eq,30mins}$	**dB(A)**	**44.7**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	TKW-1-1
Location:	Parc 22
Assessed Floor	1
Item:	52

Train Speed: 70 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	85	15	86
Down Track	90	27	94

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D018	28	15	86[1]
Down Track	D002	24	20	94[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	35.3	39.3	38.3	36.3	35.3	39.3	42.3	43.3	43.3	39.3	38.3	37.3	34.3	35.3	32.3
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	15.8	13.8	8.6	1.9	-5.3	-8.4	-13.2	-15.0	-18.4	-17.3	-18.1	-16.2	-16.3	-19.4	-19.6
Up Track Vib. Level	dB re 10^{-6}in/sec	51.1	53.1	46.9	38.2	30.0	30.9	29.1	28.3	24.9	22.0	20.2	21.1	18.0	15.9	12.7
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	35.3	39.3	38.3	36.3	35.3	39.3	42.3	43.3	43.3	39.3	38.3	37.3	34.3	35.3	32.3
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-4.0	-7.2	-12.3	-15.3	-8.1	-21.5	-19.5	-11.7	-25.6	-26.9	-17.4	-14.3	-17.0	-15.4	-18.4
Down Track Vib. Level	dB re 10^{-6}in/sec	31.3	32.1	26.0	21.0	27.2	17.8	22.8	31.6	17.7	12.4	20.9	23.0	17.3	19.9	13.9
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		51.2	53.2	47.0	38.3	31.9	31.1	30.1	33.3	25.7	22.5	23.6	25.2	20.7	21.4	16.4
BCF	dB Y/N 0															
BVR-up	dB Floor 1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**67.2**	**69.2**	**63.0**	**54.3**	**47.7**	**46.5**	**45.3**	**48.3**	**40.5**	**36.5**	**36.6**	**37.2**	**31.7**	**32.1**	**27.1**
Predicted Noise Level	**Oct, dB**			**70.2**			**51.4**			**49.2**			**40.5**			**33.3**
L_{max}	**dB(A)**	**37.1**														
$L_{eq,30mins}$	**dB(A)**	**25.3**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	TKW-1-2
Location:	Sanford Mansion
Assessed Floor	1
Item:	53

Train Speed: 70 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	95	15	96
Down Track	95	27	99

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D018	28	15	96[1]
Down Track	D002	24	20	99[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	35.3	39.3	38.3	36.3	35.3	39.3	42.3	43.3	43.3	39.3	38.3	37.3	34.3	35.3	32.3
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	15.8	13.8	8.6	1.9	-5.3	-8.4	-13.2	-15.0	-18.4	-17.3	-18.1	-16.2	-16.3	-19.4	-19.6
Up Track Vib. Level	dB re 10^{-6}in/sec	51.1	53.1	46.9	38.2	30.0	30.9	29.1	28.3	24.9	22.0	20.2	21.1	18.0	15.9	12.7
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	35.3	39.3	38.3	36.3	35.3	39.3	42.3	43.3	43.3	39.3	38.3	37.3	34.3	35.3	32.3
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-4.0	-7.2	-12.3	-15.3	-8.1	-21.5	-19.5	-11.7	-25.6	-26.9	-17.4	-14.3	-17.0	-15.4	-18.4
Down Track Vib. Level	dB re 10^{-6}in/sec	31.3	32.1	26.0	21.0	27.2	17.8	22.8	31.6	17.7	12.4	20.9	23.0	17.3	19.9	13.9
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		51.2	53.2	47.0	38.3	31.9	31.1	30.1	33.3	25.7	22.5	23.6	25.2	20.7	21.4	16.4
BCF	dB Y/N 0															
BVR-up	dB Floor 1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**67.2**	**69.2**	**63.0**	**54.3**	**47.7**	**46.5**	**45.3**	**48.3**	**40.5**	**36.5**	**36.6**	**37.2**	**31.7**	**32.1**	**27.1**
Predicted Noise Level	**Oct, dB**			**70.2**			**51.4**			**49.2**			**40.5**			**33.3**
L_{max}	**dB(A)**	**37.1**														
$L_{eq,30mins}$	**dB(A)**	**25.3**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	TKW-2-1
Location:	Skytower Tower 1
Assessed Floor	5
Item:	54

Train Speed: 70 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	140	15	141
Down Track	140	27	143

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D018	28	15	141[1]
Down Track	D002	24	20	143[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	35.3	39.3	38.3	36.3	35.3	39.3	42.3	43.3	43.3	39.3	38.3	37.3	34.3	35.3	32.3
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	15.8	13.8	8.6	1.9	-5.3	-8.4	-13.2	-15.0	-18.4	-17.3	-18.1	-16.2	-16.3	-19.4	-19.6
Up Track Vib. Level	dB re 10^{-6}in/sec	51.1	53.1	46.9	38.2	30.0	30.9	29.1	28.3	24.9	22.0	20.2	21.1	18.0	15.9	12.7
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	35.3	39.3	38.3	36.3	35.3	39.3	42.3	43.3	43.3	39.3	38.3	37.3	34.3	35.3	32.3
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-4.0	-7.2	-12.3	-15.3	-8.1	-21.5	-19.5	-11.7	-25.6	-26.9	-17.4	-14.3	-17.0	-15.4	-18.4
Down Track Vib. Level	dB re 10^{-6}in/sec	31.3	32.1	26.0	21.0	27.2	17.8	22.8	31.6	17.7	12.4	20.9	23.0	17.3	19.9	13.9
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		51.2	53.2	47.0	38.3	31.9	31.1	30.1	33.3	25.7	22.5	23.6	25.2	20.7	21.4	16.4
BCF	dB Y/N 0															
BVR-up	dB Floor 5	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**59.2**	**61.2**	**55.0**	**46.3**	**39.7**	**38.5**	**37.3**	**40.3**	**32.5**	**28.5**	**28.6**	**29.2**	**23.7**	**24.1**	**19.1**
Predicted Noise Level	**Oct, dB**			**62.2**			**43.4**			**41.2**			**32.5**			**25.3**
L_{max}	**dB(A)**	**29.1**														
$L_{eq,30mins}$	**dB(A)**	**<20**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	TKW-2-2
Location:	Skytower Tower 2
Assessed Floor	5
Item:	55

Train Speed: 70 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	140	15	141
Down Track	140	27	143

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D018	28	15	141[1]
Down Track	D002	24	20	143[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	35.3	39.3	38.3	36.3	35.3	39.3	42.3	43.3	43.3	39.3	38.3	37.3	34.3	35.3	32.3
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	15.8	13.8	8.6	1.9	-5.3	-8.4	-13.2	-15.0	-18.4	-17.3	-18.1	-16.2	-16.3	-19.4	-19.6
Up Track Vib. Level	dB re 10^{-6}in/sec	51.1	53.1	46.9	38.2	30.0	30.9	29.1	28.3	24.9	22.0	20.2	21.1	18.0	15.9	12.7
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	35.3	39.3	38.3	36.3	35.3	39.3	42.3	43.3	43.3	39.3	38.3	37.3	34.3	35.3	32.3
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-4.0	-7.2	-12.3	-15.3	-8.1	-21.5	-19.5	-11.7	-25.6	-26.9	-17.4	-14.3	-17.0	-15.4	-18.4
Down Track Vib. Level	dB re 10^{-6}in/sec	31.3	32.1	26.0	21.0	27.2	17.8	22.8	31.6	17.7	12.4	20.9	23.0	17.3	19.9	13.9
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		51.2	53.2	47.0	38.3	31.9	31.1	30.1	33.3	25.7	22.5	23.6	25.2	20.7	21.4	16.4
BCF	dB Y/N 0															
BVR-up	dB Floor 5	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**59.2**	**61.2**	**55.0**	**46.3**	**39.7**	**38.5**	**37.3**	**40.3**	**32.5**	**28.5**	**28.6**	**29.2**	**23.7**	**24.1**	**19.1**
Predicted Noise Level	**Oct, dB**			**62.2**			**43.4**			**41.2**			**32.5**			**25.3**
L_{max}	**dB(A)**	**29.1**														
$L_{eq,30mins}$	**dB(A)**	**<20**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	TKW-2-3
Location:	Skytower Tower 7
Assessed Floor	5
Item:	56

Train Speed: 70 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	235	15	235
Down Track	260	27	261

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D018	28	15	235[1]
Down Track	D002	24	20	261[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	35.3	39.3	38.3	36.3	35.3	39.3	42.3	43.3	43.3	39.3	38.3	37.3	34.3	35.3	32.3
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	15.8	13.8	8.6	1.9	-5.3	-8.4	-13.2	-15.0	-18.4	-17.3	-18.1	-16.2	-16.3	-19.4	-19.6
Up Track Vib. Level	dB re 10^{-6}in/sec	46.1	48.1	41.9	33.2	25.0	25.9	24.1	23.3	19.9	17.0	15.2	16.1	13.0	10.9	7.7
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	35.3	39.3	38.3	36.3	35.3	39.3	42.3	43.3	43.3	39.3	38.3	37.3	34.3	35.3	32.3
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-4.0	-7.2	-12.3	-15.3	-8.1	-21.5	-19.5	-11.7	-25.6	-26.9	-17.4	-14.3	-17.0	-15.4	-18.4
Down Track Vib. Level	dB re 10^{-6}in/sec	26.3	27.1	21.0	16.0	22.2	12.8	17.8	26.6	12.7	7.4	15.9	18.0	12.3	14.9	8.9
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		46.2	48.2	42.0	33.3	26.9	26.1	25.1	28.3	20.7	17.5	18.6	20.2	15.7	16.4	11.4
BCF	dB Y/N 0															
BVR-up	dB Floor 5	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**54.2**	**56.2**	**50.0**	**41.3**	**34.7**	**33.5**	**32.3**	**35.3**	**27.5**	**23.5**	**23.6**	**24.2**	**18.7**	**19.1**	**14.1**
Predicted Noise Level	**Oct, dB**			**57.2**			**38.4**			**36.2**			**27.5**			**20.3**
L_{max}	**dB(A)**	**24.1**														
$L_{eq,30mins}$	**dB(A)**	**<20**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	TKW-3-1
Location:	Prince Ritz
Assessed Floor	5
Item:	57

Train Speed: 20 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	235	23	236
Down Track	255	23	256

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D002	24	20	236[1]
Down Track	D002	24	20	256[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	24.5	28.5	27.5	25.5	24.5	28.5	31.5	32.5	32.5	28.5	27.5	26.5	23.5	24.5	21.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-4.0	-7.2	-12.3	-15.3	-8.1	-21.5	-19.5	-11.7	-25.6	-26.9	-17.4	-14.3	-17.0	-15.4	-18.4
Up Track Vib. Level	dB re 10^{-6}in/sec	15.5	16.3	10.2	5.2	11.4	2.0	7.0	15.8	1.9	-3.4	5.1	7.2	1.5	4.1	-1.9
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	24.5	28.5	27.5	25.5	24.5	28.5	31.5	32.5	32.5	28.5	27.5	26.5	23.5	24.5	21.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-4.0	-7.2	-12.3	-15.3	-8.1	-21.5	-19.5	-11.7	-25.6	-26.9	-17.4	-14.3	-17.0	-15.4	-18.4
Down Track Vib. Level	dB re 10^{-6}in/sec	15.5	16.3	10.2	5.2	11.4	2.0	7.0	15.8	1.9	-3.4	5.1	7.2	1.5	4.1	-1.9
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		18.5	19.3	13.2	8.2	14.4	5.0	10.0	18.8	4.9	-0.4	8.1	10.2	4.5	7.1	1.1
BCF	dB Y/N 0															
BVR-up	dB Floor 5	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**26.5**	**27.3**	**21.2**	**16.2**	**22.2**	**12.4**	**17.2**	**25.8**	**11.7**	**5.6**	**13.1**	**14.2**	**7.5**	**9.8**	**3.8**
Predicted Noise Level	**Oct, dB**			**28.5**			**23.7**			**26.0**			**17.2**			**11.1**
L_{max}	**dB(A)**	**12.8**														
$L_{eq,30mins}$	**dB(A)**	**<20**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	TKW-3-2
Location:	Prosperity House
Assessed Floor	2
Item:	58

Train Speed: 45 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	250	23	251
Down Track	270	23	271

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D002	24	20	251[1]
Down Track	D002	24	20	271[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	31.5	35.5	34.5	32.5	31.5	35.5	38.5	39.5	39.5	35.5	34.5	33.5	30.5	31.5	28.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-4.0	-7.2	-12.3	-15.3	-8.1	-21.5	-19.5	-11.7	-25.6	-26.9	-17.4	-14.3	-17.0	-15.4	-18.4
Up Track Vib. Level	dB re 10^{-6}in/sec	22.5	23.3	17.2	12.2	18.4	9.0	14.0	22.8	8.9	3.6	12.1	14.2	8.5	11.1	5.1
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	31.5	35.5	34.5	32.5	31.5	35.5	38.5	39.5	39.5	35.5	34.5	33.5	30.5	31.5	28.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-4.0	-7.2	-12.3	-15.3	-8.1	-21.5	-19.5	-11.7	-25.6	-26.9	-17.4	-14.3	-17.0	-15.4	-18.4
Down Track Vib. Level	dB re 10^{-6}in/sec	22.5	23.3	17.2	12.2	18.4	9.0	14.0	22.8	8.9	3.6	12.1	14.2	8.5	11.1	5.1
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		25.5	26.3	20.2	15.2	21.4	12.0	17.0	25.8	11.9	6.6	15.1	17.2	11.5	14.1	8.1
BCF	dB Y/N 0															
BVR-up	dB Floor 2	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**39.5**	**40.3**	**34.2**	**29.2**	**35.2**	**25.4**	**30.2**	**38.8**	**24.7**	**18.6**	**26.1**	**27.2**	**20.5**	**22.8**	**16.8**
Predicted Noise Level	**Oct, dB**			**41.5**			**36.7**			**39.0**			**30.2**			**23.8**
L_{max}	**dB(A)**	**25.8**														
$L_{eq,30mins}$	**dB(A)**	**<20**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	TKW-P1-1
Location:	Residential premises near To Kwa Wan Station
Assessed Floor	1
Item:	59

Train Speed: 45 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	35	22	41
Down Track	15	22	27

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D002	24	20	41[1]
Down Track	D002	24	20	27[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	31.5	35.5	34.5	32.5	31.5	35.5	38.5	39.5	39.5	35.5	34.5	33.5	30.5	31.5	28.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	6.5	1.0	0.2	6.1	6.6	-2.4	-3.0	-3.9	-17.7	-19.2	-12.5	-9.9	-9.2	-11.4	-13.3
Up Track Vib. Level	dB re 10^{-6}in/sec	33.0	31.5	29.7	33.6	33.1	28.1	30.5	30.6	16.8	11.3	17.0	18.6	16.3	15.1	10.2
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	31.5	35.5	34.5	32.5	31.5	35.5	38.5	39.5	39.5	35.5	34.5	33.5	30.5	31.5	28.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	10.0	7.4	9.3	9.9	9.8	4.5	5.2	4.2	-2.5	-8.7	-3.4	-5.4	-5.6	-8.5	-9.8
Down Track Vib. Level	dB re 10^{-6}in/sec	36.5	37.9	38.8	37.4	36.3	35.0	38.7	38.7	32.0	21.8	26.1	23.1	19.9	18.0	13.7
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		38.1	38.8	39.3	38.9	38.0	35.8	39.3	39.4	32.1	22.2	26.6	24.4	21.5	19.8	15.3
BCF	dB Y/N 0															
BVR-up	dB Floor 1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**54.1**	**54.8**	**55.3**	**54.9**	**53.8**	**51.2**	**54.5**	**54.4**	**46.9**	**36.2**	**39.6**	**36.4**	**32.5**	**30.5**	**26.0**
Predicted Noise Level	**Oct, dB**			**59.8**			**58.2**			**55.1**			**41.8**			**31.8**
L_{max}	**dB(A)**	**40.2**														
$L_{eq,30mins}$	**dB(A)**	**30.3**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	MTW-6-1
Location:	Fok On Building
Assessed Floor	2
Item:	60

Train Speed: 65 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	18	15	23
Down Track	18	27	32

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D018	28	15	23[1]
Down Track	D002	24	20	32[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.7	38.7	37.7	35.7	34.7	38.7	41.7	42.7	42.7	38.7	37.7	36.7	33.7	34.7	31.7
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	19.8	19.9	19.0	19.7	15.6	7.4	1.6	-1.8	-5.2	-4.3	-4.9	0.4	-1.6	0.0	-4.0
Up Track Vib. Level	dB re 10^{-6}in/sec	54.5	58.6	56.7	55.4	50.3	46.1	43.3	40.9	37.5	34.4	32.8	37.0	32.1	34.7	27.7
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.7	38.7	37.7	35.7	34.7	38.7	41.7	42.7	42.7	38.7	37.7	36.7	33.7	34.7	31.7
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	8.5	3.1	5.5	8.6	8.8	1.1	3.5	1.3	-5.9	-13.6	-7.3	-7.0	-6.6	-9.8	-10.8
Down Track Vib. Level	dB re 10^{-6}in/sec	43.2	41.8	43.2	44.3	43.5	39.8	45.2	44.0	36.8	25.1	30.4	29.7	27.1	24.9	20.9
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		54.8	58.7	56.9	55.7	51.1	47.0	47.4	45.7	40.2	34.9	34.8	37.8	33.3	35.2	28.5
BCF	dB Y/N 0															
BVR-up	dB Floor 2	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**68.8**	**72.7**	**70.9**	**69.7**	**64.9**	**60.4**	**60.6**	**58.7**	**53.0**	**46.9**	**45.8**	**47.8**	**42.3**	**43.9**	**37.2**
Predicted Noise Level	**Oct, dB**			**76.0**			**67.3**			**60.0**			**50.6**			**44.7**
L_{max}	**dB(A)**	**48.3**														
$L_{eq,30mins}$	**dB(A)**	**36.8**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	MTW-6-2
Location:	HK Society for the Protection of Children
Assessed Floor	0
Item:	61

Train Speed: 65 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	10	15	18
Down Track	10	27	29

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D018	28	15	18[1]
Down Track	D002	24	20	29[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.7	38.7	37.7	35.7	34.7	38.7	41.7	42.7	42.7	38.7	37.7	36.7	33.7	34.7	31.7
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	20.7	20.8	20.5	21.1	19.3	13.8	11.2	8.9	5.4	1.6	3.0	6.5	4.2	7.2	6.4
Up Track Vib. Level	dB re 10^{-6}in/sec	55.4	59.5	58.2	56.8	54.0	52.5	52.9	51.6	48.1	40.3	40.7	43.2	37.9	41.9	38.1
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.7	38.7	37.7	35.7	34.7	38.7	41.7	42.7	42.7	38.7	37.7	36.7	33.7	34.7	31.7
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	9.4	5.7	7.8	9.4	9.4	3.2	4.5	3.1	-3.9	-10.6	-5.0	-6.0	-6.0	-9.0	-10.2
Down Track Vib. Level	dB re 10^{-6}in/sec	44.1	44.4	45.5	45.0	44.1	41.9	46.2	45.8	38.8	28.1	32.7	30.7	27.7	25.7	21.5
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		55.7	59.7	58.4	57.1	54.4	52.8	53.8	52.6	48.6	40.5	41.3	43.4	38.3	42.0	38.2
BCF	dB Y/N 0															
BVR-up	dB Floor 0	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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**73.7**	**77.7**	**76.4**	**75.1**	**72.2**	**70.2**	**71.0**	**69.6**	**65.4**	**56.5**	**56.3**	**57.4**	**51.3**	**54.7**	**50.9**
Predicted Noise Level	**Oct, dB**			**81.3**			**76.0**			**71.1**			**60.5**			**56.2**
L_{max}	**dB(A)**	**58.7**														
$L_{eq,30mins}$	**dB(A)**	**50[8]**														
Noise Criteria	**dB(A)**	**55[9]**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

[8] A 3dB(A) upward adjustment is made to account for the daytime headway of 22 EMU trains within a 30 minutes period.

[9] Daytime criteria are used for educational buildings, church and temple.

Project: Shatin Central Link Rail Operational GBN Assessment
NSR Ref.: MTW-6-3
Location: Chung Nam Mansion
Assessed Floor 2
Item: 62

Train Speed: 65 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	20	15	25
Down Track	20	27	34

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D018	28	15	25[1]
Down Track	D002	24	20	34[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.7	38.7	37.7	35.7	34.7	38.7	41.7	42.7	42.7	38.7	37.7	36.7	33.7	34.7	31.7
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	19.6	19.5	18.3	18.8	13.6	4.2	-0.9	-4.1	-7.5	-5.4	-6.7	-1.5	-3.0	-2.0	-6.0
Up Track Vib. Level	dB re 10^{-6}in/sec	54.2	58.2	55.9	54.4	48.2	42.8	40.8	38.6	35.2	33.3	31.0	35.2	30.7	32.7	25.7
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.7	38.7	37.7	35.7	34.7	38.7	41.7	42.7	42.7	38.7	37.7	36.7	33.7	34.7	31.7
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	8.0	2.6	4.2	8.2	8.4	0.3	2.1	-0.1	-9.1	-15.1	-8.7	-7.8	-7.2	-10.2	-11.4
Down Track Vib. Level	dB re 10^{-6}in/sec	42.7	41.3	41.9	43.9	43.1	39.0	43.8	42.6	33.6	23.6	29.0	28.9	26.5	24.5	20.3
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		54.5	58.3	56.1	54.8	49.4	44.4	45.6	44.1	37.5	33.7	33.1	36.1	32.1	33.4	26.8
BCF	dB Y/N 0															
BVR-up	dB Floor 2	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**68.5**	**72.3**	**70.1**	**68.8**	**63.2**	**57.8**	**58.8**	**57.1**	**50.3**	**45.7**	**44.1**	**46.1**	**41.1**	**42.1**	**35.5**
Predicted Noise Level	**Oct, dB**			**75.4**			**65.4**			**58.2**			**49.0**			**42.9**
L_{max}	**dB(A)**	**46.6**														
$L_{eq,30mins}$	**dB(A)**	**35.1**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.
[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.
[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.
[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.
[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(
(3dB(A) correction is added to $L_{eq,30mins}$ for leading and trailing effect for conservative approaches.)
[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.
[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	MTW-6-4
Location:	Pok Oi Lau
Assessed Floor	0
Item:	63

Train Speed: 65 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	12	15	19
Down Track	12	27	30

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D018	28	15	19[1]
Down Track	D002	24	20	30[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.7	38.7	37.7	35.7	34.7	38.7	41.7	42.7	42.7	38.7	37.7	36.7	33.7	34.7	31.7
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	20.4	20.7	20.2	21.0	18.7	12.7	8.9	6.1	2.6	0.0	0.9	5.0	2.8	5.5	3.6
Up Track Vib. Level	dB re 10^{-6}in/sec	55.1	59.4	57.9	56.7	53.4	51.4	50.6	48.8	45.3	38.7	38.6	41.7	36.5	40.2	35.3
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.7	38.7	37.7	35.7	34.7	38.7	41.7	42.7	42.7	38.7	37.7	36.7	33.7	34.7	31.7
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	9.1	4.8	7.0	9.1	9.2	2.5	4.2	2.5	-4.6	-11.6	-5.8	-6.4	-6.2	-9.3	-10.4
Down Track Vib. Level	dB re 10^{-6}in/sec	43.8	43.5	44.7	44.8	43.9	41.2	45.9	45.2	38.1	27.1	31.9	30.3	27.5	25.4	21.3
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		55.4	59.5	58.1	56.9	53.9	51.8	51.8	50.4	46.1	39.0	39.5	42.0	37.0	40.3	35.5
BCF	dB Y/N 0															
BVR-up	dB Floor 0	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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**73.4**	**77.5**	**76.1**	**74.9**	**71.7**	**69.2**	**69.0**	**67.4**	**62.9**	**55.0**	**54.5**	**56.0**	**50.0**	**53.0**	**48.2**
Predicted Noise Level	**Oct, dB**			**81.1**			**74.9**			**68.9**			**58.9**			**54.2**
L_{max}	**dB(A)**	**56.9**														
$L_{eq,30mins}$	**dB(A)**	**45.3**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	MTW-7-1
Location:	Geranium House
Assessed Floor	1
Item:	64

Train Speed: 65 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	13	17	21
Down Track	13	28	31

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D018	28	15	21[1]
Down Track	D002	24	20	31[1]

		Frequency (Hz)														
Description	Unit	20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.7	38.7	37.7	35.7	34.7	38.7	41.7	42.7	42.7	38.7	37.7	36.7	33.7	34.7	31.7
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	20.0	20.3	19.8	20.6	17.6	10.7	4.1	0.6	-2.9	-3.2	-3.2	2.2	-0.2	2.0	-2.0
Up Track Vib. Level	dB re 10^{-6}in/sec	54.7	59.0	57.5	56.3	52.3	49.4	45.8	43.3	39.8	35.5	34.5	38.9	33.5	36.7	29.7
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.7	38.7	37.7	35.7	34.7	38.7	41.7	42.7	42.7	38.7	37.7	36.7	33.7	34.7	31.7
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	8.8	4.0	6.3	8.9	9.0	1.8	3.8	1.9	-5.2	-12.6	-6.5	-6.7	-6.4	-9.5	-10.6
Down Track Vib. Level	dB re 10^{-6}in/sec	43.5	42.7	44.0	44.5	43.7	40.5	45.5	44.6	37.5	26.1	31.2	30.0	27.3	25.2	21.1
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		55.0	59.1	57.7	56.6	52.9	49.9	48.7	47.0	41.8	36.0	36.2	39.4	34.4	37.0	30.3
BCF	dB Y/N 0															
BVR-up	dB Floor 1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**71.0**	**75.1**	**73.7**	**72.6**	**68.7**	**65.3**	**63.9**	**62.0**	**56.6**	**50.0**	**49.2**	**51.4**	**45.4**	**47.7**	**41.0**
Predicted Noise Level	**Oct, dB**			**78.7**			**71.2**			**63.3**			**54.1**			**48.5**
L_{max}	**dB(A)**	**51.8**														
$L_{eq,30mins}$	**dB(A)**	**40.3**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	MTW-8-1
Location:	Horae Palace
Assessed Floor	3
Item:	65

Train Speed: 65 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	15	17	23
Down Track	15	28	32

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D018	28	15	23[1]
Down Track	D002	24	20	32[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.7	38.7	37.7	35.7	34.7	38.7	41.7	42.7	42.7	38.7	37.7	36.7	33.7	34.7	31.7
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	19.8	19.9	19.0	19.7	15.6	7.4	1.6	-1.8	-5.2	-4.3	-4.9	0.4	-1.6	0.0	-4.0
Up Track Vib. Level	dB re 10^{-6}in/sec	54.5	58.6	56.7	55.4	50.3	46.1	43.3	40.9	37.5	34.4	32.8	37.0	32.1	34.7	27.7
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.7	38.7	37.7	35.7	34.7	38.7	41.7	42.7	42.7	38.7	37.7	36.7	33.7	34.7	31.7
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	8.5	3.1	5.5	8.6	8.8	1.1	3.5	1.3	-5.9	-13.6	-7.3	-7.0	-6.6	-9.8	-10.8
Down Track Vib. Level	dB re 10^{-6}in/sec	43.2	41.8	43.2	44.3	43.5	39.8	45.2	44.0	36.8	25.1	30.4	29.7	27.1	24.9	20.9
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		54.8	58.7	56.9	55.7	51.1	47.0	47.4	45.7	40.2	34.9	34.8	37.8	33.3	35.2	28.5
BCF	dB Y/N 0															
BVR-up	dB Floor 3	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**66.8**	**70.7**	**68.9**	**67.7**	**62.9**	**58.4**	**58.6**	**56.7**	**51.0**	**44.9**	**43.8**	**45.8**	**40.3**	**41.9**	**35.2**
Predicted Noise Level	**Oct, dB**			**74.0**			**65.3**			**58.0**			**48.6**			**42.7**
L_{max}	**dB(A)**	**46.3**														
$L_{eq,30mins}$	**dB(A)**	**34.8**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	MTW-9-1
Location:	Majestic Park
Assessed Floor	3
Item:	66

Train Speed: 65 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	35	18	39
Down Track	35	30	46

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D012	34	18	39[1]
Down Track	D002	24	20	46[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.7	38.7	37.7	35.7	34.7	38.7	41.7	42.7	42.7	38.7	37.7	36.7	33.7	34.7	31.7
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	19.8	20.7	18.7	15.2	6.4	-3.6	-7.7	-10.7	-15.0	-12.7	-13.4	-6.1	-11.4	-14.5	-15.6
Up Track Vib. Level	dB re 10^{-6}in/sec	54.5	59.4	56.4	50.9	41.1	35.1	34.0	32.0	27.7	26.0	24.3	30.6	22.3	20.2	16.1
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.7	38.7	37.7	35.7	34.7	38.7	41.7	42.7	42.7	38.7	37.7	36.7	33.7	34.7	31.7
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	5.4	0.1	-1.6	3.5	4.7	-4.5	-7.0	-5.0	-19.4	-20.2	-13.1	-10.3	-10.7	-11.8	-14.2
Down Track Vib. Level	dB re 10^{-6}in/sec	40.1	38.8	36.1	39.2	39.4	34.2	34.7	37.7	23.3	18.5	24.6	26.4	23.0	22.9	17.5
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		54.6	59.4	56.5	51.2	43.3	37.6	37.4	38.7	29.0	26.7	27.5	32.0	25.6	24.8	19.9
BCF	dB Y/N 0															
BVR-up	dB Floor 3	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**66.6**	**71.4**	**68.5**	**63.2**	**55.1**	**49.0**	**48.6**	**49.7**	**39.8**	**36.7**	**36.5**	**40.0**	**32.6**	**31.5**	**26.6**
Predicted Noise Level	**Oct, dB**			**73.6**			**56.8**			**50.3**			**42.1**			**32.7**
L_{max}	**dB(A)**	**39.2**														
$L_{eq,30mins}$	**dB(A)**	**27.7**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	MTW-10-1
Location:	18 Farm Road
Assessed Floor	3
Item:	67

Train Speed: 65 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	15	18	23
Down Track	15	30	34

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D012	34	18	23[1]
Down Track	D002	24	20	34[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.7	38.7	37.7	35.7	34.7	38.7	41.7	42.7	42.7	38.7	37.7	36.7	33.7	34.7	31.7
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	25.3	27.0	26.3	26.0	20.1	11.0	3.0	-2.5	-7.6	-9.7	-10.1	-4.3	-9.1	-11.1	-13.0
Up Track Vib. Level	dB re 10^{-6}in/sec	60.0	65.7	64.0	61.7	54.8	49.7	44.7	40.2	35.1	29.0	27.6	32.4	24.6	23.6	18.7
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.7	38.7	37.7	35.7	34.7	38.7	41.7	42.7	42.7	38.7	37.7	36.7	33.7	34.7	31.7
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	8.0	2.6	4.2	8.2	8.4	0.3	2.1	-0.1	-9.1	-15.1	-8.7	-7.8	-7.2	-10.2	-11.4
Down Track Vib. Level	dB re 10^{-6}in/sec	42.7	41.3	41.9	43.9	43.1	39.0	43.8	42.6	33.6	23.6	29.0	28.9	26.5	24.5	20.3
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		60.1	65.7	64.0	61.8	55.1	50.1	47.3	44.6	37.4	30.1	31.3	34.0	28.7	27.1	22.6
BCF	dB Y/N 0															
BVR-up	dB Floor 3	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**72.1**	**77.7**	**76.0**	**73.8**	**66.9**	**61.5**	**58.5**	**55.6**	**48.2**	**40.1**	**40.3**	**42.0**	**35.7**	**33.8**	**29.3**
Predicted Noise Level	**Oct, dB**			**80.9**			**68.4**			**56.4**			**44.8**			**35.1**
L_{max}	**dB(A)**	**46.4**														
$L_{eq,30mins}$	**dB(A)**	**34.8**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	MTW-11-1
Location:	Farm Road Government Primary School
Assessed Floor	0
Item:	68

Train Speed: 65 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	65	18	67
Down Track	65	30	72

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D012	34	18	67[1]
Down Track	D002	24	20	72[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.7	38.7	37.7	35.7	34.7	38.7	41.7	42.7	42.7	38.7	37.7	36.7	33.7	34.7	31.7
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	15.8	13.4	8.6	2.7	-4.2	-7.6	-11.7	-13.6	-17.4	-16.1	-16.7	-8.1	-14.3	-17.6	-18.1
Up Track Vib. Level	dB re 10^{-6}in/sec	50.5	52.1	46.3	38.4	30.5	31.1	30.0	29.1	25.3	22.6	21.0	28.6	19.4	17.1	13.6
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.7	38.7	37.7	35.7	34.7	38.7	41.7	42.7	42.7	38.7	37.7	36.7	33.7	34.7	31.7
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-3.2	-6.3	-11.3	-14.6	-7.5	-19.8	-18.4	-10.7	-24.8	-26.1	-16.7	-13.6	-16.2	-14.7	-17.7
Down Track Vib. Level	dB re 10^{-6}in/sec	31.5	32.4	26.4	21.1	27.2	18.9	23.3	32.0	17.9	12.6	21.0	23.1	17.5	20.0	14.0
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		50.5	52.2	46.3	38.5	32.2	31.3	30.8	33.8	26.0	23.1	24.0	29.7	21.6	21.8	16.8
BCF	dB Y/N 0															
BVR-up	dB Floor 0	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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**68.5**	**70.2**	**64.3**	**56.5**	**50.0**	**48.7**	**48.0**	**50.8**	**42.8**	**39.1**	**39.0**	**43.7**	**34.6**	**34.5**	**29.5**
Predicted Noise Level	**Oct, dB**			**71.3**			**53.8**			**51.7**			**45.3**			**35.7**
L_{max}	**dB(A)**	**40.4**														
$L_{eq,30mins}$	**dB(A)**	**32[8]**														
Noise Criteria	**dB(A)**	**55[9]**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

[8] A 3dB(A) upward adjustment is made to account for the daytime headway of 22 EMU trains within a 30 minutes period.

[9] Daytime criteria are used for educational buildings, church and temple.

Project: Shatin Central Link Rail Operational GBN Assessment
NSR Ref.: MTW-12-1
Location: Yuet Fai Mansion
Assessed Floor 1
Item: 69

Train Speed: 65 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	18	18	25
Down Track	18	30	35

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D012	34	18	25[1]
Down Track	D002	24	20	35[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.7	38.7	37.7	35.7	34.7	38.7	41.7	42.7	42.7	38.7	37.7	36.7	33.7	34.7	31.7
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	24.6	26.4	25.7	25.4	18.8	8.8	1.4	-3.8	-8.8	-10.1	-10.6	-4.5	-9.4	-11.6	-13.3
Up Track Vib. Level	dB re 10^{-6}in/sec	59.3	65.1	63.4	61.1	53.5	47.5	43.1	38.9	33.9	28.6	27.1	32.2	24.3	23.1	18.4
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.7	38.7	37.7	35.7	34.7	38.7	41.7	42.7	42.7	38.7	37.7	36.7	33.7	34.7	31.7
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	7.8	2.3	3.5	8.0	8.2	-0.1	1.4	-0.8	-10.7	-15.8	-9.4	-8.2	-7.5	-10.4	-11.7
Down Track Vib. Level	dB re 10^{-6}in/sec	42.5	41.0	41.2	43.7	42.9	38.6	43.1	41.9	32.0	22.9	28.3	28.5	26.2	24.3	20.0
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		59.4	65.1	63.4	61.2	53.9	48.0	46.1	43.7	36.1	29.6	30.7	33.7	28.4	26.7	22.3
BCF	dB Y/N 0															
BVR-up	dB Floor 1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**75.4**	**81.1**	**79.4**	**77.2**	**69.7**	**63.4**	**61.3**	**58.7**	**50.9**	**43.6**	**43.7**	**45.7**	**39.4**	**37.4**	**33.0**
Predicted Noise Level	**Oct, dB**			**84.3**			**71.1**			**59.5**			**48.4**			**38.8**
L_{max}	**dB(A)**	**49.5**														
$L_{eq,30mins}$	**dB(A)**	**38.0**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.
[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.
[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.
[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.
[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(
(3dB(A) correction is added to $L_{eq,30mins}$ for leading and trailing effect for conservative approaches.)
[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.
[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	MTW-12-2
Location:	Delight Court
Assessed Floor	3
Item:	70

Train Speed: 65 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	18	20	27
Down Track	18	30	35

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D002	24	20	27[1]
Down Track	D002	24	20	35[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.7	38.7	37.7	35.7	34.7	38.7	41.7	42.7	42.7	38.7	37.7	36.7	33.7	34.7	31.7
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	10.0	7.4	9.3	9.9	9.8	4.5	5.2	4.2	-2.5	-8.7	-3.4	-5.4	-5.6	-8.5	-9.8
Up Track Vib. Level	dB re 10^{-6}in/sec	44.7	46.1	47.0	45.5	44.5	43.2	46.9	46.9	40.2	30.0	34.3	31.3	28.1	26.2	21.9
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.7	38.7	37.7	35.7	34.7	38.7	41.7	42.7	42.7	38.7	37.7	36.7	33.7	34.7	31.7
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	7.8	2.3	3.5	8.0	8.2	-0.1	1.4	-0.8	-10.7	-15.8	-9.4	-8.2	-7.5	-10.4	-11.7
Down Track Vib. Level	dB re 10^{-6}in/sec	42.5	41.0	41.2	43.7	42.9	38.6	43.1	41.9	32.0	22.9	28.3	28.5	26.2	24.3	20.0
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		46.7	47.3	48.0	47.7	46.8	44.5	48.4	48.1	40.8	30.8	35.2	33.2	30.3	28.4	24.1
BCF	dB Y/N 0															
BVR-up	dB Floor 3	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**58.7**	**59.3**	**60.0**	**59.7**	**58.6**	**55.9**	**59.6**	**59.1**	**51.6**	**40.8**	**44.2**	**41.2**	**37.3**	**35.1**	**30.8**
Predicted Noise Level	**Oct, dB**			**64.5**			**63.1**			**59.9**			**46.5**			**36.4**
L_{max}	**dB(A)**	**45.0**														
$L_{eq,30mins}$	**dB(A)**	**33.5**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	MTW-12-3
Location:	Lucky Mansion
Assessed Floor	3
Item:	71

Train Speed: 55 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	15	20	25
Down Track	15	30	34

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D002	24	20	25[1]
Down Track	D002	24	20	34[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	33.2	37.2	36.2	34.2	33.2	37.2	40.2	41.2	41.2	37.2	36.2	35.2	32.2	33.2	30.2
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	10.6	9.1	10.8	10.4	10.2	5.9	5.9	5.4	-1.2	-6.7	-1.9	-4.7	-5.2	-8.0	-9.4
Up Track Vib. Level	dB re 10^{-6}in/sec	38.8	41.4	42.1	39.6	38.4	38.2	41.1	41.7	35.1	25.6	29.4	25.5	22.0	20.3	15.8
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	33.2	37.2	36.2	34.2	33.2	37.2	40.2	41.2	41.2	37.2	36.2	35.2	32.2	33.2	30.2
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	8.0	2.6	4.2	8.2	8.4	0.3	2.1	-0.1	-9.1	-15.1	-8.7	-7.8	-7.2	-10.2	-11.4
Down Track Vib. Level	dB re 10^{-6}in/sec	36.3	34.8	35.4	37.4	36.6	32.6	37.3	36.2	27.2	17.2	22.5	22.5	20.1	18.0	13.8
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		40.8	42.2	42.9	41.7	40.6	39.2	42.6	42.7	35.7	26.1	30.2	27.3	24.2	22.3	18.0
BCF	dB Y/N 0															
BVR-up	dB Floor 3	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**52.8**	**54.2**	**54.9**	**53.7**	**52.4**	**50.6**	**53.8**	**53.7**	**46.5**	**36.1**	**39.2**	**35.3**	**31.2**	**29.0**	**24.7**
Predicted Noise Level	**Oct, dB**			**59.1**			**57.3**			**54.6**			**41.1**			**30.4**
L_{max}	**dB(A)**	**39.5**														
$L_{eq,30mins}$	**dB(A)**	**28.7**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	MTW-12-4
Location:	352-354 Ma Tau Wai Road
Assessed Floor	2
Item:	72

Train Speed: 40 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	15	20	25
Down Track	15	30	34

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D002	24	20	25[1]
Down Track	D002	24	20	34[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	30.5	34.5	33.5	31.5	30.5	34.5	37.5	38.5	38.5	34.5	33.5	32.5	29.5	30.5	27.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	10.6	9.1	10.8	10.4	10.2	5.9	5.9	5.4	-1.2	-6.7	-1.9	-4.7	-5.2	-8.0	-9.4
Up Track Vib. Level	dB re 10^{-6}in/sec	36.1	38.6	39.3	36.8	35.7	35.4	38.3	38.9	32.3	22.8	26.6	22.8	19.3	17.5	13.1
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	30.5	34.5	33.5	31.5	30.5	34.5	37.5	38.5	38.5	34.5	33.5	32.5	29.5	30.5	27.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	8.0	2.6	4.2	8.2	8.4	0.3	2.1	-0.1	-9.1	-15.1	-8.7	-7.8	-7.2	-10.2	-11.4
Down Track Vib. Level	dB re 10^{-6}in/sec	33.5	32.1	32.7	34.6	33.8	29.8	34.6	33.4	24.4	14.4	19.7	19.7	17.3	15.3	11.1
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		38.0	39.5	40.2	38.9	37.9	36.5	39.9	40.0	33.0	23.4	27.4	24.5	21.4	19.5	15.2
BCF	dB Y/N 0															
BVR-up	dB Floor 2	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**52.0**	**53.5**	**54.2**	**52.9**	**51.7**	**49.9**	**53.1**	**53.0**	**45.8**	**35.4**	**38.4**	**34.5**	**30.4**	**28.2**	**23.9**
Predicted Noise Level	**Oct, dB**			**58.3**			**56.5**			**53.8**			**40.4**			**29.6**
L_{max}	**dB(A)**	**38.8**														
$L_{eq,30mins}$	**dB(A)**	**29.3**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	MTW-12-5
Location:	Seng Cheong Building
Assessed Floor	1
Item:	73

Train Speed: 50 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	18	17	24
Down Track	18	27	32

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D018	28	15	24[1]
Down Track	D002	24	20	32[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	32.4	36.4	35.4	33.4	32.4	36.4	39.4	40.4	40.4	36.4	35.4	34.4	31.4	32.4	29.4
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	19.7	19.7	18.6	19.2	14.6	5.8	0.4	-2.9	-6.4	-4.9	-5.8	-0.6	-2.3	-1.0	-5.0
Up Track Vib. Level	dB re 10^{-6}in/sec	47.1	51.1	49.1	47.6	42.0	37.2	34.8	32.5	29.1	26.6	24.6	28.8	24.2	26.5	19.5
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	32.4	36.4	35.4	33.4	32.4	36.4	39.4	40.4	40.4	36.4	35.4	34.4	31.4	32.4	29.4
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	8.5	3.1	5.5	8.6	8.8	1.1	3.5	1.3	-5.9	-13.6	-7.3	-7.0	-6.6	-9.8	-10.8
Down Track Vib. Level	dB re 10^{-6}in/sec	35.9	34.5	35.9	37.0	36.2	32.5	37.9	36.7	29.5	17.8	23.1	22.4	19.8	17.6	13.6
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		47.4	51.2	49.3	48.0	43.0	38.5	39.6	38.1	32.3	27.1	26.9	29.7	25.5	27.0	20.5
BCF	dB Y/N 0															
BVR-up	dB Floor 1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**63.4**	**67.2**	**65.3**	**64.0**	**58.8**	**53.9**	**54.8**	**53.1**	**47.1**	**41.1**	**39.9**	**41.7**	**36.5**	**37.7**	**31.2**
Predicted Noise Level	**Oct, dB**			**70.5**			**61.2**			**54.3**			**44.7**			**38.6**
L_{max}	**dB(A)**	**42.4**														
$L_{eq,30mins}$	**dB(A)**	**32.0**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	MTW-12-6
Location:	Great Wall Building
Assessed Floor	3
Item:	74

Train Speed: 65 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	30	18	35
Down Track	30	30	42

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D012	34	18	35[1]
Down Track	D002	24	20	42[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.7	38.7	37.7	35.7	34.7	38.7	41.7	42.7	42.7	38.7	37.7	36.7	33.7	34.7	31.7
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	20.9	23.5	22.5	22.4	12.5	-2.3	-6.5	-10.0	-14.6	-12.3	-13.1	-5.7	-11.0	-14.1	-14.9
Up Track Vib. Level	dB re 10^{-6}in/sec	55.6	62.2	60.2	58.1	47.2	36.4	35.2	32.7	28.1	26.4	24.6	31.0	22.7	20.6	16.8
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.7	38.7	37.7	35.7	34.7	38.7	41.7	42.7	42.7	38.7	37.7	36.7	33.7	34.7	31.7
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	6.2	0.8	-0.2	5.6	6.2	-2.9	-3.8	-4.2	-18.0	-19.4	-12.6	-9.9	-9.5	-11.4	-13.4
Down Track Vib. Level	dB re 10^{-6}in/sec	40.9	39.5	37.5	41.3	40.9	35.8	37.9	38.5	24.7	19.3	25.1	26.8	24.2	23.3	18.3
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		55.7	62.2	60.2	58.2	48.1	39.1	39.8	39.5	29.7	27.2	27.8	32.4	26.5	25.1	20.6
BCF	dB Y/N 0															
BVR-up	dB Floor 3	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**67.7**	**74.2**	**72.2**	**70.2**	**59.9**	**50.5**	**51.0**	**50.5**	**40.5**	**37.2**	**36.8**	**40.4**	**33.5**	**31.8**	**27.3**
Predicted Noise Level	**Oct, dB**			**77.3**			**60.9**			**51.1**			**42.6**			**33.1**
L_{max}	**dB(A)**	**41.8**														
$L_{eq,30mins}$	**dB(A)**	**30.3**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	MTW-12-7
Location:	197-199 Ma Tau Wai Road
Assessed Floor	2
Item:	75

Train Speed: 65 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	15	18	23
Down Track	15	30	34

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D012	34	18	23[1]
Down Track	D002	24	20	34[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.7	38.7	37.7	35.7	34.7	38.7	41.7	42.7	42.7	38.7	37.7	36.7	33.7	34.7	31.7
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	25.3	27.0	26.3	26.0	20.1	11.0	3.0	-2.5	-7.6	-9.7	-10.1	-4.3	-9.1	-11.1	-13.0
Up Track Vib. Level	dB re 10^{-6}in/sec	60.0	65.7	64.0	61.7	54.8	49.7	44.7	40.2	35.1	29.0	27.6	32.4	24.6	23.6	18.7
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.7	38.7	37.7	35.7	34.7	38.7	41.7	42.7	42.7	38.7	37.7	36.7	33.7	34.7	31.7
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	8.0	2.6	4.2	8.2	8.4	0.3	2.1	-0.1	-9.1	-15.1	-8.7	-7.8	-7.2	-10.2	-11.4
Down Track Vib. Level	dB re 10^{-6}in/sec	42.7	41.3	41.9	43.9	43.1	39.0	43.8	42.6	33.6	23.6	29.0	28.9	26.5	24.5	20.3
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		60.1	65.7	64.0	61.8	55.1	50.1	47.3	44.6	37.4	30.1	31.3	34.0	28.7	27.1	22.6
BCF	dB Y/N 0															
BVR-up	dB Floor 2	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**74.1**	**79.7**	**78.0**	**75.8**	**68.9**	**63.5**	**60.5**	**57.6**	**50.2**	**42.1**	**42.3**	**44.0**	**37.7**	**35.8**	**31.3**
Predicted Noise Level	**Oct, dB**			**82.9**			**70.4**			**58.4**			**46.8**			**37.1**
L_{max}	**dB(A)**	**48.4**														
$L_{eq,30mins}$	**dB(A)**	**36.8**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	MTW-12-8
Location:	Pak Tai Mansion
Assessed Floor	1
Item:	76

Train Speed: 65 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	12	18	22
Down Track	12	30	32

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D012	34	18	22[1]
Down Track	D002	24	20	32[1]

		Frequency (Hz)														
Description	Unit	20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.7	38.7	37.7	35.7	34.7	38.7	41.7	42.7	42.7	38.7	37.7	36.7	33.7	34.7	31.7
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	26.0	27.4	26.6	26.2	20.7	12.3	5.7	0.5	-4.6	-8.1	-8.3	-3.5	-8.2	-9.6	-11.2
Up Track Vib. Level	dB re 10^{-6}in/sec	60.6	66.1	64.3	61.9	55.4	50.9	47.4	43.2	38.1	30.6	29.4	33.2	25.5	25.1	20.5
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.7	38.7	37.7	35.7	34.7	38.7	41.7	42.7	42.7	38.7	37.7	36.7	33.7	34.7	31.7
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	8.5	3.1	5.5	8.6	8.8	1.1	3.5	1.3	-5.9	-13.6	-7.3	-7.0	-6.6	-9.8	-10.8
Down Track Vib. Level	dB re 10^{-6}in/sec	43.2	41.8	43.2	44.3	43.5	39.8	45.2	44.0	36.8	25.1	30.4	29.7	27.1	24.9	20.9
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		60.7	66.1	64.4	62.0	55.7	51.3	49.4	46.6	40.5	31.7	32.9	34.8	29.4	28.0	23.7
BCF	dB Y/N 0															
BVR-up	dB Floor 1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**76.7**	**82.1**	**80.4**	**78.0**	**71.5**	**66.7**	**64.6**	**61.6**	**55.3**	**45.7**	**45.9**	**46.8**	**40.4**	**38.7**	**34.4**
Predicted Noise Level	**Oct, dB**			**85.2**			**73.3**			**62.6**			**49.9**			**40.1**
L_{max}	**dB(A)**	**51.5**														
$L_{eq,30mins}$	**dB(A)**	**39.9**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	MTW-12-9
Location:	Residential premises along Hung Kwong Street
Assessed Floor	2
Item:	77

Train Speed: 65 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	12	19	22
Down Track	12	32	34

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D012	34	18	22[1]
Down Track	D002	24	20	34[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.7	38.7	37.7	35.7	34.7	38.7	41.7	42.7	42.7	38.7	37.7	36.7	33.7	34.7	31.7
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	26.0	27.4	26.6	26.2	20.7	12.3	5.7	0.5	-4.6	-8.1	-8.3	-3.5	-8.2	-9.6	-11.2
Up Track Vib. Level	dB re 10^{-6}in/sec	60.6	66.1	64.3	61.9	55.4	50.9	47.4	43.2	38.1	30.6	29.4	33.2	25.5	25.1	20.5
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.7	38.7	37.7	35.7	34.7	38.7	41.7	42.7	42.7	38.7	37.7	36.7	33.7	34.7	31.7
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	8.0	2.6	4.2	8.2	8.4	0.3	2.1	-0.1	-9.1	-15.1	-8.7	-7.8	-7.2	-10.2	-11.4
Down Track Vib. Level	dB re 10^{-6}in/sec	42.7	41.3	41.9	43.9	43.1	39.0	43.8	42.6	33.6	23.6	29.0	28.9	26.5	24.5	20.3
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		60.7	66.1	64.3	62.0	55.6	51.2	49.0	45.9	39.4	31.4	32.2	34.6	29.1	27.8	23.4
BCF	dB Y/N 0															
BVR-up	dB Floor 2	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**74.7**	**80.1**	**78.3**	**76.0**	**69.4**	**64.6**	**62.2**	**58.9**	**52.2**	**43.4**	**43.2**	**44.6**	**38.1**	**36.5**	**32.1**
Predicted Noise Level	**Oct, dB**			**83.2**			**71.2**			**59.9**			**47.5**			**37.9**
L_{max}	**dB(A)**	**49.2**														
$L_{eq,30mins}$	**dB(A)**	**37.6**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	MTW-12-10
Location:	Lucky Building
Assessed Floor	2
Item:	78

Train Speed: 55 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	15	18	23
Down Track	15	28	32

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D012	34	18	23[1]
Down Track	D002	24	20	32[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	33.2	37.2	36.2	34.2	33.2	37.2	40.2	41.2	41.2	37.2	36.2	35.2	32.2	33.2	30.2
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	25.3	27.0	26.3	26.0	20.1	11.0	3.0	-2.5	-7.6	-9.7	-10.1	-4.3	-9.1	-11.1	-13.0
Up Track Vib. Level	dB re 10^{-6}in/sec	53.5	59.2	57.5	55.2	48.3	43.2	38.2	33.7	28.6	22.5	21.1	25.9	18.1	17.1	12.2
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	33.2	37.2	36.2	34.2	33.2	37.2	40.2	41.2	41.2	37.2	36.2	35.2	32.2	33.2	30.2
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	8.5	3.1	5.5	8.6	8.8	1.1	3.5	1.3	-5.9	-13.6	-7.3	-7.0	-6.6	-9.8	-10.8
Down Track Vib. Level	dB re 10^{-6}in/sec	36.7	35.3	36.7	37.8	37.0	33.3	38.7	37.5	30.3	18.6	23.9	23.2	20.6	18.4	14.4
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		53.6	59.3	57.6	55.3	48.7	43.7	41.5	39.1	32.6	24.0	25.8	27.8	22.6	20.9	16.5
BCF	dB Y/N 0															
BVR-up	dB Floor 2	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**67.6**	**73.3**	**71.6**	**69.3**	**62.5**	**57.1**	**54.7**	**52.1**	**45.4**	**36.0**	**36.8**	**37.8**	**31.6**	**29.6**	**25.2**
Predicted Noise Level	**Oct, dB**			**76.4**			**64.1**			**53.0**			**40.9**			**30.9**
L_{max}	**dB(A)**	**42.3**														
$L_{eq,30mins}$	**dB(A)**	**31.4**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	MTW-12-11
Location:	Jing Ming Building
Assessed Floor	2
Item:	79

Train Speed: 50 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	19	20	28
Down Track	19	30	36

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D002	24	20	28[1]
Down Track	D002	24	20	36[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	32.4	36.4	35.4	33.4	32.4	36.4	39.4	40.4	40.4	36.4	35.4	34.4	31.4	32.4	29.4
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	9.7	6.6	8.6	9.6	9.6	3.9	4.9	3.7	-3.2	-9.7	-4.2	-5.7	-5.8	-8.8	-10.0
Up Track Vib. Level	dB re 10^{-6}in/sec	37.1	38.0	39.0	38.0	37.0	35.3	39.3	39.1	32.2	21.8	26.2	23.7	20.6	18.7	14.4
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	32.4	36.4	35.4	33.4	32.4	36.4	39.4	40.4	40.4	36.4	35.4	34.4	31.4	32.4	29.4
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	7.6	2.1	2.9	7.7	7.9	-0.4	0.7	-1.4	-12.2	-16.6	-10.2	-8.5	-7.7	-10.6	-12.0
Down Track Vib. Level	dB re 10^{-6}in/sec	35.0	33.5	33.3	36.2	35.4	31.0	35.1	34.0	23.2	14.8	20.3	20.9	18.7	16.8	12.4
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		39.2	39.3	40.0	40.2	39.3	36.6	40.7	40.2	32.7	22.6	27.2	25.5	22.8	20.8	16.5
BCF	dB Y/N 0															
BVR-up	dB Floor 2	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**53.2**	**53.3**	**54.0**	**54.2**	**53.1**	**50.0**	**53.9**	**53.2**	**45.5**	**34.6**	**38.2**	**35.5**	**31.8**	**29.5**	**25.2**
Predicted Noise Level	**Oct, dB**			**58.6**			**57.4**			**54.0**			**40.7**			**30.9**
L_{max}	**dB(A)**	**39.2**														
$L_{eq,30mins}$	**dB(A)**	**28.8**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	MTW-12-12
Location:	One Elegance
Assessed Floor	3
Item:	80

Train Speed: 65 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	12	18	22
Down Track	12	30	32

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D012	34	18	22[1]
Down Track	D002	24	20	32[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.7	38.7	37.7	35.7	34.7	38.7	41.7	42.7	42.7	38.7	37.7	36.7	33.7	34.7	31.7
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	26.0	27.4	26.6	26.2	20.7	12.3	5.7	0.5	-4.6	-8.1	-8.3	-3.5	-8.2	-9.6	-11.2
Up Track Vib. Level	dB re 10^{-6}in/sec	60.6	66.1	64.3	61.9	55.4	50.9	47.4	43.2	38.1	30.6	29.4	33.2	25.5	25.1	20.5
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.7	38.7	37.7	35.7	34.7	38.7	41.7	42.7	42.7	38.7	37.7	36.7	33.7	34.7	31.7
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	8.5	3.1	5.5	8.6	8.8	1.1	3.5	1.3	-5.9	-13.6	-7.3	-7.0	-6.6	-9.8	-10.8
Down Track Vib. Level	dB re 10^{-6}in/sec	43.2	41.8	43.2	44.3	43.5	39.8	45.2	44.0	36.8	25.1	30.4	29.7	27.1	24.9	20.9
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		60.7	66.1	64.4	62.0	55.7	51.3	49.4	46.6	40.5	31.7	32.9	34.8	29.4	28.0	23.7
BCF	dB Y/N 0															
BVR-up	dB Floor 3	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**72.7**	**78.1**	**76.4**	**74.0**	**67.5**	**62.7**	**60.6**	**57.6**	**51.3**	**41.7**	**41.9**	**42.8**	**36.4**	**34.7**	**30.4**
Predicted Noise Level	**Oct, dB**			**81.2**			**69.3**			**58.6**			**45.9**			**36.1**
L_{max}	**dB(A)**	**47.5**														
$L_{eq,30mins}$	**dB(A)**	**35.9**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	MTW-13-1
Location:	Cheung Chuk Shan Memorial School
Assessed Floor	0
Item:	81

Train Speed: 65 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	10	20	22
Down Track	10	30	32

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D002	24	20	22[1]
Down Track	D002	24	20	32[1]

		Frequency (Hz)														
Description	Unit	20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.7	38.7	37.7	35.7	34.7	38.7	41.7	42.7	42.7	38.7	37.7	36.7	33.7	34.7	31.7
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	12.8	11.5	12.9	12.4	12.5	10.9	11.4	10.9	6.9	1.3	3.8	0.2	-1.4	-1.4	-2.1
Up Track Vib. Level	dB re 10^{-6}in/sec	42.4	45.1	45.6	43.0	42.2	44.5	48.0	48.6	44.5	35.0	36.5	31.8	27.3	28.3	24.6
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.7	38.7	37.7	35.7	34.7	38.7	41.7	42.7	42.7	38.7	37.7	36.7	33.7	34.7	31.7
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	8.5	3.1	5.5	8.6	8.8	1.1	3.5	1.3	-5.9	-13.6	-7.3	-7.0	-6.6	-9.8	-10.8
Down Track Vib. Level	dB re 10^{-6}in/sec	38.2	36.8	38.2	39.3	38.5	34.8	40.2	39.0	31.8	20.1	25.4	24.7	22.1	19.9	15.9
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		43.8	45.7	46.3	44.6	43.7	45.0	48.7	49.0	44.8	35.1	36.8	32.6	28.5	28.9	25.2
BCF	dB Y/N 0															
BVR-up	dB Floor 0	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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**61.8**	**63.7**	**64.3**	**62.6**	**61.5**	**62.4**	**65.9**	**66.0**	**61.6**	**51.1**	**51.8**	**46.6**	**41.5**	**41.6**	**37.9**
Predicted Noise Level	**Oct, dB**			**68.4**			**68.5**			**67.5**			**53.3**			**43.2**
L_{max}	**dB(A)**	**52.2**														
$L_{eq,30mins}$	**dB(A)**	**44[8]**														
Noise Criteria	**dB(A)**	**55[9]**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

[8] A 3dB(A) upward adjustment is made to account for the daytime headway of 22 EMU trains within a 30 minutes period.

[9] Daytime criteria are used for educational buildings, church and temple.

Project: Shatin Central Link Rail Operational GBN Assessment
NSR Ref.: MTW-14-1
Location: PLK Lam Man Chan English Primary School
Assessed Floor 1
Item: 82

Train Speed: 55 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	35	20	40
Down Track	35	30	46

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D002	24	20	40[1]
Down Track	D002	24	20	46[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	33.2	37.2	36.2	34.2	33.2	37.2	40.2	41.2	41.2	37.2	36.2	35.2	32.2	33.2	30.2
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	6.7	1.1	0.6	6.6	6.9	-2.0	-2.2	-3.7	-17.3	-19.0	-12.4	-9.8	-8.9	-11.3	-13.1
Up Track Vib. Level	dB re 10^{-6}in/sec	34.9	33.4	31.8	35.8	35.2	30.2	33.0	32.5	18.9	13.2	18.8	20.5	18.3	17.0	12.2
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	33.2	37.2	36.2	34.2	33.2	37.2	40.2	41.2	41.2	37.2	36.2	35.2	32.2	33.2	30.2
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	5.4	0.1	-1.6	3.5	4.7	-4.5	-7.0	-5.0	-19.4	-20.2	-13.1	-10.3	-10.7	-11.8	-14.2
Down Track Vib. Level	dB re 10^{-6}in/sec	33.6	32.4	29.7	32.8	33.0	27.7	28.2	31.2	16.9	12.0	18.2	20.0	16.5	16.5	11.1
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		37.3	35.9	33.9	37.6	37.2	32.2	34.3	34.9	21.0	15.7	21.5	23.2	20.5	19.7	14.7
BCF	dB Y/N 0															
BVR-up	dB Floor 1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**53.3**	**51.9**	**49.9**	**53.6**	**53.0**	**47.6**	**49.5**	**49.9**	**35.8**	**29.7**	**34.5**	**35.2**	**31.5**	**30.4**	**25.4**
Predicted Noise Level	**Oct, dB**			**56.8**			**55.4**			**50.1**			**38.8**			**31.6**
L_{max}	**dB(A)**	**36.4**														
$L_{eq,30mins}$	**dB(A)**	**29[8]**														
Noise Criteria	**dB(A)**	**55[9]**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.
[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.
[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.
[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.
[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(
(3dB(A) correction is added to $L_{eq,30mins}$ for leading and trailing effect for conservative approaches.)
[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.
[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.
[8] A 3dB(A) upward adjustment is made to account for the daytime headway of 22 EMU trains within a 30 minutes period.

[9] Daytime criteria are used for educational buildings, church and temple.

Project: Shatin Central Link Rail Operational GBN Assessment
NSR Ref.: MTW-15-1
Location: Hung Hom Lutheran Primary School
Assessed Floor 0
Item: 83

Train Speed: 50 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	10	20	22
Down Track	10	30	32

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D002	24	20	22[1]
Down Track	D002	24	20	32[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	32.4	36.4	35.4	33.4	32.4	36.4	39.4	40.4	40.4	36.4	35.4	34.4	31.4	32.4	29.4
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	12.8	11.5	12.9	12.4	12.5	10.9	11.4	10.9	6.9	1.3	3.8	0.2	-1.4	-1.4	-2.1
Up Track Vib. Level	dB re 10^{-6}in/sec	40.2	42.9	43.3	40.8	39.9	42.3	45.8	46.3	42.3	32.7	34.2	29.6	25.1	26.1	22.4
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	32.4	36.4	35.4	33.4	32.4	36.4	39.4	40.4	40.4	36.4	35.4	34.4	31.4	32.4	29.4
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	8.5	3.1	5.5	8.6	8.8	1.1	3.5	1.3	-5.9	-13.6	-7.3	-7.0	-6.6	-9.8	-10.8
Down Track Vib. Level	dB re 10^{-6}in/sec	35.9	34.5	35.9	37.0	36.2	32.5	37.9	36.7	29.5	17.8	23.1	22.4	19.8	17.6	13.6
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		41.6	43.5	44.0	42.3	41.5	42.7	46.4	46.8	42.5	32.9	34.5	30.3	26.2	26.6	22.9
BCF	dB Y/N 0															
BVR-up	dB Floor 0	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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**59.6**	**61.5**	**62.0**	**60.3**	**59.3**	**60.1**	**63.6**	**63.8**	**59.3**	**48.9**	**49.5**	**44.3**	**39.2**	**39.3**	**35.6**
Predicted Noise Level	**Oct, dB**			**66.1**			**66.2**			**65.2**			**51.0**			**40.9**
L_{max}	**dB(A)**	**50.0**														
$L_{eq,30mins}$	**dB(A)**	**43[8]**														
Noise Criteria	**dB(A)**	**55[9]**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.
[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.
[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.
[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.
[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(
(3dB(A) correction is added to $L_{eq,30mins}$ for leading and trailing effect for conservative approaches.)
[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.
[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.
[8] A 3dB(A) upward adjustment is made to account for the daytime headway of 22 EMU trains within a 30 minutes period.

[9] Daytime criteria are used for educational buildings, church and temple.

Project: Shatin Central Link Rail Operational GBN Assessment
NSR Ref.: MTW-16-1
Location: SKH Good Shepherd Primary School
Assessed Floor 0
Item: 84

Train Speed: 45 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	10	20	22
Down Track	10	30	32

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D002	24	20	22[1]
Down Track	D002	24	20	32[1]

		Frequency (Hz)														
Description	Unit	20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	31.5	35.5	34.5	32.5	31.5	35.5	38.5	39.5	39.5	35.5	34.5	33.5	30.5	31.5	28.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	12.8	11.5	12.9	12.4	12.5	10.9	11.4	10.9	6.9	1.3	3.8	0.2	-1.4	-1.4	-2.1
Up Track Vib. Level	dB re 10^{-6}in/sec	39.3	42.0	42.4	39.9	39.0	41.4	44.9	45.4	41.4	31.8	33.3	28.7	24.2	25.2	21.5
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	31.5	35.5	34.5	32.5	31.5	35.5	38.5	39.5	39.5	35.5	34.5	33.5	30.5	31.5	28.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	8.5	3.1	5.5	8.6	8.8	1.1	3.5	1.3	-5.9	-13.6	-7.3	-7.0	-6.6	-9.8	-10.8
Down Track Vib. Level	dB re 10^{-6}in/sec	35.0	33.6	35.0	36.1	35.3	31.6	37.0	35.8	28.6	16.9	22.2	21.5	18.9	16.7	12.7
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		40.6	42.5	43.1	41.4	40.5	41.8	45.5	45.9	41.6	31.9	33.6	29.4	25.3	25.7	22.0
BCF	dB Y/N 0															
BVR-up	dB Floor 0	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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**58.6**	**60.5**	**61.1**	**59.4**	**58.3**	**59.2**	**62.7**	**62.9**	**58.4**	**47.9**	**48.6**	**43.4**	**38.3**	**38.4**	**34.7**
Predicted Noise Level	**Oct, dB**			**65.2**			**65.3**			**64.3**			**50.1**			**40.0**
L_{max}	**dB(A)**	**49.0**														
$L_{eq,30mins}$	**dB(A)**	**42[8]**														
Noise Criteria	**dB(A)**	**55[9]**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.
[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.
[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.
[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.
[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(
(3dB(A) correction is added to $L_{eq,30mins}$ for leading and trailing effect for conservative approaches.)
[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.
[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.
[8] A 3dB(A) upward adjustment is made to account for the daytime headway of 22 EMU trains within a 30 minutes period.

[9] Daytime criteria are used for educational buildings, church and temple.

Project: Shatin Central Link Rail Operational GBN Assessment
NSR Ref.: MTW-17-1
Location: Loyal Mansion
Assessed Floor 3
Item: 85

Train Speed: 55 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	20	17	26
Down Track	20	28	34

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D018	28	15	26[1]
Down Track	D002	24	20	34[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	33.2	37.2	36.2	34.2	33.2	37.2	40.2	41.2	41.2	37.2	36.2	35.2	32.2	33.2	30.2
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	19.4	19.3	17.9	18.3	12.5	2.5	-2.1	-5.3	-8.7	-6.0	-7.5	-2.4	-3.6	-2.9	-6.9
Up Track Vib. Level	dB re 10^{-6}in/sec	52.7	56.5	54.1	52.5	45.8	39.8	38.2	36.0	32.6	31.3	28.7	32.8	28.6	30.3	23.3
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	33.2	37.2	36.2	34.2	33.2	37.2	40.2	41.2	41.2	37.2	36.2	35.2	32.2	33.2	30.2
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	8.0	2.6	4.2	8.2	8.4	0.3	2.1	-0.1	-9.1	-15.1	-8.7	-7.8	-7.2	-10.2	-11.4
Down Track Vib. Level	dB re 10^{-6}in/sec	41.3	39.8	40.4	42.4	41.6	37.6	42.3	41.2	32.2	22.2	27.5	27.5	25.1	23.0	18.8
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		53.0	56.6	54.3	52.9	47.2	41.8	43.7	42.3	35.4	31.8	31.2	33.9	30.2	31.1	24.6
BCF	dB Y/N 0															
BVR-up	dB Floor 3	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**65.0**	**68.6**	**66.3**	**64.9**	**59.0**	**53.2**	**54.9**	**53.3**	**46.2**	**41.8**	**40.2**	**41.9**	**37.2**	**37.8**	**31.3**
Predicted Noise Level	**Oct, dB**			**71.7**			**61.2**			**54.3**			**45.0**			**38.6**
L_{max}	**dB(A)**	**42.6**														
$L_{eq,30mins}$	**dB(A)**	**31.8**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.
[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.
[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.
[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.
[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(
(3dB(A) correction is added to $L_{eq,30mins}$ for leading and trailing effect for conservative approaches.)
[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.
[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	MTW-18-1
Location:	Residential premises along Chi Kiang St
Assessed Floor	2
Item:	86

Train Speed: 50 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	45	17	48
Down Track	45	27	52

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D018	28	15	48[1]
Down Track	D002	24	20	52[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	32.4	36.4	35.4	33.4	32.4	36.4	39.4	40.4	40.4	36.4	35.4	34.4	31.4	32.4	29.4
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	18.4	16.4	11.1	4.9	-1.7	-5.3	-9.1	-11.7	-15.2	-13.7	-14.1	-11.9	-11.9	-15.2	-16.1
Up Track Vib. Level	dB re 10^{-6}in/sec	45.9	47.8	41.5	33.3	25.7	26.1	25.3	23.7	20.2	17.8	16.3	17.5	14.5	12.2	8.3
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	32.4	36.4	35.4	33.4	32.4	36.4	39.4	40.4	40.4	36.4	35.4	34.4	31.4	32.4	29.4
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	3.1	-1.4	-4.3	-2.7	0.7	-8.5	-11.1	-6.3	-20.9	-21.6	-13.7	-10.7	-12.1	-12.1	-14.9
Down Track Vib. Level	dB re 10^{-6}in/sec	30.5	30.0	26.1	25.7	28.1	22.9	23.3	29.1	14.5	9.8	16.7	18.7	14.3	15.3	9.5
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		46.0	47.9	41.6	34.0	30.1	27.8	27.4	30.2	21.2	18.4	19.5	21.2	17.4	17.0	11.9
BCF	dB Y/N 0															
BVR-up	dB Floor 2	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**60.0**	**61.9**	**55.6**	**48.0**	**43.9**	**41.2**	**40.6**	**43.2**	**34.0**	**30.4**	**30.5**	**31.2**	**26.4**	**25.7**	**20.6**
Predicted Noise Level	**Oct, dB**			**63.0**			**46.9**			**43.9**			**34.6**			**26.9**
L_{max}	**dB(A)**	**31.2**														
$L_{eq,30mins}$	**dB(A)**	**20.8**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	MTW-18-2
Location:	No. 2 Kowloon City Road
Assessed Floor	2
Item:	87

Train Speed: 50 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	28	17	33
Down Track	28	27	39

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D018	28	15	33[1]
Down Track	D002	24	20	39[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	32.4	36.4	35.4	33.4	32.4	36.4	39.4	40.4	40.4	36.4	35.4	34.4	31.4	32.4	29.4
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	19.0	17.8	14.1	9.6	2.6	-3.9	-7.5	-10.2	-13.3	-9.1	-11.3	-6.7	-7.2	-7.6	-11.5
Up Track Vib. Level	dB re 10^{-6}in/sec	46.4	49.2	44.5	38.0	30.0	27.5	26.9	25.2	22.1	22.3	19.1	22.7	19.2	19.8	12.9
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	32.4	36.4	35.4	33.4	32.4	36.4	39.4	40.4	40.4	36.4	35.4	34.4	31.4	32.4	29.4
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	6.9	1.3	0.9	7.1	7.3	-1.6	-1.4	-3.5	-17.0	-18.8	-12.3	-9.7	-8.6	-11.2	-12.9
Down Track Vib. Level	dB re 10^{-6}in/sec	34.3	32.7	31.3	35.5	34.7	29.8	33.0	31.9	18.4	12.6	18.1	19.7	17.8	16.2	11.5
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		46.6	49.3	44.7	40.0	36.0	31.8	34.0	32.8	23.7	22.8	21.7	24.5	21.6	21.4	15.3
BCF	dB Y/N 0															
BVR-up	dB Floor 2	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**60.6**	**63.3**	**58.7**	**54.0**	**49.8**	**45.2**	**47.2**	**45.8**	**36.5**	**34.8**	**32.7**	**34.5**	**30.6**	**30.1**	**24.0**
Predicted Noise Level	**Oct, dB**			**64.9**			**52.6**			**46.5**			**37.6**			**31.1**
L_{max}	**dB(A)**	**34.9**														
$L_{eq,30mins}$	**dB(A)**	**24.4**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	MTW-19-1
Location:	Holy Trinity Church
Assessed Floor	0
Item:	88

Train Speed: 55 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	55	18	58
Down Track	65	25	70

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D012	34	18	58[1]
Down Track	D002	24	20	70[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	33.2	37.2	36.2	34.2	33.2	37.2	40.2	41.2	41.2	37.2	36.2	35.2	32.2	33.2	30.2
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	17.2	15.0	9.9	4.0	-2.9	-6.3	-10.1	-12.3	-15.9	-14.6	-15.2	-7.2	-12.8	-16.1	-16.8
Up Track Vib. Level	dB re 10^{-6}in/sec	50.4	52.2	46.1	38.3	30.4	30.9	30.1	29.0	25.3	22.6	21.1	28.1	19.4	17.1	13.5
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	33.2	37.2	36.2	34.2	33.2	37.2	40.2	41.2	41.2	37.2	36.2	35.2	32.2	33.2	30.2
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-2.7	-5.9	-10.8	-14.2	-7.1	-19.0	-17.8	-10.3	-24.4	-25.6	-16.4	-13.2	-15.7	-14.4	-17.4
Down Track Vib. Level	dB re 10^{-6}in/sec	30.5	31.3	25.4	20.0	26.1	18.2	22.4	31.0	16.8	11.6	19.8	22.0	16.5	18.8	12.8
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		50.5	52.3	46.2	38.3	31.8	31.1	30.8	33.1	25.9	22.9	23.5	29.0	21.2	21.1	16.2
BCF	dB Y/N 0															
BVR-up	dB Floor 0	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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**68.5**	**70.3**	**64.2**	**56.3**	**49.6**	**48.5**	**48.0**	**50.1**	**42.7**	**38.9**	**38.5**	**43.0**	**34.2**	**33.8**	**28.9**
Predicted Noise Level	**Oct, dB**			**71.4**			**53.5**			**51.1**			**44.7**			**35.0**
L_{max}	**dB(A)**	**39.9**														
$L_{eq,30mins}$	**dB(A)**	**29.1**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	HOM-1-1
Location:	Ko Shan Theartre
Assessed Floor	0
Item:	89

Train Speed: 55 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	50	35	61
Down Track	50	40	64

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D002	24	34	61[1]
Down Track	D018	28	40	64[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	33.2	37.2	36.2	34.2	33.2	37.2	40.2	41.2	41.2	37.2	36.2	35.2	32.2	33.2	30.2
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-7.8	-8.3	-11.1	-10.1	-5.6	-13.8	-15.1	-9.9	-20.5	-20.5	-19.7	-11.9	-14.1	-13.8	-15.4
Up Track Vib. Level	dB re 10^{-6}in/sec	25.5	29.0	25.1	24.2	27.6	23.5	25.1	31.4	20.7	16.8	16.6	23.4	18.1	19.4	14.9
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	33.2	37.2	36.2	34.2	33.2	37.2	40.2	41.2	41.2	37.2	36.2	35.2	32.2	33.2	30.2
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	2.8	-2.6	-3.2	-4.8	-2.1	-5.0	-1.6	-13.3	-12.4	-13.3	-16.6	-10.5	-11.5	-16.1	-15.3
Down Track Vib. Level	dB re 10^{-6}in/sec	36.0	34.6	33.1	29.4	31.1	32.3	38.6	28.0	28.9	24.0	19.6	24.8	20.8	17.1	15.0
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		36.4	35.7	33.7	30.5	32.7	32.8	38.8	33.0	29.5	24.7	21.4	27.1	22.7	21.4	17.9
BCF	dB Y/N 0															
BVR-up	dB Floor 0	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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**54.4**	**53.7**	**51.7**	**48.5**	**50.5**	**50.2**	**56.0**	**50.0**	**46.3**	**40.7**	**36.4**	**41.1**	**35.7**	**34.1**	**30.6**
Predicted Noise Level	**Oct, dB**			**56.6**			**57.9**			**51.9**			**43.2**			**35.7**
L_{max}	**dB(A)**	**40.5**														
$L_{eq,30mins}$	**dB(A)**	**29.7**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	HOM-2-1
Location:	Faerie Court
Assessed Floor	2
Item:	90

Train Speed: 55 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	20	18	27
Down Track	20	29	35

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D012	34	18	27[1]
Down Track	D002	24	20	35[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	33.2	37.2	36.2	34.2	33.2	37.2	40.2	41.2	41.2	37.2	36.2	35.2	32.2	33.2	30.2
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	23.8	25.8	25.0	24.8	17.6	6.6	-0.2	-5.0	-9.9	-10.6	-11.1	-4.8	-9.7	-12.1	-13.6
Up Track Vib. Level	dB re 10^{-6}in/sec	57.1	63.1	61.3	59.0	50.8	43.8	40.1	36.2	31.3	26.7	25.1	30.5	22.5	21.1	16.6
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	33.2	37.2	36.2	34.2	33.2	37.2	40.2	41.2	41.2	37.2	36.2	35.2	32.2	33.2	30.2
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	7.8	2.3	3.5	8.0	8.2	-0.1	1.4	-0.8	-10.7	-15.8	-9.4	-8.2	-7.5	-10.4	-11.7
Down Track Vib. Level	dB re 10^{-6}in/sec	41.1	39.6	39.8	42.2	41.4	37.2	41.6	40.5	30.6	21.4	26.8	27.1	24.8	22.8	18.5
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		57.2	63.1	61.3	59.1	51.3	44.7	43.9	41.9	34.0	27.8	29.1	32.1	26.8	25.1	20.7
BCF	dB Y/N 0															
BVR-up	dB Floor 2	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**71.2**	**77.1**	**75.3**	**73.1**	**65.1**	**58.1**	**57.1**	**54.9**	**46.8**	**39.8**	**40.1**	**42.1**	**35.8**	**33.8**	**29.4**
Predicted Noise Level	**Oct, dB**			**80.2**			**66.4**			**55.6**			**44.8**			**35.1**
L_{max}	**dB(A)**	**45.4**														
$L_{eq,30mins}$	**dB(A)**	**34.6**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	HOM-2-2
Location:	Lee Wing Building
Assessed Floor	2
Item:	91

Train Speed: 55 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	0	19	19
Down Track	0	30	30

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D012	34	18	19[1]
Down Track	D002	24	20	30[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	33.2	37.2	36.2	34.2	33.2	37.2	40.2	41.2	41.2	37.2	36.2	35.2	32.2	33.2	30.2
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	27.9	28.5	27.6	26.9	22.5	16.0	13.7	9.4	4.3	-3.1	-2.8	-1.1	-5.4	-5.1	-5.8
Up Track Vib. Level	dB re 10^{-6}in/sec	61.1	65.7	63.8	61.1	55.7	53.2	53.9	50.6	45.5	34.1	33.4	34.1	26.8	28.1	24.4
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	33.2	37.2	36.2	34.2	33.2	37.2	40.2	41.2	41.2	37.2	36.2	35.2	32.2	33.2	30.2
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	9.1	4.8	7.0	9.1	9.2	2.5	4.2	2.5	-4.6	-11.6	-5.8	-6.4	-6.2	-9.3	-10.4
Down Track Vib. Level	dB re 10^{-6}in/sec	42.3	42.1	43.3	43.3	42.4	39.7	44.4	43.7	36.7	25.6	30.5	28.9	26.0	24.0	19.8
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		61.2	65.8	63.9	61.2	55.9	53.4	54.4	51.4	46.1	34.7	35.2	35.3	29.5	29.6	25.7
BCF	dB Y/N 0															
BVR-up	dB Floor 2	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**75.2**	**79.8**	**77.9**	**75.2**	**69.7**	**66.8**	**67.6**	**64.4**	**58.9**	**46.7**	**46.2**	**45.3**	**38.5**	**38.3**	**34.4**
Predicted Noise Level	**Oct, dB**			**82.8**			**73.0**			**65.6**			**49.2**			**39.8**
L_{max}	**dB(A)**	**52.1**														
$L_{eq,30mins}$	**dB(A)**	**41.3**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	HOM-2-3
Location:	Wing Lam Mansion
Assessed Floor	2
Item:	92

Train Speed: 55 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	15	20	25
Down Track	15	30	34

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D002	24	20	25[1]
Down Track	D002	24	20	34[1]

		Frequency (Hz)														
Description	Unit	20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	33.2	37.2	36.2	34.2	33.2	37.2	40.2	41.2	41.2	37.2	36.2	35.2	32.2	33.2	30.2
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	10.6	9.1	10.8	10.4	10.2	5.9	5.9	5.4	-1.2	-6.7	-1.9	-4.7	-5.2	-8.0	-9.4
Up Track Vib. Level	dB re 10^{-6}in/sec	43.8	46.4	47.1	44.6	43.4	43.2	46.1	46.7	40.1	30.6	34.4	30.5	27.0	25.3	20.8
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	33.2	37.2	36.2	34.2	33.2	37.2	40.2	41.2	41.2	37.2	36.2	35.2	32.2	33.2	30.2
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	8.0	2.6	4.2	8.2	8.4	0.3	2.1	-0.1	-9.1	-15.1	-8.7	-7.8	-7.2	-10.2	-11.4
Down Track Vib. Level	dB re 10^{-6}in/sec	41.3	39.8	40.4	42.4	41.6	37.6	42.3	41.2	32.2	22.2	27.5	27.5	25.1	23.0	18.8
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		45.8	47.2	47.9	46.7	45.6	44.2	47.6	47.7	40.7	31.1	35.2	32.3	29.2	27.3	23.0
BCF	dB Y/N 0															
BVR-up	dB Floor 2	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**59.8**	**61.2**	**61.9**	**60.7**	**59.4**	**57.6**	**60.8**	**60.7**	**53.5**	**43.1**	**46.2**	**42.3**	**38.2**	**36.0**	**31.7**
Predicted Noise Level	**Oct, dB**			**66.1**			**64.3**			**61.6**			**48.1**			**37.4**
L_{max}	**dB(A)**	**46.5**														
$L_{eq,30mins}$	**dB(A)**	**35.7**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	HOM-2-4
Location:	Tak Lee Court
Assessed Floor	1
Item:	93

Train Speed: 60 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	50	35	61
Down Track	55	45	71

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D002	24	34	61[1]
Down Track	D028	22	44	71[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.0	38.0	37.0	35.0	34.0	38.0	41.0	42.0	42.0	38.0	37.0	36.0	33.0	34.0	31.0
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-7.8	-8.3	-11.1	-10.1	-5.6	-13.8	-15.1	-9.9	-20.5	-20.5	-19.7	-11.9	-14.1	-13.8	-15.4
Up Track Vib. Level	dB re 10^{-6}in/sec	26.2	29.7	25.9	24.9	28.4	24.2	25.9	32.1	21.5	17.5	17.3	24.1	18.9	20.2	15.6
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.0	38.0	37.0	35.0	34.0	38.0	41.0	42.0	42.0	38.0	37.0	36.0	33.0	34.0	31.0
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-0.2	1.3	0.4	-2.3	-7.9	-10.8	-20.6	-19.2	-22.7	-20.1	-11.1	-5.7	-2.1	3.4	-5.4
Down Track Vib. Level	dB re 10^{-6}in/sec	33.8	39.3	37.4	32.7	26.1	27.2	20.4	22.8	19.3	17.9	25.9	30.3	30.9	37.4	25.6
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		34.5	39.8	37.7	33.4	30.4	29.0	27.0	32.6	23.5	20.7	26.5	31.2	31.2	37.5	26.0
BCF	dB Y/N 0															
BVR-up	dB Floor 1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**50.5**	**55.8**	**53.7**	**49.4**	**46.2**	**44.4**	**42.2**	**47.6**	**38.3**	**34.7**	**39.5**	**43.2**	**42.2**	**48.2**	**36.7**
Predicted Noise Level	**Oct, dB**			**58.4**			**49.3**			**48.3**			**46.7**			**48.5**
L_{max}	**dB(A)**	**46.0**														
$L_{eq,30mins}$	**dB(A)**	**34.8**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	HOM-2-5
Location:	Chat Ma Mansion
Assessed Floor	1
Item:	94

Train Speed: 55 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	45	20	49
Down Track	45	30	54

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D002	24	20	49[1]
Down Track	D002	24	20	54[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	33.2	37.2	36.2	34.2	33.2	37.2	40.2	41.2	41.2	37.2	36.2	35.2	32.2	33.2	30.2
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	4.7	-0.4	-2.6	2.0	3.6	-5.8	-9.4	-5.7	-20.4	-20.8	-13.4	-10.5	-11.6	-12.0	-14.7
Up Track Vib. Level	dB re 10^{-6}in/sec	37.9	36.8	33.6	36.2	36.8	31.4	30.8	35.5	20.8	16.4	22.8	24.7	20.6	21.2	15.5
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	33.2	37.2	36.2	34.2	33.2	37.2	40.2	41.2	41.2	37.2	36.2	35.2	32.2	33.2	30.2
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	2.0	-2.0	-5.5	-5.8	-1.3	-10.4	-12.2	-6.6	-21.3	-22.1	-14.0	-10.8	-12.5	-12.2	-15.1
Down Track Vib. Level	dB re 10^{-6}in/sec	35.2	35.2	30.8	28.5	32.0	26.9	28.0	34.6	20.0	15.2	22.3	24.4	19.8	21.0	15.2
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		39.8	39.1	35.4	36.9	38.1	32.7	32.7	38.1	23.4	18.9	25.6	27.6	23.2	24.1	18.4
BCF	dB Y/N 0															
BVR-up	dB Floor 1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**55.8**	**55.1**	**51.4**	**52.9**	**53.9**	**48.1**	**47.9**	**53.1**	**38.2**	**32.9**	**38.6**	**39.6**	**34.2**	**34.8**	**29.1**
Predicted Noise Level	**Oct, dB**			**58.2**			**55.7**			**53.3**			**42.8**			**35.9**
L_{max}	**dB(A)**	**39.3**														
$L_{eq,30mins}$	**dB(A)**	**28.5**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	HOM-2-6
Location:	Chatham Mansion
Assessed Floor	1
Item:	95

Train Speed: 55 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	0	19	19
Down Track	0	30	30

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D012	34	18	19[1]
Down Track	D002	24	20	30[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	33.2	37.2	36.2	34.2	33.2	37.2	40.2	41.2	41.2	37.2	36.2	35.2	32.2	33.2	30.2
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	27.9	28.5	27.6	26.9	22.5	16.0	13.7	9.4	4.3	-3.1	-2.8	-1.1	-5.4	-5.1	-5.8
Up Track Vib. Level	dB re 10^{-6}in/sec	61.1	65.7	63.8	61.1	55.7	53.2	53.9	50.6	45.5	34.1	33.4	34.1	26.8	28.1	24.4
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	33.2	37.2	36.2	34.2	33.2	37.2	40.2	41.2	41.2	37.2	36.2	35.2	32.2	33.2	30.2
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	9.1	4.8	7.0	9.1	9.2	2.5	4.2	2.5	-4.6	-11.6	-5.8	-6.4	-6.2	-9.3	-10.4
Down Track Vib. Level	dB re 10^{-6}in/sec	42.3	42.1	43.3	43.3	42.4	39.7	44.4	43.7	36.7	25.6	30.5	28.9	26.0	24.0	19.8
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		61.2	65.8	63.9	61.2	55.9	53.4	54.4	51.4	46.1	34.7	35.2	35.3	29.5	29.6	25.7
BCF	dB Y/N 0															
BVR-up	dB Floor 1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**77.2**	**81.8**	**79.9**	**77.2**	**71.7**	**68.8**	**69.6**	**66.4**	**60.9**	**48.7**	**48.2**	**47.3**	**40.5**	**40.3**	**36.4**
Predicted Noise Level	**Oct, dB**			**84.8**			**75.0**			**67.6**			**51.2**			**41.8**
L_{max}	**dB(A)**	**54.1**														
$L_{eq,30mins}$	**dB(A)**	**43.3**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	HOM-3-1
Location:	Fook Sing Mansion
Assessed Floor	1
Item:	96

Train Speed: 55 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	85	35	92
Down Track	100	40	108

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D002	24	34	92[1]
Down Track	D018	28	40	108[1]

		Frequency (Hz)														
Description	Unit	20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	33.2	37.2	36.2	34.2	33.2	37.2	40.2	41.2	41.2	37.2	36.2	35.2	32.2	33.2	30.2
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-11.2	-12.7	-16.2	-17.9	-10.9	-21.6	-22.8	-13.7	-27.0	-26.9	-24.0	-15.1	-17.7	-17.3	-19.1
Up Track Vib. Level	dB re 10^{-6}in/sec	22.0	24.5	20.0	16.3	22.3	15.6	17.4	27.5	14.2	10.3	12.2	20.1	14.5	15.9	11.1
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	33.2	37.2	36.2	34.2	33.2	37.2	40.2	41.2	41.2	37.2	36.2	35.2	32.2	33.2	30.2
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	1.3	-4.7	-5.1	-7.1	-4.2	-7.0	-2.5	-16.1	-14.8	-15.6	-19.2	-13.0	-13.8	-18.8	-17.8
Down Track Vib. Level	dB re 10^{-6}in/sec	34.5	32.5	31.1	27.1	29.0	30.2	37.7	25.1	26.4	21.6	17.0	22.2	18.4	14.4	12.4
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		34.8	33.2	31.5	27.5	29.9	30.4	37.8	29.5	26.7	22.0	18.3	24.3	19.9	18.3	14.9
BCF	dB Y/N 0															
BVR-up	dB Floor 1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**50.8**	**49.2**	**47.5**	**43.5**	**45.7**	**45.8**	**53.0**	**44.5**	**41.5**	**36.0**	**31.3**	**36.3**	**30.9**	**29.0**	**25.6**
Predicted Noise Level	**Oct, dB**			**52.1**			**54.4**			**46.7**			**38.4**			**30.6**
L_{max}	**dB(A)**	**36.0**														
$L_{eq,30mins}$	**dB(A)**	**25.2**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	HOM-3-2
Location:	Marigold Mansion, Block A
Assessed Floor	1
Item:	97

Train Speed: 55 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	85	45	96
Down Track	110	45	119

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D028	22	44	96[1]
Down Track	D028	22	44	119[1]

		Frequency (Hz)														
Description	Unit	20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	33.2	37.2	36.2	34.2	33.2	37.2	40.2	41.2	41.2	37.2	36.2	35.2	32.2	33.2	30.2
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-0.2	1.3	0.4	-2.3	-7.9	-10.8	-20.6	-19.2	-22.7	-20.1	-11.1	-5.7	-2.1	3.4	-5.4
Up Track Vib. Level	dB re 10^{-6}in/sec	33.0	38.5	36.6	31.9	25.3	26.4	19.6	22.0	18.5	17.1	25.1	29.5	30.1	36.6	24.8
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	33.2	37.2	36.2	34.2	33.2	37.2	40.2	41.2	41.2	37.2	36.2	35.2	32.2	33.2	30.2
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-0.2	1.3	0.4	-2.3	-7.9	-10.8	-20.6	-19.2	-22.7	-20.1	-11.1	-5.7	-2.1	3.4	-5.4
Down Track Vib. Level	dB re 10^{-6}in/sec	33.0	38.5	36.6	31.9	25.3	26.4	19.6	22.0	18.5	17.1	25.1	29.5	30.1	36.6	24.8
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		36.1	41.6	39.7	35.0	28.4	29.5	22.7	25.1	21.6	20.2	28.2	32.6	33.2	39.7	27.9
BCF	dB Y/N 0															
BVR-up	dB Floor 1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**52.1**	**57.6**	**55.7**	**51.0**	**44.2**	**44.9**	**37.9**	**40.1**	**36.4**	**34.2**	**41.2**	**44.6**	**44.2**	**50.4**	**38.6**
Predicted Noise Level	**Oct, dB**			**60.3**			**48.0**			**42.3**			**48.3**			**50.6**
L_{max}	**dB(A)**	**48.0**														
$L_{eq,30mins}$	**dB(A)**	**37.2**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	HOM-4-1
Location:	Yee Fu Building
Assessed Floor	1
Item:	98

Train Speed: 55 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	40	45	60
Down Track	70	45	83

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D028	22	44	60[1]
Down Track	D028	22	44	83[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	33.2	37.2	36.2	34.2	33.2	37.2	40.2	41.2	41.2	37.2	36.2	35.2	32.2	33.2	30.2
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	0.1	1.4	0.6	-2.0	-7.7	-9.9	-18.7	-18.3	-20.5	-18.6	-10.0	-4.8	-1.1	4.3	-2.7
Up Track Vib. Level	dB re 10^{-6}in/sec	28.4	33.7	31.8	27.2	20.6	22.3	16.5	17.9	15.7	13.6	21.2	25.4	26.2	32.6	22.6
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	33.2	37.2	36.2	34.2	33.2	37.2	40.2	41.2	41.2	37.2	36.2	35.2	32.2	33.2	30.2
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-0.2	1.3	0.4	-2.3	-7.9	-10.8	-20.6	-19.2	-22.7	-20.1	-11.1	-5.7	-2.1	3.4	-5.4
Down Track Vib. Level	dB re 10^{-6}in/sec	28.0	33.5	31.6	26.9	20.3	21.4	14.6	17.0	13.5	12.1	20.1	24.5	25.1	31.6	19.8
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		31.2	36.6	34.8	30.1	23.5	24.9	18.7	20.5	17.8	16.0	23.7	28.0	28.7	35.1	24.4
BCF	dB Y/N 0															
BVR-up	dB Floor 1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**47.2**	**52.6**	**50.8**	**46.1**	**39.3**	**40.3**	**33.9**	**35.5**	**32.6**	**30.0**	**36.7**	**40.0**	**39.7**	**45.8**	**35.1**
Predicted Noise Level	**Oct, dB**			**55.3**			**43.4**			**38.0**			**43.8**			**46.2**
L_{max}	**dB(A)**	**43.6**														
$L_{eq,30mins}$	**dB(A)**	**32.7**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	HOM-5-1
Location:	271 Chatham Road North
Assessed Floor	2
Item:	99

Train Speed: 35 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	75	45	87
Down Track	75	45	87

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D028	22	44	87[1]
Down Track	D028	22	44	87[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	29.3	33.3	32.3	30.3	29.3	33.3	36.3	37.3	37.3	33.3	32.3	31.3	28.3	29.3	26.3
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-0.2	1.3	0.4	-2.3	-7.9	-10.8	-20.6	-19.2	-22.7	-20.1	-11.1	-5.7	-2.1	3.4	-5.4
Up Track Vib. Level	dB re 10^{-6}in/sec	24.1	29.6	27.7	23.0	16.4	17.5	10.7	13.1	9.6	8.2	16.2	20.6	21.2	27.7	15.9
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	29.3	33.3	32.3	30.3	29.3	33.3	36.3	37.3	37.3	33.3	32.3	31.3	28.3	29.3	26.3
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-0.2	1.3	0.4	-2.3	-7.9	-10.8	-20.6	-19.2	-22.7	-20.1	-11.1	-5.7	-2.1	3.4	-5.4
Down Track Vib. Level	dB re 10^{-6}in/sec	24.1	29.6	27.7	23.0	16.4	17.5	10.7	13.1	9.6	8.2	16.2	20.6	21.2	27.7	15.9
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		27.1	32.6	30.7	26.0	19.4	20.5	13.7	16.1	12.6	11.2	19.2	23.6	24.2	30.7	18.9
BCF	dB Y/N 0															
BVR-up	dB Floor 2	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**41.1**	**46.6**	**44.7**	**40.0**	**33.2**	**33.9**	**26.9**	**29.1**	**25.4**	**23.2**	**30.2**	**33.6**	**33.2**	**39.4**	**27.6**
Predicted Noise Level	**Oct, dB**			**49.3**			**37.0**			**31.4**			**37.4**			**39.7**
L_{max}	**dB(A)**	**37.1**														
$L_{eq,30mins}$	**dB(A)**	**28.2**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

[8] A 3dB(A) upward adjustment is made to account for the daytime headway of 22 EMU trains within a 30 minutes period.

[9] Daytime criteria are used for educational buildings, church and temple.

Project: Shatin Central Link Rail Operational GBN Assessment
NSR Ref.: HOM-P2
Location: HKPU Phase 3
Assessed Floor 1
Item: 100

Train Speed: 50 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	35	45	57
Down Track	65	45	79

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D028	22	44	57[1]
Down Track	D028	22	44	79[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	32.4	36.4	35.4	33.4	32.4	36.4	39.4	40.4	40.4	36.4	35.4	34.4	31.4	32.4	29.4
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	0.5	1.6	0.8	-1.7	-7.4	-9.0	-16.8	-17.5	-18.3	-17.1	-9.0	-3.9	0.0	5.3	0.1
Up Track Vib. Level	dB re 10^{-6}in/sec	27.9	33.0	31.2	26.7	20.0	22.4	17.6	17.9	17.1	14.3	21.4	25.5	26.4	32.7	24.5
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	32.4	36.4	35.4	33.4	32.4	36.4	39.4	40.4	40.4	36.4	35.4	34.4	31.4	32.4	29.4
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-0.2	1.3	0.4	-2.3	-7.9	-10.8	-20.6	-19.2	-22.7	-20.1	-11.1	-5.7	-2.1	3.4	-5.4
Down Track Vib. Level	dB re 10^{-6}in/sec	27.2	32.7	30.8	26.1	19.5	20.6	13.8	16.2	12.7	11.3	19.3	23.7	24.3	30.8	19.0
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		30.6	35.9	34.0	29.4	22.8	24.6	19.1	20.2	18.5	16.1	23.5	27.7	28.5	34.9	25.6
BCF	dB Y/N 0															
BVR-up	dB Floor 1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**46.6**	**51.9**	**50.0**	**45.4**	**38.6**	**40.0**	**34.3**	**35.2**	**33.3**	**30.1**	**36.5**	**39.7**	**39.5**	**45.6**	**36.3**
Predicted Noise Level	**Oct, dB**			**54.6**			**43.0**			**38.1**			**43.6**			**46.0**
L_{max}	**dB(A)**	**43.4**														
$L_{eq,30mins}$	**dB(A)**	**36[8]**														
Noise Criteria	**dB(A)**	**55[9]**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.
[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.
[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.
[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.
[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(
(3dB(A) correction is added to $L_{eq,30mins}$ for leading and trailing effect for conservative approaches.)
[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.
[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	HOM-P3-1
Location:	Residential Building, HOM Station Development
Assessed Floor	1
Item:	101

Train Speed: 50 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	0	45	45
Down Track	0	45	45

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D028	22	44	45[1]
Down Track	D028	22	44	45[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	32.4	36.4	35.4	33.4	32.4	36.4	39.4	40.4	40.4	36.4	35.4	34.4	31.4	32.4	29.4
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	2.7	3.8	3.8	3.8	2.5	7.4	2.4	-1.5	4.4	3.3	5.0	6.6	7.1	8.9	7.6
Up Track Vib. Level	dB re 10^{-6}in/sec	30.1	35.2	34.2	32.2	29.9	38.8	36.8	33.9	39.8	34.7	35.4	36.0	33.5	36.3	32.0
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	32.4	36.4	35.4	33.4	32.4	36.4	39.4	40.4	40.4	36.4	35.4	34.4	31.4	32.4	29.4
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	2.7	3.8	3.8	3.8	2.5	7.4	2.4	-1.5	4.4	3.3	5.0	6.6	7.1	8.9	7.6
Down Track Vib. Level	dB re 10^{-6}in/sec	30.1	35.2	34.2	32.2	29.9	38.8	36.8	33.9	39.8	34.7	35.4	36.0	33.5	36.3	32.0
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		33.1	38.2	37.2	35.2	32.9	41.8	39.8	36.9	42.8	37.7	38.4	39.0	36.5	39.3	35.0
BCF	dB Y/N 0															
BVR-up	dB Floor 1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**49.1**	**54.2**	**53.2**	**51.2**	**48.7**	**57.2**	**55.0**	**51.9**	**57.6**	**51.7**	**51.4**	**51.0**	**47.5**	**50.0**	**45.7**
Predicted Noise Level	**Oct, dB**			**57.8**			**59.6**			**59.5**			**55.1**			**51.4**
L_{max}	**dB(A)**	**51.4**														
$L_{eq,30mins}$	**dB(A)**	**41.0**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

[8] A 3dB(A) upward adjustment is made to account for the daytime headway of 22 EMU trains within a 30 minutes period.

[9] Daytime criteria are used for educational buildings, church and temple.

Project: Shatin Central Link Rail Operational GBN Assessment
NSR Ref.: HUH-1-1
Location: Cartas Branchi College of Careers
Assessed Floor 0
Item: 102

Train Speed: 45 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	95	30	100
Down Track	125	30	129

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D002	24	20	100[1]
Down Track	D002	24	20	129[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	31.5	35.5	34.5	32.5	31.5	35.5	38.5	39.5	39.5	35.5	34.5	33.5	30.5	31.5	28.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-4.0	-7.2	-12.3	-15.3	-8.1	-21.5	-19.5	-11.7	-25.6	-26.9	-17.4	-14.3	-17.0	-15.4	-18.4
Up Track Vib. Level	dB re 10^{-6}in/sec	22.5	23.3	17.2	12.2	18.4	9.0	14.0	22.8	8.9	3.6	12.1	14.2	8.5	11.1	5.1
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	31.5	35.5	34.5	32.5	31.5	35.5	38.5	39.5	39.5	35.5	34.5	33.5	30.5	31.5	28.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0	j														
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	-4.0	-7.2	-12.3	-15.3	-8.1	-21.5	-19.5	-11.7	-25.6	-26.9	-17.4	-14.3	-17.0	-15.4	-18.4
Down Track Vib. Level	dB re 10^{-6}in/sec	22.5	23.3	17.2	12.2	18.4	9.0	14.0	22.8	8.9	3.6	12.1	14.2	8.5	11.1	5.1
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		25.5	26.3	20.2	15.2	21.4	12.0	17.0	25.8	11.9	6.6	15.1	17.2	11.5	14.1	8.1
BCF	dB Y/N 0															
BVR-up	dB Floor 0	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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**43.5**	**44.3**	**38.2**	**33.2**	**39.2**	**29.4**	**34.2**	**42.8**	**28.7**	**22.6**	**30.1**	**31.2**	**24.5**	**26.8**	**20.8**
Predicted Noise Level	**Oct, dB**			**45.5**			**40.7**			**43.0**			**34.2**			**27.8**
L_{max}	**dB(A)**	**29.8**														
$L_{eq,30mins}$	**dB(A)**	**<20[8]**														
Noise Criteria	**dB(A)**	**55[9]**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.
[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.
[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.
[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.
[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(
(3dB(A) correction is added to $L_{eq,30mins}$ for leading and trailing effect for conservative approaches.)
[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.
[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	HUH-1-2
Location:	Lok Ka House
Assessed Floor	1
Item:	103

Train Speed: 50 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	55	18	58
Down Track	80	18	82

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D012	34	18	58[1]
Down Track	D012	34	18	82[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	32.4	36.4	35.4	33.4	32.4	36.4	39.4	40.4	40.4	36.4	35.4	34.4	31.4	32.4	29.4
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	17.2	15.0	9.9	4.0	-2.9	-6.3	-10.1	-12.3	-15.9	-14.6	-15.2	-7.2	-12.8	-16.1	-16.8
Up Track Vib. Level	dB re 10^{-6}in/sec	46.6	48.4	42.3	34.4	26.5	27.1	26.3	25.1	21.5	18.8	17.3	24.2	15.6	13.3	9.6
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	32.4	36.4	35.4	33.4	32.4	36.4	39.4	40.4	40.4	36.4	35.4	34.4	31.4	32.4	29.4
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	14.4	12.1	7.5	1.4	-5.6	-9.1	-13.5	-15.0	-19.0	-17.5	-18.2	-9.1	-15.9	-19.3	-19.6
Down Track Vib. Level	dB re 10^{-6}in/sec	43.8	45.5	39.9	31.8	23.8	24.3	22.9	22.4	18.4	15.9	14.2	22.3	12.5	10.1	6.8
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		48.4	50.2	44.3	36.3	28.4	28.9	27.9	27.0	23.2	20.6	19.0	26.4	17.3	15.0	11.5
BCF	dB Y/N 0															
BVR-up	dB Floor 1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**64.4**	**66.2**	**60.3**	**52.3**	**44.2**	**44.3**	**43.1**	**42.0**	**38.0**	**34.6**	**32.0**	**38.4**	**28.3**	**25.7**	**22.2**
Predicted Noise Level	**Oct, dB**			**67.3**			**48.7**			**44.0**			**39.6**			**27.3**
L_{max}	**dB(A)**	**34.5**														
$L_{eq,30mins}$	**dB(A)**	**24.0**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	HUH-1-3
Location:	Wing Fung Building
Assessed Floor	1
Item:	104

Train Speed: 60 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	10	18	21
Down Track	25	18	31

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D012	34	18	21[1]
Down Track	D012	34	18	31[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.0	38.0	37.0	35.0	34.0	38.0	41.0	42.0	42.0	38.0	37.0	36.0	33.0	34.0	31.0
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	26.6	27.8	27.0	26.5	21.3	13.5	8.4	3.5	-1.7	-6.4	-6.5	-2.7	-7.3	-8.1	-9.4
Up Track Vib. Level	dB re 10^{-6}in/sec	57.6	62.8	61.0	58.5	52.3	48.5	46.4	42.5	37.4	28.6	27.6	30.3	22.8	22.9	18.6
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.0	38.0	37.0	35.0	34.0	38.0	41.0	42.0	42.0	38.0	37.0	36.0	33.0	34.0	31.0
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	22.4	24.7	23.8	23.6	15.0	2.1	-3.3	-7.5	-12.3	-11.4	-12.1	-5.2	-10.4	-13.1	-14.3
Down Track Vib. Level	dB re 10^{-6}in/sec	53.4	59.7	57.8	55.6	46.0	37.1	34.7	31.5	26.7	23.6	21.9	27.8	19.6	17.9	13.7
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		59.0	64.5	62.7	60.3	53.2	48.8	46.6	42.8	37.7	29.8	28.6	32.2	24.5	24.1	19.8
BCF	dB Y/N 0															
BVR-up	dB Floor 1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**75.0**	**80.5**	**78.7**	**76.3**	**69.0**	**64.2**	**61.8**	**57.8**	**52.5**	**43.8**	**41.6**	**44.2**	**35.5**	**34.8**	**30.5**
Predicted Noise Level	**Oct, dB**			**83.6**			**70.8**			**59.0**			**46.5**			**36.2**
L_{max}	**dB(A)**	**48.9**														
$L_{eq,30mins}$	**dB(A)**	**37.7**														
Noise Criteria	**dB(A)**	**45**														
Compliance		**Yes**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	HUH-2-1
Location:	Cheung On Tak Lecture Theatre
Assessed Floor	2
Item:	105

Train Speed: 70 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	115	0	115
Down Track	110	0	110

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D018	28	15	115[1]
Down Track	D018	28	15	110[1]

		Frequency (Hz)														
Description	Unit	20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	35.3	39.3	38.3	36.3	35.3	39.3	42.3	43.3	43.3	39.3	38.3	37.3	34.3	35.3	32.3
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	15.8	13.8	8.6	1.9	-5.3	-8.4	-13.2	-15.0	-18.4	-17.3	-18.1	-16.2	-16.3	-19.4	-19.6
Up Track Vib. Level	dB re 10^{-6}in/sec	48.1	50.1	43.9	35.2	27.0	27.9	26.1	25.3	21.9	19.0	17.2	18.1	15.0	12.9	9.7
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	35.3	39.3	38.3	36.3	35.3	39.3	42.3	43.3	43.3	39.3	38.3	37.3	34.3	35.3	32.3
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	15.8	13.8	8.6	1.9	-5.3	-8.4	-13.2	-15.0	-18.4	-17.3	-18.1	-16.2	-16.3	-19.4	-19.6
Down Track Vib. Level	dB re 10^{-6}in/sec	48.1	50.1	43.9	35.2	27.0	27.9	26.1	25.3	21.9	19.0	17.2	18.1	15.0	12.9	9.7
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		51.1	53.1	46.9	38.2	30.0	30.9	29.1	28.3	24.9	22.0	20.2	21.1	18.0	15.9	12.7
BCF	dB Y/N 0															
BVR-up	dB Floor 2	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**65.1**	**67.1**	**60.9**	**52.2**	**43.8**	**44.3**	**42.3**	**41.3**	**37.7**	**34.0**	**31.2**	**31.1**	**27.0**	**24.6**	**21.4**
Predicted Noise Level	**Oct, dB**			**68.2**			**48.4**			**43.5**			**35.0**			**26.4**
L_{max}	**dB(A)**	**32.5**														
$L_{eq,30mins}$	**dB(A)**	**<20**														
Noise Criteria	**dB(A)**	**26**														
Compliance		**55**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	HUH-3-1
Location:	Royal Penisula Block 2
Assessed Floor	1
Item:	106

Train Speed: 60 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	145	0	145
Down Track	155	0	155

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D018	28	15	145[1]
Down Track	D018	28	15	155[1]

		Frequency (Hz)														
Description	Unit	20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.0	38.0	37.0	35.0	34.0	38.0	41.0	42.0	42.0	38.0	37.0	36.0	33.0	34.0	31.0
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	15.8	13.8	8.6	1.9	-5.3	-8.4	-13.2	-15.0	-18.4	-17.3	-18.1	-16.2	-16.3	-19.4	-19.6
Up Track Vib. Level	dB re 10^{-6}in/sec	46.8	48.8	42.6	33.9	25.7	26.6	24.8	24.0	20.6	17.7	15.9	16.8	13.7	11.6	8.4
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	34.0	38.0	37.0	35.0	34.0	38.0	41.0	42.0	42.0	38.0	37.0	36.0	33.0	34.0	31.0
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	15.8	13.8	8.6	1.9	-5.3	-8.4	-13.2	-15.0	-18.4	-17.3	-18.1	-16.2	-16.3	-19.4	-19.6
Down Track Vib. Level	dB re 10^{-6}in/sec	46.8	48.8	42.6	33.9	25.7	26.6	24.8	24.0	20.6	17.7	15.9	16.8	13.7	11.6	8.4
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		49.8	51.8	45.6	36.9	28.7	29.6	27.8	27.0	23.6	20.7	18.9	19.8	16.7	14.6	11.4
BCF	dB Y/N 0															
BVR-up	dB Floor 1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**65.8**	**67.8**	**61.6**	**52.9**	**44.5**	**45.0**	**43.0**	**42.0**	**38.4**	**34.7**	**31.9**	**31.8**	**27.7**	**25.3**	**22.1**
Predicted Noise Level	**Oct, dB**			**68.9**			**49.0**			**44.1**			**35.6**			**27.0**
L_{max}	**dB(A)**	**33.2**														
$L_{eq,30mins}$	**dB(A)**	**<20**														
Noise Criteria	**dB(A)**	**#####**														
Compliance		**45**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	HUH-4-1
Location:	The Metropolis Residence Tower 2
Assessed Floor	2
Item:	107

Train Speed: 10 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	110	0	110
Down Track	125	0	125

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D018	28	15	110[1]
Down Track	D018	28	15	125[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	18.4	22.4	21.4	19.4	18.4	22.4	25.4	26.4	26.4	22.4	21.4	20.4	17.4	18.4	15.4
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	15.8	13.8	8.6	1.9	-5.3	-8.4	-13.2	-15.0	-18.4	-17.3	-18.1	-16.2	-16.3	-19.4	-19.6
Up Track Vib. Level	dB re 10^{-6}in/sec	29.2	31.2	25.0	16.3	8.1	9.0	7.2	6.4	3.0	0.1	-1.7	-0.8	-3.9	-6.0	-9.2
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	18.4	22.4	21.4	19.4	18.4	22.4	25.4	26.4	26.4	22.4	21.4	20.4	17.4	18.4	15.4
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	15.8	13.8	8.6	1.9	-5.3	-8.4	-13.2	-15.0	-18.4	-17.3	-18.1	-16.2	-16.3	-19.4	-19.6
Down Track Vib. Level	dB re 10^{-6}in/sec	29.2	31.2	25.0	16.3	8.1	9.0	7.2	6.4	3.0	0.1	-1.7	-0.8	-3.9	-6.0	-9.2
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		32.2	34.2	28.0	19.3	11.1	12.0	10.2	9.4	6.0	3.1	1.3	2.2	-0.9	-3.0	-6.2
BCF	dB Y/N 0															
BVR-up	dB Floor 2	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**46.2**	**48.2**	**42.0**	**33.3**	**24.9**	**25.4**	**23.4**	**22.4**	**18.8**	**15.1**	**12.3**	**12.2**	**8.1**	**5.7**	**2.5**
Predicted Noise Level	**Oct, dB**			**49.3**			**29.5**			**24.5**			**16.1**			**8.2**
L_{max}	**dB(A)**	**13.6**														
$L_{eq,30mins}$	**dB(A)**	**<20**														
Noise Criteria	**dB(A)**	**#####**														
Compliance		**45**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	HUH-5-1
Location:	Harbour Plaza Metropolis
Assessed Floor	3
Item:	108

Train Speed: 40 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	100	0	100
Down Track	115	0	115

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D018	28	15	100[1]
Down Track	D018	28	15	115[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	30.5	34.5	33.5	31.5	30.5	34.5	37.5	38.5	38.5	34.5	33.5	32.5	29.5	30.5	27.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	15.8	13.8	8.6	1.9	-5.3	-8.4	-13.2	-15.0	-18.4	-17.3	-18.1	-16.2	-16.3	-19.4	-19.6
Up Track Vib. Level	dB re 10^{-6}in/sec	41.3	43.3	37.1	28.4	20.2	21.1	19.3	18.5	15.1	12.2	10.4	11.3	8.2	6.1	2.9
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	30.5	34.5	33.5	31.5	30.5	34.5	37.5	38.5	38.5	34.5	33.5	32.5	29.5	30.5	27.5
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	15.8	13.8	8.6	1.9	-5.3	-8.4	-13.2	-15.0	-18.4	-17.3	-18.1	-16.2	-16.3	-19.4	-19.6
Down Track Vib. Level	dB re 10^{-6}in/sec	41.3	43.3	37.1	28.4	20.2	21.1	19.3	18.5	15.1	12.2	10.4	11.3	8.2	6.1	2.9
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		44.3	46.3	40.1	31.4	23.2	24.1	22.3	21.5	18.1	15.2	13.4	14.3	11.2	9.1	5.9
BCF	dB Y/N 0															
BVR-up	dB Floor 3	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**56.3**	**58.3**	**52.1**	**43.4**	**35.0**	**35.5**	**33.5**	**32.5**	**28.9**	**25.2**	**22.4**	**22.3**	**18.2**	**15.8**	**12.6**
Predicted Noise Level	**Oct, dB**			**59.3**			**39.5**			**34.6**			**26.1**			**17.6**
L_{max}	**dB(A)**	**23.7**														
$L_{eq,30mins}$	**dB(A)**	**<20**														
Noise Criteria	**dB(A)**	**#####**														
Compliance		**45**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	HUH-6-1
Location:	HK Fire Services Headquarters Building
Assessed Floor	1
Item:	109

Train Speed: 70 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	90	0	90
Down Track	85	0	85

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D018	28	15	90[1]
Down Track	D018	28	15	85[1]

		Frequency (Hz)														
Description	Unit	20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	35.3	39.3	38.3	36.3	35.3	39.3	42.3	43.3	43.3	39.3	38.3	37.3	34.3	35.3	32.3
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	15.8	13.8	8.6	1.9	-5.3	-8.4	-13.2	-15.0	-18.4	-17.3	-18.1	-16.2	-16.3	-19.4	-19.6
Up Track Vib. Level	dB re 10^{-6}in/sec	48.1	50.1	43.9	35.2	27.0	27.9	26.1	25.3	21.9	19.0	17.2	18.1	15.0	12.9	9.7
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	35.3	39.3	38.3	36.3	35.3	39.3	42.3	43.3	43.3	39.3	38.3	37.3	34.3	35.3	32.3
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	15.8	13.8	8.6	1.9	-5.3	-8.4	-13.2	-15.0	-18.4	-17.3	-18.1	-16.2	-16.3	-19.4	-19.6
Down Track Vib. Level	dB re 10^{-6}in/sec	48.1	50.1	43.9	35.2	27.0	27.9	26.1	25.3	21.9	19.0	17.2	18.1	15.0	12.9	9.7
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		51.1	53.1	46.9	38.2	30.0	30.9	29.1	28.3	24.9	22.0	20.2	21.1	18.0	15.9	12.7
BCF	dB Y/N 0															
BVR-up	dB Floor 1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**67.1**	**69.1**	**62.9**	**54.2**	**45.8**	**46.3**	**44.3**	**43.3**	**39.7**	**36.0**	**33.2**	**33.1**	**29.0**	**26.6**	**23.4**
Predicted Noise Level	**Oct, dB**			**70.2**			**50.4**			**45.5**			**37.0**			**28.4**
L_{max}	**dB(A)**	**34.5**														
$L_{eq,30mins}$	**dB(A)**	**<20**														
Noise Criteria	**dB(A)**	**<20**														
Compliance		**45**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations

Project:	Shatin Central Link Rail Operational GBN Assessment
NSR Ref.:	HUH-7-1
Location:	Hotel Nikko Hong Kong
Assessed Floor	4
Item:	110

Train Speed: 70 kph

	Horizontal Dist, m	Vertical Dist, m	Slant Dist, m
Up Track	50	0	50
Down Track	45	0	45

Selected Borehole Details:

	Borehole Ref.	Rockhead Depth, m	Hole Depth, m	Slant Dist, m
Up Track	D018	28	15	50[1]
Down Track	D018	28	15	45[1]

Description	Unit	Frequency (Hz)														
		20	25	32	40	50	63	80	100	125	160	200	250	315	400	500
Up Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	35.3	39.3	38.3	36.3	35.3	39.3	42.3	43.3	43.3	39.3	38.3	37.3	34.3	35.3	32.3
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	18.3	16.2	10.8	4.8	-1.8	-5.5	-9.3	-11.8	-15.3	-13.8	-14.4	-12.0	-12.0	-15.3	-16.2
Up Track Vib. Level	dB re 10^{-6}in/sec	50.7	52.6	46.2	38.1	30.5	30.9	30.1	28.5	25.1	22.6	21.0	22.3	19.3	17.0	13.2
Down Track Calculation																
FDL	dB re 1 lb/in$^{0.5}$	35.3	39.3	38.3	36.3	35.3	39.3	42.3	43.3	43.3	39.3	38.3	37.3	34.3	35.3	32.3
CCF	dB Y/N N															
TIL	dB Type 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCF	dB	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3
TOC	dB Type 0															
LSR	dB re 10^{-6}in/s*in$^{0.5}$/lb	18.6	16.6	11.5	5.2	-1.6	-5.1	-8.9	-11.5	-15.0	-13.0	-13.7	-11.1	-11.2	-14.0	-15.5
Down Track Vib. Level	dB re 10^{-6}in/sec	50.9	53.0	46.8	38.5	30.8	31.2	30.5	28.9	25.4	23.4	21.7	23.3	20.2	18.4	13.9
Total of Up and Down Tracks Calculation																
Total Vibration Level Outside Building		53.8	55.8	49.5	41.3	33.7	34.1	33.3	31.7	28.2	26.0	24.4	25.8	22.8	20.7	16.5
BCF	dB Y/N 0															
BVR-up	dB Floor 4	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8
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	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SAF	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Predicted Noise Level	**1/3 Oct, dB**	**63.8**	**65.8**	**59.5**	**51.3**	**43.5**	**43.5**	**42.5**	**40.7**	**37.0**	**34.0**	**31.4**	**31.8**	**27.8**	**25.4**	**21.2**
Predicted Noise Level	**Oct, dB**			**66.8**			**47.9**			**42.9**			**35.4**			**26.9**
L_{max}	**dB(A)**	**32.3**														
$L_{eq,30mins}$	**dB(A)**	**22.9**														
Noise Criteria	**dB(A)**	**23**														
Compliance		**45**														

Notes: [1] Linear interpolation has been applied to slant distance where appropriate.

[2] FDL based on 60kph data and adjusted by the correction factor of 20xlog(V/Vref), in line with FTA manual.

[3] LSR based on the same or the next available smaller borehole depth. LSR data are interpolated against slant distance.

[4] Lmax has incorporated a +0.5dB(A) correction to passby Leq as per measurement at Pat Heung Depot.

[5] $L_{eq,30mins}$ = L_{eq}(double passbys) + 10*log(Passby duration in sec) + 3dB(A) + 10*log(no. of events in 30mins per direction) - 32.6dB(

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

[6] $L_{eq,30mins}$ is based on train frequency of 6 trains per 30mins in each direction.

[7] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate; Type 2 = Egg type baseplate; Type 3 = 12.5Hz FST.

Appendix 9.3: Detailed Operational Groundborne Noise Calculations