

**Appendix 5.1 Calculations of Emission Rates (SCL (MKK - HUH))**

**Short-Term Tier 1 Assessment (1-hr & 24-hr)**

Location	Source	Emission Rates	(Unmitigated)	(Mitigated)	Parameters	Remarks
North of Hung Hom Station	North Approaching Tunnel Construction (Cut & Cover Areas and Stockpile Areas)  ID: NAT	Heavy Construction Area Source (g/m <sup>2</sup> /s) (At working hour)	2.075617E-04	1.722762E-05	TSP emission factor (Mg/hectare/month of activity) Emission strength (%) no. of operation hour (hr) Dust suppression (%)	2.69 from AP-42, S13.2.3, 1/95 ed. 100 Tier 1 testing 12 from engineer 91.7 for watering once on active construction areas for every working hour
		Wind erosion (g/m <sup>2</sup> /s) (At non-working hour)	2.695332E-06	2.695332E-06	TSP emission factor (Mg/hectare/yr) Emission strength (%)	0.85 from AP-42, Table 11.9.4, 5th edition 100 Tier 1 testing
South of Hung Hom Station	South Approaching Tunnel Construction (Cut & Cover Areas and Stockpile Areas)  ID: H1	Heavy Construction Area Source (g/m <sup>2</sup> /s) (At working hour)	2.075617E-04	1.722762E-05	TSP emission factor (Mg/hectare/month of activity) Emission strength (%) no. of operation hour (hr) Dust suppression (%)	2.69 from AP-42, S13.2.3, 1/95 ed. 100 Tier 1 testing 12 from engineer 91.7 for watering once on active construction areas for every working hour
		Wind erosion (g/m <sup>2</sup> /s) (At non-working hour)	2.695332E-06	2.695332E-06	TSP emission factor (Mg/hectare/yr) Emission strength (%)	0.85 from AP-42, Table 11.9.4, 5th edition 100 Tier 1 testing
Hung Hom Freight Pier	Haul Road to Barging Point  ID: HAUL_RD, HOLD_RD  Barging point  ID: BP1, BP2	Paved Haul Road - Transport the spoils from the construction sites to the barging point Area Source (g/m <sup>2</sup> /s)	2.075617E-04	1.722762E-05	TSP emission factor (Mg/hectare/month of activity) Emission strength (%) no. of operation hour (hr) Dust suppression (%)	2.69 from AP-42, S13.2.3, 1/95 ed. 100 assumed to be fully utilized 12 from engineer 91.7 for watering once on active construction areas for every working hour
		Spoil handling Unloading of spoils to barge Point Source (g/s)	3.965454E-02	1.982727E-02	TSP emission factor (kg/Mg)  Particle size multiplier, k Material moisture content, M (%) Average wind speed, U (m/s) E (kg/Mg) Average daily Handling capacity (Mg/hr) no. of operation hour (hr) Emission height (m) Dust suppression (%)	$E = k \times (0.0016) \times [(U/2.2)^{1.3} / (M/2)^{1.4}]$ AP-42, Section 13.2.4, 11/06 ed. 0.74 AP-42, S13.2.4, particle size < 30 um, 1/95 ed. 4.8 Obtained from Spoil data, from engineer 2.1744 from HKO 2008 data 3.4234E-04 by formula above 417 Maximum Capacity provided by Engineer 12 from engineer 0.5 With reference to XRL & WIL 50 for Enclosed tipping hall, flexible dust curtains and water spraying, AP-42, Section 11.2.3, 1/95 ed.

**Remarks:**

Percentage of Dust Suppression by Watering is derived from the equation  $C = 100 - 0.8pd/t$  (USEPA, Control of Open Fugitive Dust Sources, 1998)

where p = potential average hourly daytime evaporation rate, mm/h = 0.25916 ([http://www.weather.gov.hk/cis/normal/1971\\_2000/normals\\_e.htm](http://www.weather.gov.hk/cis/normal/1971_2000/normals_e.htm))

d = average hourly daytime traffic rate per hour = 69.5

i = application intensity, L/m<sup>2</sup> = 1.74

t = time between applications, hr = 1

The water intensity is an assumption used in the dust modeling only. Any potential dust impact and mitigation would be subject to actual site condition and managed by the EM&A programme during the construction stage

**Appendix 5.1 Calculations of Emission Rates (SCL (MKK - HUH))**  
**Annual Assessment**

Location	Source	Emission Rates	(Unmitigated)	(Mitigated)	Parameters	Remarks
North of Hung Hom Station	North Approaching Tunnel Construction (Cut & Cover Areas and Stockpile Areas)  ID: NAT	<b>Individual Emission Rates</b>				
		Heavy Construction Area Source (g/m <sup>2</sup> /s)	2.075617E-04	1.722762E-05	TSP emission factor (Mg/hectare/month of activity) Emission strength (%) no. of operation hour (hr) Dust suppression (%)	2.69 from AP-42, S13.2.3, 1/95 ed. 100 full strength 12 from engineer 91.7 for watering once on active construction areas for every working hour
		Wind erosion (g/m <sup>2</sup> /s)	2.695332E-06	2.237126E-07	TSP emission factor (Mg/hectare/yr) Emission strength (%) Dust suppression (%)	0.85 from AP-42, Table 11.9.4, 5th edition 100 full strength 91.7 for watering once on active construction areas for every working hour
		<b>Total Effective Emission Rates</b> (At working hour) (At non-working hour)	1.261542E-05 1.617199E-07	1.047080E-06 1.617199E-07	Percentage area actively operating (%)	6 Due to the uncertainty on works location throughout a year, works are assumed to distributed evenly in the area. A factor is therefore applied to the emission rate. Derivation of the percentage refers to Appendix 5.5 (Heavy Construction + Wind erosion) * Percentage area actively operating Wind erosion (Unmitigated) * Percentage area actively operating
South of Hung Hom Station	South Approaching Tunnel Construction (Cut & Cover Areas and Stockpile Areas)  ID: H1	<b>Individual Emission Rates</b>				
		Heavy Construction Area Source (g/m <sup>2</sup> /s)	2.075617E-04	1.722762E-05	TSP emission factor (Mg/hectare/month of activity) Emission strength (%) no. of operation hour (hr) Dust suppression (%)	2.69 from AP-42, S13.2.3, 1/95 ed. 100 full strength 12 from engineer 91.7 for watering once on active construction areas for every working hour
		Wind erosion (g/m <sup>2</sup> /s)	2.695332E-06	2.237126E-07	TSP emission factor (Mg/hectare/yr) Emission strength (%) Dust suppression (%)	0.85 from AP-42, Table 11.9.4, 5th edition 100 full strength 91.7 for watering once on active construction areas for every working hour
		<b>Total Effective Emission Rates</b> (At working hour) (At non-working hour)	3.153856E-05 4.042998E-07	2.617700E-06 4.042998E-07	Percentage area actively operating (%)	15 Due to the uncertainty on works location throughout a year, works are assumed to distributed evenly in the area. A factor is therefore applied to the emission rate. Derivation of the percentage refers to Appendix 5.5 (Heavy Construction + Wind erosion) * Percentage area actively operating Wind erosion (Unmitigated) * Percentage area actively operating
Hung Hom Freight Pier	Haul Road to Barging Point  ID: HAUL_RD, HOLD_RD  Barging point  ID: BP1, BP2	Paved Haul Road - Transport the spoils from the construction sites to the barging point Area Source (g/m <sup>2</sup> /s)	2.075617E-04	1.722762E-05	TSP emission factor (Mg/hectare/month of activity) Emission strength (%) no. of operation hour (hr) Dust suppression (%)	2.69 from AP-42, S13.2.3, 1/95 ed. 100 assumed to be fully utilized 12 from engineer 91.7 for watering once on active construction areas for every working hour
		Spoil handling Unloading of spoils to barge Point Source (g/s)	3.965454E-02	1.982727E-02	TSP emission factor (kg/Mg)  Particle size multiplier, k Material moisture content, M (%) Average wind speed, U (m/s) E (kg/Mg) Average daily Handling capacity (Mg/hr) no. of operation hour (hr) Emission height (m) Dust suppression (%)	$E = k \times (0.0016) \times [(U/2.2)^{1.3} / (M/2)^{1.4}]$ AP-42, Section 13.2.4, 11/06 ed. 0.74 AP-42, S13.2.4, particle size < 30 um, 1/95 ed. 4.8 Obtained from Spoil data, from engineer 2.1744 from HKO 2008 data 3.4234E-04 by formula above 417 Maximum Capacity provided by Engineer 12 from engineer 0.5 With reference to XRL & WIL 50 for Enclosed tipping hall, flexible dust curtains and water spraying, AP-42, Section 11.2.3, 1/95 ed.

**Remarks:**

Percentage of Dust Suppression by Watering is derived from the equation  $C = 100 - 0.8pdt/i$  (USEPA, Control of Open Fugitive Dust Sources, 1998)

where p = potential average hourly daytime evaporation rate, mm/h = 0.25916 ([http://www.weather.gov.hk/cis/normal/1971\\_2000/normal\\_e.htm](http://www.weather.gov.hk/cis/normal/1971_2000/normal_e.htm))

d = average hourly daytime traffic rate per hour = 69.5

i = application intensity, L/m<sup>2</sup> = 1.74

t = time between applications, hr = 1

The water intensity is an assumption used in the dust modeling only. Any potential dust impact and mitigation would be subject to actual site condition and managed by the EM&A programme during the construction stage



**Appendix 5.1 Calculation of Emission Rate (SCL (MKK - HUH))**

**North Approaching Tunnel and Station Dust Sources**

Source	Type	X1	Y1	X2	Y2	Height (m)	Width / Angle	Working Hour	Tier 1		Annual	
									Working emission (g/m <sup>2</sup> -s)	Wind erosion (g/m <sup>2</sup> -s)	Working emission (g/m <sup>2</sup> -s)	Wind erosion (g/m <sup>2</sup> -s)
NAT1	Area	836479.09	818995.86	19.25	13.89	0.5	47.01	07:00 - 19:00	1.723E-05	2.695E-06	1.047E-06	1.617E-07
NAT2	Area	836488.69	818985.81	19.06	13.87	0.5	47.01	07:00 - 19:00	1.723E-05	2.695E-06	1.047E-06	1.617E-07
NAT3	Area	836498.25	818975.71	18.98	13.88	0.5	47.01	07:00 - 19:00	1.723E-05	2.695E-06	1.047E-06	1.617E-07
NAT4	Area	836507.81	818965.61	18.92	13.85	0.5	47.01	07:00 - 19:00	1.723E-05	2.695E-06	1.047E-06	1.617E-07
NAT5	Area	836517.20	818955.34	19.33	13.87	0.5	47.01	07:00 - 19:00	1.723E-05	2.695E-06	1.047E-06	1.617E-07
NAT6	Area	836531.43	818941.65	24.11	25.29	0.5	43.2	07:00 - 19:00	1.723E-05	2.695E-06	1.047E-06	1.617E-07
NAT7	Area	836551.56	818922.17	29.27	30.99	0.5	42.74	07:00 - 19:00	1.723E-05	2.695E-06	1.047E-06	1.617E-07
NAT8	Area	836576.50	818898.59	33.65	38.03	0.5	43.1	07:00 - 19:00	1.723E-05	2.695E-06	1.047E-06	1.617E-07
NAT9	Area	836602.11	818870.47	33.2	38.03	0.5	43.1	07:00 - 19:00	1.723E-05	2.695E-06	1.047E-06	1.617E-07
NAT10	Area	836622.75	818844.79	28.57	27.67	0.5	43.1	07:00 - 19:00	1.723E-05	2.695E-06	1.047E-06	1.617E-07
NAT11	Area	836640.59	818823.78	48.59	27.34	0.5	43.3	07:00 - 19:00	1.723E-05	2.695E-06	1.047E-06	1.617E-07
NAT12	Area	836658.94	818802.68	46.35	28.54	0.5	43.3	07:00 - 19:00	1.723E-05	2.695E-06	1.047E-06	1.617E-07
NAT13	Area	836684.33	818783.98	31.05	33.99	0.5	42.4	07:00 - 19:00	1.723E-05	2.695E-06	1.047E-06	1.617E-07
NAT14	Area	836700.54	818760.81	24.45	21.75	0.5	42.67	07:00 - 19:00	1.723E-05	2.695E-06	1.047E-06	1.617E-07
NAT15	Area	836716.79	818742.21	24.2	27.61	0.5	41.2	07:00 - 19:00	1.723E-05	2.695E-06	1.047E-06	1.617E-07
NAT16	Area	836732.80	818721.83	22.94	24.32	0.5	35.3	07:00 - 19:00	1.723E-05	2.695E-06	1.047E-06	1.617E-07
NAT17	Area	836745.43	818702.69	22.02	21.56	0.5	31.25	07:00 - 19:00	1.723E-05	2.695E-06	1.047E-06	1.617E-07
NAT18	Area	836755.73	818683.87	21.4	21.4	0.5	27.27	07:00 - 19:00	1.723E-05	2.695E-06	1.047E-06	1.617E-07
NAT19	Area	836762.30	818669.70	20.6	9.84	0.5	22.5	07:00 - 19:00	1.723E-05	2.695E-06	1.047E-06	1.617E-07
NAT20	Area	836766.98	818658.41	20.66	14.62	0.5	22.5	07:00 - 19:00	1.723E-05	2.695E-06	1.047E-06	1.617E-07
NAT21	Area	836772.29	818639.61	21.3	24.16	0.5	19.24	07:00 - 19:00	1.723E-05	2.695E-06	1.047E-06	1.617E-07
NAT22	Area	836778.52	818614.85	22.55	27.46	0.5	13.91	07:00 - 19:00	1.723E-05	2.695E-06	1.047E-06	1.617E-07
NAT23	Area	836784.38	818585.00	26.03	31.77	0.5	14.92	07:00 - 19:00	1.723E-05	2.695E-06	1.047E-06	1.617E-07
NAT24	Area	836790.12	818550.61	30.89	37.8	0.5	14.62	07:00 - 19:00	1.723E-05	2.695E-06	1.047E-06	1.617E-07
NAT25	Area	836796.35	818509.04	38.41	45.62	0.5	14.62	07:00 - 19:00	1.723E-05	2.695E-06	1.047E-06	1.617E-07
NAT26	Area	836802.11	818473.94	47.42	26.21	0.5	8.85	07:00 - 19:00	1.723E-05	2.695E-06	1.047E-06	1.617E-07
NAT27	Area	836805.94	818445.77	56.17	30.7	0.5	8.81	07:00 - 19:00	1.723E-05	2.695E-06	1.047E-06	1.617E-07
NAT28	Area	836807.21	818395.57	69.29	69.59	0.5	89.98	07:00 - 19:00	1.723E-05	2.695E-06	1.047E-06	1.617E-07
H1	Area	836789.34	817951.90	30.65	36.75	0.5	84.53	07:00 - 19:00	1.723E-05	2.695E-06	2.618E-06	4.043E-07

**Appendix 5.1 Calculation of Emission Rate (SCL (MKK - HUH))**

**Hung Hom Freight Pier Dust Sources**

Source	Type	X1	Y1	X2	Y2	Height (m)	Width / Angle	Working Hour	Tier 1		Annual	
									Working emission (g/m <sup>2</sup> -s)	Wind erosion (g/m <sup>2</sup> -s)	Working emission (g/m <sup>2</sup> -s)	Wind erosion (g/m <sup>2</sup> -s)
HAUL_RD1	Area	836983.59	817973.52	6.5	31.52	0.5	0	07:00 - 19:00	1.723E-05	0.000E+00	1.723E-05	0.000E+00
HAUL_RD2	Area	836976.8	817940.69	36.74	6.5	0.5	68.37	07:00 - 19:00	1.723E-05	0.000E+00	1.723E-05	0.000E+00
HAUL_RD3	Area	836963.45	817907.02	35.69	6.5	0.5	68.37	07:00 - 19:00	1.723E-05	0.000E+00	1.723E-05	0.000E+00
HAUL_RD4	Area	836942.15	817883.09	32.9	6.5	0.5	26.51	07:00 - 19:00	1.723E-05	0.000E+00	1.723E-05	0.000E+00
HAUL_RD5	Area	836912.71	817868.41	32.9	6.5	0.5	26.51	07:00 - 19:00	1.723E-05	0.000E+00	1.723E-05	0.000E+00
HAUL_RD6	Area	836897.42	817836.05	6.5	50.32	0.5	0	07:00 - 19:00	1.723E-05	0.000E+00	1.723E-05	0.000E+00
HAUL_RD7	Area	836897.42	817785.74	6.5	50.32	0.5	0	07:00 - 19:00	1.723E-05	0.000E+00	1.723E-05	0.000E+00
HAUL_RD8	Area	836897.42	817736.34	6.5	48.48	0.5	0	07:00 - 19:00	1.723E-05	0.000E+00	1.723E-05	0.000E+00
HAUL_RD9	Area	836897.42	817687.86	6.5	48.48	0.5	0	07:00 - 19:00	1.723E-05	0.000E+00	1.723E-05	0.000E+00
HAUL_RD10	Area	836883.84	817648.11	41.22	6.5	0.5	48.81	07:00 - 19:00	1.723E-05	0.000E+00	1.723E-05	0.000E+00
HAUL_RD11	Area	836860.47	817643.18	6.5	35	0.5	29.69	07:00 - 19:00	1.723E-05	0.000E+00	1.723E-05	0.000E+00
HAUL_RD12	Area	836867.38	817671.47	37.58	6.5	0.5	56.63	07:00 - 19:00	1.723E-05	0.000E+00	1.723E-05	0.000E+00
HAUL_RD13	Area	836877.71	817705.6	6.5	36.88	0.5	0	07:00 - 19:00	1.723E-05	0.000E+00	1.723E-05	0.000E+00
HAUL_RD14	Area	836877.71	817742.48	6.5	36.88	0.5	0	07:00 - 19:00	1.723E-05	0.000E+00	1.723E-05	0.000E+00
HAUL_RD15	Area	836877.71	817779.36	6.5	36.88	0.5	0	07:00 - 19:00	1.723E-05	0.000E+00	1.723E-05	0.000E+00
HAUL_RD16	Area	836877.71	817816.24	6.5	36.88	0.5	0	07:00 - 19:00	1.723E-05	0.000E+00	1.723E-05	0.000E+00
HAUL_RD17	Area	836878.62	817849.1	28.51	6.43	0.5	86.53	07:00 - 19:00	1.723E-05	0.000E+00	1.723E-05	0.000E+00
HAUL_RD18	Area	836880.31	817877.56	28.51	6.5	0.5	86.53	07:00 - 19:00	1.723E-05	0.000E+00	1.723E-05	0.000E+00
HAUL_RD19	Area	836881.16	817908.15	6.5	33.12	0.5	0.03	07:00 - 19:00	1.723E-05	0.000E+00	1.723E-05	0.000E+00
HAUL_RD20	Area	836881.15	817941.27	6.5	33.12	0.5	0.02	07:00 - 19:00	1.723E-05	0.000E+00	1.723E-05	0.000E+00
HOLD_RD1	Area	836981.21	817907.36	6.5	36.8	0.5	23.94	07:00 - 19:00	1.723E-05	0.000E+00	1.723E-05	0.000E+00
HOLD_RD2	Area	836996.14	817873.73	6.5	36.8	0.5	23.94	07:00 - 19:00	1.723E-05	0.000E+00	1.723E-05	0.000E+00
HOLD_RD3	Area	836994.67	817850.84	25.34	6.5	0.5	17.51	07:00 - 19:00	1.723E-05	0.000E+00	1.723E-05	0.000E+00
HOLD_RD4	Area	836970.34	817846.89	24.49	6.36	0.5	0.32	07:00 - 19:00	1.723E-05	0.000E+00	1.723E-05	0.000E+00
HOLD_RD5	Area	836945.86	817846.82	24.49	6.5	0.5	0.32	07:00 - 19:00	1.723E-05	0.000E+00	1.723E-05	0.000E+00
HOLD_RD6	Area	836936.75	817856.36	6.5	12.6	0.5	1.03	07:00 - 19:00	1.723E-05	0.000E+00	1.723E-05	0.000E+00
HOLD_RD7	Area	836950.37	817866.22	28.38	6.5	0.5	14.56	07:00 - 19:00	1.723E-05	0.000E+00	1.723E-05	0.000E+00
HOLD_RD8	Area	836961.44	817880.03	6.5	20.6	0.5	14.56	07:00 - 19:00	1.723E-05	0.000E+00	1.723E-05	0.000E+00
BP-1	Point	836913.8	817747.3	0	0	0.5	0	07:00 - 19:00	1.983E-02	0.000E+00	1.983E-02	0.000E+00
BP-2	Point	836866.8	817604.9	0	0	0.5	0	07:00 - 19:00	1.983E-02	0.000E+00	1.983E-02	0.000E+00