

Appendix 3-9
Calculated Dust Suppression Efficiency and
Annual Active Works Area

Appendix 3-9A Calculation of Dust Suppression Efficiency of this Project

Methodology:

The same methodology adopted in the approved "Liantang / Heung Yuen Wai Boundary Control Point and Associated Works EIA report"¹ for estimating construction dust suppression efficiency (both short-term and long-term) on the "cut and cover area", "construction of connecting road", and "slope stabilization" by watering, has also been adopted for this Project in view of similar types of construction activities.

According to the above-mentioned approved EIA report, dust suppression rates can be estimated based on Equation 3-2 provided in the Control of Open Fugitive Dust Sources Final Report⁽²⁾, which is also referenced in the AP-42. Equation 3-2 is shown below:

$$C = 100 - \frac{0.8 p d t}{i} \quad (3-2)$$

where: C = average control efficiency, percent
P = potential average hourly daytime evaporation rate, mm/h
d = average hourly daytime traffic rate, (h⁻¹)
i = application intensity, L/m²
t = time between applications, h

Estimates of the potential average hourly daytime evaporation rate may be obtained from:

P = 0.0049 x evaporation for annual conditions

Assumptions:

P value in Equation 3-2 is calculated based on information from Hong Kong Observatory's (HKO) website (http://www.weather.gov.hk/cis/normal/1981_2010/normals_e.htm). According to HKO, the recorded annual total evaporation was 1227.3mm, which is equivalent to 48.3188 inch.

Thus, the P value is calculated by 0.0049 x 48.3188 = 0.2368 mm/hr according to Equation 3-2 above.

d is the maximum no. of vehicles generated per hour during peak construction period according to Section 3.7.1.3 of this EIA Report (i.e. 10 vehicles/ hr)

i is the Application Intensity = 0.24 L/m². (Note: The Project construction site is only accessible from Yau Pok Road with limited amount of construction vehicles (10 vehicles/hr). Also, higher watering frequency is proposed to suppress dust emission. Thus relatively lower application intensity is required in order to achieve the dust suppression rate in accordance with the above equation.)

t is the time between application. Assuming the construction works are undertaken 10 hours a day from 0800 to 1800 hours as stated in Section 3.7.1.3 of this EIA report. For a water spraying frequency of 8 times a day, t = 10/8 = 1.25 hour. (Note: water spraying of 8 times a day has been specified in Section 3.9.1 of this EIA Report, and will be included in the contract with Contractor).

Hence,

By applying the above Equation 3-2 and the assumptions, the dust suppression efficiency is estimated as followings:

$$\begin{aligned} \text{Dust suppression efficiency (C)} &= 100 - (0.8 \times 0.2368 \times 10 \times 1.25/0.24) \\ &= \mathbf{90.1\%} \end{aligned}$$

According to the "Gregory E. Muleski, Chatten Cowherd Jr. & John S. Kinsey (2005): Particulate Emissions from Construction Activities, *Journal of the Air & Waste Management Association*, 55:6, 772-783", (also available at: <http://www.tandfonline.com/doi/abs/10.1080/10473289.2005.10464669>), the published control efficiency of particulate emissions by applying water, is reportedly to reach over 90%. Thus, the above calculated dust suppression control efficiency is achievable.

A dust suppression efficiency of 90% is adopted in this assessment.

Remark:

(1) Appendix 3.1f, 3.1a, and 3.1b, Agreement No. CE 45/2008 (CE) Liantang / Heung Yuen Wai Boundary Control Point and Associated Works, Environmental Impact Assessment Report (EIA-190/2010)

(2) C. Cowherd, Jr., et al., Control Of Open Fugitive Dust Sources - Final Report, EPA-450/3-88-008, U.S. Environmental Protection Agency, Research Triangle Park, NC, September 1988.

Appendix 3-9B-1 Average Active Works Area for Southern Portion

Since the Southern Portion will be constructed in phased and only one construction zone will be in operation in any one time. The corresponding % of site area occupied by each construction zone is estimated below.

According to the estimation, the annual average active works area of the Southern Portion is about 5% of the total works area at Southern Portion. Thus, this figure has been applied to calculation of annual average TSP emission factor as shown in Appendix 3-5.

Site Area of Southern Portion, m²	43,000
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Phasing Zone *	% of Site Area
S1	6%
S2	7%
S3	5%
S4	4%
S5	5%
S6	6%
S7	5%
S8	5%
S9	3%
S10	5%
S11	3%
S12	3%
S13	6%
S14	6%
S15	4%
S16	4%
S17	7%
S18	6%
S19	10%
Total	100%

Annual Average Active Works Area, %	5%
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Remark: * Please refer to Appendix 3-8 for the phasing plan.

Appendix 3-9B-2 Estimation of Active Construction Area by Construction Plants

Works Area : Southern Portion

A sensitivity test was also carried out based on the number of construction plants to be used during the site formation stage and the approx. size of each plant.

It was found that the estimated active construction area occupied by the construction plants, is about 1% of the site area and is smaller than the estimated annual average figure presented in Appendix 3-9B-1.

Works Area (approx.) = 43,000 m²

Activity During Site Formation Stage

Activity : Site Formation, Filling and Excavation

Powered Mechanical Equipment * (PME)	No. of Items *	Plant Size		Area (m ²)
		B (m)	L (m)	
Air Compressor	3	2.2	5.0	33.0
Excavator, wheeled/tracked	4	3.2	8.0	102.4
Generator, super silenced	3	0.3	0.3	0.3
Dump Truck	4	2.4	10.0	96.0
Breaker, mini-robot mounted	1	0.5	1.0	0.5
Excavator, wheeled/tracked	1	3.2	8.0	25.6
Roller, vibratory	4	1.4	4.5	25.2
Bulldozer	4	4.5	8.3	149.4
Subtotal:				432.4

Total Active Construction Area Occupied	432.4
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Works Area (m²)	43,000
% of Usage Area to Works Area	1.0%
Active Area <5%?	Yes

Remark:

* Based on the type and no. of PMEs during site formation stage as shown in the plant inventory in Table 4-11 of the EIA report.

The actual dust emission area for each plant/activity was estimated and given as "Area", by taking account the maximum area of dust emissions which could be created by the plant/activity at any time instant.

Justification provided above is for the purpose of assessment only. Actual figures would be subject to detailed design stage.

Appendix 3-9C-1 Average Active Works Area for Northern Portion

Since the Northern Portion will be constructed in phased and only one construction zone will be in operation in any one time. The corresponding % of site area occupied by each construction zone is estimated below.

According to the estimation, the annual average active works area of the Northern Portion is about 5% of the total works area at Northern Portion. Thus, this figure has been applied to calculation of annual average TSP emission factor as shown in Appendix 3-5.

Site Area of Northern Portion, m²	44,500
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Phasing Zone *	% of Site Area
N1	4%
N2	4%
N3	5%
N4	7%
N5	6%
N6	5%
N7	5%
N8	4%
N9	4%
N10	3%
N11	6%
N12	7%
N13	6%
N14	5%
N15	7%
N16	6%
N17	7%
N18	5%
N19	4%
Total	100%

Annual Average Active Works Area, %	5%
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Remark: * Please refer to Appendix 3-8 for the phasing plan.

Appendix 3-9C-2 Estimation of Active Construction Area by Construction Plants

Works Area : Northern Portion

A sensitivity test was also carried out based on the number of construction plants to be used during the site formation stage and the approx. size of each plant.

It was found that the estimated active construction area occupied by the construction plants, is about 1.6% of the site area and is smaller than the estimated annual average figure presented in Appendix 3-9C-1.

Works Area (approx.) = 44,500 m²

Activity During Site Formation Stage

Activity : Site Formation, Filling and Excavation

Powered Mechanical Equipment * (PME)	No. of Items *	Plant Size		Area (m ²)
		B (m)	L (m)	
Air Compressor	4	2.2	5.0	44.0
Excavator, wheeled/tracked	6	3.2	8.0	153.6
Generator, super silenced	6	0.3	0.3	0.5
Dump Truck	6	2.4	10.0	144.0
Breaker, mini-robot mounted	2	0.5	1.0	1.0
Excavator, wheeled/tracked	1	3.2	8.0	25.6
Roller, vibratory	8	1.4	4.5	50.4
Bulldozer	8	4.5	8.3	298.8
Subtotal (B):				717.9

Total Active Construction Area Estimate (A+B)	717.9
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Works Area (m²)	44,500
% of Usage Area to Works Area	1.6%
Active Area <5%?	Yes

Remark:

* Based on the type and no. of PMEs during site formation stage as shown in the plant inventory in Table 4-10 of the EIA report.

The actual dust emission area for each plant/activity was estimated and given as "Area", by taking account the maximum area of dust emissions which could be created by the plant/activity at any time instant.

Justification provided above is for the purpose of assessment only. Actual figures would be subject to detailed design stage.