

Appendix 3-9

Calculation of 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 3.7.1.4 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 and only be accessed by 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 3.7.1.4 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:

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

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 (Based on Proposed Sub-zones)

Since the Phases B, C, and D including its adjacent buffer planting area will be constructed in phased and only one sub-zone will be under construction in any one time. The corresponding % of site area occupied by each sub-zone zone is estimated below.

According to the estimation, the annual average active works area (by each sub-zone) is about 5% of the concerned total works area.

Works Area (Phases B to D), m² **	44,000
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Phase	Phasing Sub-zone *	% of Site Area
Phase B	Y01	3%
	Y02	3%
	Y03	4%
	Y04	4%
	Y05	5%
	Y06	4%
	Y07	4%
Phase C	Y08	8%
	Y09	6%
	Y10	4%
	Y11	8%
	Y12	5%
	Y13	5%
	Y14	8%
Phase D	Y15	3%
	Y16	3%
	Y17	4%
	Y18	4%
	Y19	4%
	Y20	6%
	Y21	4%
Total		100%

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

** Total site area of Phases B to D as well as buffer planting area along its edge in adjacent to the WRA, is taken as 4.4ha.

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

Works Area :

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 concerned works area and is smaller than the estimated annual average figure presented in Appendix 3-9B-1.

Works Area (approx.) ** = 44,000 m²

Activity During Site Formation Stage

Activity : Site Formation, Filling and Excavation

Powered Mechanical Equipment * (PME)	No. of Items *	Plan Size		Area (m ²)
		B (m)	L (m)	
Air Compressor	2	2.2	5.0	22.0
Excavator, wheeled/tracked	4	3.2	8.0	102.4
Generator, super silenced	2	0.3	0.3	0.2
Dump Truck	3	2.4	10.0	72.0
Breaker, mini-robot mounted	2	0.5	1.0	1.0
Mobile crane	1	2.6	10.0	26.0
Roller, vibratory	3	1.4	4.5	18.9
Bulldozer	3	4.5	8.3	112.1
power rammer	1	0.5	0.5	0.3
continuous flight auger	2	39.5		79.0
concrete lorry mixer	1	2.4	10.0	24.0
concrete pump	2	2.4	10.0	48.0
poker, vibratory, hand-held	1	0.5	1.2	0.6
bar-bender and cutter	1	1.5	1.5	2.3
Subtotal:				508.6

Total Active Construction Area Occupied	508.6
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Works Area (m²) **	44,000
% of Usage Area to Works Area	1.2%
Active Area <5%?	Yes

Remark:

* The above figures are based on the type and maximum no. of PME's during the site formation stage as shown in the plant inventory in the Noise Chapter of the EIA report (i.e. Appendix 4-3B refers). Please note that the above calculation of plan area has been based on a conservative approach by assuming all the equipment is used at the same time. However, some equipment will only be used at certain stages of construction and not all the equipment will be operated at the same time.

** Total site area of Phases B to D as well as buffer planting area along its edge in adjacent to the WRA, is taken as 4.4ha.

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.