Cross Bay Link, Tseung Kwan O - Investigation

Summary of Active Construction Area Estimate

Works Area	Estimated Max. Active Area (m^2) [1]		Estimated Max. Percentage Active Area (%)		Assumed Percentage Active Area for Construction Dust Assessment (%) [2]	
	1-hour & 24-hour	Annual	1-hour & 24-hour	Annual	1-hour & 24-hour	Annual
Road D9 Construction	2,144	1,196	7.3%	4.1%	30.0%	6.0%

Note:

[1] Active works areas that would generate dust emissions during construction phase are estimated by the Engineer. Details are provided in this appendix.

[2] As a conservative assessment, it is assumed that the 1-hour/24-hour and annual percentage active areas are 30% and 6% respectively.

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Active Construction Area Estimate - Road D9 Construction

Works Area = 29200 m^2
(total area of works area ID D9-1 to D9-3 in air quality assessment)

Construction Activities	From	To	Duration (Month)	Active Area (m^2)	% Active Area to Works Area
Activity 1 - Earthworks for seawall modification	01-Aug-17	30-May-18	10	1579	5.4%
Activity 2 - Sea Wall Strengthening	01-Dec-17	30-May-18	6	565	1.9%
Activity 3 - Ground Improvement Works (TBC)	01-Jun-18	30-Sep-18	4	431	1.5%
Activity 4 - Piling for noise barrier	01-Oct-18	31-Mar-19	6	635	2.2%
Activity 5 - Noise barrier erection	01-Apr-19	30-Sep-19	6	312	1.1%
Activity 6 - Street furniture, Pavement and Road markings	01-Apr-19	30-Aug-19	5	1293	4.4%

Note:

1. Active Area means the works area that would generate dust emissions during construction phase (estimated by the Engineer).
2. Estimations provided above are for the purpose of assessment only. Actual figures would be defined during detailed design stage.

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Preliminary Construction Programme for Road D9 Construction

Activities	2017												2018												2019												2020											
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Road D9 Construction																																															
Activity 1 - Earthworks for seawall modification								5.4%	5.4%	5.4%	5.4%	5.4%	5.4%	5.4%	5.4%	5.4%	5.4%																																	
Activity 2 - Sea Wall Strengthening												1.9%	1.9%	1.9%	1.9%	1.9%	1.9%																																	
Activity 3 - Ground Improvement Works (TBC)																		1.5%	1.5%	1.5%	1.5%																												
Activity 4 - Piling for noise barrier																						2.2%	2.2%	2.2%	2.2%	2.2%	2.2%																						
Activity 5 - Noise barrier erection																												1.1%	1.1%	1.1%	1.1%	1.1%	1.1%															
Activity 6 - Street furniture, Pavement and Road markings																												4.4%	4.4%	4.4%	4.4%	4.4%	4.4%															
Combined 1-hour & 24-hour Percentage Active Area	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	5.4%	5.4%	5.4%	5.4%	7.3%	7.3%	7.3%	7.3%	7.3%	7.3%	1.5%	1.5%	1.5%	1.5%	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Combined Annual Percentage Actice Area												2.4%												4.1%											3.3%												0.0%
Max. 1-hour & 24-hour Percentage Active Area	**7.3%**																																														
Max. Annual Percentage Actice Area	**4.1%**																																														

Active Area (m^2)

Works Area	2017												2018												2019												2020											
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Road D9 Construction	0	0	0	0	0	0	0	1579	1579	1579	1579	2144	2144	2144	2144	2144	2144	431	431	431	431	635	635	635	635	635	635	1605	1605	1605	1605	1605	1605	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Monthly 1-hour & 24-hour Active Area	0	0	0	0	0	0	0	1579	1579	1579	1579	2144	2144	2144	2144	2144	2144	431	431	431	431	635	635	635	635	635	635	1605	1605	1605	1605	1605	1605	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual Actice Area												705												1196											961												0	
Max. 1-hour & 24-hour Active Area =	**2144**	**m^2**																																													
Max. Annual Active Area =	**1196**	**m^2**																																													

Calculation of Watering Efficiency

With reference to Cowherd et al., "Control of Open Fugitive Dust Sources, EPA-450/3-88-008, U.S. Environmental Protection Agency, Research Triangle Park, NC, percentage of dust mitigation efficiency is calculated from Equation (3-2) :

$$C = 100 - \frac{0.8\,p\,d\,t}{i}$$

Where

p = Potential average hourly daytime evaporation rate, mm/hr = 0.25916 [1]

d = Average hourly daytime traffic rate per hour = 20/hr [2]

I = Application intensity = 0.5 L/m^2 [3]

Note:

[1] p = 0.0049 x 52.8898 inch where 52.8898 inch is equivalent to the total evaporation of 1343.4mm obtained from Hong Kong Observatory (http://www.weather.gov.hk/cis/normal/1971_2000/normals_e.htm)

[2] Estimated by Engineer

[3] The assumptions provided are for the purpose of assessment predictions only. Actual figures would be defined in the detailed design stage.

By applying the Equation (3-2) with the above assumptions,

Dust suppression efficiency = 100 – 0.8 x (0.25916 x 20 x t) / 0.5 [t = time between application, hr]

Therefore,

For watering once per 1 hour (i.e. t =1 hour), the estimated dust suppression efficiency is 91.7%

EPA-450/3-88-008

CONTROL OF OPEN FUGITIVE DUST SOURCES

FINAL REPORT

by

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MRI Project 8985-14

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This report has been reviewed by the Emission Standards Division of the Office of Air Quality Planning and Standards, EPA, and approved for publication. Mention of trade names or commercial products is not intended to constitute endorsement or recommendation for use. Copies of this report are available through the Library Services Office (MD-35), U.S. Environmental Protection Agency, Research Triangle Park NC 27711, or from National Technical Information Services, 5285 Port Royal, Springfield VA 22161.

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3.3.3 Surface Treatments

3.3.3.1 Watering. The control efficiency of unpaved road watering depends upon (a) the amount of water applied per unit area of road surface, (b) the time between reapplications, (c) traffic volume during that period, and (d) prevailing meteorological conditions during the period. While several investigations have estimated or studied watering efficiencies, few have specified all the factors listed above.

An empirical model for the performance of watering as a control technique has been developed.[8] The supporting data base consists of 14 tests performed in four states during five different summer and fall months. The model is:

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

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/m^2

t = time between applications, h

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

$$p = \begin{matrix} 0.0049 \text{ x (value in Figure 3-2) for annual conditions} \\ 0.0065 \text{ x (value in Figure 3-2) for summer conditions} \end{matrix}$$

An alternative approach (which is potentially suitable for a regulatory format) is shown as Figure 3-3. This figure is adapted from 11 field tests conducted at a coal-fired power plant. Measured control efficiencies did not correlate well with either time or vehicle passes after application. However, this is believed due to reduced evening evaporation (logistics delayed the start of testing until 3 p.m. and testing continued through the early evening). Surface moisture grab samples were taken throughout the testing period, and not surprisingly, these show a strong correlation with control efficiency.

Figure 3-3 shows that between the average uncontrolled moisture content and a value of twice that, a small increase in moisture content results in a large increase in control efficiency. Beyond this point, control efficiency grows slowly with increased moisture content. Although