

### Appendix 3.6 In-Tunnel Calculation

#### In-Tunnel Calculation (Peak Traffic Condition) - Year 2027

##### Tunnel Parameter

Length (L):	175 m
Height (H):	6 m
Width (W):	6.8 m
Equivalent Diameter (dt):	7.207 m
Cross-section area = H * W, (At):	40.8 m <sup>2</sup>
Perimeter = $(4*At/\pi)^{0.5}$ , (P):	25.6 m
Equivalent length of tunnel = L + 2*3*dt, (Le):	218.245 m

##### Emission Data

Traffic flow (Q) - peak traffic flow: 1014 veh/hr

Traffic Breakdown	PC	TAXI	LGV3	LGV4	LGV6	HGV7	HGV8	PLB	PV4	PV5	NFB6	NFB7	NFB8	FBSD	FBDD	MC	Total
77 Eastern Connection Road (SB) (50km/hr)	133	81	0	1	1	1	2	0	0	0	0	0	0	12	0	39	
78 Eastern Connection Road (NB)(50km/hr)	379	232	0	2	1	1	2	0	1	0	1	1	1	12	0	111	
No. of Vehicles	512	313	0	3	2	2	4	0	1	0	1	1	1	24	0	150	1014
% vehicle	50.49%	30.87%	0.00%	0.30%	0.20%	0.20%	0.39%	0.00%	0.10%	0.00%	0.10%	0.10%	0.10%	2.37%	0.00%	14.79%	
NO2 emission factor (g/s):	13.635	173.764	0.000	1.879	1.704	2.550	9.274	0.000	0.068	0.000	0.751	1.319	1.972	86.930	0.000	165.697	

Composite Emission Factor Nox: 0.453 g/km/veh

Total NO2 emission factor (g/m/s): (w) 0.0000160 g/m/s

Note: NO2 conversion factor is 12.5% (including tailpipe NO2 emission taken as 7.5% of Nox and 5% of NO2/Nox for tunnel air)

##### Vehicle Data

Nominal dimensions of vehicles	W (m)	H (m)	L (m)	% veh	%L
PC	1.7	1.5	4.6	0.505	2.323
TAXI	1.7	1.5	4.6	0.309	1.420
LGV3	2.1	1.6	5.2	0.000	0.000
LGV4	2.1	1.6	5.2	0.003	0.015
LGV6	2.1	1.6	5.2	0.002	0.010
HGV7	2.5	4.6	16	0.002	0.032
HGV8	2.5	4.6	16	0.004	0.063
PLB	2	3	6.5	0.000	0.000
PV4	2	3	6.5	0.001	0.006
PV5	2	3	6.5	0.000	0.000
NFB6	2.5	3.5	12	0.001	0.012
NFB7	2.5	3.5	12	0.001	0.012
NFB8	2.5	3.5	12	0.001	0.012
FBSD	2.5	3.5	12	0.024	0.284
FBDD	2.5	4.6	12	0.000	0.000
MC	1.7	1.5	4.6	0.148	0.680

Note: No dimensions for motor cycles and non-franchised buses are provided. Fro the purpose of this study, the dimension of motor cycles and taxi are assumed to be the same as private car and the dimension of non-franchised buses are assumed to be the same as single deck franchised buses.

Nominal cross-section Area A<sub>c</sub>: 2.775 m<sup>2</sup>

Equivalent length of each vehicle 4.869 m

No. of lane per direction, n1: 1

Equivalent cross-sectional A for each direction, A<sub>v</sub> 2.775 m<sup>2</sup>

Equivalent diameter (m) dv 1.880 m

Distance between vehicle head to head distance on a lane, l 1 m  
 Traffic density, N 5.869 m  
 Ave speed, v 0.282 veh/s  
 0.827 m/s

**Diffusion Parameters**

Reynolds number, Re 99607.058

Since l/dt 0.814

$D/(N * dt^2 * Re^{0.13}) = 0.15$

Diffusion coefficient, D 9.799

Max Conc NO2 237.628 ug/m3

**Background Concentration**

Caline and ISCST cumulative results:

x	y	Height	NO2
826733	842594	0	90.75
826733	842594	3.5	82.68
826733	842594	7	74.32
826871	842481	0	66.27
826871	842481	3.5	65.60
826871	842481	7	65.03
826735	842587	0	85.38
826735	842587	3.5	79.75
826735	842587	7	72.87
826874	842484	0	66.58
826874	842484	3.5	65.65
826874	842484	7	65.00
			90.75

In-Tunnel NO2: 328.38 ug/m3