Annex I
Marine Emission Rate for River Trade Terminal in Year 2048
River Trade Vessels
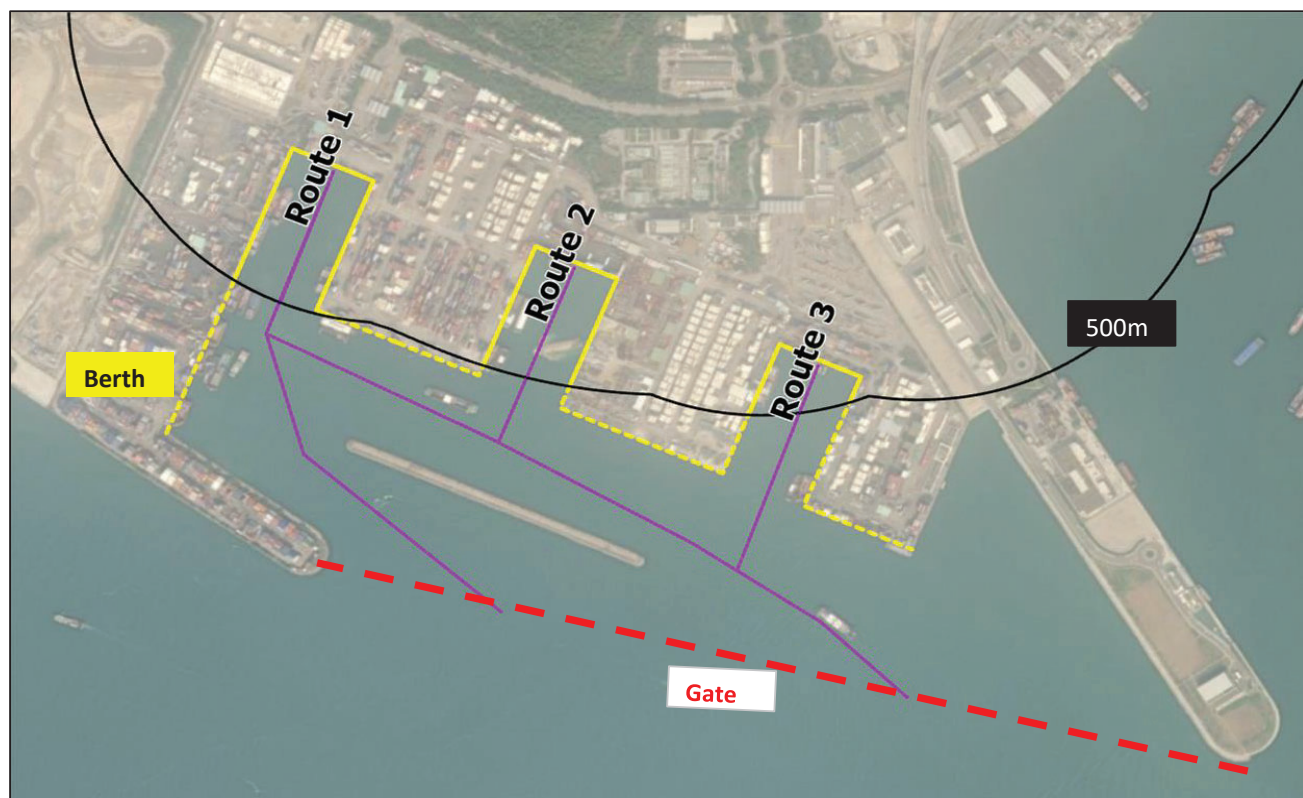
Marine Traffic Information of the Entire River Trade Terminal (RTT)

Assessment Year	2048
Assessed Vessel Type	River Trade Vessels
Location	River Trade Terminal
Total Length of Berth (m)	3050
Monthly Vessel Count for arrival and departure in RTT [1]	8020
Monthly Vessel Count for Hotelling at RTT [1]	4010
Travelling Speed (knots) [2]	4
Hotelling Time (hours) [2]	2

Notes:

[1] Monthly vessel count for manevuering is advised by Marine Traffic Consultant and accepted by Marine Department, and that for hotelling is half of the number for manevuering.

[2] Average travelling speed of 4 knot and average hotelling time of 2 hours are provided by Marine Traffic Consultant.

Marine Traffic Information by Routes

Sailing Route	Length of Berth within Assessment Area (m)	Monthly Vessel Count in Aug for Maneuvering within Assessment Area [1]	Travelling Speed (knots)[2]	Length of Sailing Route within Assessment Area (m) [4]	Monthly Vessel Count in Aug for Hotelling within Assessment Area[1]	Hotelling Time (hours) [3]
1	696	1,830	4	251	915	2
2	589	1,549	4	211	774	2
3	333	876	4	90	438	2

Notes:

[1] No information on the vessel count breakdown at different berth and routes. Hence monthly vessel count by routes is estimated by pro-rata to the length of the approached berth.

[2] Average speed of 4 knot is provided by Marine Traffic Consultant.

[3] Average hotelling time of 2 hours are provided by Marine Traffic Consultant.

[4] Possible maximum length of sailing route for each route is estimated for conservative assessment.

[5] As advised by Marine Traffic Consultant, the RTVs include container vessel, local lighter/barge/cargo junk, local bunker vessel, and tug and tow.

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Marine Emission Inventory during Maneuvering

Calculation of Time-In-Mode by Route

Sailing Route	Speed (m/s) [1]	Length of Sailing Route within Assessment Area (m) [2]	Time-In-Mode (minutes) during Maneuvering [3]
1	2.06	251	2.03
2	2.06	211	1.71
3	2.06	90	0.73

Notes:
[1] Average speed of 4 knot is provided by Marine Traffic Consultant and assumed to be constant throughout River Trade Terminal.
[2] Possible maximum length of sailing route is estimated for conservative assessment.
[3] Time-in-mode during maneuvering is derived from the length of sailing route and averaged speed within assessment area.

Total Emission Rate per Trip by Route

Sailing Route	Group [1]	Vessel Type	Emission Rate per Trip (g/s) [2] NOx	Emission Rate per Trip (g/s) [2] RSP	Emission Rate per Trip (g/s) [2] FSP	Annual No. of Vessel Arrivals in Year 2019 [3]	Composite Emission Rate per Trip (g/s) [4] NOx	Composite Emission Rate per Trip (g/s) [4] RSP	Composite Emission Rate per Trip (g/s) [4] FSP
1	1	Fully Cellular Container Vessel	1.68E-02	5.39E-04	5.22E-04	34718	1.65E-02	5.30E-04	5.14E-04
		Semi-container Vessel	1.55E-02	5.00E-04	4.85E-04	9943			
	2	Conventional Cargo Vessel	1.55E-02	4.98E-04	4.83E-04	-	1.55E-02	4.98E-04	4.83E-04
	3	Dry Bulk Carrier	1.62E-02	5.21E-04	5.05E-04	-	1.62E-02	5.21E-04	5.05E-04
	4	Tug	5.18E-02	2.77E-03	2.69E-03	-	5.18E-02	2.77E-03	2.69E-03
	5	Chemical Carrier	4.11E-02	1.80E-03	1.75E-03	247	4.15E-02	1.81E-03	1.76E-03
		Gas Carrier	4.16E-02	1.82E-03	1.76E-03	134			
		Oil Tanker	4.16E-02	1.82E-03	1.76E-03	419			
	6	Mechanised Lighter/Barge/Cargo Junk	1.84E-02	5.98E-04	5.79E-04	-	1.84E-02	5.98E-04	5.79E-04
2	1	Fully Cellular Container Vessel	1.41E-02	4.53E-04	4.39E-04	34718	1.39E-02	4.46E-04	4.32E-04
		Semi-container Vessel	1.31E-02	4.21E-04	4.08E-04	9943			
	2	Conventional Cargo Vessel	1.30E-02	4.19E-04	4.06E-04	-	1.30E-02	4.19E-04	4.06E-04
	3	Dry Bulk Carrier	1.36E-02	4.38E-04	4.25E-04	-	1.36E-02	4.38E-04	4.25E-04
	4	Tug	4.36E-02	2.33E-03	2.26E-03	-	4.36E-02	2.33E-03	2.26E-03
	5	Chemical Carrier	3.45E-02	1.51E-03	1.47E-03	247	3.49E-02	1.52E-03	1.48E-03
		Gas Carrier	3.50E-02	1.53E-03	1.48E-03	134			
		Oil Tanker	3.50E-02	1.53E-03	1.48E-03	419			
	6	Mechanised Lighter/Barge/Cargo Junk	1.54E-02	5.02E-04	4.87E-04	-	1.54E-02	5.02E-04	4.87E-04
3	1	Fully Cellular Container Vessel	6.03E-03	1.93E-04	1.87E-04	34718	5.93E-03	1.90E-04	1.84E-04
		Semi-container Vessel	5.57E-03	1.79E-04	1.74E-04	9943			
	2	Conventional Cargo Vessel	5.55E-03	1.79E-04	1.73E-04	-	5.55E-03	1.79E-04	1.73E-04
	3	Dry Bulk Carrier	5.82E-03	1.87E-04	1.81E-04	-	5.82E-03	1.87E-04	1.81E-04
	4	Tug	1.86E-02	9.92E-04	9.64E-04	-	1.86E-02	9.92E-04	9.64E-04
	5	Chemical Carrier	1.47E-02	6.45E-04	6.27E-04	247	1.49E-02	6.49E-04	6.31E-04
		Gas Carrier	1.49E-02	6.51E-04	6.33E-04	134			
		Oil Tanker	1.49E-02	6.51E-04	6.33E-04	419			
	6	Mechanised Lighter/Barge/Cargo Junk	6.58E-03	2.14E-04	2.08E-04	-	6.58E-03	2.14E-04	2.08E-04

Engine in Operation

Engine	On (1) or Off (0) [2]
ME	1
AE	1

Notes:
[1] The vessel type is grouped according to the modelling parameter (i.e. stack height, exit temperature, exit velocity etc). Vessel types with the identical modelling parameters will be grouped.
[2] Main and auxiliary engine are assumed in operation during maneuvering for conservative assessment with reference to Table 3-25 of Study on Marine Vessels Emission Inventory Final Report (HKUST, February 2012). The emission rate per trip considers the emission from the engine in operation as indicated in the table "Engine in Operation", and the calculation is documented in the "Technical Notes on Marine Emission for Pillar Point Area" submitted to EPD.
[3] Marine Traffic Consultant has provided the total number of RTVs but without breakdown into different vessel types. Hence, reference has been made to Marine Department's Vessels Arrivals by Ship Type and Ocean/River (https://www.mardep.gov.hk/en/fact/pdf/portstat_2_y_a2.pdf). Due to the pandemic situation, there was a significant change in marine traffic from Year 2020 to Year 2022. In view of this, the monthly profile of Year 2019 is considered the most appropriate and therefore adopted and assumed the same for future years.
[4] The emission rate per trip is calculated based on the following equation. Breakdown is provided and documented in "Technical Notes on Marine Emission for Pillar Point Area" submitted to EPD and emission rates are evenly apportioned into point sources in the model as shown in subsequent pages of this Appendix.
Engine Emission Rate per Trip = (i)Time-in-mode x (ii)Engine Load Factors x (iii) Engine Power x (iv) Emission Factor, where
(i) As indicated in the table of "calculation of Time-In-Mode by Route", time-in-mode is calculated from the average speed and possible maximum length of sailing route within assessment area provided by Marine Traffic Consultant.
(ii) Engine Load Factors are made reference to Table 4-7, Table 4-10 and Table 3-24 of Study on Marine Vessels Emission Inventory Final Report (HKUST, February 2012).
(iii) The average engine powers are made reference to Table 4-5 and Table 4-6 of the Study on Marine Vessels Emission Inventory Final Report (HKUST, February 2012).
(iv) The emission factor is made reference to Study on Marine Vessels Emission Inventory Final Report (HKUST, February 2012) Table 4-16. Under the Air Pollution Control (Fuel for Vessels) Regulation, all vessels assumed to use MGO due to requirement to fuel switch to compliant fuel (sulphur content <=0.5%) within Hong Kong waters.

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Modelling Parameters

Group	Sailing Route	Source ID	Type	X	Y	Base Elevation	Release Height [1]	Exit Temperature [1]	Exit velocity [1]	Internal diameter [1]	Emission Rate per Trip		
											NOx	RSP	FSP
				(m)	(m)	(mpd)	(m)	(K)	(m/s)	(m)	(g/s)	(g/s)	(g/s)
1	1	RT_RM1_001	POINT	811627.3	825147	0	34.2	537	24.6	1.9	3.31E-03	1.06E-04	1.03E-04
1	1	RT_RM1_002	POINT	811608.9	825100.5	0	34.2	537	24.6	1.9	3.31E-03	1.06E-04	1.03E-04
1	1	RT_RM1_003	POINT	811590.4	825054	0	34.2	537	24.6	1.9	3.31E-03	1.06E-04	1.03E-04
1	1	RT_RM1_004	POINT	811572	825007.6	0	34.2	537	24.6	1.9	3.31E-03	1.06E-04	1.03E-04
1	1	RT_RM1_005	POINT	811553.6	824961.1	0	34.2	537	24.6	1.9	3.31E-03	1.06E-04	1.03E-04
1	2	RT_RM1_006	POINT	812035.9	824974.6	0	34.2	537	24.6	1.9	3.47E-03	1.11E-04	1.08E-04
1	2	RT_RM1_007	POINT	812016.8	824928.4	0	34.2	537	24.6	1.9	3.47E-03	1.11E-04	1.08E-04
1	2	RT_RM1_008	POINT	811997.6	824882.2	0	34.2	537	24.6	1.9	3.47E-03	1.11E-04	1.08E-04
1	2	RT_RM1_009	POINT	811978.4	824836.1	0	34.2	537	24.6	1.9	3.47E-03	1.11E-04	1.08E-04
1	3	RT_RM1_010	POINT	812452.4	824799.4	0	34.2	537	24.6	1.9	5.93E-03	1.90E-04	1.84E-04
2	1	RT_RM2_001	POINT	811627.3	825147	0	11	555	25	0.8	3.09E-03	9.97E-05	9.66E-05
2	1	RT_RM2_002	POINT	811608.9	825100.5	0	11	555	25	0.8	3.09E-03	9.97E-05	9.66E-05
2	1	RT_RM2_003	POINT	811590.4	825054	0	11	555	25	0.8	3.09E-03	9.97E-05	9.66E-05
2	1	RT_RM2_004	POINT	811572	825007.6	0	11	555	25	0.8	3.09E-03	9.97E-05	9.66E-05
2	1	RT_RM2_005	POINT	811553.6	824961.1	0	11	555	25	0.8	3.09E-03	9.97E-05	9.66E-05
2	2	RT_RM2_006	POINT	812035.9	824974.6	0	11	555	25	0.8	3.25E-03	1.05E-04	1.02E-04
2	2	RT_RM2_007	POINT	812016.8	824928.4	0	11	555	25	0.8	3.25E-03	1.05E-04	1.02E-04
2	2	RT_RM2_008	POINT	811997.6	824882.2	0	11	555	25	0.8	3.25E-03	1.05E-04	1.02E-04
2	2	RT_RM2_009	POINT	811978.4	824836.1	0	11	555	25	0.8	3.25E-03	1.05E-04	1.02E-04
2	3	RT_RM2_010	POINT	812452.4	824799.4	0	11	555	25	0.8	5.55E-03	1.79E-04	1.73E-04
3	1	RT_RM3_001	POINT	811627.3	825147	0	8	555	25	0.8	3.25E-03	1.04E-04	1.01E-04
3	1	RT_RM3_002	POINT	811608.9	825100.5	0	8	555	25	0.8	3.25E-03	1.04E-04	1.01E-04
3	1	RT_RM3_003	POINT	811590.4	825054	0	8	555	25	0.8	3.25E-03	1.04E-04	1.01E-04
3	1	RT_RM3_004	POINT	811572	825007.6	0	8	555	25	0.8	3.25E-03	1.04E-04	1.01E-04
3	1	RT_RM3_005	POINT	811553.6	824961.1	0	8	555	25	0.8	3.25E-03	1.04E-04	1.01E-04
3	2	RT_RM3_006	POINT	812035.9	824974.6	0	8	555	25	0.8	3.41E-03	1.10E-04	1.06E-04
3	2	RT_RM3_007	POINT	812016.8	824928.4	0	8	555	25	0.8	3.41E-03	1.10E-04	1.06E-04
3	2	RT_RM3_008	POINT	811997.6	824882.2	0	8	555	25	0.8	3.41E-03	1.10E-04	1.06E-04
3	2	RT_RM3_009	POINT	811978.4	824836.1	0	8	555	25	0.8	3.41E-03	1.10E-04	1.06E-04
3	3	RT_RM3_010	POINT	812452.4	824799.4	0	8	555	25	0.8	5.82E-03	1.87E-04	1.81E-04
4	1	RT_RM4_001	POINTHOR	811627.3	825147	0	4	694.7	8	0.2	1.04E-02	5.53E-04	5.38E-04
4	1	RT_RM4_002	POINTHOR	811608.9	825100.5	0	4	694.7	8	0.2	1.04E-02	5.53E-04	5.38E-04
4	1	RT_RM4_003	POINTHOR	811590.4	825054	0	4	694.7	8	0.2	1.04E-02	5.53E-04	5.38E-04
4	1	RT_RM4_004	POINTHOR	811572	825007.6	0	4	694.7	8	0.2	1.04E-02	5.53E-04	5.38E-04
4	1	RT_RM4_005	POINTHOR	811553.6	824961.1	0	4	694.7	8	0.2	1.04E-02	5.53E-04	5.38E-04
4	2	RT_RM4_006	POINTHOR	812035.9	824974.6	0	4	694.7	8	0.2	1.09E-02	5.81E-04	5.65E-04
4	2	RT_RM4_007	POINTHOR	812016.8	824928.4	0	4	694.7	8	0.2	1.09E-02	5.81E-04	5.65E-04
4	2	RT_RM4_008	POINTHOR	811997.6	824882.2	0	4	694.7	8	0.2	1.09E-02	5.81E-04	5.65E-04
4	2	RT_RM4_009	POINTHOR	811978.4	824836.1	0	4	694.7	8	0.2	1.09E-02	5.81E-04	5.65E-04
4	3	RT_RM4_010	POINTHOR	812452.4	824799.4	0	4	694.7	8	0.2	1.86E-02	9.92E-04	9.64E-04
5	1	RT_RM5_001	POINT	811627.3	825147	0	20	555	25	0.8	8.29E-03	3.62E-04	3.52E-04
5	1	RT_RM5_002	POINT	811608.9	825100.5	0	20	555	25	0.8	8.29E-03	3.62E-04	3.52E-04
5	1	RT_RM5_003	POINT	811590.4	825054	0	20	555	25	0.8	8.29E-03	3.62E-04	3.52E-04
5	1	RT_RM5_004	POINT	811572	825007.6	0	20	555	25	0.8	8.29E-03	3.62E-04	3.52E-04
5	1	RT_RM5_005	POINT	811553.6	824961.1	0	20	555	25	0.8	8.29E-03	3.62E-04	3.52E-04
5	2	RT_RM5_006	POINT	812035.9	824974.6	0	20	555	25	0.8	8.71E-03	3.81E-04	3.70E-04
5	2	RT_RM5_007	POINT	812016.8	824928.4	0	20	555	25	0.8	8.71E-03	3.81E-04	3.70E-04
5	2	RT_RM5_008	POINT	811997.6	824882.2	0	20	555	25	0.8	8.71E-03	3.81E-04	3.70E-04
5	2	RT_RM5_009	POINT	811978.4	824836.1	0	20	555	25	0.8	8.71E-03	3.81E-04	3.70E-04
5	3	RT_RM5_010	POINT	812452.4	824799.4	0	20	555	25	0.8	1.49E-02	6.49E-04	6.31E-04
6	1	RT_RM6_001	POINT	811627.3	825147	0	11	588	8	0.2	3.67E-03	1.20E-04	1.16E-04
6	1	RT_RM6_002	POINT	811608.9	825100.5	0	11	588	8	0.2	3.67E-03	1.20E-04	1.16E-04
6	1	RT_RM6_003	POINT	811590.4	825054	0	11	588	8	0.2	3.67E-03	1.20E-04	1.16E-04
6	1	RT_RM6_004	POINT	811572	825007.6	0	11	588	8	0.2	3.67E-03	1.20E-04	1.16E-04
6	1	RT_RM6_005	POINT	811553.6	824961.1	0	11	588	8	0.2	3.67E-03	1.20E-04	1.16E-04
6	2	RT_RM6_006	POINT	812035.9	824974.6	0	11	588	8	0.2	3.86E-03	1.26E-04	1.22E-04
6	2	RT_RM6_007	POINT	812016.8	824928.4	0	11	588	8	0.2	3.86E-03	1.26E-04	1.22E-04
6	2	RT_RM6_008	POINT	811997.6	824882.2	0	11	588	8	0.2	3.86E-03	1.26E-04	1.22E-04
6	2	RT_RM6_009	POINT	811978.4	824836.1	0	11	588	8	0.2	3.86E-03	1.26E-04	1.22E-04
6	3	RT_RM6_010	POINT	812452.4	824799.4	0	11	588	8	0.2	6.58E-03	2.14E-04	2.08E-04

Notes:

[1] Modelling parameters are referred to "Generating an Hour-By-Hour Model-Ready Marine Emission Inventory, RWDI Air Inc. and Environment Canada, US EPA 17th International Emission Inventory Conference, 2-5 June 2008, Portland, Oregon", approved EIA of Tuen Mun South Extension (AERIAR-236/2022), and approved EIA of Lei Yue Mun Waterfront Enhancement Project (AERIAR-219/2018).

Marine Emission Inventory during Hotelling

Calculation of Time-In-Mode by Route

Sailing Route	Time-In-Mode (minutes) during Hotelling for 1 Hour [1]
1 to 3	60

Notes:

[1] Since the averaged TIM for hotelling provided by Marine Traffic Consultant is 2 hours which is larger than 1 hour, the emission rate is to calculate the emission per hour, i.e. hotelling for 60mins. The number of vessels per hour are adjusted to cater the hotelling duration.

Total Emission Rate per Trip for All Routes [1]

Engine in Operation

Group [1]	Vessel Type	Emission Rate per Trip (g/s) [2]			Annual No. of Vessel Arrivals in Year 2019 [3]	Composite Emission Rate per Trip (g/s) [4]		
		NO_X	RSP	FSP		NOx	RSP	FSP
1	Fully Cellular Container Vessel	1.02E-01	4.06E-03	3.96E-03	34718	1.02E-01	4.06E-03	3.96E-03
	Semi-container Vessel	1.02E-01	4.06E-03	3.96E-03	9943			
2	Conventional Cargo Vessel	1.02E-01	4.06E-03	3.96E-03	-	1.02E-01	4.06E-03	3.96E-03
3	Dry Bulk Carrier	1.02E-01	4.06E-03	3.96E-03	-	1.02E-01	4.06E-03	3.96E-03
4	Tug	1.23E-01	4.92E-03	4.80E-03	-	1.23E-01	4.92E-03	4.80E-03
5	Chemical Carrier	2.65E-01	1.06E-02	1.03E-02	247	2.65E-01	1.06E-02	1.03E-02
	Gas Carrier	2.65E-01	1.06E-02	1.03E-02	134			
	Oil Tanker	2.65E-01	1.06E-02	1.03E-02	419			
6	Mechanised Lighter/Barge/Cargo Junk	1.39E-01	5.54E-03	5.40E-03	-	1.39E-01	5.54E-03	5.40E-03

Engine	On (1) or Off (0) [2]
AE	1

Notes:

[1] The vessel type is grouped according to the modelling parameter (i.e. stack height, exit temperature, exit velocity etc). Vessel types with the identical modelling parameters will be grouped.

[2] Only auxiliary engine is assumed in operation during hotelling with reference to Table 3-25 of Study on Marine Vessels Emission Inventory Final Report (HKUST, February 2012). The emission rate per trip considers the emission from the engine in operation as indicated in the table "Engine in Operation", and the calculation is documented in the "Technical Notes on Marine Emission for Pillar Point Area" submitted to EPD.

[3] Marine Traffic Consultant has provided the total number of RTVs but without breakdown into different vessel types. Hence, reference has been made to Marine Department's Vessels Arrivals by Ship Type and Ocean/River (https://www.mardep.gov.hk/en/fact/pdf/portstat_2_y_a2.pdf). Due to the pandemic situation, there was a significant change in marine traffic from Year 2020 to Year 2022. In view of this, the monthly profile of Year 2019 is considered the most appropriate and therefore adopted and assumed the same for future years.

[4] The emission rate per trip is calculated based on the following equation. Breakdown is provided and documented in "Technical Notes on Marine Emission for Pillar Point Area" submitted to EPD and emission rates are evenly apportioned into point sources in the model as shown in subsequent pages of this Appendix.

Engine Emission Rate per Trip = (i)Time-in-mode x (ii)Engine Load Factors x (iii) Engine Power x (iv) Emission Factor, where

(i) As indicated in the table of "calculation of Time-In-Mode by Route", time-in-mode is calculated from the average speed and possible maximum length of sailing route within assessment area provided by Marine Traffic Consultant.

(ii) Engine Load Factors are made reference to Table 4-7, Table 4-10 and Table 3-24 of Study on Marine Vessels Emission Inventory Final Report (HKUST, February 2012).

(iii) The average engine powers are made reference to Table 4-5 and Table 4-6 of the Study on Marine Vessels Emission Inventory Final Report (HKUST, February 2012).

(iv) The emission factor is made reference to Study on Marine Vessels Emission Inventory Final Report (HKUST, February 2012) Table 4-16. Under the Air Pollution Control (Fuel for Vessels) Regulation, all vessels assumed to use MGO due to requirement to fuel switch to compliant fuel (sulphur content <=0.5%) within Hong Kong waters.

Modelling Parameters

Group	Sailing Route	Source ID	Type	X	Y	Base Elevation	Release Height [1]	Exit Temperature [1]	Exit velocity [1]	Internal diameter [1]	Emission Rate per Trip		
											NOx	RSP	FSP
				(m)	(m)	(mpd)	(m)	(K)	(m/s)	(m)	(g/s)	(g/s)	(g/s)
1	1	RT_RH1_001	POINT	811581.2	825220.8	0	34.2	537	24.6	1.9	1.13E-02	4.51E-04	4.40E-04
1	1	RT_RH1_002	POINT	811554.0	825156.3	0	34.2	537	24.6	1.9	1.13E-02	4.51E-04	4.40E-04
1	1	RT_RH1_003	POINT	811526.8	825091.8	0	34.2	537	24.6	1.9	1.13E-02	4.51E-04	4.40E-04
1	1	RT_RH1_004	POINT	811499.6	825027.3	0	34.2	537	24.6	1.9	1.13E-02	4.51E-04	4.40E-04
1	1	RT_RH1_005	POINT	811645.7	825193.5	0	34.2	537	24.6	1.9	1.13E-02	4.51E-04	4.40E-04
1	1	RT_RH1_006	POINT	811700.5	825170.3	0	34.2	537	24.6	1.9	1.13E-02	4.51E-04	4.40E-04
1	1	RT_RH1_007	POINT	811673.3	825105.8	0	34.2	537	24.6	1.9	1.13E-02	4.51E-04	4.40E-04
1	1	RT_RH1_008	POINT	811646.1	825041.3	0	34.2	537	24.6	1.9	1.13E-02	4.51E-04	4.40E-04
1	1	RT_RH1_009	POINT	811618.9	824976.8	0	34.2	537	24.6	1.9	1.13E-02	4.51E-04	4.40E-04
1	2	RT_RH1_010	POINT	811995.1	825045.9	0	34.2	537	24.6	1.9	1.27E-02	5.08E-04	4.95E-04
1	2	RT_RH1_011	POINT	811968.0	824981.3	0	34.2	537	24.6	1.9	1.27E-02	5.08E-04	4.95E-04
1	2	RT_RH1_012	POINT	811940.9	824916.8	0	34.2	537	24.6	1.9	1.27E-02	5.08E-04	4.95E-04
1	2	RT_RH1_013	POINT	811913.8	824852.3	0	34.2	537	24.6	1.9	1.27E-02	5.08E-04	4.95E-04
1	2	RT_RH1_014	POINT	812059.7	825018.9	0	34.2	537	24.6	1.9	1.27E-02	5.08E-04	4.95E-04
1	2	RT_RH1_015	POINT	812115.1	824995.7	0	34.2	537	24.6	1.9	1.27E-02	5.08E-04	4.95E-04
1	2	RT_RH1_016	POINT	812087.8	824931.2	0	34.2	537	24.6	1.9	1.27E-02	5.08E-04	4.95E-04
1	2	RT_RH1_017	POINT	812060.6	824866.7	0	34.2	537	24.6	1.9	1.27E-02	5.08E-04	4.95E-04
1	3	RT_RH1_018	POINT	812383.0	824806.9	0	34.2	537	24.6	1.9	2.54E-02	1.02E-03	9.90E-04
1	3	RT_RH1_019	POINT	812410.2	824871.4	0	34.2	537	24.6	1.9	2.54E-02	1.02E-03	9.90E-04
1	3	RT_RH1_020	POINT	812474.7	824844.2	0	34.2	537	24.6	1.9	2.54E-02	1.02E-03	9.90E-04
1	3	RT_RH1_021	POINT	812529.8	824820.9	0	34.2	537	24.6	1.9	2.54E-02	1.02E-03	9.90E-04
2	1	RT_RH2_001	POINT	811581.2	825220.8	0	11	555	25	0.8	1.13E-02	4.51E-04	4.40E-04
2	1	RT_RH2_002	POINT	811554.0	825156.3	0	11	555	25	0.8	1.13E-02	4.51E-04	4.40E-04
2	1	RT_RH2_003	POINT	811526.8	825091.8	0	11	555	25	0.8	1.13E-02	4.51E-04	4.40E-04
2	1	RT_RH2_004	POINT	811499.6	825027.3	0	11	555	25	0.8	1.13E-02	4.51E-04	4.40E-04
2	1	RT_RH2_005	POINT	811645.7	825193.5	0	11	555	25	0.8	1.13E-02	4.51E-04	4.40E-04
2	1	RT_RH2_006	POINT	811700.5	825170.3	0	11	555	25	0.8	1.13E-02	4.51E-04	4.40E-04
2	1	RT_RH2_007	POINT	811673.3	825105.8	0	11	555	25	0.8	1.13E-02	4.51E-04	4.40E-04
2	1	RT_RH2_008	POINT	811646.1	825041.3	0	11	555	25	0.8	1.13E-02	4.51E-04	4.40E-04
2	1	RT_RH2_009	POINT	811618.9	824976.8	0	11	555	25	0.8	1.13E-02	4.51E-04	4.40E-04
2	2	RT_RH2_010	POINT	811995.1	825045.9	0	11	555	25	0.8	1.27E-02	5.08E-04	4.95E-04
2	2	RT_RH2_011	POINT	811968.0	824981.3	0	11	555	25	0.8	1.27E-02	5.08E-04	4.95E-04
2	2	RT_RH2_012	POINT	811940.9	824916.8	0	11	555	25	0.8	1.27E-02	5.08E-04	4.95E-04
2	2	RT_RH2_013	POINT	811913.8	824852.3	0	11	555	25	0.8	1.27E-02	5.08E-04	4.95E-04
2	2	RT_RH2_014	POINT	812059.7	825018.9	0	11	555	25	0.8	1.27E-02	5.08E-04	4.95E-04
2	2	RT_RH2_015	POINT	812115.1	824995.7	0	11	555	25	0.8	1.27E-02	5.08E-04	4.95E-04
2	2	RT_RH2_016	POINT	812087.8	824931.2	0	11	555	25	0.8	1.27E-02	5.08E-04	4.95E-04
2	2	RT_RH2_017	POINT	812060.6	824866.7	0	11	555	25	0.8	1.27E-02	5.08E-04	4.95E-04
2	3	RT_RH2_018	POINT	812383.0	824806.9	0	11	555	25	0.8	2.54E-02	1.02E-03	9.90E-04
2	3	RT_RH2_019	POINT	812410.2	824871.4	0	11	555	25	0.8	2.54E-02	1.02E-03	9.90E-04
2	3	RT_RH2_020	POINT	812474.7	824844.2	0	11	555	25	0.8	2.54E-02	1.02E-03	9.90E-04
2	3	RT_RH2_021	POINT	812529.8	824820.9	0	11	555	25	0.8	2.54E-02	1.02E-03	9.90E-04
3	1	RT_RH3_001	POINT	811581.2	825220.8	0	8	555	25	0.8	1.13E-02	4.51E-04	4.40E-04
3	1	RT_RH3_002	POINT	811554.0	825156.3	0	8	555	25	0.8	1.13E-02	4.51E-04	4.40E-04
3	1	RT_RH3_003	POINT	811526.8	825091.8	0	8	555	25	0.8	1.13E-02	4.51E-04	4.40E-04
3	1	RT_RH3_004	POINT	811499.6	825027.3	0	8	555	25	0.8	1.13E-02	4.51E-04	4.40E-04
3	1	RT_RH3_005	POINT	811645.7	825193.5	0	8	555	25	0.8	1.13E-02	4.51E-04	4.40E-04
3	1	RT_RH3_006	POINT	811700.5	825170.3	0	8	555	25	0.8	1.13E-02	4.51E-04	4.40E-04
3	1	RT_RH3_007	POINT	811673.3	825105.8	0	8	555	25	0.8	1.13E-02	4.51E-04	4.40E-04
3	1	RT_RH3_008	POINT	811646.1	825041.3	0	8	555	25	0.8	1.13E-02	4.51E-04	4.40E-04
3	1	RT_RH3_009	POINT	811618.9	824976.8	0	8	555	25	0.8	1.13E-02	4.51E-04	4.40E-04
3	2	RT_RH3_010	POINT	811995.1	825045.9	0	8	555	25	0.8	1.27E-02	5.08E-04	4.95E-04
3	2	RT_RH3_011	POINT	811968.0	824981.3	0	8	555	25	0.8	1.27E-02	5.08E-04	4.95E-04
3	2	RT_RH3_012	POINT	811940.9	824916.8	0	8	555	25	0.8	1.27E-02	5.08E-04	4.95E-04
3	2	RT_RH3_013	POINT	811913.8	824852.3	0	8	555	25	0.8	1.27E-02	5.08E-04	4.95E-04
3	2	RT_RH3_014	POINT	812059.7	825018.9	0	8	555	25	0.8	1.27E-02	5.08E-04	4.95E-04
3	2	RT_RH3_015	POINT	812115.1	824995.7	0	8	555	25	0.8	1.27E-02	5.08E-04	4.95E-04
3	2	RT_RH3_016	POINT	812087.8	824931.2	0	8	555	25	0.8	1.27E-02	5.08E-04	4.95E-04
3	2	RT_RH3_017	POINT	812060.6	824866.7	0	8	555	25	0.8	1.27E-02	5.08E-04	4.95E-04
3	3	RT_RH3_018	POINT	812383.0	824806.9	0	8	555	25	0.8	2.54E-02	1.02E-03	9.90E-04
3	3	RT_RH3_019	POINT	812410.2	824871.4	0	8	555	25	0.8	2.54E-02	1.02E-03	9.90E-04
3	3	RT_RH3_020	POINT	812474.7	824844.2	0	8	555	25	0.8	2.54E-02	1.02E-03	9.90E-04
3	3	RT_RH3_021	POINT	812529.8	824820.9	0	8	555	25	0.8	2.54E-02	1.02E-03	9.90E-04
4	1	RT_RH4_001	POINTHOR	811581.2	825220.8	0	4	694.7	8	0.2	1.37E-02	5.47E-04	5.33E-04
4	1	RT_RH4_002	POINTHOR	811554.0	825156.3	0	4	694.7	8	0.2	1.37E-02	5.47E-04	5.33E-04
4	1	RT_RH4_003	POINTHOR	811526.8	825091.8	0	4	694.7	8	0.2	1.37E-02	5.47E-04	5.33E-04
4	1	RT_RH4_004	POINTHOR	811499.6	825027.3	0	4	694.7	8	0.2	1.37E-02	5.47E-04	5.33E-04
4	1	RT_RH4_005	POINTHOR	811645.7	825193.5	0	4	694.7	8	0.2	1.37E-02	5.47E-04	5.33E-04
4	1	RT_RH4_006	POINTHOR	811700.5	825170.3	0	4	694.7	8	0.2	1.37E-02	5.47E-04	5.33E-04
4	1	RT_RH4_007	POINTHOR	811673.3	825105.8	0	4	694.7	8	0.2	1.37E-02	5.47E-04	5.33E-04
4	1	RT_RH4_008	POINTHOR	811646.1	825041.3	0	4	694.7	8	0.2	1.37E-02	5.47E-04	5.33E-04
4	1	RT_RH4_009	POINTHOR	811618.9	824976.8	0	4	694.7	8	0.2	1.37E-02	5.47E-04	5.33E-04
4	2	RT_RH4_010	POINTHOR	811995.1	825045.9	0	4	694.7	8	0.2	1.54E-02	6.15E-04	6.00E-04
4	2	RT_RH4_011	POINTHOR	811968.0	824981.3	0	4	694.7	8	0.2	1.54E-02	6.15E-04	6.00E-04
4	2	RT_RH4_012	POINTHOR	811940.9	824916.8	0	4	694.7	8	0.2	1.54E-02	6.15E-04	6.00E-04
4	2	RT_RH4_013	POINTHOR	811913.8	824852.3	0	4	694.7	8	0.2	1.54E-02	6.15E-04	6.00E-04
4	2	RT_RH4_014	POINTHOR	812059.7	825018.9	0	4	694.7	8	0.2	1.54E-02	6.15E-04	6.00E-04
4	2	RT_RH4_015	POINTHOR	812115.1	824995.7	0	4	694.7	8	0.2	1.54E-02	6.15E-04	6.00E-04
4	2	RT_RH4_016	POINTHOR	812087.8	824931.2	0	4	694.7	8	0.2	1.54E-02	6.15E-04	6.00E-04
4	2	RT_RH4_017	POINTHOR	812060.6	824866.7	0	4	694.7	8	0.2	1.54E-02	6.15E-04	6.00E-04
4	3	RT_RH4_018	POINTHOR	812383.0	824806.9	0	4	694.7	8	0.2	3.08E-02	1.23E-03	1.20E-03
4	3	RT_RH4_019	POINTHOR	812410.2	824871.4	0	4	694.7	8	0.2	3.08E-02	1.23E-03	1.20E-03
4	3	RT_RH4_020	POINTHOR	812474.7	824844.2	0	4	694.7	8	0.2	3.08E-02	1.23E-03	1.20E-03
4	3	RT_RH4_021	POINTHOR	812529.8	824820.9	0	4	694.7	8	0.2	3.08E-02	1.23E-03	1.20E-03
5	1	RT_RH5_001	POINT	811581.2	825220.8	0	20	555	25	0.8	2.95E-02	1.18E-03	1.15E-03
5	1	RT_RH5_002	POINT	811554.0	825156.3	0	20	555	25	0.8	2.95E-02	1.18E-03	1.15E-03
5	1	RT_RH5_003	POINT	811526.8	825091.8	0	20	555	25	0.8	2.95E-02	1.18E-03	1.15E-03
5	1	RT_RH5_004	POINT	811499.6	825027.3	0	20	555	25	0.8	2.95E-02	1.18E-03	1.15E-03

Modelling Parameters

Group	Sailing Route	Source ID	Type	X	Y	Base Elevation	Release Height [1]	Exit Temperature [1]	Exit velocity [1]	Internal diameter [1]	Emission Rate per Trip		
											NOx	RSP	FSP
				(m)	(m)	(mpd)	(m)	(K)	(m/s)	(m)	(g/s)	(g/s)	(g/s)
5	1	RT_RH5_005	POINT	811645.7	825193.5	0	20	555	25	0.8	2.95E-02	1.18E-03	1.15E-03
5	1	RT_RH5_006	POINT	811700.5	825170.3	0	20	555	25	0.8	2.95E-02	1.18E-03	1.15E-03
5	1	RT_RH5_007	POINT	811673.3	825105.8	0	20	555	25	0.8	2.95E-02	1.18E-03	1.15E-03
5	1	RT_RH5_008	POINT	811646.1	825041.3	0	20	555	25	0.8	2.95E-02	1.18E-03	1.15E-03
5	1	RT_RH5_009	POINT	811618.9	824976.8	0	20	555	25	0.8	2.95E-02	1.18E-03	1.15E-03
5	2	RT_RH5_010	POINT	811995.1	825045.9	0	20	555	25	0.8	3.31E-02	1.33E-03	1.29E-03
5	2	RT_RH5_011	POINT	811968.0	824981.3	0	20	555	25	0.8	3.31E-02	1.33E-03	1.29E-03
5	2	RT_RH5_012	POINT	811940.9	824916.8	0	20	555	25	0.8	3.31E-02	1.33E-03	1.29E-03
5	2	RT_RH5_013	POINT	811913.8	824852.3	0	20	555	25	0.8	3.31E-02	1.33E-03	1.29E-03
5	2	RT_RH5_014	POINT	812059.7	825018.9	0	20	555	25	0.8	3.31E-02	1.33E-03	1.29E-03
5	2	RT_RH5_015	POINT	812115.1	824995.7	0	20	555	25	0.8	3.31E-02	1.33E-03	1.29E-03
5	2	RT_RH5_016	POINT	812087.8	824931.2	0	20	555	25	0.8	3.31E-02	1.33E-03	1.29E-03
5	2	RT_RH5_017	POINT	812060.6	824866.7	0	20	555	25	0.8	3.31E-02	1.33E-03	1.29E-03
5	3	RT_RH5_018	POINT	812383.0	824806.9	0	20	555	25	0.8	6.63E-02	2.65E-03	2.59E-03
5	3	RT_RH5_019	POINT	812410.2	824871.4	0	20	555	25	0.8	6.63E-02	2.65E-03	2.59E-03
5	3	RT_RH5_020	POINT	812474.7	824844.2	0	20	555	25	0.8	6.63E-02	2.65E-03	2.59E-03
5	3	RT_RH5_021	POINT	812529.8	824820.9	0	20	555	25	0.8	6.63E-02	2.65E-03	2.59E-03
6	1	RT_RH6_001	POINT	811581.2	825220.8	0	11	588	8	0.2	1.54E-02	6.16E-04	6.00E-04
6	1	RT_RH6_002	POINT	811554.0	825156.3	0	11	588	8	0.2	1.54E-02	6.16E-04	6.00E-04
6	1	RT_RH6_003	POINT	811526.8	825091.8	0	11	588	8	0.2	1.54E-02	6.16E-04	6.00E-04
6	1	RT_RH6_004	POINT	811499.6	825027.3	0	11	588	8	0.2	1.54E-02	6.16E-04	6.00E-04
6	1	RT_RH6_005	POINT	811645.7	825193.5	0	11	588	8	0.2	1.54E-02	6.16E-04	6.00E-04
6	1	RT_RH6_006	POINT	811700.5	825170.3	0	11	588	8	0.2	1.54E-02	6.16E-04	6.00E-04
6	1	RT_RH6_007	POINT	811673.3	825105.8	0	11	588	8	0.2	1.54E-02	6.16E-04	6.00E-04
6	1	RT_RH6_008	POINT	811646.1	825041.3	0	11	588	8	0.2	1.54E-02	6.16E-04	6.00E-04
6	1	RT_RH6_009	POINT	811618.9	824976.8	0	11	588	8	0.2	1.54E-02	6.16E-04	6.00E-04
6	2	RT_RH6_010	POINT	811995.1	825045.9	0	11	588	8	0.2	1.73E-02	6.93E-04	6.75E-04
6	2	RT_RH6_011	POINT	811968.0	824981.3	0	11	588	8	0.2	1.73E-02	6.93E-04	6.75E-04
6	2	RT_RH6_012	POINT	811940.9	824916.8	0	11	588	8	0.2	1.73E-02	6.93E-04	6.75E-04
6	2	RT_RH6_013	POINT	811913.8	824852.3	0	11	588	8	0.2	1.73E-02	6.93E-04	6.75E-04
6	2	RT_RH6_014	POINT	812059.7	825018.9	0	11	588	8	0.2	1.73E-02	6.93E-04	6.75E-04
6	2	RT_RH6_015	POINT	812115.1	824995.7	0	11	588	8	0.2	1.73E-02	6.93E-04	6.75E-04
6	2	RT_RH6_016	POINT	812087.8	824931.2	0	11	588	8	0.2	1.73E-02	6.93E-04	6.75E-04
6	2	RT_RH6_017	POINT	812060.6	824866.7	0	11	588	8	0.2	1.73E-02	6.93E-04	6.75E-04
6	3	RT_RH6_018	POINT	812383.0	824806.9	0	11	588	8	0.2	3.46E-02	1.39E-03	1.35E-03
6	3	RT_RH6_019	POINT	812410.2	824871.4	0	11	588	8	0.2	3.46E-02	1.39E-03	1.35E-03
6	3	RT_RH6_020	POINT	812474.7	824844.2	0	11	588	8	0.2	3.46E-02	1.39E-03	1.35E-03
6	3	RT_RH6_021	POINT	812529.8	824820.9	0	11	588	8	0.2	3.46E-02	1.39E-03	1.35E-03

Notes:

[1] Modelling parameters are referred to "Generating an Hour-By-Hour Model-Ready Marine Emission Inventory, RWDI Air Inc. and Environment Canada, US EPA 17th International Emission Inventory Conference, 2-5 June 2008, Portland, Oregon", approved EIA of Tuen Mun South Extension (AERIAR-236/2022), and approved EIA of Lei Yue Mun Waterfront Enhancement Project (AERIAR-219/2018).

Calculation of Multiplying Factor for Total Vessel Count

Monthly Vessel Count for Year 2048

Sailing Route	Monthly Vessel Count in Aug for Maneuvering [1]	Monthly Vessel Count in Aug for Hotelling [1]
Route 1	1,830	915
Route 2	1,549	774
Route 3	876	438

Notes:

[1] The marine traffic data for August is provided by Marine Traffic Consultant.

Monthly Multiplying Factor dervied from Marine Traffic in Year 2019

Month	Total No. of Arrivals by RTVs [1]	Monthly Multiplying Factor
Jan-19	5,820	1.03
Feb-19	3,401	0.60
Mar-19	5,783	1.02
Apr-19	5,411	0.96
May-19	5,766	1.02
Jun-19	5,456	0.96
Jul-19	5,645	1.00
Aug-19	**5,659**	**1.00**
Sep-19	5,382	0.95
Oct-19	5,160	0.91
Nov-19	5,534	0.98
Dec-19	5,632	1.00

Notes:

[1] Since no monthly profile is available from Marine Traffic Consultant, the annual vessel count is calculated based on monthly profile in "Monthly Vessel Arrivals by Ocean/River and Cargo/Passenger Vessels" published by Marine Department (https://www.mardep.gov.hk/en/fact/pdf/portstat_2_m_a1.pdf). Due to the pandemic situation, there was a significant change in marine traffic from Year 2020 to Year 2022. In view of this, the monthly profile of Year 2019 is considered the most appropriate and therefore adopted and assumed the same for future years.

Hourly Multiplying Factor derived from Marine Traffic in August 2048

Hour		No. of Marine Vessels for Maneuvering of the Entire RTT [1]	Monthly-Hourly Multiplying Factor for Maneuvering [2]	No. of Marine Vessels for Hotelling for the Entire RTT [1]	Monthly-Hourly Multiplying Factor for Hotelling [2]
Start	End				
0	1	223	2.8%	112	2.8%
1	2	205	2.6%	102	2.6%
2	3	223	2.8%	112	2.8%
3	4	164	2.0%	82	2.0%
4	5	164	2.0%	82	2.0%
5	6	174	2.2%	87	2.2%
6	7	177	2.2%	88	2.2%
7	8	229	2.9%	115	2.9%
8	9	288	3.6%	144	3.6%
9	10	372	4.6%	186	4.6%
10	11	406	5.1%	203	5.1%
11	12	459	5.7%	229	5.7%
12	13	431	5.4%	215	5.4%
13	14	394	4.9%	197	4.9%
14	15	391	4.9%	195	4.9%
15	16	440	5.5%	220	5.5%
16	17	487	6.1%	243	6.1%
17	18	474	5.9%	237	5.9%
18	19	378	4.7%	189	4.7%
19	20	350	4.4%	175	4.4%
20	21	437	5.5%	219	5.5%
21	22	440	5.5%	220	5.5%
22	23	391	4.9%	195	4.9%
23	24	322	4.0%	161	4.0%

Notes:

[1] The number of vessels refers to the number of vessels going in and out the entire RTT but not the assessed route of RTT .The number of hourly marine vessels for Aug 2048 is provided by Marine Traffic Consultant. It contains the total number of marine vessels going in and out RTT for the 31 days in Aug in Year 2048 for each hour. For example, from Hour 0 to Hour 1 (i.e. first hour of 1 Aug + first hour of 2 Aug, ... 1st hour of 31 Aug), there are total 223 marine vessels maneuvering and total 112 marine hotelling for the first hour during the whole August.
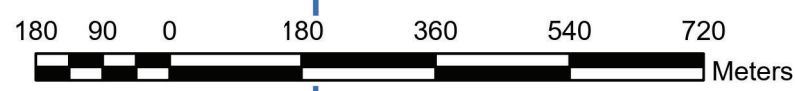
[2] The hourly profile of the entire RTT is assumed to be the same for each route.
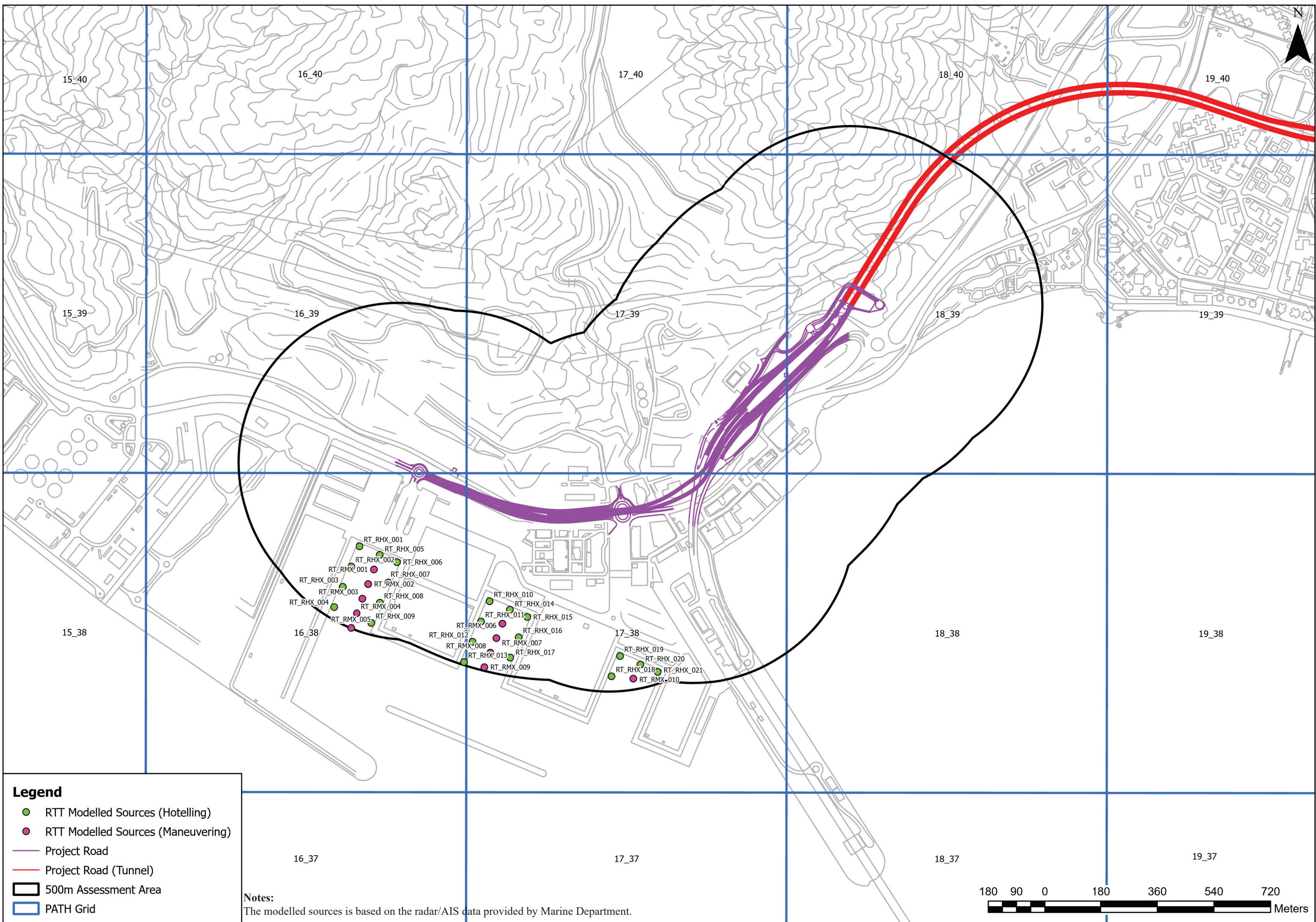
Legend

- 🟢 RTT Modelled Sources (Hotelling)
- 🟣 RTT Modelled Sources (Maneuvering)
- Project Road
- Project Road (Tunnel)
- 500m Assessment Area
- PATH Grid

Notes:
The modelled sources is based on the radar/AIS data provided by Marine Department.

180 90 0 180 360 540 720
Meters

N

15_40   16_40   17_40   18_40   19_40

15_39   16_39   17_39   18_39   19_39

RT_RHX_001
RT_RHX_005
RT_RHX_002   RT_RHX_006
RT_RMX_001   RT_RHX_007
RT_RHX_003   RT_RMX_002
RT_RMX_003   RT_RHX_008
RT_RHX_004   RT_RMX_004   RT_RHX_010
RT_RMX_005   RT_RHX_009   RT_RHX_014
RT_RHX_011   RT_RHX_015
RT_RMX_006   RT_RHX_016
RT_RMX_012   RT_RMX_007
RT_RMX_008   RT_RHX_017   RT_RHX_019
RT_RHX_013   RT_RHX_020
RT_RMX_009   RT_RHX_018   RT_RHX_021
RT_RMX_010

15_38   16_38   17_38   18_38   19_38

16_37   17_37   18_37   19_37

N

RT_RHX_001
RT_RHX_005
RT_RHX_006
RT_RHX_002
RT_RMX_001
RT_RHX_003
RT_RMX_002
RT_RHX_007
RT_RMX_003
RT_RHX_008
RT_RHX_004
RT_RMX_004
RT_RHX_009
RT_RMX_005

16_38

RT_RHX_010
RT_RHX_014
RT_RHX_011
RT_RHX_015
RT_RMX_006
RT_RHX_012
RT_RMX_007
RT_RHX_016
RT_RMX_008
RT_RHX_017
RT_RHX_013
RT_RMX_009

17_38
RT_RHX_019
RT_RHX_020
RT_RHX_021
RT_RHX_018
RT_RMX_010

16_37

17_37

Legend

- RTT Modelled Sources (Hotelling)
- RTT Modelled Sources (Maneuvering)
- Project Road
- Project Raod (Tunnel)
- 500m Assessment Area
- PATH Grid

Notes:
The modelled sources is based on the radar/AIS data provided by Marine Department.

80 40 0   80   160   240   320

Meters
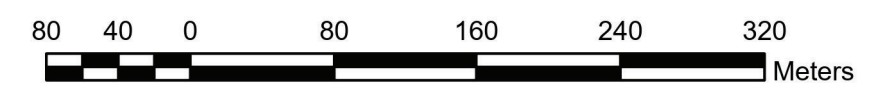
Annex II
Marine Emission Rate for River Trade Terminal in Year 2048
Small Craft - Boat

Marine Traffic Information of the Entire River Trade Terminal (RTT)

Assessment Year	2048
Assessed Vessel Type	Small Craft - Boat
Location	River Trade Terminal
Total Length of Berth (m)	3050
Monthly Vessel Count for arrival and departure in RTT [1]	828
Monthly Vessel Count for Hotelling at RTT [1]	414
Travelling Speed (knots) [2]	5
Hotelling Time (hours) [2]	1

Notes:

[1] Monthly vessel count for manevuering is advised by Marine Traffic Consultant and accepted by Marine Department, and that for hotelling is half of the number for manevuering.

[2] Average travelling speed of 5 knot and average hotelling time of 1 hours are provided by Marine Traffic Consultant.

Marine Traffic Information by Routes

Sailing Route	Length of Berth within Assessment Area (m)	Monthly Vessel Count in Aug for Maneuvering within Assessment Area [1]	Travelling Speed (knots)[2]	Length of Sailing Route within Assessment Area (m) [4]	Monthly Vessel Count in Aug for Hotelling within Assessment Area[1]	Hotelling Time (hours) [3]
1	696	189	5	251	94	1
2	589	160	5	211	80	1
3	333	90	5	90	45	1

Notes:

[1] No information on the vessel count breakdown at different berth and routes. Hence monthly vessel count by routes is estimated by pro-rata to the length of the approached berth.

[2] Average speed of 5 knot is provided by Marine Traffic Consultant.

[3] Average hotelling time of 1 hours are provided by Marine Traffic Consultant.

[4] Possible maximum length of sailing route for each route is estimated for conservative assessment.

[5] As advised by Marine Traffic Consultant, the small crafts include work boat, tugboat and Boats. For the calculation of marine emission for tug boat and work boat, please refer to "Marine Emission Rate for River Trade Terminal in Year 2048 for Small Craft - Work Boat and Tugboat".

Marine Emission Inventory during Maneuvering

Calculation of Time-In-Mode by Route

Sailing Route	Speed (m/s) [1]	Length of Sailing Route within Assessment Area (m) [2]	Time-In-Mode (minutes) during Maneuvering [3]
1	2.57	251	1.63
2	2.57	211	1.37
3	2.57	90	0.58

Notes:

[1] Average speed of 5 knot is provided by Marine Traffic Consultant and assumed to be constant throughout River Trade Terminal.

[2] Possible maximum length of sailing route is estimated for conservative assessment.

[3] Time-in-mode during maneuvering is derived from the length of sailing route and averaged speed within assessment area.

Total Emission Rate per Trip by Route

Sailing Route	Group [1]	Vessel Type	Emission Rate per Trip (g/s) [2]		
			NO$_X$	RSP	FSP
1	1	Boat	6.07E-04	1.66E-05	1.66E-05
2	1	Boat	5.10E-04	1.39E-05	1.39E-05
3	1	Boat	2.18E-04	5.95E-06	5.95E-06

Notes:

[1] The vessel type is grouped according to the modelling parameter (i.e. stack height, exit temperature, exit velocity etc). Vessel types with the identical modelling parameters will be grouped.

[2] The emission rate per trip is calculated based on the following equation. Breakdown is provided and documented in "Technical Notes on Marine Emission for Pillar Point Area" submitted to EPD and emission rates are evenly apportioned into point sources in the model as shown in subsequent pages of this Appendix.

Engine Emission Rate per Trip = (i)Time-in-mode x (ii)Engine Load Factors x (iii) Engine Power x (iv) Emission Factor, where

(i) As indicated in the table of "Calculation of Time-In-Mode by Route", time-in-mode is calculated from the average speed and possible maximum length of sailing route within assessment area provided by Marine Traffic Consultant.

(ii) Engine Load Factors are made reference to Table 3-2 and Table 3-3 of USEPA (2008) – "Regulatory Impact Analysis: Control of Emissions of Air Pollution from Locomotive Engines and Marine Compression Ignition Engines Less than 30 Liters Per Cylinder".

(iii) As advised by the Operator, the boat is small only. However, due to privacy issue, they cannot release more information. There is no photo on the boat. The average engine powers are made reference to the engine power of typical small crafts in River Trade Terminal provided by the Operator.

(iv) The engine emission factors are made reference to Table 3-4 and Table 3-58 of USEPA (2008) – "Regulatory Impact Analysis: Control of Emissions of Air Pollution from Locomotive Engines and Marine Compression Ignition Engines Less than 30 Liters Per Cylinder". Tier 2 emission factors are adopted, which assumed the age of vessels is >40 years old in Year 2048 for conservative assessment. Emission factors of FSP is assumed to be the same as those of RSP.

Modelling Parameters

Group	Sailing Route	Source ID	Type	X	Y	Base Elevation	Release Height [1]	Exit Temperature [1]	Exit velocity [1]	Internal diameter [1]	Emission Rate per Trip		
											NOx	RSP	FSP
				(m)	(m)	(mpd)	(m)	(K)	(m/s)	(m)	(g/s)	(g/s)	(g/s)
1	1	RT_PM1_001	POINTHOR	811627.3	825147	0	1.3	773	8	0.7	1.21E-04	3.32E-06	3.32E-06
1	1	RT_PM1_002	POINTHOR	811608.9	825100.5	0	1.3	773	8	0.7	1.21E-04	3.32E-06	3.32E-06
1	1	RT_PM1_003	POINTHOR	811590.4	825054	0	1.3	773	8	0.7	1.21E-04	3.32E-06	3.32E-06
1	1	RT_PM1_004	POINTHOR	811572	825007.6	0	1.3	773	8	0.7	1.21E-04	3.32E-06	3.32E-06
1	1	RT_PM1_005	POINTHOR	811553.6	824961.1	0	1.3	773	8	0.7	1.21E-04	3.32E-06	3.32E-06
1	2	RT_PM1_006	POINTHOR	812035.9	824974.6	0	1.3	773	8	0.7	1.28E-04	3.48E-06	3.48E-06
1	2	RT_PM1_007	POINTHOR	812016.8	824928.4	0	1.3	773	8	0.7	1.28E-04	3.48E-06	3.48E-06
1	2	RT_PM1_008	POINTHOR	811997.6	824882.2	0	1.3	773	8	0.7	1.28E-04	3.48E-06	3.48E-06
1	2	RT_PM1_009	POINTHOR	811978.4	824836.1	0	1.3	773	8	0.7	1.28E-04	3.48E-06	3.48E-06
1	3	RT_PM1_010	POINTHOR	812452.4	824799.4	0	1.3	773	8	0.7	2.18E-04	5.95E-06	5.95E-06

Notes:

[1] The release height refers to HK China Ferry Terminal in Approved EIA of Proposed Road Improvement Works in West Kowloon Reclamation Development – Phase 1 – Investigation, Design and Construction (AEIAR-179/2013) and other modelling parameters such as exit temperature, exit velocity and internal diameter refers to Expansion of Hong Kong Airport into a Three-Runway System (AEIAR-185/2014).

Marine Emission Inventory during Hotelling

Calculation of Time-In-Mode by Route

Sailing Route	Time-In-Mode (minutes) during Hotelling for 1 Hour [1]
1 to 3	60

Notes:

[1] The averaged TIM for hotelling provided by Marine Traffic Consultant is 1 hour and the emission rate is to calculate the emission per hour, i.e. hotelling for 60mins. The number of vessels per hour are adjusted to cater the hotelling duration.

Total Emission Rate per Trip for All Routes [1]

Group [1]	Vessel Type	Emission Rate per Trip (g/s) [2]		
		NOx	RSP	FSP
1	Boat	2.24E-02	6.12E-04	6.12E-04

Notes:

[1] The vessel type is grouped according to the modelling parameter (i.e. stack height, exit temperature, exit velocity etc). Vessel types with the identical modelling parameters will be grouped.

[2] The emission rate per trip is calculated based on the following equation. Breakdown is provided and documented in "Technical Notes on Marine Emission for Pillar Point Area" submitted to EPD and emission rates are evenly apportioned into point sources in the model as shown in subsequent pages of this Appendix.

Engine Emission Rate per Trip = (i)Time-in-mode x (ii)Engine Load Factors x (iii) Engine Power x (iv) Emission Factor, where

(i) As indicated in the table of "Calculation of Time-In-Mode by Route", time-in-mode is calculated from the average speed and possible maximum length of sailing route within assessment area provided by Marine Traffic Consultant.

(ii) Engine Load Factors are made reference to Table 3-2 and Table 3-3 of USEPA (2008) – "Regulatory Impact Analysis: Control of Emissions of Air Pollution from Locomotive Engines and Marine Compression Ignition Engines Less than 30 Liters Per Cylinder".

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(iv) The engine emission factors are made reference to Table 3-4 and Table 3-58 of USEPA (2008) – "Regulatory Impact Analysis: Control of Emissions of Air Pollution from Locomotive Engines and Marine Compression Ignition Engines Less than 30 Liters Per Cylinder". Tier 2 emission factors are adopted, which assumed the age of vessels is >40 years old in Year 2048 for conservative assessment. Emission factors of FSP is assumed to be the same as those of RSP.

Modelling Parameters

Group	Sailing Route	Source ID	Type	X	Y	Base Elevation	Release Height [1]	Exit Temperature [1]	Exit velocity [1]	Internal diameter [1]	Emission Rate per Trip		
											NOx	RSP	FSP
				(m)	(m)	(mpd)	(m)	(K)	(m/s)	(m)	(g/s)	(g/s)	(g/s)
1	1	RT_PH1_001	POINTHOR	811581.2	825220.8	0	1.3	773	8	0.7	2.49E-03	6.80E-05	6.80E-05
1	1	RT_PH1_002	POINTHOR	811554.0	825156.3	0	1.3	773	8	0.7	2.49E-03	6.80E-05	6.80E-05
1	1	RT_PH1_003	POINTHOR	811526.8	825091.8	0	1.3	773	8	0.7	2.49E-03	6.80E-05	6.80E-05
1	1	RT_PH1_004	POINTHOR	811499.6	825027.3	0	1.3	773	8	0.7	2.49E-03	6.80E-05	6.80E-05
1	1	RT_PH1_005	POINTHOR	811645.7	825193.5	0	1.3	773	8	0.7	2.49E-03	6.80E-05	6.80E-05
1	1	RT_PH1_006	POINTHOR	811700.5	825170.3	0	1.3	773	8	0.7	2.49E-03	6.80E-05	6.80E-05
1	1	RT_PH1_007	POINTHOR	811673.3	825105.8	0	1.3	773	8	0.7	2.49E-03	6.80E-05	6.80E-05
1	1	RT_PH1_008	POINTHOR	811646.1	825041.3	0	1.3	773	8	0.7	2.49E-03	6.80E-05	6.80E-05
1	1	RT_PH1_009	POINTHOR	811618.9	824976.8	0	1.3	773	8	0.7	2.49E-03	6.80E-05	6.80E-05
1	2	RT_PH1_010	POINTHOR	811995.1	825045.9	0	1.3	773	8	0.7	2.80E-03	7.65E-05	7.65E-05
1	2	RT_PH1_011	POINTHOR	811968.0	824981.3	0	1.3	773	8	0.7	2.80E-03	7.65E-05	7.65E-05
1	2	RT_PH1_012	POINTHOR	811940.9	824916.8	0	1.3	773	8	0.7	2.80E-03	7.65E-05	7.65E-05
1	2	RT_PH1_013	POINTHOR	811913.8	824852.3	0	1.3	773	8	0.7	2.80E-03	7.65E-05	7.65E-05
1	2	RT_PH1_014	POINTHOR	812059.7	825018.9	0	1.3	773	8	0.7	2.80E-03	7.65E-05	7.65E-05
1	2	RT_PH1_015	POINTHOR	812115.1	824995.7	0	1.3	773	8	0.7	2.80E-03	7.65E-05	7.65E-05
1	2	RT_PH1_016	POINTHOR	812087.8	824931.2	0	1.3	773	8	0.7	2.80E-03	7.65E-05	7.65E-05
1	2	RT_PH1_017	POINTHOR	812060.6	824866.7	0	1.3	773	8	0.7	2.80E-03	7.65E-05	7.65E-05
1	3	RT_PH1_018	POINTHOR	812383.0	824806.9	0	1.3	773	8	0.7	5.60E-03	1.53E-04	1.53E-04
1	3	RT_PH1_019	POINTHOR	812410.2	824871.4	0	1.3	773	8	0.7	5.60E-03	1.53E-04	1.53E-04
1	3	RT_PH1_020	POINTHOR	812474.7	824844.2	0	1.3	773	8	0.7	5.60E-03	1.53E-04	1.53E-04
1	3	RT_PH1_021	POINTHOR	812529.8	824820.9	0	1.3	773	8	0.7	5.60E-03	1.53E-04	1.53E-04

Notes:

[1] The release height refers to HK China Ferry Terminal in Approved EIA of Proposed Road Improvement Works in West Kowloon Reclamation Development – Phase 1 – Investigation, Design and Construction (AEIAR-179/2013) and other modelling parameters such as exit temperature, exit velocity and internal diameter refers to Expansion of Hong Kong Airport into a Three-Runway System (AEIAR-185/2014)

Calculation of Multiplying Factor for Total Vessel Count

Monthly Vessel Count for Year 2048

Sailing Route	Monthly Vessel Count in Aug for Maneuvering [1]	Monthly Vessel Count in Aug for Hotelling [1]
Route 1	189	94
Route 2	160	80
Route 3	90	45

Notes:
[1] The marine traffic data for August is provided by Marine Traffic Consultant.

Monthly Multiplying Factor dervied from Marine Traffic in Year 2019

Month	Total No. of Arrivals by RTVs [1]	Monthly Multiplying Factor
Jan-19	5,820	1.03
Feb-19	3,401	0.60
Mar-19	5,783	1.02
Apr-19	5,411	0.96
May-19	5,766	1.02
Jun-19	5,456	0.96
Jul-19	5,645	1.00
Aug-19	**5,659**	**1.00**
Sep-19	5,382	0.95
Oct-19	5,160	0.91
Nov-19	5,534	0.98
Dec-19	5,632	1.00

Notes:

[1] Since no monthly profile is available from Marine Traffic Consultant, the annual vessel count is calculated based on monthly profile in "Monthly Vessel Arrivals by Ocean/River and Cargo/Passenger Vessels" published by Marine Department (https://www.mardep.gov.hk/en/fact/pdf/portstat_2_m_a1.pdf). Due to the pandemic situation, there was a significant change in marine traffic from Year 2020 to Year 2022. In view of this, the monthly profile of Year 2019 is considered the most appropriate and therefore adopted and assumed the same for future years.
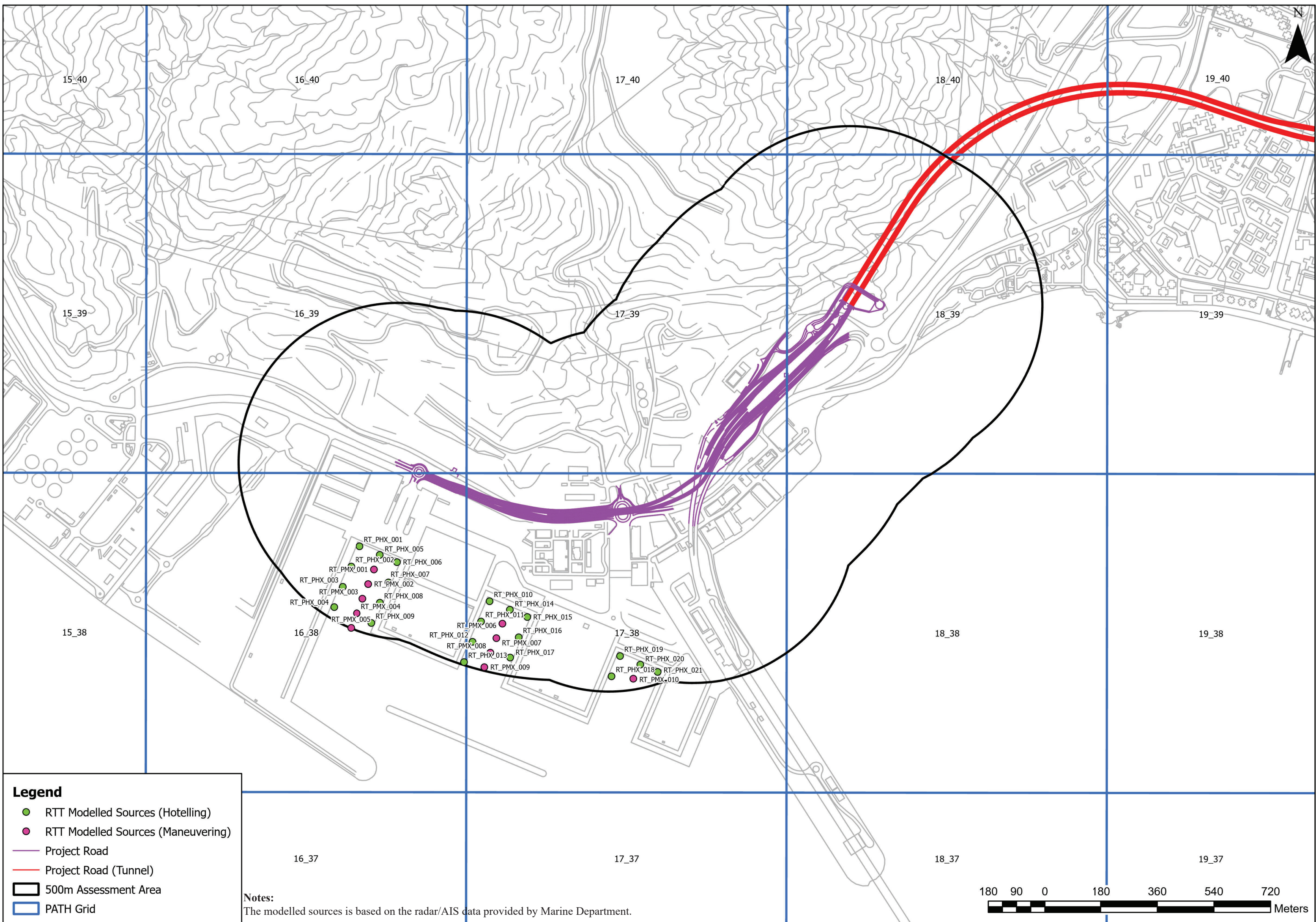
Hourly Multiplying Factor derived from Marine Traffic in August 2048

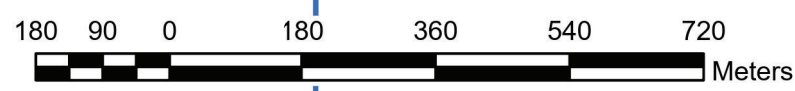| Hour		No. of Marine Vessels for Maneuvering of the Entire RTT [1]	Monthly-Hourly Multiplying Factor for Maneuvering [2]	No. of Marine Vessels for Hotelling for the Entire RTT [1]	Monthly-Hourly Multiplying Factor for Hotelling [2]
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7	8	229	2.9%	115	2.9%
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14	15	391	4.9%	195	4.9%
15	16	440	5.5%	220	5.5%
16	17	487	6.1%	243	6.1%
17	18	474	5.9%	237	5.9%
18	19	378	4.7%	189	4.7%
19	20	350	4.4%	175	4.4%
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22	23	391	4.9%	195	4.9%
23	24	322	4.0%	161	4.0%

Notes:
[1] The number of vessels refers to the number of vessels going in and out the entire RTT but not the assessed route of RTT .The number of hourly marine vessels for Aug 2048 is provided by Marine Traffic Consultant. It contains the total number of marine vessels going in and out RTT for the 31 days in Aug in Year 2048 for each hour. For example, from Hour 0 to Hour 1 (i.e. first hour of 1 Aug + first hour of 2 Aug, ... 1st hour of 31 Aug), there are total 223 marine vessels manevuering and total 112 marine hotelling for the first hour during the whole August. Since there is no information, the hourly profile of small craft is adopted for the small craft (boat).
[2] The hourly profile of the entire RTT is assumed to be the same for each route.

15_40   16_40   17_40   18_40   19_40

15_39   16_39   17_39   18_39   19_39

RT_PHX_001
RT_PHX_005
RT_PHX_002   RT_PHX_006
RT_PMX_001   RT_PHX_007
RT_PHX_003
RT_PMX_003   RT_PHX_008
RT_PHX_004   RT_PMX_004
RT_PMX_005   RT_PHX_009

RT_PHX_010
RT_PHX_014
RT_PHX_011   RT_PHX_015
RT_PMX_006   RT_PHX_016
RT_PMX_012
RT_PMX_008   RT_PMX_007
RT_PHX_013   RT_PHX_017
RT_PMX_009

RT_PHX_019
RT_PHX_020
RT_PHX_018   RT_PHX_021
RT_PMX_010

15_38   16_38   17_38   18_38   19_38

Legend

● RTT Modelled Sources (Hotelling)

● RTT Modelled Sources (Maneuvering)

— Project Road

— Project Road (Tunnel)

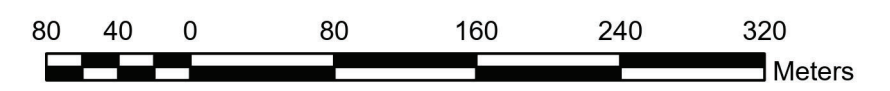▭ 500m Assessment Area

▭ PATH Grid

16_37   17_37   18_37   19_37

Notes:
The modelled sources is based on the radar/AIS data provided by Marine Department.

180 90 0   180   360   540   720
Meters

N

RT_PHX_001
RT_PHX_005
RT_PHX_006
RT_PHX_002
RT_PMX_001
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RT_PMX_004
RT_PMX_005
RT_PHX_009

16_38

RT_PHX_010
RT_PHX_014
RT_PHX_015
RT_PHX_011
RT_PMX_006
RT_PMX_007
RT_PHX_016
RT_PHX_012
RT_PMX_008
RT_PHX_017
RT_PHX_013
RT_PMX_009

17_38
RT_PHX_019
RT_PHX_020
RT_PHX_018
RT_PMX_010
RT_PHX_021

16_37

17_37

Notes:
The modelled sources is based on the radar/AIS data provided by Marine Department.

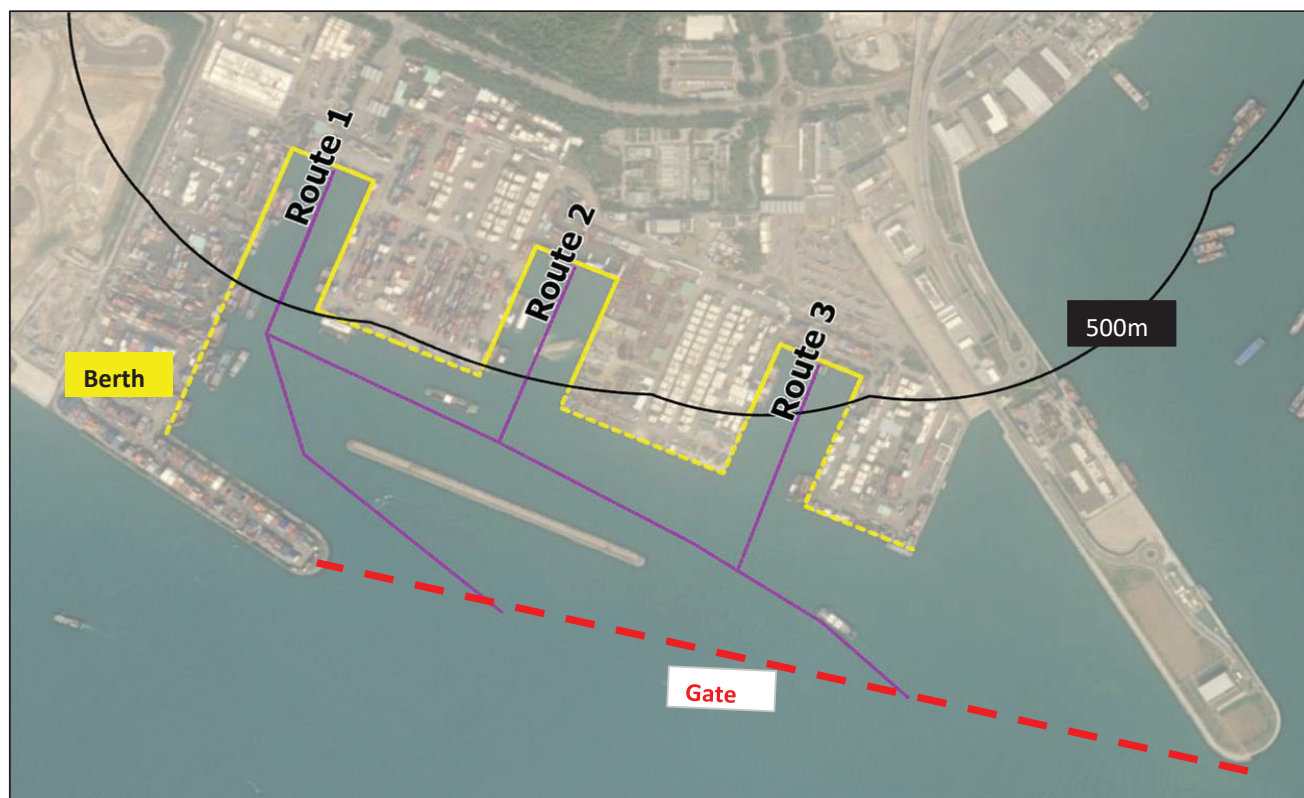80   40   0   80   160   240   320

Meters

Marine Traffic Information of the Entire River Trade Terminal (RTT)

Assessment Year	2048
Assessed Vessel Type	Small Craft - Work Boat and Tugboat
Location	River Trade Terminal
Total Length of Berth (m)	3050
Monthly Vessel Count for arrival and departure in RTT [1]	207
Monthly Vessel Count for Hotelling at RTT [1]	104
Travelling Speed (knots) [2]	5
Hotelling Time (hours) [2]	1

Notes:

[1] Monthly vessel count for manevuering is advised by Marine Traffic Consultant and accepted by Marine Department, and that for hotelling is half of the number for manevuering.

[2] Average travelling speed of 5 knot and average hotelling time of 1 hours are provided by Marine Traffic Consultant.

Marine Traffic Information by Routes

Sailing Route	Length of Berth within Assessment Area (m)	Monthly Vessel Count in Aug for Maneuvering within Assessment Area [1]	Travelling Speed (knots)[2]	Length of Sailing Route within Assessment Area (m) [4]	Monthly Vessel Count in Aug for Hotelling within Assessment Area [1]	Hotelling Time (hours) [3]
1	696	47	5	251	24	1
2	589	40	5	211	20	1
3	333	23	5	90	11	1

Notes:

[1] No information on the vessel count breakdown at different berth and routes. Hence monthly vessel count by routes is estimated by pro-rata to the length of the approached berth.

[2] Average speed of 5 knot is provided by Marine Traffic Consultant.

[3] Average hotelling time of 1 hours are provided by Marine Traffic Consultant.

[4] Possible maximum length of sailing route for each route is estimated for conservative assessment.

[5] As advised by Marine Traffic Consultant, the small crafts include tugboat, work boat and passenger boat. For the calculation of marine emission for passenger boat, please refer to "Marine Emission Rate for Tsing Lung Tau Fairway in Year 2048 for Small Crafts - Passenger Boat".

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2

Marine Emission Inventory during Maneuvering

Calculation of Time-In-Mode by Route

Sailing Route	Speed (m/s) [1]	Length of Sailing Route within Assessment Area (m) [2]	Time-In-Mode (minutes) during Maneuvering [3]
1	2.57	251	1.63
2	2.57	211	1.37
3	2.57	90	0.58

Notes
[1] Average speed of 5 knot is provided by Marine Traffic Consultant and assumed to be constant throughout River Trade Terminal.
[2] Possible maximum length of sailing route is estimated for conservative assessment.
[3] Time-in-mode during maneuvering is derived from the length of sailing route and averaged speed within assessment area.

Total Emission Rate per Trip by Route

Sailing Route	Group [1]	Vessel Type	Emission Rate per Trip (g/s) [2][3]		
			NOₓ	RSP	FSP
1	1	Work Boat	9.29E-03	3.16E-04	3.07E-04
	2	Tugboat	1.97E-02	1.06E-03	1.03E-03
2	1	Work Boat	7.81E-03	2.66E-04	2.58E-04
	2	Tugboat	1.66E-02	8.90E-04	8.66E-04
3	1	Work Boat	3.33E-03	1.13E-04	1.10E-04
	2	Tugboat	7.07E-03	3.80E-04	3.69E-04

Engine in Operation

Engine	On (1) or Off (0) [2]
ME	1
AE	1

Notes
[1] The vessel type is grouped according to the modelling parameter (i.e. stack height, exit temperature, exit velocity etc). Vessel types with the identical modelling parameters will be grouped.
[2] Main and auxiliary engine are assumed in operation during maneuvering for conservative assessment with reference to Table 3-25 of Study on Marine Vessels Emission Inventory Final Report (HKUST, February 2012). The emission rate per trip considers the emission from the engine in operation as indicated in the table "Engine in Operation", and the calculation is documented in the "Technical Notes on Marine Emission for Pillar Point Area" submitted to EPD.
[3] The emission rate per trip is calculated based on the following equation. Breakdown is provided and documented in "Technical Notes on Marine Emission for Pillar Point Area" submitted to EPD and emission rates are evenly apportioned into point sources in the model as shown in subsequent pages of this Appendix.
Engine Emission Rate per Trip = (i)Time-in-mode x (ii)Engine Load Factors x (iii) Engine Power x (iv) Emission Factor, where
(i) As indicated in the table of "Calculation of Time-In-Mode by Route", time-in-mode is calculated from the average speed and possible maximum length of sailing route within assessment area provided by Marine Traffic Consultant.
(ii) Engine Load Factors are made reference to Table 4-7, Table 4-10 and Table 3-24 of Study on Marine Vessels Emission Inventory Final Report (HKUST, February 2012).
(iii) The engine powers are made reference to Table 4-5 and Table 4-6 of Study on Marine Vessels Emission Inventory Final Report (HKUST, February 2012) - cargo junk of GRT 0-499 class and tug of GRT 0-499 (average of Grade II tug boat of locally licensed vessel).
(iv) The emission factor is made reference to Study on Marine Vessels Emission Inventory Final Report (HKUST, February 2012) Table 4-16. Under the Air Pollution Control (Fuel for Vessels) Regulation, all vessels assumed to use MGO due to requirement to fuel switch to compliant fuel (sulphur content <=0.5%) within Hong Kong waters.

Modelling Parameters

Group	Sailing Route	Source ID	Type	X	Y	Base Elevation	Release Height [1]	Exit Temperature [1]	Exit velocity [1]	Internal diameter [1]	Emission Rate per Trip		
											NOx	RSP	FSP
				(m)	(m)	(mpd)	(m)	(K)	(m/s)	(m)	(g/s)	(g/s)	(g/s)
1	1	RT_TM1_001	POINT	811627.3	825147	0	11	588	8	0.2	1.86E-03	6.33E-05	6.14E-05
1	1	RT_TM1_002	POINT	811608.9	825100.5	0	11	588	8	0.2	1.86E-03	6.33E-05	6.14E-05
1	1	RT_TM1_003	POINT	811590.4	825054	0	11	588	8	0.2	1.86E-03	6.33E-05	6.14E-05
1	1	RT_TM1_004	POINT	811572	825007.6	0	11	588	8	0.2	1.86E-03	6.33E-05	6.14E-05
1	1	RT_TM1_005	POINT	811553.6	824961.1	0	11	588	8	0.2	1.86E-03	6.33E-05	6.14E-05
1	2	RT_TM1_006	POINT	812035.9	824974.6	0	11	588	8	0.2	1.95E-03	6.65E-05	6.45E-05
1	2	RT_TM1_007	POINT	812016.8	824928.4	0	11	588	8	0.2	1.95E-03	6.65E-05	6.45E-05
1	2	RT_TM1_008	POINT	811997.6	824882.2	0	11	588	8	0.2	1.95E-03	6.65E-05	6.45E-05
1	2	RT_TM1_009	POINT	811978.4	824836.1	0	11	588	8	0.2	1.95E-03	6.65E-05	6.45E-05
1	3	RT_TM1_010	POINT	812452.4	824799.4	0	11	588	8	0.2	3.33E-03	1.13E-04	1.10E-04
2	1	RT_TM2_001	POINTHOR	811627.3	825147	0	4	694.7	8	0.3	3.94E-03	2.12E-04	2.06E-04
2	1	RT_TM2_002	POINTHOR	811608.9	825100.5	0	4	694.7	8	0.3	3.94E-03	2.12E-04	2.06E-04
2	1	RT_TM2_003	POINTHOR	811590.4	825054	0	4	694.7	8	0.3	3.94E-03	2.12E-04	2.06E-04
2	1	RT_TM2_004	POINTHOR	811572	825007.6	0	4	694.7	8	0.3	3.94E-03	2.12E-04	2.06E-04
2	1	RT_TM2_005	POINTHOR	811553.6	824961.1	0	4	694.7	8	0.3	3.94E-03	2.12E-04	2.06E-04
2	2	RT_TM2_006	POINTHOR	812035.9	824974.6	0	4	694.7	8	0.3	4.14E-03	2.23E-04	2.16E-04
2	2	RT_TM2_007	POINTHOR	812016.8	824928.4	0	4	694.7	8	0.3	4.14E-03	2.23E-04	2.16E-04
2	2	RT_TM2_008	POINTHOR	811997.6	824882.2	0	4	694.7	8	0.3	4.14E-03	2.23E-04	2.16E-04
2	2	RT_TM2_009	POINTHOR	811978.4	824836.1	0	4	694.7	8	0.3	4.14E-03	2.23E-04	2.16E-04
2	3	RT_TM2_010	POINTHOR	812452.4	824799.4	0	4	694.7	8	0.3	7.07E-03	3.80E-04	3.69E-04

Notes:
[1] Modelling parameters are referred to Tuen Mun South Extension (AERIAR-236/2022).

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3

Marine Emission Inventory during Hotelling

Calculation of Time-In-Mode by Route

Sailing Route	Time-In-Mode (minutes) during Hotelling for 1 Hour[1]
1 to 3	60

Notes:
[1] The averaged TIM for hotelling provided by Marine Traffic Consultant is 1 hour and the emission rate is to calculate the emission per hour, i.e. hotelling for 60mins.

Total Emission Rate per Trip for All Routes [1]

Group [1]	Vessel Type	Emission Rate per Trip (g/s) [2][3]		
		NO_X	RSP	FSP
1	Work Boat	1.39E-01	5.54E-03	5.40E-03
2	Tugboat	3.94E-02	1.58E-03	1.54E-03

Engine in Operation

Engine	On (1) or Off (0) [2]
AE	1

Notes
[1] The vessel type is grouped according to the modelling parameter (i.e. stack height, exit temperature, exit velocity etc). Vessel types with the identical modelling parameters will be grouped.
[2] Only auxiliary engine is assumed in operation during hotelling with reference to Table 3-25 of Study on Marine Vessels Emission Inventory Final Report (HKUST, February 2012). The emission per trip considers the emission from the engine in operation as indicated in the table "Engine in Operation", and the calculation is documented in the "Technical Notes on Marine Emission for Pillar Point Area" submitted to EPD.
[3] The emission rate per trip is calculated based on the following equation. Breakdown is provided and documented in "Technical Notes on Marine Emission for Pillar Point Area" submitted to EPD and emission rates are evenly apportioned into point sources in the model as shown in subsequent pages of this Appendix.
Engine Emission Rate per Trip = (i)Time-in-mode x (ii)Engine Load Factors x (iii) Engine Power x (iv) Emission Factor, where
(i) As indicated in the table of "Calculation of Time-In-Mode by Route", time-in-mode is calculated from the average speed and possible maximum length of sailing route within assessment area provided by Marine Traffic Consultant.
(ii) Engine Load Factors are made reference to Table 4-7, Table 4-10 and Table 3-24 of Study on Marine Vessels Emission Inventory Final Report (HKUST, February 2012).
(iii) The engine powers are made reference to Table 4-5 and Table 4-6 of Study on Marine Vessels Emission Inventory Final Report (HKUST, February 2012) - cargo junk of GRT 0-499 class and tug of GRT 0-499 (average of Grade II tug boat of locally licensed vessel).
(iv) The emission factor is made reference to Study on Marine Vessels Emission Inventory Final Report (HKUST, February 2012) Table 4-16. Under the Air Pollution Control (Fuel for Vessels) Regulation, all vessels assumed to use MGO due to requirement to fuel switch to compliant fuel (sulphur content <=0.5%) within Hong Kong waters.

Modelling Parameters

Group	Sailing Route	Source ID	Type	X	Y	Base Elevation	Release Height [1]	Exit Temperature [1]	Exit velocity [1]	Internal diameter [1]	Emission Rate per Trip		
											NOx	RSP	FSP
				(m)	(m)	(mpd)	(m)	(K)	(m/s)	(m)	(g/s)	(g/s)	(g/s)
1	1	RT_TH1_001	POINT	811581.2	825220.8	0	11	588	8	0.2	1.54E-02	6.16E-04	6.00E-04
1	1	RT_TH1_002	POINT	811554.0	825156.3	0	11	588	8	0.2	1.54E-02	6.16E-04	6.00E-04
1	1	RT_TH1_003	POINT	811526.8	825091.8	0	11	588	8	0.2	1.54E-02	6.16E-04	6.00E-04
1	1	RT_TH1_004	POINT	811499.6	825027.3	0	11	588	8	0.2	1.54E-02	6.16E-04	6.00E-04
1	1	RT_TH1_005	POINT	811645.7	825193.5	0	11	588	8	0.2	1.54E-02	6.16E-04	6.00E-04
1	1	RT_TH1_006	POINT	811700.5	825170.3	0	11	588	8	0.2	1.54E-02	6.16E-04	6.00E-04
1	1	RT_TH1_007	POINT	811673.3	825105.8	0	11	588	8	0.2	1.54E-02	6.16E-04	6.00E-04
1	1	RT_TH1_008	POINT	811646.1	825041.3	0	11	588	8	0.2	1.54E-02	6.16E-04	6.00E-04
1	1	RT_TH1_009	POINT	811618.9	824976.8	0	11	588	8	0.2	1.54E-02	6.16E-04	6.00E-04
1	2	RT_TH1_010	POINT	811995.1	825045.9	0	11	588	8	0.2	1.73E-02	6.93E-04	6.75E-04
1	2	RT_TH1_011	POINT	811968.0	824981.3	0	11	588	8	0.2	1.73E-02	6.93E-04	6.75E-04
1	2	RT_TH1_012	POINT	811940.9	824916.8	0	11	588	8	0.2	1.73E-02	6.93E-04	6.75E-04
1	2	RT_TH1_013	POINT	811913.8	824852.3	0	11	588	8	0.2	1.73E-02	6.93E-04	6.75E-04
1	2	RT_TH1_014	POINT	812059.7	825018.9	0	11	588	8	0.2	1.73E-02	6.93E-04	6.75E-04
1	2	RT_TH1_015	POINT	812115.1	824995.7	0	11	588	8	0.2	1.73E-02	6.93E-04	6.75E-04
1	2	RT_TH1_016	POINT	812087.8	824931.2	0	11	588	8	0.2	1.73E-02	6.93E-04	6.75E-04
1	2	RT_TH1_017	POINT	812060.6	824866.7	0	11	588	8	0.2	1.73E-02	6.93E-04	6.75E-04
1	3	RT_TH1_018	POINT	812383.0	824806.9	0	11	588	8	0.2	3.46E-02	1.39E-03	1.35E-03
1	3	RT_TH1_019	POINT	812410.2	824871.4	0	11	588	8	0.2	3.46E-02	1.39E-03	1.35E-03
1	3	RT_TH1_020	POINT	812474.7	824844.2	0	11	588	8	0.2	3.46E-02	1.39E-03	1.35E-03
1	3	RT_TH1_021	POINT	812529.8	824820.9	0	11	588	8	0.2	3.46E-02	1.39E-03	1.35E-03
2	1	RT_TH2_001	POINTHOR	811581.2	825220.8	0	4	694.7	8	0.3	4.38E-03	1.75E-04	1.71E-04
2	1	RT_TH2_002	POINTHOR	811554.0	825156.3	0	4	694.7	8	0.3	4.38E-03	1.75E-04	1.71E-04
2	1	RT_TH2_003	POINTHOR	811526.8	825091.8	0	4	694.7	8	0.3	4.38E-03	1.75E-04	1.71E-04
2	1	RT_TH2_004	POINTHOR	811499.6	825027.3	0	4	694.7	8	0.3	4.38E-03	1.75E-04	1.71E-04
2	1	RT_TH2_005	POINTHOR	811645.7	825193.5	0	4	694.7	8	0.3	4.38E-03	1.75E-04	1.71E-04
2	1	RT_TH2_006	POINTHOR	811700.5	825170.3	0	4	694.7	8	0.3	4.38E-03	1.75E-04	1.71E-04
2	1	RT_TH2_007	POINTHOR	811673.3	825105.8	0	4	694.7	8	0.3	4.38E-03	1.75E-04	1.71E-04
2	1	RT_TH2_008	POINTHOR	811646.1	825041.3	0	4	694.7	8	0.3	4.38E-03	1.75E-04	1.71E-04
2	1	RT_TH2_009	POINTHOR	811618.9	824976.8	0	4	694.7	8	0.3	4.38E-03	1.75E-04	1.71E-04
2	2	RT_TH2_010	POINTHOR	811995.1	825045.9	0	4	694.7	8	0.3	4.93E-03	1.97E-04	1.92E-04
2	2	RT_TH2_011	POINTHOR	811968.0	824981.3	0	4	694.7	8	0.3	4.93E-03	1.97E-04	1.92E-04
2	2	RT_TH2_012	POINTHOR	811940.9	824916.8	0	4	694.7	8	0.3	4.93E-03	1.97E-04	1.92E-04
2	2	RT_TH2_013	POINTHOR	811913.8	824852.3	0	4	694.7	8	0.3	4.93E-03	1.97E-04	1.92E-04
2	2	RT_TH2_014	POINTHOR	812059.7	825018.9	0	4	694.7	8	0.3	4.93E-03	1.97E-04	1.92E-04
2	2	RT_TH2_015	POINTHOR	812115.1	824995.7	0	4	694.7	8	0.3	4.93E-03	1.97E-04	1.92E-04
2	2	RT_TH2_016	POINTHOR	812087.8	824931.2	0	4	694.7	8	0.3	4.93E-03	1.97E-04	1.92E-04
2	2	RT_TH2_017	POINTHOR	812060.6	824866.7	0	4	694.7	8	0.3	4.93E-03	1.97E-04	1.92E-04
2	3	RT_TH2_018	POINTHOR	812383.0	824806.9	0	4	694.7	8	0.3	9.85E-03	3.94E-04	3.84E-04
2	3	RT_TH2_019	POINTHOR	812410.2	824871.4	0	4	694.7	8	0.3	9.85E-03	3.94E-04	3.84E-04
2	3	RT_TH2_020	POINTHOR	812474.7	824844.2	0	4	694.7	8	0.3	9.85E-03	3.94E-04	3.84E-04
2	3	RT_TH2_021	POINTHOR	812529.8	824820.9	0	4	694.7	8	0.3	9.85E-03	3.94E-04	3.84E-04

Notes:
[1] For reference of modelling parameter, please see "Modelling Parametes of Marine Vessel from Approved EIA Studies".

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4

Calculation of Multiplying Factor for Total Vessel Count

Monthly Vessel Count for Year 2048

Sailing Route	Monthly Vessel Count in Aug for Maneuvering [1]	Monthly Vessel Count in Aug for Hotelling [1]
Route 1	47	24
Route 2	40	20
Route 3	23	11

Notes:
[1] The marine traffic data for August is provided by Marine Traffic Consultant.

Monthly Multiplying Factor dervied from Marine Traffic in Year 2019

Month	Total No. of Arrivals by RTVs [1]	Monthly Multiplying Factor
Jan-19	5,820	1.03
Feb-19	3,401	0.60
Mar-19	5,783	1.02
Apr-19	5,411	0.96
May-19	5,766	1.02
Jun-19	5,456	0.96
Jul-19	5,645	1.00
Aug-19	**5,659**	**1.00**
Sep-19	5,382	0.95
Oct-19	5,160	0.91
Nov-19	5,534	0.98
Dec-19	5,632	1.00

Notes:

[1] Since no monthly profile is available from Marine Traffic Consultant, the annual vessel count is calculated based on monthly profile in "Monthly Vessel Arrivals by Ocean/River and Cargo/Passenger Vessels" published by Marine Department (https://www.mardep.gov.hk/en/fact/pdf/portstat_2_m_a1.pdf). Due to the pandemic situation, there was a significant change in marine traffic from Year 2020 to Year 2022. In view of this, the monthly profile of Year 2019 is considered the most appropriate and therefore adopted and assumed the same for future years.
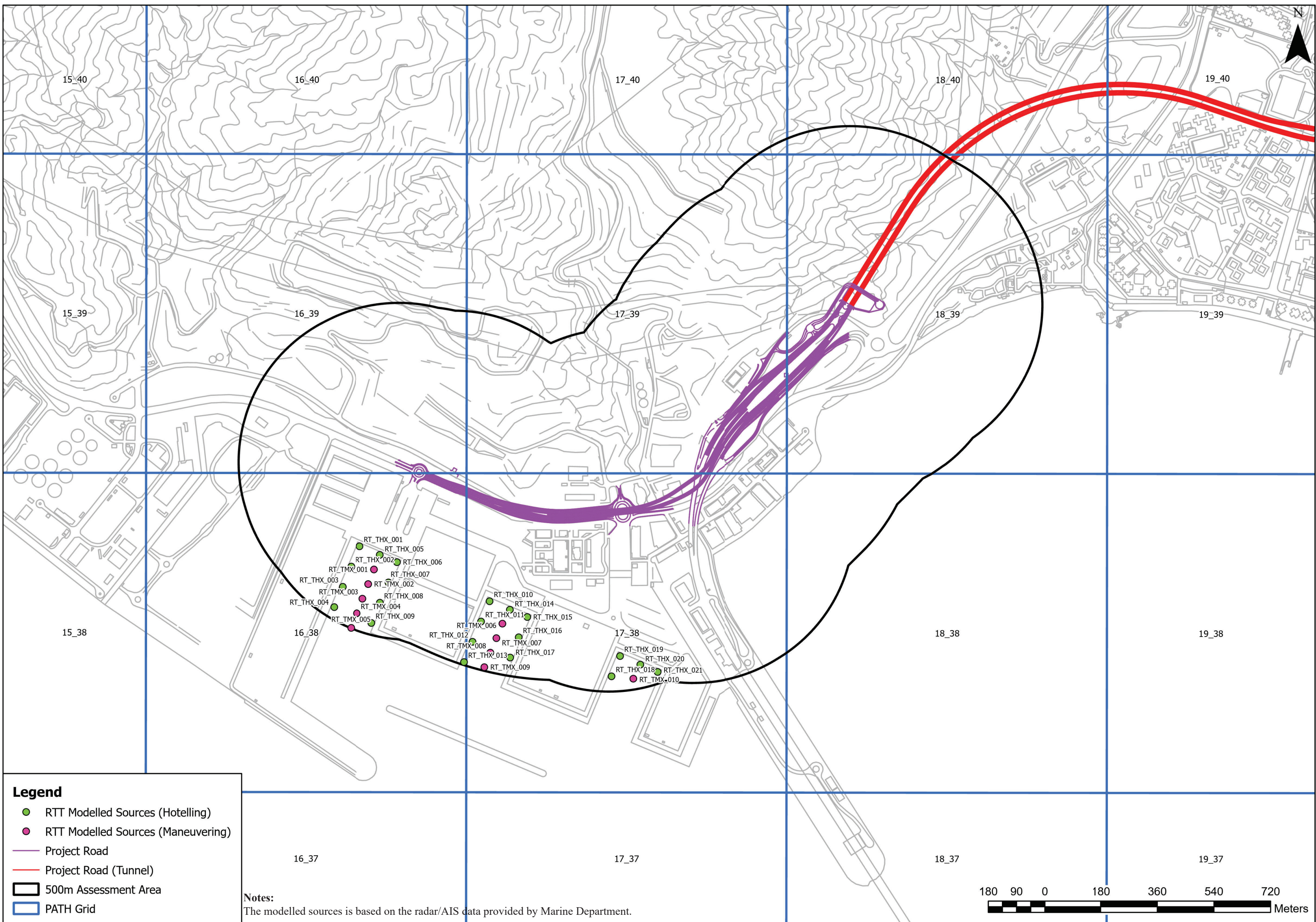
Hourly Multiplying Factor derived from Marine Traffic in August 2048

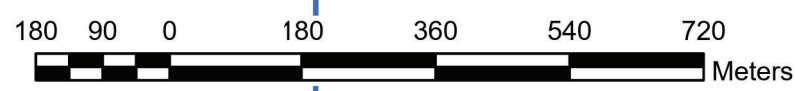| Hour		No. of Marine Vessels for Maneuvering of the Entire RTT [1]	Monthly-Hourly Multiplying Factor for Maneuvering [2]	No. of Marine Vessels for Hotelling for the Entire RTT [1]	Monthly-Hourly Multiplying Factor for Hotelling [2]
Start	End				
0	1	223	2.8%	112	2.8%
1	2	205	2.6%	102	2.6%
2	3	223	2.8%	112	2.8%
3	4	164	2.0%	82	2.0%
4	5	164	2.0%	82	2.0%
5	6	174	2.2%	87	2.2%
6	7	177	2.2%	88	2.2%
7	8	229	2.9%	115	2.9%
8	9	288	3.6%	144	3.6%
9	10	372	4.6%	186	4.6%
10	11	406	5.1%	203	5.1%
11	12	459	5.7%	229	5.7%
12	13	431	5.4%	215	5.4%
13	14	394	4.9%	197	4.9%
14	15	391	4.9%	195	4.9%
15	16	440	5.5%	220	5.5%
16	17	487	6.1%	243	6.1%
17	18	474	5.9%	237	5.9%
18	19	378	4.7%	189	4.7%
19	20	350	4.4%	175	4.4%
20	21	437	5.5%	219	5.5%
21	22	440	5.5%	220	5.5%
22	23	391	4.9%	195	4.9%
23	24	322	4.0%	161	4.0%

Notes:

[1] The number of vessels refers to the number of vessels going in and out the entire RTT but not the assessed route of RTT .The number of hourly marine vessels for Aug 2048 is provided by Marine Traffic Consultant. It contains the total number of marine vessels going in and out RTT for the 31 days in Aug in Year 2048 for each hour. For example, from Hour 0 to Hour 1 (i.e. first hour of 1 Aug + first hour of 2 Aug, ... 1st hour of 31 Aug), there are total 223 marine vessels manevuering and total 112 marine hotelling for the first hour during the whole August. Since there is no information, the hourly profile of river trade terminal is adopted for the small craft (tug and workboat).

[2] The hourly profile of the entire RTT is assumed to be the same for each route.

Legend

- ● RTT Modelled Sources (Hotelling)
- ● RTT Modelled Sources (Maneuvering)
- — Project Road
- — Project Road (Tunnel)
- ▭ 500m Assessment Area
- ▭ PATH Grid

Notes:
The modelled sources is based on the radar/AIS data provided by Marine Department.

180 90 0 180 360 540 720
Meters

N

N

RT_THX_001
RT_THX_005
RT_THX_006
RT_THX_002
RT_TMX_001
RT_THX_003
RT_TMX_002
RT_THX_007
RT_TMX_003
RT_THX_008
RT_THX_004
RT_TMX_004
RT_TMX_005
RT_THX_009

RT_THX_010
RT_THX_014
RT_THX_011
RT_THX_015
RT_TMX_006
RT_THX_012
RT_TMX_007
RT_THX_016
RT_TMX_008
RT_THX_017
RT_THX_013
RT_TMX_009

17_38
RT_THX_019
RT_THX_020
RT_THX_021
RT_THX_018
RT_TMX_010

16_38

16_37

17_37

Legend

- RTT Modelled Sources (Hotelling)
- RTT Modelled Sources (Maneuvering)
- Project Road
- Project Raod (Tunnel)
- 500m Assessment Area
- PATH Grid

Notes:
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80 40 0 80 160 240 320

Meters