Appendix 3.3 EMFAC-HK Model Assumptions

Estimation of Vehicular Emission for the Study Area with EMFAC-HK model

EMFAC-HK v4.2 model was adopted to estimate the vehicular emission rates of NO_X, NO_2, TSP, RSP and FSP. The input parameters and model assumptions made in EMFAC-HK model are summarized as follows.

Model Year

EMFAC-HK considers 45 years of model years for the estimation of vehicular emission. The model years start from 45 years preceding the year of interest to the year of interest as the final model year. The following table summarizes the starting and final model years of the assessment years implemented in EMFAC-HK.

Table 1 Starting and Final Model Years in EMFAC-HK

Scenario Year	Starting Model Year	Final Model Year
2028	1984	2028
2035	1991	2035
2043 [1]	1996	2040

Note:
[1] According to *Guideline on Modelling Vehicle Emissions* published by Environmental Protection Department, EMFAC-HK can estimate the emissions/emission factors from Year 1997 to Year 2040. Therefore, Year 2040 (i.e. the final available year) was adopted for Year 2043 Scenario.

Vehicle Technology fraction

Exhaust technology fraction and evaporative technology fraction in the model are based on the default value.

The "2016 Licensed Vehicle by Age and Technology Group Fractions" provided in EPD's website, was adopted in this assessment. Since the provided exhaust technology fractions are only up to Year 2016 at the time of the assessment, those after Year 2016 are projected in accordance with EPD's *Guideline on Modelling Vehicle Emissions* – Appendix 3 "Implementation Schedule of Vehicle Emission Standards in Hong Kong (updated as at May 2020)" and Appendix 4 "EMFAC-HK Technology Group Indexes (Released in January 2020)".

Vehicle Population

As recommended in the EPD's *Guideline on Modelling Vehicle Emissions*, default vehicle populations forecast in EMFAC-HK was used.

Vehicle Accrual

The default accrual rates in EMFAC-HK are estimated from the local mileage data adjusted to reflect the total VKT for each vehicle class. The default value was used.

Appendix 3.3 EMFAC-HK Model Assumptions

Vehicle Kilometre Travel (VKT)

The "vehicle fleet" refers to all motor vehicles operating on roads within this assessment area. The modelled fleet was broken down into 16 vehicle classes based on the information in the Transport Monthly Digest and vehicle population provided by EPD.

Vehicle-kilometre-travelled (VKT) represents the total distance travelled on a weekday. The VKT is calculated by multiplying the number of vehicles, which based on the highest predicted hourly traffic flow, and the length of road travelled in the assessment area. The diurnal variation of VKT in the assessment area was provided by the traffic consultant.

Trips

Start emissions of vehicles in the assessment were simulated by two approaches, namely broad-brush approach and precise approach, which would be detailed later in this appendix. Given that no buses would be parked on street and start emission factors of franchised single-deck buses (FBSD) and franchised double-deck buses (FBDD) are more significant than other vehicle classes, the start emission of identified FBDD were localized at the bus termini and was assessed using precise approach.

Other than bus termini, public light bus (PLB) termini, heavy goods vehicle (HGV) parking sites and coach (NFB) parking sites were identified within the study area. To avoid any underestimation of air quality impact at the exit of termini and parking sites, precise approach has also been adopted to simulate the start emissions of PLB, HGV and NFB induced by these termini and parking sites.

For other vehicle classes such as private cars, it was noted that the start emission factors are minimal when compared to FBSD and FBDD. There are private carparks within the assessment area, and hence a sensitivity test is carried out to compare the impacts predicted from different modelling approaches to demonstrate the broad-brush approach adopted for private carpark is appropriate. Hilton Plaza carpark located within 500 m Study Area has been selected as it is equipped with mechanical ventilation and with ASRs located in close proximity to its openings and ventilation exhausts. The modelling approaches and findings are presented in **Annex A**. The findings showed that the air quality impact induced by the start emission was insignificant, with the max. hourly NOx concentration of around 0.4 $\mu g/m^3$ and annual average NOx concentration of around 0.02 $\mu g/m^3$ among the identified ASRs. In addition, the NOx concentrations using broad-brush approach were in general slightly higher than that using precise approach, with the max. differences of around 0.4 $\mu g/m^3$ (1^{st} highest hourly), 0.3 $\mu g/m^3$ (19^{th} highest hourly) and 0.06$\mu g/m^3$ (annual average). Therefore, broad-brush approach was considered reasonable and adopted for private cars.

Diurnal variation of daily trips was used to estimate the start emissions of petrol, LPG vehicles and diesel vehicles fitted with selective catalytic reduction (SCR) devices. Zero trip was assumed for roads with post speed greater than 50 km/hr as no cold start would be anticipated on these roads.

Broad-brush Approach

Start emissions of vehicles were distributed on local and rural roads with post speed of 50 km/hr with the number of trips for each vehicle class except FBDD, FBSD, PLB, HGV and NFB assumed directly proportional to VKT and estimated by the following formula.

Appendix 3.3 EMFAC-HK Model Assumptions

$$\begin{aligned}&Trip\ for\ local\ and\ rural\ roads\ within\ the\ study\ area\\&= VKT\ for\ local\ and\ rural\ roads\ within\ the\ study\ area\\&\times \frac{Trip\ for\ local\ and\ rural\ roads\ within\ Hong\ Kong}{VKT\ for\ local\ and\ rural\ roads\ within\ Hong\ Kong}\end{aligned}$$

Trip within Hong Kong and VKT within Hong Kong were obtained from the default values from EMFAC-HK. The proportion of local and rural roads within Hong Kong was obtained from the Annual Traffic Census prepared by Transport Department and is presented in **Annex B**. VKT within the study area was calculated by multiplying the number of vehicles by the distance travelled within the study area. The trips per VKT is also presented in **Annex B**.

The highest NO_x (and the corresponding NO and NO_2), TSP, RSP and FSP start emission factor for each vehicle class among different soak time were adopted as a conservative approach.

Precise Approach

Bus (FBDD) and PLB termini, NFB and HGV parking sites were identified within the study area. For these termini and parking sites, the number of trips for FBDD, PLB, NFB and HGV was obtained by on-site survey and information from the operators. Calculations of emissions associated with these termini and parking sites were referenced to the *Calculation of Start Emissions in Air Quality Impact Assessment* (**Appendix 3.7**) published by EPD.

Travelling Speed

Based on the available speed information provided by traffic consultant, emission factors of each vehicle class were adopted according to the travelling speed of each road link at each hour. All the vehicle classes on the same road link were assumed to have the same travelling speed, except medium goods vehicles, heavy goods vehicles, buses and public light buses, which have speed limit.

In accordance with the Road Traffic Ordinance, for any road with design speed limit of 70 kph or above, the speed limit for medium goods vehicles, heavy goods vehicles and buses would be limited to not more than 70 kph. Thus, for medium goods vehicles, heavy goods vehicles and buses, the flow speed or 70 kph, whichever is lower, have been adopted. For the public light buses, the speed limit should be limited to speed limit of the carriageway or 80 kph, whichever is lower, were adopted.

Temperature and Humidity Profile

For the estimation of short-term and long-term air quality impact of NO_2, TSP, RSP and FSP except long-term air quality impact of NO_2 (i.e. annual average NO_2) , the lowest hourly temperature (9^{o}C) and relative humidity data (24%) (>90% valid data) provided by Hong Kong Observatory (HKO) at Sha Tin weather station for Year 2019 were adopted for the model input.

For the estimation of long-term air quality impact of NO_2 (i.e. annual average NO_2), the daily profile of averaged temperature and relative humidity data in each hour for each month (i.e. 24 hours data in each month and for 12 months) provided by HKO at Sha Tin weather station for Year 2019 were adopted for the model input. A summary table for the temperature and relative humidity adopted is provided in **Annex C**.

Appendix 3.3 EMFAC-HK Model Assumptions

Estimation of Composite Vehicular Emission Factor

Referring to the EPD's *Guideline on Modelling Vehicle Emissions*, "Emfac mode" was used for calculating emission factors in terms of grams of pollutants emitted per vehicle activity. It was applied for this Project, since it provides the emission factors according to the actual hourly travelling speeds of vehicles of each road.

Assuming that NO_X is comprised of NO and NO_2 only, the hourly emission of NO was calculated as the difference in emissions between NO_x and NO_2 extracted from EMFAC-HK for each vehicle type. The NO, NO_2, TSP, RSP and FSP running exhaust and start emission factors of 16 vehicle classes for the estimation air quality impact except long-term air quality impact of NO_2 (i.e. annual average NO_2) are presented in **Appendix 3.4**.

Given that there would be no cold starts on roads with post speed greater than 50 km/hr, only running exhaust was considered for these road sections, while both running exhaust and starting emissions were considered for local road with post speed of 50km/hr. The 24-hour traffic flows and composite emission factors for each road adopted in the subsequent air dispersion modelling for the estimation air quality impact except long-term air quality impact of NO_2 (i.e. annual average NO_2) are presented in **Appendix 3.5**.

Vehicular Emission Burden by EMFAC-HK (for Determination of Assessment Year) – Construction Phase

Vehicular emission burdens (TSP, RSP and FSP) for the Years of 2023, 2025 and 2028 were calculated based on the traffic forecast and composite emission factors. The results are summarized in Table 2. According to the results, Year 2023 was selected as the worst affected year for the air quality assessment of construction phase.

Table 2 Vehicular Emission Burden of Open Road Source during Construction Phase

Year	TSP (g/day)	RSP (g/day)	FSP (g/day)
2023	**12988**	**12951**	**11901**
2025[1]	12912	12871	11833
2028	12613	12573	11568

Note:

[1] As there is no traffic data available for Year 2025, it is calculated based on traffic data of Year 2028 (Without Project Scenario) and composite emission factors of Year 2025. With regards to the vehicular emission factors, taking into account solely the natural retirement of aged vehicles and the replacement with newer vehicles with better exhaust technologies, the vehicular emission factors would be under a decreasing trend. In other words, the vehicular emission factors at 2025 would represent the highest vehicular emission factors within 2025 to 2028. Therefore, as a conservative approach for this assessment, the vehicular emission burden at Year 2025 is estimated from combination of the highest vehicular emission factors with the highest predicted traffic flow (i.e. at year 2028).

Vehicular Emission Burden by EMFAC-HK (for Determination of Assessment Year) – Operation Phase

Vehicular emission burdens (NOx and RSP) for the Years of 2028, 2035 and 2043 were calculated based on the traffic forecast and composite emission factors. The results are summarized in Table 3. According to the results, Year 2028 was selected as the worst affected year for the air quality assessment of operation phase.

Appendix 3.3 EMFAC-HK Model Assumptions

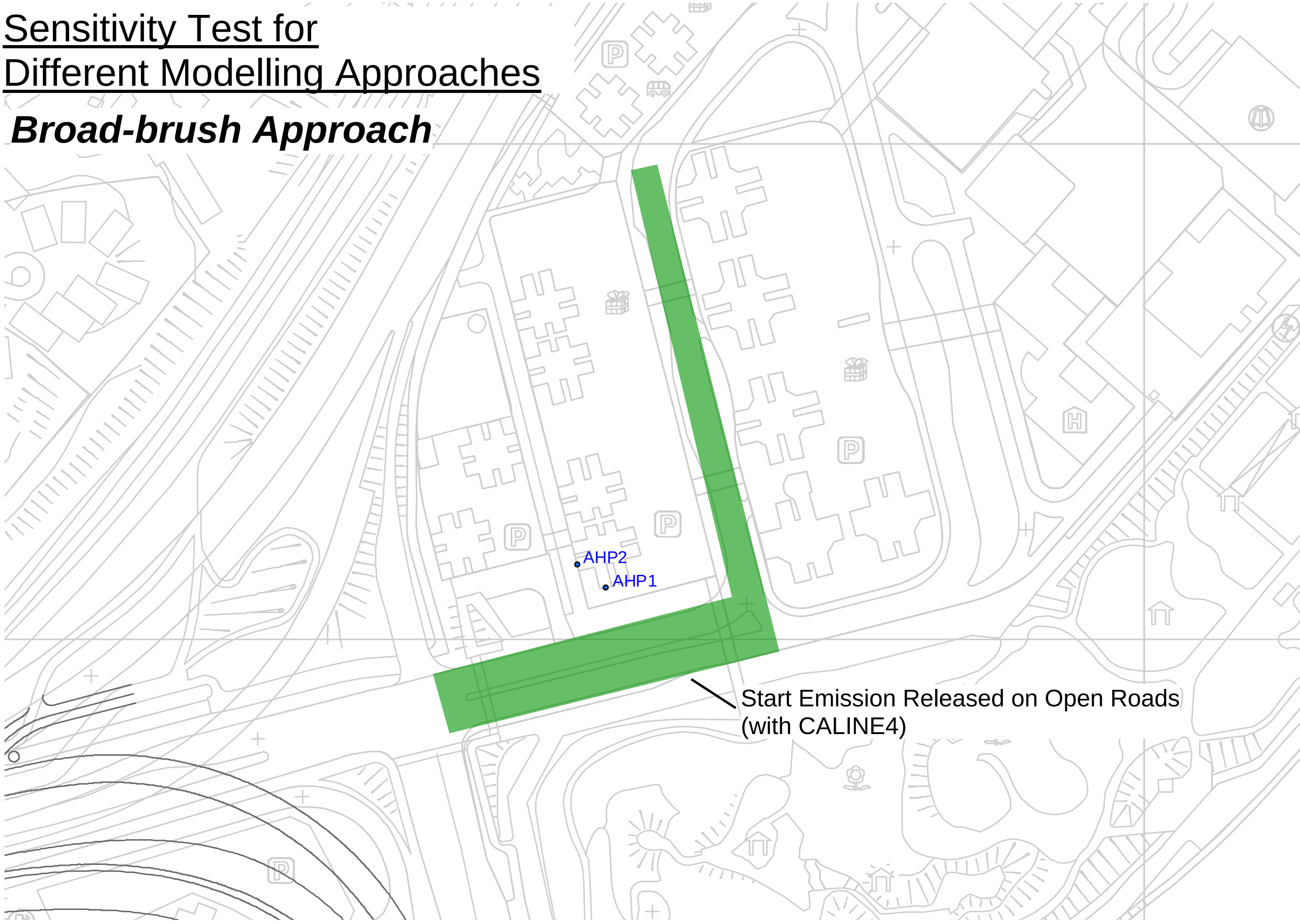
Table 3 Vehicular Emission Burden of Open Road Source during Operation Phase

Year	NOx (g/day)	RSP (g/day)	FSP (g/day)
2028	**328308**	**12307**	**11323**
2035	142605	4822	4440
2043	138746	4439	4090

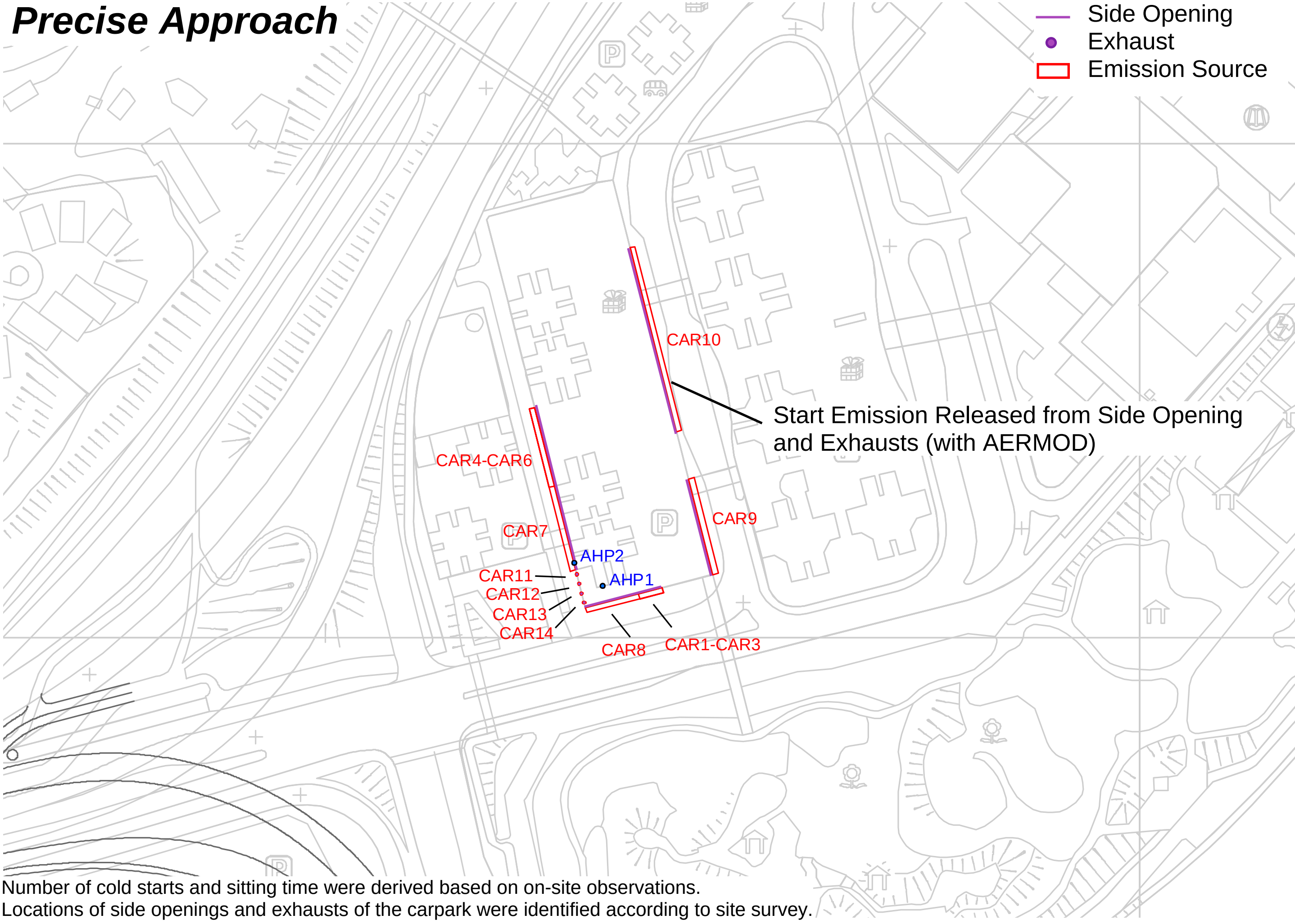
Annex A

Sensitivity Test for Different Modelling Approaches

Broad-brush Approach



Precise Approach



Number of cold starts and sitting time were derived based on on-site observations.
Locations of side openings and exhausts of the carpark were identified according to site survey.

Annex A

Private Carpark Sensitivity Test Results

ASR: AHP1_10mAG

Averaging Time	Total NOx (ug/m^3)		Difference
	Precise Approach	Broad-brush Approach	
Max. 1-hr	0.4	0.8	-0.4
19th highest hr	0.3	0.6	-0.3
Annual	0.02	0.08	-0.06

ASR: AHP2_10mAG

Averaging Time	Total NOx (ug/m^3)		Difference
	Precise Approach	Broad-brush Approach	
Max. 1-hr	0.4	0.7	-0.3
19th highest hr	0.2	0.5	-0.3
Annual	0.02	0.08	-0.06

Emission Inventory of AERMOD Model – Starting Emission from Hilton Plaza Carpark

Activity	Source	Type	X	Y	Release Height	Exit Temperature	Exit Velocity	Stack Diameter	Length of X Side	Length of Y Side	Angle	Area	Max. Hourly Emission Rate	
													NO	NO_2
	ID		(m)	(m)	(mAG)	(K)	(m/s)	(m)	(m)	(m)	(degree)	(m^2)	(g/s) or (g/m^2/s)	
Starting Emission of Hilton Plaza Carpark	CAR1	AREA	837309.5	826641.7	0.0	-	-	-	2.0	9.3	75.6	18.6	9.009E-07	4.734E-08
	CAR2	AREA	837309.5	826641.7	2.0	-	-	-	2.0	9.3	75.6	18.6	9.009E-07	4.734E-08
	CAR3	AREA	837309.5	826641.7	4.0	-	-	-	2.0	9.3	75.6	18.6	9.009E-07	4.734E-08
	CAR4	AREA	837268.2	826711.9	0.0	-	-	-	30.7	2.0	75.8	61.4	9.009E-07	4.734E-08
	CAR5	AREA	837268.2	826711.9	2.0	-	-	-	30.7	2.0	75.8	61.4	9.009E-07	4.734E-08
	CAR6	AREA	837268.2	826711.9	4.0	-	-	-	30.7	2.0	75.8	61.4	9.009E-07	4.734E-08
	CAR7	AREA	837268.2	826711.9	6.0	-	-	-	63.4	2.0	75.8	126.8	9.009E-07	4.734E-08
	CAR8	AREA	837318.5	826644.1	6.0	-	-	-	30.1	2.0	165.6	60.2	9.009E-07	4.734E-08
	CAR9	AREA	837328.7	826685.3	6.0	-	-	-	37.5	2.0	75.8	74.9	9.009E-07	4.734E-08
	CAR10	AREA	837306.4	826773.0	6.0	-	-	-	71.9	2.0	75.8	143.9	9.009E-07	4.734E-08
	CAR11	POINTHOR	837286.2	826649.1	6.0	0.0	1.0	1.5	-	-	-	-	7.273E-05	3.822E-06
	CAR12	POINTHOR	837287.1	826645.5	6.0	0.0	1.0	1.5	-	-	-	-	7.273E-05	3.822E-06
	CAR13	POINTHOR	837288.0	826641.9	6.0	0.0	1.0	1.5	-	-	-	-	7.273E-05	3.822E-06
	CAR14	POINTHOR	837288.9	826638.3	6.0	0.0	1.0	1.5	-	-	-	-	7.273E-05	3.822E-06

Annex A

24-hr Emission Rate and Hourly Profile of AERMOD Model – Starting Emission from Hilton Plaza Carpark

Time		24-hr Emission Rate (g/s)		Hourly Profile	
		NO	NO2	NO	NO2
0000	0100	0.000E+00	0.000E+00	0.000	0.000
0100	0200	2.658E-05	1.389E-06	0.030	0.030
0200	0300	0.000E+00	0.000E+00	0.000	0.000
0300	0400	0.000E+00	0.000E+00	0.000	0.000
0400	0500	3.183E-05	1.667E-06	0.036	0.036
0500	0600	0.000E+00	0.000E+00	0.000	0.000
0600	0700	0.000E+00	0.000E+00	0.000	0.000
0700	0800	0.000E+00	0.000E+00	0.000	0.000
0800	0900	8.125E-05	4.278E-06	0.093	0.093
0900	1000	5.442E-05	2.861E-06	0.062	0.062
1000	1100	2.750E-04	1.444E-05	0.315	0.315
1100	1200	2.480E-04	1.306E-05	0.284	0.285
1200	1300	2.911E-04	1.528E-05	0.334	0.333
1300	1400	3.027E-04	1.589E-05	0.347	0.346
1400	1500	3.587E-04	1.886E-05	0.411	0.411
1500	1600	5.153E-04	2.706E-05	0.590	0.590
1600	1700	6.378E-04	3.356E-05	0.731	0.732
1700	1800	7.342E-04	3.861E-05	0.841	0.842
1800	1900	5.249E-04	2.756E-05	0.602	0.601
1900	2000	8.727E-04	4.586E-05	1.000	1.000
2000	2100	5.374E-04	2.825E-05	0.616	0.616
2100	2200	2.321E-04	1.219E-05	0.266	0.266
2200	2300	2.053E-04	1.081E-05	0.235	0.236
2300	2400	5.539E-05	2.917E-06	0.063	0.064

Number of Cold Starts of Private Cars in Hilton Plaza Carpark

		Cold Start (min)																	
Time		5	10	20	30	40	50	60	120	180	240	300	360	420	480	540	600	660	720
0000	0100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0100	0200	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
0200	0300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0300	0400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0400	0500	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
0500	0600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0600	0700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0700	0800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0800	0900	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1
0900	1000	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0
1000	1100	0	1	2	0	0	1	2	0	0	0	0	0	0	0	0	3	0	2
1100	1200	0	0	1	2	3	2	0	0	0	0	0	0	0	0	0	0	1	1
1200	1300	0	0	0	2	1	1	4	1	1	0	0	0	0	0	0	0	0	1
1300	1400	0	0	1	1	0	0	4	1	2	0	1	0	0	0	0	0	0	1
1400	1500	0	0	1	0	1	3	1	3	0	1	1	1	0	0	0	0	0	1
1500	1600	2	0	3	2	1	0	3	0	0	1	0	3	0	1	0	0	0	4
1600	1700	0	0	2	1	3	3	3	2	1	1	1	0	0	2	1	0	0	4
1700	1800	0	0	3	0	3	2	6	2	0	1	2	0	2	3	0	2	0	1
1800	1900	0	0	0	3	0	2	1	1	1	0	0	1	0	1	1	4	1	4
1900	2000	0	0	1	0	1	0	2	5	3	3	1	2	1	2	0	4	3	3
2000	2100	0	0	2	0	1	0	2	4	0	1	0	1	0	1	1	2	3	2
2100	2200	0	1	0	0	0	0	1	2	0	0	0	0	0	1	0	0	1	3
2200	2300	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	1	0	4
2300	2400	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
	Total	2	2	17	11	14	14	31	21	10	9	6	8	4	13	4	16	9	33

Annex B

Proportion of Local and Rural Roads within Hong Kong

Region	Average Daily Vehicle-Kilometre in Year 2018		
	Major Roads	Minor Roads	Total
HK Island	4856454	1082420	5938874
Kowloon	8010289	1039537	9049826
New Territories	20732342	2714257	23446599
Total	**33599085**	**4836214**	**38435299**
Percentage	**87%**	**13%**	**100%**

Trips per VKT

Year 2028

Vehicle Classes	No. of Trips within HK			VKT within HK			VKT for Local and Rural Roads within HK			Trips per VKT
	Petrol	Diesel	LPG	Petrol	Diesel	LPG	Petrol	Diesel	LPG	
01 - Private Cars (PC)	1035924	10727	0	20018920	202326	0	2522384	25493	0	0.41079
02 - Taxi	35	0	73158	3755	0	7948669	473	0	1001532	0.07305
03 - Light Goods Vehicles<=2.5t	57	2279	0	894	38389	0	113	4837	0	0.47189
04 - Lt Goods Vehicles 2.5-3.5t	4873	212198	0	79316	3620139	0	9994	456138	0	0.46569
05 - Light Goods Vehicles>3.5t	0	85588	0	0	1930981	0	0	243304	0	0.35178
06 - Medium & Heavy Goods Vehicl	0	49895	0	0	1059151	0	0	133453	0	0.37388
07 - Medium & Heavy Goods Vehicl	0	130952	0	0	2786687	0	0	351123	0	0.37295
08 - Public Light Buses	0	13003	4385	0	898261	302912	0	113181	38167	0.11489
09 - Private Light Bus <=3.5t	626	1074	0	16782	33097	0	2114	4170	0	0.27051
10 - Private Light Bus >3.5t	8	8956	1318	141	250483	25086	18	31561	3161	0.29597
11 - Non-franchised Bus<=6.4t	0	10945	0	0	321741	0	0	40539	0	0.26999
12 - Non-franchised Bus 6.4-15t	0	7593	0	0	223912	0	0	28213	0	0.26912
13 - Non-franchised Bus >15t	0	13613	0	0	400580	0	0	50473	0	0.26972
14 - Franchised Bus (SD)	0	3340	0	0	77969	0	0	9824	0	0.33998
15 - Franchised Bus (DD)	0	59633	0	0	1234854	0	0	155592	0	0.38327
16 - Motorcycles (MC)	402498	0	0	1110553	0	0	139930	0	0	2.87643
17 - <Placeholder (P1)>	0	0	0	0	0	0	0	0	0	0.00000
18 - <Placeholder (P2)>	0	0	0	0	0	0	0	0	0	0.00000
19 - <Placeholder (P3)>	0	0	0	0	0	0	0	0	0	0.00000
20 - <Placeholder (P4)>	0	0	0	0	0	0	0	0	0	0.00000
21 - <Placeholder (P5)>	0	0	0	0	0	0	0	0	0	0.00000

Annex B

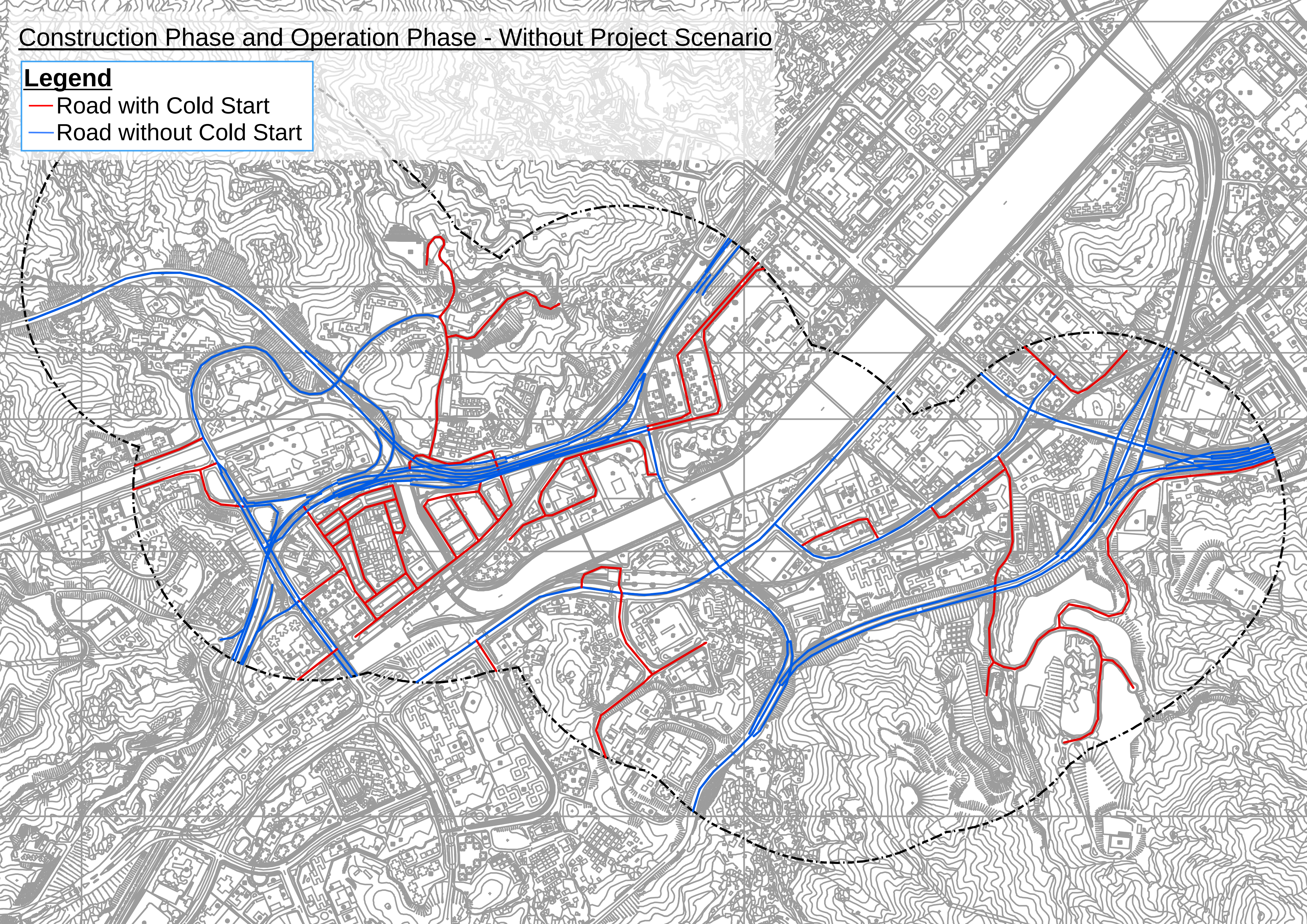
Year 2023

Vehicle Classes	No. of Trips within HK			VKT within HK			VKT for Local and Rural Roads within HK			Trips per VKT
	Petrol	Diesel	LPG	Petrol	Diesel	LPG	Petrol	Diesel	LPG	
01 - Private Cars (PC)	938268	10727	0	18116508	194069	0	2282680	24453	0	0.41133
02 - Taxi	49	0	73144	5303	0	7947121	668	0	1001337	0.07305
03 - Light Goods Vehicles<=2.5t	93	2185	0	1379	36855	0	174	4644	0	0.47290
04 - Lt Goods Vehicles 2.5-3.5t	6195	205529	0	101639	3647638	0	12806	459602	0	0.44818
05 - Light Goods Vehicles>3.5t	0	83480	0	0	1996252	0	0	251528	0	0.33189
06 - Medium & Heavy Goods Vehicl	0	48666	0	0	1040706	0	0	131129	0	0.37113
07 - Medium & Heavy Goods Vehicl	0	127727	0	0	2733762	0	0	344454	0	0.37081
08 - Public Light Buses	0	9366	8022	0	647012	554161	0	81523	69824	0.11489
09 - Private Light Bus <=3.5t	770	930	0	20629	31059	0	2599	3913	0	0.26105
10 - Private Light Bus >3.5t	14	7880	2389	282	225956	51895	36	28470	6539	0.29339
11 - Non-franchised Bus<=6.4t	0	10945	0	0	321008	0	0	40447	0	0.27060
12 - Non-franchised Bus 6.4-15t	0	7593	0	0	224069	0	0	28233	0	0.26894
13 - Non-franchised Bus >15t	0	13613	0	0	400136	0	0	50417	0	0.27001
14 - Franchised Bus (SD)	0	3340	0	0	77969	0	0	9824	0	0.33998
15 - Franchised Bus (DD)	0	59633	0	0	1264347	0	0	159308	0	0.37433
16 - Motorcycles (MC)	364555	0	0	998653	0	0	125830	0	0	2.89720
17 - <Placeholder (P1)>	0	0	0	0	0	0	0	0	0	0.00000
18 - <Placeholder (P2)>	0	0	0	0	0	0	0	0	0	0.00000
19 - <Placeholder (P3)>	0	0	0	0	0	0	0	0	0	0.00000
20 - <Placeholder (P4)>	0	0	0	0	0	0	0	0	0	0.00000
21 - <Placeholder (P5)>	0	0	0	0	0	0	0	0	0	0.00000

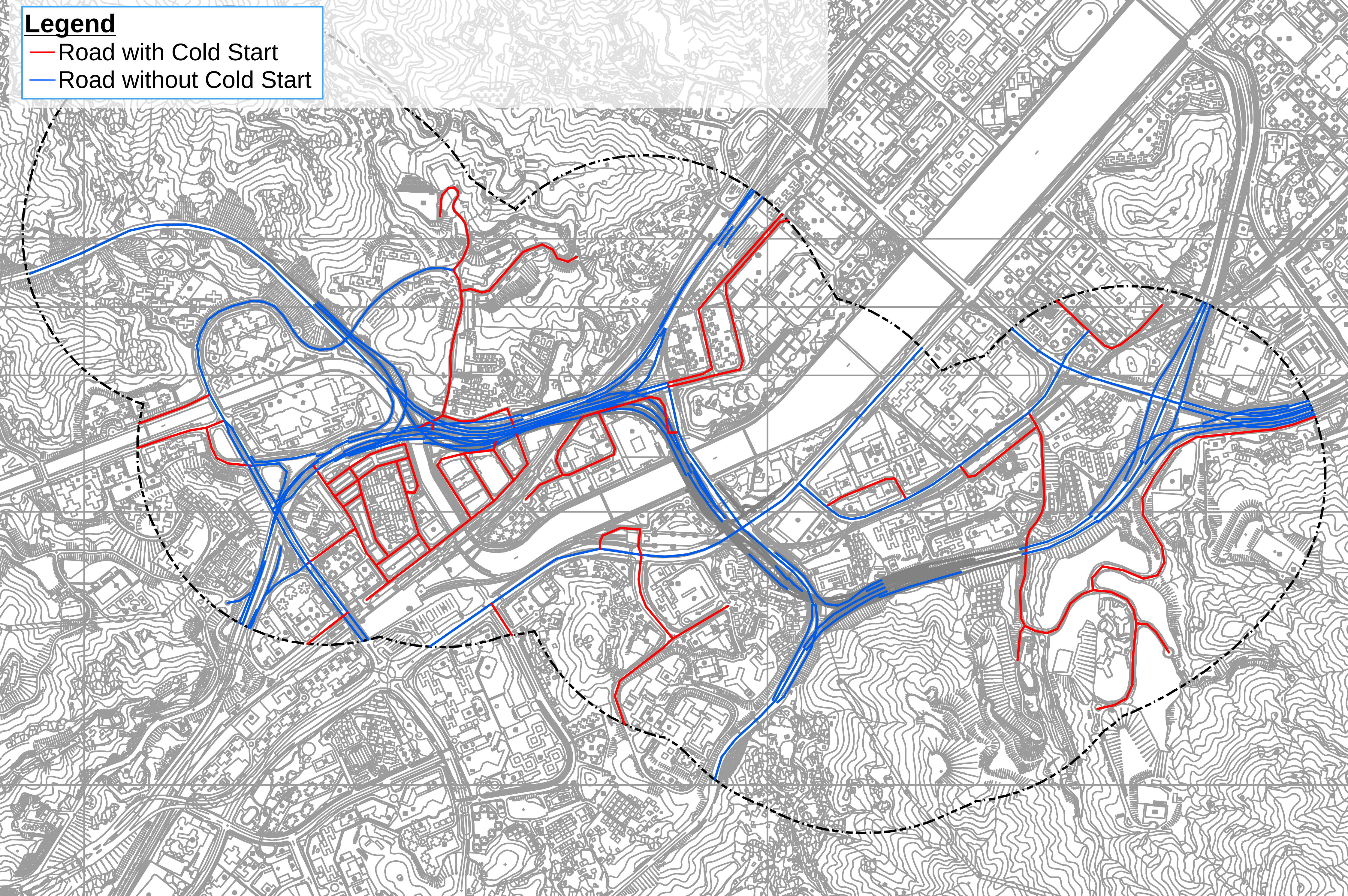
Annex C

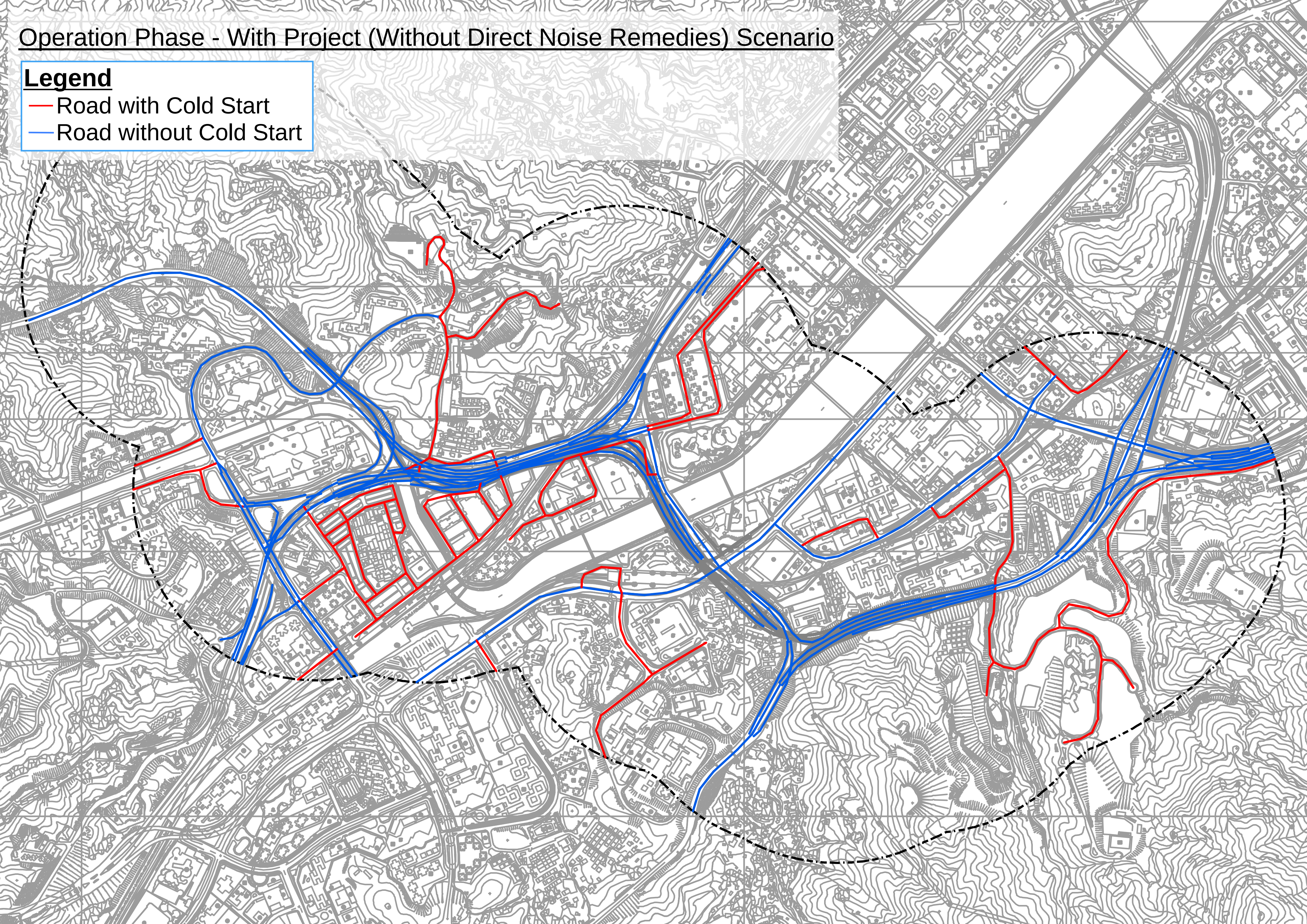
Temperatue and Relative Humidity Data Adopted for Estimation of Long-term Air Quality Impact of NO_2

	January		February		March		April		May		June		July		August		September		October		November		December	
Hours	Temp	RH	Temp	RH	Temp	RH	Temp	RH	Temp	RH	Temp	RH	Temp	RH	Temp	RH	Temp	RH	Temp	RH	Temp	RH	Temp	RH
0000-0100	16	80	19	88	20	88	23	87	25	86	28	86	29	83	28	84	27	79	25	80	21	75	17	72
0100-0200	16	81	19	88	20	87	23	88	25	87	28	87	28	84	28	84	27	81	24	81	21	74	17	73
0200-0300	16	81	19	88	20	88	23	88	24	88	28	87	28	85	28	85	26	82	24	81	20	75	17	73
0300-0400	16	82	18	88	19	88	23	88	24	88	27	88	28	85	28	85	26	82	24	80	20	74	17	73
0400-0500	16	81	18	88	19	88	23	88	24	88	27	88	28	84	28	85	26	83	24	81	20	75	17	73
0500-0600	15	81	18	89	19	87	23	89	24	88	27	88	28	86	28	86	26	84	24	81	20	76	16	75
0600-0700	15	81	18	88	19	87	23	88	24	87	28	86	28	85	28	84	26	83	24	80	20	76	16	74
0700-0800	16	80	18	88	20	85	24	84	25	84	29	82	29	81	29	81	28	74	26	74	21	71	17	72
0800-0900	17	75	19	86	20	82	25	81	25	82	30	77	30	78	30	77	29	69	27	68	22	64	18	65
0900-1000	18	71	20	81	21	79	25	78	26	80	30	74	30	77	30	74	30	66	27	65	23	59	19	61
1000-1100	19	68	21	78	21	77	26	76	26	78	31	72	31	75	31	73	30	63	28	61	24	56	20	57
1100-1200	19	66	21	77	22	76	26	75	26	77	31	72	31	74	31	71	31	60	29	59	25	54	21	56
1200-1300	20	64	21	75	22	75	26	75	26	77	31	73	31	72	31	72	31	60	29	58	25	52	21	56
1300-1400	20	63	22	74	22	75	26	75	26	77	31	72	31	73	31	71	32	59	29	59	26	50	22	55
1400-1500	20	64	22	75	22	76	26	76	27	77	31	74	31	74	31	71	32	59	29	61	26	51	22	56
1500-1600	20	64	22	75	22	77	26	75	26	78	30	77	31	73	31	72	31	62	28	61	26	53	21	56
1600-1700	20	67	21	77	22	79	26	77	26	79	30	78	30	74	30	74	30	65	28	64	24	59	21	58
1700-1800	19	70	21	81	21	81	25	80	26	81	30	79	30	77	30	77	29	68	27	69	23	64	19	63
1800-1900	18	74	20	83	21	82	25	83	25	84	29	82	29	80	29	78	29	72	26	73	22	68	19	68
1900-2000	18	75	20	84	21	83	24	84	25	84	28	83	29	82	29	80	28	74	26	75	22	71	18	70
2000-2100	17	77	20	85	21	84	24	85	25	84	28	84	29	81	29	81	28	75	25	76	21	72	18	71
2100-2200	17	79	20	86	20	85	24	85	25	84	28	84	29	82	29	80	28	77	25	77	21	73	18	71
2200-2300	17	79	19	86	20	86	24	86	25	85	28	85	29	82	29	81	27	78	25	78	21	72	18	71
2300-0000	17	80	19	87	20	86	24	87	25	86	28	85	29	83	29	82	27	79	25	79	21	74	17	72


Construction Phase and Operation Phase - Without Project Scenario
Legend
Road with Cold Start
Road without Cold Start

Operation Phase - With Project (With Direct Noise Remedies) Scenario




Operation Phase - With Project (Without Direct Noise Remedies) Scenario
Legend
Road with Cold Start
Road without Cold Start