Chapter 6 NOISE ASSESSMENT

6.1 Introduction

6.1.1 To recap the baseline year 1997 situations, it has been estimated that some 429,000 people living along selected roadway stations studied within the CTS-3 scope were affected by excessive road traffic noise. The development pressure exerted by a fast growing Hong Kong population is acute. The relevant noise situations will be evaluated with reference to the time horizons of years of 2001, 2006, 2011 and 2016 ultimately.

6.1.2 The ideal situation would be one whereby fewer people are exposed to excessive noise. It is also a situation whereby not just the baseline status quo noise level is being maintained but rather, the shortcomings and inadequacies of the current situation are progressively tackled and improved upon. This is a tremendous challenge to policy makers and environmental noise professionals.

6.2 Methodology

6.2.1 The same environmental performance indicators and evaluation methodology applicable to the baseline conditions are employed to assess the various future year scenarios. This is for the purpose of consistency and easy comparison.

6.2.2 Please refer to the "Evaluation Methodology" paragraphs under Section 3.2.5 for full description and details.

6.3 Results

6.3.1 Some 99 future years scenarios have been developed. These include:

Year 2001 - 6 scenarios
Year 2006 - 26 scenarios
Year 2011 - 30 scenarios
Year 2016 - 37 scenarios

6.3.2 These scenarios cover a series of possible types of future year traffic and related infrastructure situations and have all been evaluated on noise grounds. Their respective noise scores are presented in Table 6.3a.

6.4 Discussion

6.4.1 Because of the large number of future years scenarios that have been generated and evaluated, it would be helpful to discuss the respective situations according to their reference years.

6.4.2 To assist the readers in obtaining an overall view of the relevant situations, selected scenarios within particular reference years have been extracted and highlighted. Because of the many different future possibilities, the following descriptions are unavoidably simplified. The descriptions seek only to generally demarcate the very wide range of noise situations.

6.4.3 To further facilitate the readers in comprehending the respective noise situations of different reference years, two sets of scenarios (together with their noise scores) are presented for each reference year. The first set of scenarios covers sensitivity tests with regard to fleet size performed on the respective base cases. (Base case is one that all the other scenarios within that year would draw reference from.) The second set of scenarios reports on the "recommended transport strategies" situations. These "recommended transport strategies" are put forward on transport grounds.

6.4.4 In deriving the recommended transport strategies many tests were performed, and a large number of tests were evaluated for their noise performance. The transport tests were used to derive the final transport strategy, and the noise evaluation was part of that derivation. This chapter presents some of the scenarios that were evaluated in order to give the reader information regarding the range of noise scores that were encountered. The transport strategies run over all the milestone years, and contain different infrastructure, population and vehicle fleets for those years. The noise aspects have therefore been evaluated for all years.

6.4.5 For further elaborations and discussions on the different infrastructure, population and vehicle fleets for the milestone years, please refer to Chapter 4.

Year 2001

6.4.6 The reference year 2001 is so close to in the time horizon that only a few changes from the baseline conditions are anticipated. It is generally expected that the noise conditions will be marginally improved due to the coming into operation of some infrastructure projects which have been designed with the HKPSG criteria in mind and would share some of the traffic. It should be noted, however, that the anticipated improvements are so small that it is statistically inconclusive that the year 2001 situation would see substantial improvement over the baseline year.

Sensitivity scenarios:

Year	Run No.	Description	Noise Score
2001	39	LOW/Toll Scheme A	0.96
2001	40	LOW/Toll Scheme B	0.94
2001	41	LOW/Toll Scheme C	0.95
2001	43	LOW/Toll Scheme D1	0.95

Table 6.3a Noise Scores Summary of Main Model Runs

Year	Run No.	Description	Population Scenario	Noise Score
2001	39	LOW / Toll Scheme A	1	0.96
2001	40	LOW / Toll Scheme B	1	0.94
2001	41	LOW / Toll Scheme C	1	0.95
2001	43	LOW / Toll Scheme D1	1	0.95
2001	47	LOW / Toll Scheme D	1	0.97
2001	**48**	**LOW / Budget Toll**	**1**	**0.97**
2006	49	High Car High Goods	2	1.10
2006	50	Medium Car High Goods	2	1.10
2006	52	High Car Medium Goods	2	1.04
2006	54	Medium Car Medium Goods	2	1.04
2006	58	Scenario 2, Toll D, HVF, System Test 1	2	1.06
2006	75	Scenario 2, Toll D, HVF, System 2 w/o Route 7	2	1.08
2006	76	Scenario 2, Toll D, HVF, System Test 2	2	1.05
2006	77	Scenario 2, Toll D, HVF, System Test 2, w/o CKR	2	1.10
2006	78	Scenario 2, Toll D, HVF, System Test 2, w/o Route 9	2	1.09
2006	80	Scenario 2, Toll D, HVF, System Test 2, w/o IEC	2	1.07
2006	81	Scenario 2, Toll D, HVF, System Test 2, w/o T2	2	1.11
2006	82	Scenario 2, Toll D, HVF, System Test 2, w/o Route 5	2	1.08
2006	83	Scenario 2, Toll D, HVF, System Test 2, w/o Route 10	2	1.08
2006	84	Scenario 2, Toll D, HVF, System Test 2, w/o Route 16	2	1.10
2006	85	Scenario 2, Toll D, HVF, System Test 2, w/o WCR & Cross BayBridge	2	1.08
2006	86	Scenario 2, Toll D, HVF, System Test 2, w/o all	2	1.15
2006	89	Scenario 2, Toll D, HVF, System Test 2, w/o TM Southern Bypass & Port Expressway	2	1.07
2006	91	Rail Priority Base Case	2	1.11
2006	92	Low Car, Toll B	2	1.10
2006	94	Rail Priority	2	1.11
2006	95	Base Case	2	1.11
2006	97	(Sc I, Lo, Toll D) Least Demand	1	0.99
2006	98	System Test 2 without TKO Rail Phase II	2	1.08
2006	102	Existing Plus Commited Infra	2	1.15
2006	**106**	**Scenario II Full High Budget Toll with New Bus**	**2**	**1.07**
2006	**107**	**Scenario II Practical Medium Budget Toll with New Bus**	**2**	**1.03**

Table 6.3a Noise Scores Summary of Main Model Runs

Year	Run No.	Description	Population Scenario	Noise Score
2011	41	High Car High Goods	2	1.21
2011	42	Medium Car High Goods	2	1.19
2011	43	Medium Car Medium Goods	2	1.08
2011	44	High Car Medium Goods	2	1.10
2011	55	PT Fare Policy	2	1.21
2011	69	ScII, Toll D, Hi, Base	2	1.21
2011	69p	Park and Ride	2	1.21
2011	71	(ScI, TollD, Lo) Least Demand	1	1.03
2011	74	(ScII, TollD, Hi) System Test 4	2	1.20
2011	75	(ScII, TollB, Hi) System Test 4	2	1.20
2011	76	System Test 4 without IWC	2	1.21
2011	77	System Test 4 without Central Wanchai Bypass	2	1.22
2011	78	System Test 4 without Lantau P1 Road	2	1.20
2011	79	System Test 4 without IEC	2	1.20
2011	80	System Test 4 without East-West Link	2	1.21
2011	81	System Test 4 without Lantau Road Link	2	1.21
2011	82	System Test 4 without Eastern Highway	2	1.23
2011	83	(ScII, TollD,Hi) System Test 4 without HK - Lantau Link	2	1.23
2011	84	(ScII, TollB, Hi) System Test 4 (EHX - Toll D)	2	1.19
2011	87	System Test 4 without North Hong Kong Line (Central to North Point)	2	1.20
2011	88	System Test 4 without West Hong Kong Line (Sheung Wan to Green Island)	2	1.21
2011	89	System Test 4 without Hung Hom to Wan Chai (KCRC)	2	1.20
2011	90	System Test 4 without East Kowloon Line (Tai Wai to Hung Hom)	2	1.20
2011	93	P T Fare Integration	2	1.21
2011	97	Existing Plus Commited Infra	2	1.43
2011	103	High Xborder Case	2	1.24
2011	**104**	**Scenario II Full High Budget Toll with New Bus**	**2**	**1.19**
2011	**105**	**Scenario II Practical Medium Budget Toll with New Bus**	**2**	**1.11**
2011	106	Port Rail	2	1.17
2011	107	Without Rail Between Tai Wai & Diamond Hill	2	1.21
2016	7	High Car High Goods	2	1.50
2016	8	Medium Car High Goods	2	1.45

Table 6.3a Noise Scores Summary of Main Model Runs

Year	Run No.	Description	Population Scenario	Noise Score
2016	10	Medium Car Medium Goods	2	1.25
2016	12	High Car Medium Goods	2	1.27
2016	18	(ScII, TollD,Hi, Base)	2	1.49
2016	19	(ScI, TollD, Low) Least Demand	1	1.18
2016	21	(ScII, TollB,Base, Low Car, Hi GV)	2	1.48
2016	23	(ScIII, TollD, Hi) Most Demand	3	1.59
2016	35	System Test 2A - M4 Northern Bias	2	1.38
2016	36	System Test 2A - M3 Lantau Bias	2	1.33
2016	37	System Test 2A without IWC	2	1.38
2016	38	System Test 2A without Route 81	2	1.39
2016	39	System Test 2A without TST P1 Road	2	1.39
2016	40	System Test 2A without TMS Link	2	1.40
2016	41	System Test 2A without TM Western Bypass	2	1.39
2016	42	System Test 2A without HK - Lantau Link	2	1.43
2016	43	System Test 2A without HK North Bypass	2	1.40
2016	44	System Test 2A without Kln Northern Bypass So Kwun Wat to Tai Mo Shan Link	2	1.44
2016	45	System Test 2A without TM-CLK Link	2	1.38
2016	46	System Test 2A without Further Widening YL HW	2	1.40
2016	47	System Test 2A without IEC Imp	2	1.38
2016	48	System Test 2A without Hong Kong Rail	2	1.40
2016	49	System Test 2A without Siu Sai Wan Station	2	1.38
2016	50	System Test 2A without WR Yen Chow Street to TST	2	1.40
2016	51	System Test 2A without SE KL West-East Rail	2	1.40
2016	52	System Test 2A without Outer Western Corridor	2	1.39
2016	53	System Test 2A without MOSR Ext	2	1.38
2016	54	System Test 2A without XB Western Corridor	2	1.37
2016	55	Recommended Infrastructure with New Kowloon Northern Bypass & So Kwun Wat to Tai Mo Shan Link	2	1.38
2016	64	Existing Plus Commited Infra	2	1.84
2016	75	High Xborder Case	2	1.52
2016	**82**	**High Growth (Low End)**	**2**	**1.39**
2016	**83**	**High Growth (High End)**	**3**	**1.50**

Table 6.3a Noise Scores Summary of Main Model Runs

Year	Run No.	Description	Population Scenario	Noise Score
2016	**84**	**Medium Growth**	**2**	**1.27**
2016	**86**	**Low Growth**	**1**	**1.06**
2016	87	High Growth Networks	3	1.49
2016	88	Practical Networks	2	1.25
2016	89	Without 4th Harbour Crossing	2	1.39
2016	90	Without T1	2	1.39

Recommended transport strategy:

Year	Run No.	Description	Noise Score
2001	48	Low/Budget Toll	0.97

Year 2006

6.4.7 The reference year 2006 could see a very large deviation in possible noise situation outcomes. Depending on the fleet size and potential mix proportions, the overall noise scores have the possibility of representing a mild deterioration (4% worse) over year 1997 situations on the one hand to a more noticeable worsening (10% worse) on the other side of the spectrum.

Sensitivity scenarios:

Year	Run No.	Description	Noise Score
2006	49	High Car High Goods	1.10
2006	50	Medium Car High Goods	1.10
2006	52	High Car Medium Goods	1.04
2006	54	Medium Car Medium Goods	1.04

Recommended transport strategies:

Year	Run No.	Description	Noise Score
2006	106	High Growth	1.07
2006	107	Medium Growth	1.03

Year 2011

6.4.8 The reference year 2011 would see a general trend which is quite similar to the year 2006 possibilities. Again depending on the likely fleet size and composition, a relatively small deterioration of 8% over year 1997 situations would be possible as well as a 21% worsening of the situation.

Sensitivity scenarios:

Year	Run No.	Description	Noise Score
2011	41	High Car High Goods	1.21
2011	42	Medium Car High Goods	1.19
2011	44	High Car Medium Goods	1.10
2011	43	Medium Car Medium Goods	1.08

Recommended transport strategies:

Year	Run No.	Description	Noise Score
2011	104	High Growth	1.19
2011	105	Medium Growth	1.11

Year 2016

6.4.9 The reference year 2016 is the ultimate timeframe limit within the CTS-3 context and would certainly warrant more attention. More than 30 different scenarios have been developed to cover the possible happenings in year 2016. The general trend reported for earlier reference years again is showing up here. This is represented by a potential major deterioration of 50% over year 1997 situations as well as limiting the worsening to 25% as compared to baseline conditions.

Sensitivity scenarios:

Year	Run No.	Description	Noise Score
2016	7	High Car High Goods	1.50
2016	8	Medium Car High Goods	1.45
2016	12	High Car Medium Goods	1.27
2016	10	Medium Car Medium Goods	1.25

Recommended transport strategies:

Year	Run No.	Description	Noise Score
2016	82	High Growth (Low End)	1.39
2016	83	High Growth (High End)	1.50
2016	84	Medium Growth	1.27
2016	86	Low Growth	1.06

6.4.10 The data computation files related to all the "recommended transport strategies" could be found in Appendix B.

6.5 Related Observations

6.5.1 Figure 6.5a is the likely trend showing the number of people affected by excessive traffic noise in the different reference years under base case situations.

6.5.2 It could be seen that there is a general rising trend (note the deteriorating noise scores on successive reference years) towards the ultimate reference year of 2016. While the number of people affected in Kowloon and Hong Kong Island are more or less being kept constant, the affected New Territories population is on the rise. By year 2016, it is possible that 50% more people in the New Territories would be exposed to excessive traffic noise as compared to year 1997. This is perhaps easy enough to

explain as the New Territories is being more intensively developed to accommodate the growing population. The worrying element, however, is that even people who resides in new developed areas could not be guaranteed a noise disturbance free ambient.

6.5.3 The exposure pattern of New Territories areas is also worrying. To illustrate a typical situation that could be observed in other parts of the territory, Figure 6.5b shows the respective hourly exposure situation of different reference years for a study station in Tseung Kwan O, which is a new development area. By focusing on the baseline year of 1997 and the ultimate reference year of 2016, one could find substantial deterioration represented on two fronts.

6.5.4 Firstly, there is the worsening of the excessive noise levels. The maximum noise level for the baseline year was 75 dB(A) while it would be 79 dB(A) in year 2016. Secondly, there is the worsening of the exposure duration. In year 1997, while the hourly levels could not comply with the relevant criterion, it was only marginally exceeded during evening hours. But by year 2016, all the 16 studied hours would show substantial criterion exceedance.

6.5.5 The very unfavorable exposure duration situation for this station in Tseung Kwan O actually is the norm for most, if not all, of the roadways. Residents are basically being bombarded by excessive traffic noise from early in the morning to deep into the nighttime hours. While the criterion calls for the evaluation of only the peak hour situation, it is noted that criterion exceedance for most residents does not mean that noise levels are high on just one or two hours. It is a no-escape every hour situation. The peak hour criterion exceedance is not telling their entire story.

6.5.6 Another observation would be the by and large keeping of status quo situation for the more developed areas of Kowloon and Hong Kong Island. Without drastic measures, there would be virtually no improvements to the current situations. One may point out that this is the reality of living within the major built up areas. But it also implies that the shortcomings arising from past oversights are left unattended.

6.5.7 Figure 6.5c is a summary of anticipated fleet sizes, compositions and their relevant contributions to the noise climate for different reference years. It could be noted that while the total numbers of heavy vehicles are always substantially fewer than those of light vehicles in Hong Kong, their respective noise contributions are way out of proportion to their numbers. Heavy vehicles, for all base cases of the reference years, are really the key players. Apart from the fact that their relative proportions out of the total vehicle flows on certain trunk routes are high (some in excess of 70% of total flows), they have much higher noise emission values on an individual vehicle basis when compared to light vehicles.

6.5.8 It is obvious that if one is not to tackle the heavy vehicles situations, the road traffic noise problem would unlikely see any real progress.

6.6 Noise Preferred Options

6.6.1 With regard to noise impact, the predicted noise exposure is measured as a combination of the number of people affected by excessive noise and the degree to which they are affected. From the noise management perspective, the noise performance under the Recommended Transport Strategies would not be acceptable because of general deterioration (noise scores greater than 1.0, that is worse than baseline year 1997 levels) in the relevant noise climate associated with the strategies. However, the more preferred options (those less damaging) for all reference years would be those scenarios within the context of low heavy vehicle traffic.

6.6.2 Low heavy vehicle traffic could be actualized on two fronts apparently. Either the heavy vehicle fleet size should be restrained or their use managed (or a combination of these). Such management approaches, while producing desirable noise outcome, may have implications on the transport and economic aspects such as mobility of goods and people. These issues are however outside the scope of this noise assessment chapter and should be deliberated and addressed in the wider context of injecting environmental considerations into policy and decision making.

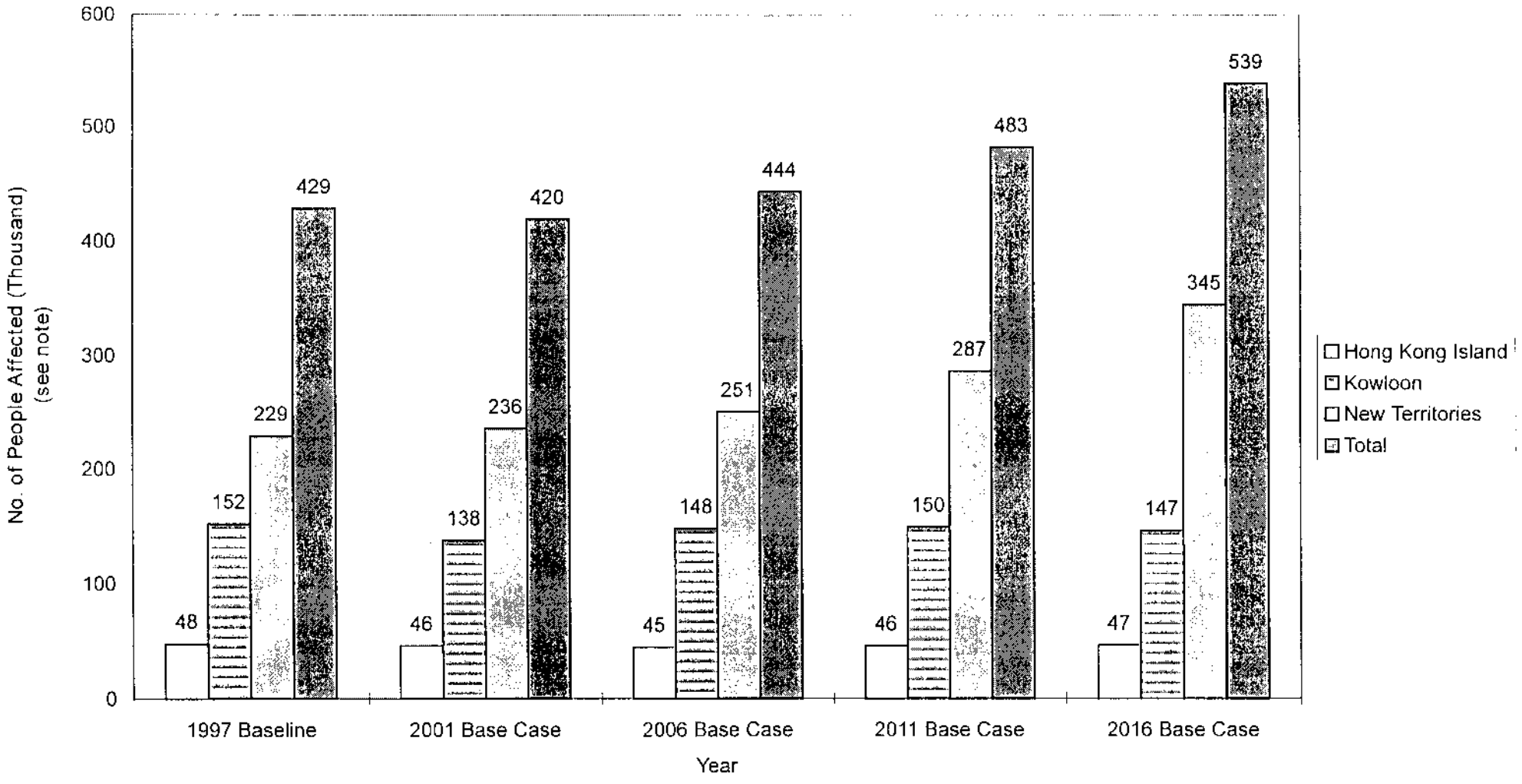
6.6.3 On the issue of controlling or containing the growth of heavy vehicles, it should be noted that a range of values have been considered for the heavy commercial vehicle fleet in CTS-3, but they simply represent a range of potential future scenarios. The required size of the vehicle fleet depends upon the type of future economy that Hong Kong will experience. As service industries increase in proportion to manufacturing and other types, then the proportion of heavy vehicles will decrease. However, it is not possible at this time to forecast how the economy of Hong Kong will change in the future, and so the range of assumptions is simply that and no more. Changing this aspect of the inputs is beyond the scope of CTS-3.

6.7 Methodology Considerations

6.7.1 While the noise indicator is useful, it could not be regarded as an all-purpose all-accurate way to reflect every aspect of the noise situation. Similar limitations exist with regard to the indicator processing methodology. (Please also see the discussions on the constraints on indicators and methodology under Section 3.2.5)

6.7.2 Because of the multiple screenings adopted, factors like urban renewals that may affect population sizes, spreading of traffic due to possible parallel routes, etc. may not be fully reflected in the score generating exercise.

6.7.3 The methodology and indicators are chosen as they represent the relevant current developments and are most appropriate for CTS-3. The readers are reminded not to view the chosen methodology and indicators as absolute. But rather, they are employed to provide a general appreciation of the overall situations.



NOTE: COVERS ONLY THOSE SELECTED ROAD STATIONS SCOPED UNDER THE STUDY

Third Comprehensive Transport Study (CE 84/96)

AFFECTED POPULATIONS - WHOLE TERRITORY

Figure 6.5a

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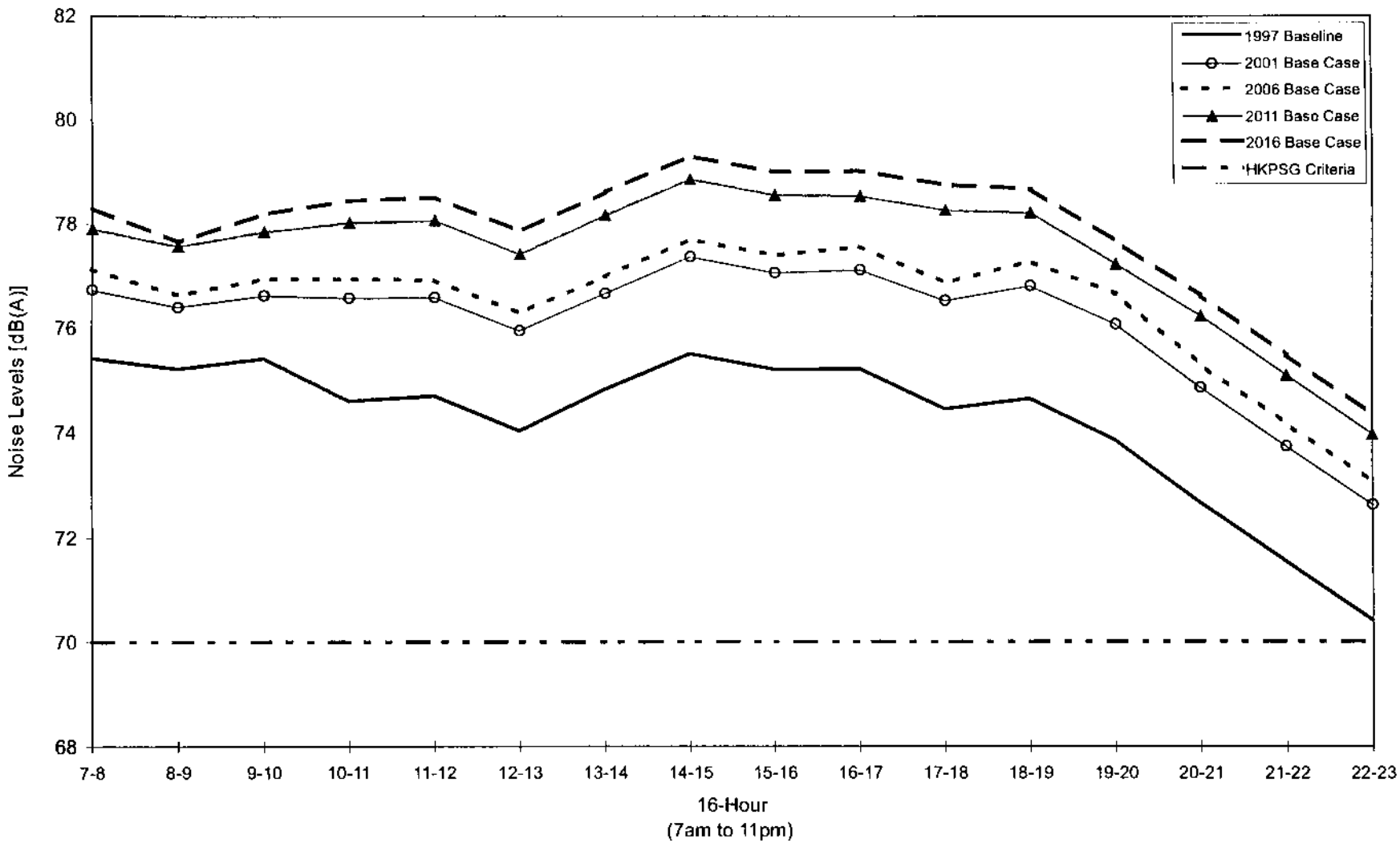

Third Comprehensive Transport Study (CE 84/96)

A PLOT OF 16-HOUR NOISE SITUATION
LOCATION: PO SHUN ROAD, TSEUNG KWAN O (STATION 5691)

Figure 6.5b

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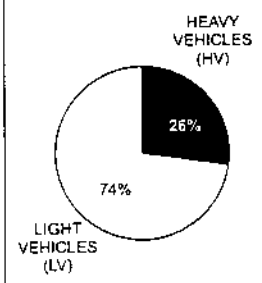
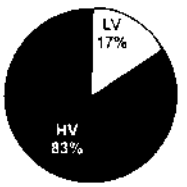
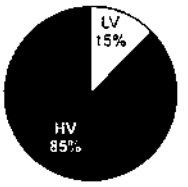
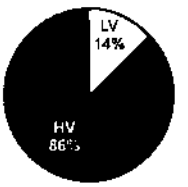
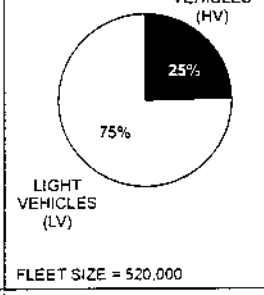
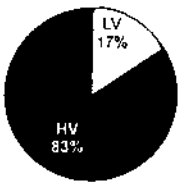
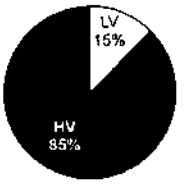
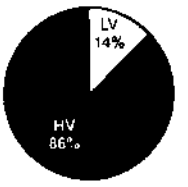
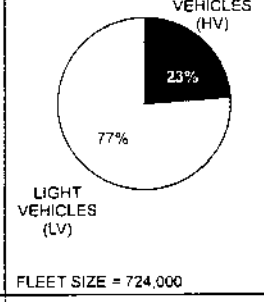
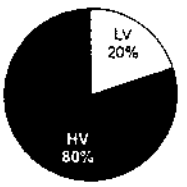
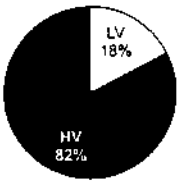
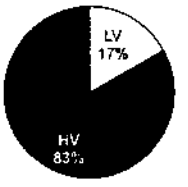
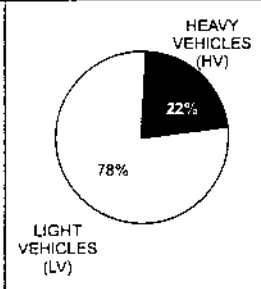
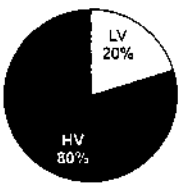
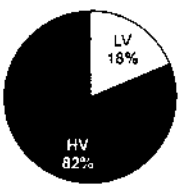
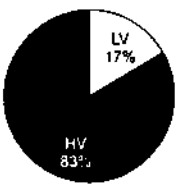
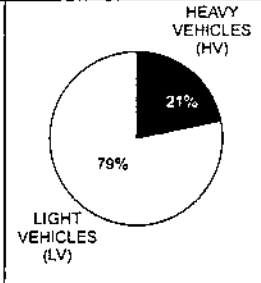
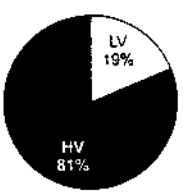
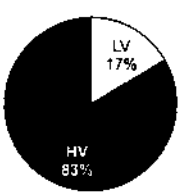
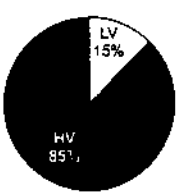
YEAR	FLEET COMPOSITION*	NOISE CONTRIBUTION		
		AM PEAK	PM PEAK	OFF PEAK
1997	 FLEET SIZE = 444,000			
2001	 FLEET SIZE = 520,000			
2006	 FLEET SIZE = 724,000			
2011	 FLEET SIZE = 958,000			
2016	 FLEET SIZE = 1,222,000			

* NOTE: HEAVY VEHICLES FOR NOISE ASSESSMENT PURPOSES ARE THOSE WITH AN UNLADEN WEIGHT EXCEEDING 1525kg

Third Comprehensive Transport Study (CE 84/96)

SUMMARY OF FLEET SIZES, COMPOSITIONS AND NOISE CONTRIBUTION FOR BASE CASES OF DIFFERENT REFERENCE YEARS

FIGURE 6.5c

FILE: C1699/14