

Chapter 10 CONCLUSION AND RECOMMENDATIONS

10.1 Air Quality

Introduction

- 10.1.1 As detailed in Chapter 5, a comprehensive air quality assessment has been undertaken as part of the Strategic Environmental Assessment. The assessment was divided into two stages, each of which utilised an independent methodology to assess the impacts of various transport strategies. The first stage of the assessment was based upon the formulation and use of emissions inventories for oxides of nitrogen (NO_x), volatile organic compounds (VOC) and respirable suspended particulates (RSP) for both engine emissions (tailpipe) and paved road dust (prd). This methodology was used to assess emissions from a wide range of transport scenarios, each of which was assigned a Composite Air Score on the basis of its emissions relative to the baseline year (1997). The three pollutants were identified as being those of most concern in terms of the current levels of compliance with the AQOs, the trends in reported concentrations over the last five to ten years, and the relative importance of transport-related emissions.
- 10.1.2 The second stage of the assessment was undertaken using a sophisticated mesoscale air quality modelling system. This technique was used to appraise the air quality impacts on a territory-wide scale. The analysis was undertaken in two steps, the first addressing air quality with proposed emissions reductions in place and the second addressing a hypothetical set of additional measures. The air quality modelling system was used to assess the impacts of the four Recommended Transport Strategies in the year 2016.
- 10.1.3 It should be noted that assessment conducted for this study is on a strategic level and hence all major transport infrastructure projects should be assessed in detail during the EIA stage in accordance with the *Environmental Impact Assessment Ordinance* to ensure that potential air quality impacts are properly addressed at project level.

Emissions Inventories

- 10.1.4 The following summarises the findings of the analyses undertaken using the emissions inventories.
- The emissions inventories show that Heavy Goods Vehicles and Private Cars are significant contributors to each of the three groups of pollutants.
 - The proposed control measures will generally reduce vehicle emissions in the short to medium term. However, in the longer term and depending on the

growth scenario, such reduction may be offset by the increase in traffic. As demonstrated by Figure 5.2p, air quality management strategies that focus on the control of emissions from vehicles become less effective as time passes and the quantity of vehicle kilometres travelled increases. The best examples of this are for emissions of NO_x and VOC which in 2006 and 2011 are less than the quantities emitted in 1997 but by 2016 (High Growth scenario) have grown back up to or beyond the levels in 1997. This finding indicates that whilst a valuable air quality management mechanism, vehicle emission standards either need to be continuously tightened or supplemented with measures to control the level of vehicle activity if they are to be effective on a territory-wide basis. Nevertheless, such measures would be of greater benefit in terms of reducing pollutant levels at roadside locations.

- Strategies that favour the use of rail for the movement of people and goods tend to have emissions benefits at the local or district level. On a territory-wide basis, the change in overall emissions is considered quite minor based on the assessment for a single port rail.
- Strategies that favour or encourage the use of road vehicles for the movement of goods into and out of the SAR, result in quite significant increases in emissions in some districts, e.g. Yuen Long and North New Territories. Cross boundary traffic is demonstrated to make a significant contribution to emissions in these districts and is projected to grow considerably.
- The introduction of park and ride schemes would not have a significant impact on emissions if implemented in isolation and on the small scale assumed in this study.
- Under the Low, Medium and High Growth scenarios of the Recommended Transport Strategy, the Composite Air Scores are 0.83, 1.01 and 1.17-1.25, respectively. Under the upper bound estimate for vehicle and population growth (High Growth - High End scenario), emissions of NO_x , VOC, RSP (tailpipe) and RSP (paved road dust) were predicted to be 114%, 134%, 59% and 219% of the levels in 1997, respectively. For the lower bound estimate (Low Growth scenario), emissions were estimated to have changed to 76% (NO_x), 80% (VOC), 41% (RSP-tailpipe) and 159% (RSP-prd) of 1997 levels.
- The most significant growth (>200%) in emissions of all pollutants, is predicted in the Yuen Long, Sai Kung and Island Districts for the recommended strategies in 2016. The latter two districts are included as the level of traffic is predicted to grow significantly from a low baseline in 1997. The growth of emissions in Yuen Long is a cause of concern, as this is already an area in which there are non-compliances with the AQOs.

10.1.5 The emissions inventory analyses have demonstrated that for the High Growth scenarios, emissions of each of the key pollutants are set to increase relative to levels in 1997.

Mesoscale Model Runs

10.1.6 A series of model runs was undertaken for each of the recommended strategies to determine ambient levels of nitrogen dioxide (NO₂), RSP and ozone (O₃). A review of monitoring data from the Environmental Protection Department's network of Air Quality Monitoring Stations (AQMS) has indicated non-compliances with the standards for NO₂ and RSP, at a range of locations in the SAR. A total of 10 non-compliances were reported in 1997. The most pressing concerns are the annual average levels of RSP and short-term concentrations of nitrogen dioxide. In the longer term, ozone levels may emerge as an issue of concern.

10.1.7 For all scenarios, including the Low Growth scenario, non-compliances are predicted to persist. Under the upper and lower bound estimates of vehicle and population growth, the number of predicted non-compliances in 2016 was 14 and 10, respectively.

10.1.8 A set of contour plots showing air quality across the SAR was presented in Chapter 5 for each of the four recommended scenarios in 2016. The following general conclusions were drawn.

- Air quality in the North West New Territories is predicted to undergo significant deterioration. Continued non-compliance with the annual average AQO for RSP is predicted at the Yuen Long AQMS under all scenarios. The deterioration in air quality in this area is considered to be attributable to the growth in cross boundary and local traffic and the associated provision of new highway infrastructure.
- In the urban areas of Tai Po, Sham Shui Po, Tsuen Wan, Sha Tin and Kwun Tong, air quality is also predicted to deteriorate under most scenarios due to the anticipated growth in vehicle numbers, which off-sets the benefits from improved emission control technologies and tighter emission standards.
- Anticipated increases in RSP concentrations remain a major concern in Mong Kok, Sham Shui Po, Kwun Tong, Tai Po, Tsuen Wan and Yuen Long.

10.1.9 Analyses were undertaken to determine which areas of the SAR are most heavily impacted by vehicle emissions. The assessment demonstrated that the importance of vehicle emissions varies significantly across the SAR. Areas such as eastern side of the SAR are predicted to be far less heavily impacted by vehicle emissions than areas such as Tsuen Wan and Yuen Long. These findings could be used as the basis for focusing local air quality management strategies. It should also be noted that cross

boundary fluxes of pollutants have a marked impact on air quality in the SAR.

- 10.1.10 In Chapter 8 of the report, we have examined the effectiveness of introducing further measures to reduce air quality impacts from road traffic. It was concluded that even with the application of such hypothetical measures, in addition to the proposed measures, exceedances of the AQOs are predicted to persist. RSP will continue to be of concern and bringing down the predicted concentrations will require further mitigation measures such as traffic management, more frequent street washing or additional vehicle restraint measures.
- 10.1.11 Whilst the conclusions given above are related to ambient air quality on a territory-wide scale, it is acknowledged that measures to reduce engine emissions would yield significant benefits at the roadside, and such measures should be implemented.

10.2 Noise

- 10.2.1 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.
- 10.2.2 It is recommended that a series of mitigation measures be considered for full scale implementation. These include policy initiatives (such as expanding the rail network, putting roads underground and pedestrianisation), engineering measures (such as tightening vehicle noise standards, engine encapsulation and introducing trolley buses), near or at source measures (like extensive use of low noise surfaces and retrofitting existing roads), and management possibilities (such as traffic management and speed regulation). Although such measures would not cure all of the future problems and correct past shortcomings, they would provide Hong Kong with a firm and confident footing to tackle the very challenging road traffic noise situation. All major transport infrastructure projects should be assessed in detail during the EIA stage in accordance with the *Environmental Impact Assessment Ordinance* to ensure that potential noise impacts are properly addressed and mitigated.

10.3 Ecology

- 10.3.1 The CTS-recommended strategic highway alignments have avoided ecological constraints including the recognised conservation areas as well as areas of ecological interest, either through careful routing or the use of tunnels.
- 10.3.2 Overall most of the strategic highways will have direct impact mainly on secondary habitat types (e.g. grassland, shrubland) and therefore the ecological impact is expected to be low. A few alignments would encroach into more important habitats such as natural woodland. Refinement of the alignments should be considered to

avoid or minimise the potential impacts. All of these strategic highway schemes should be assessed in detail in the EIA stage, in accordance with the EIA Ordinance requirements, to investigate the ecological conditions of the affected areas, avoid ecological important habitats or species, and ensure that there are no unacceptable ecological impacts arising from the implementation of the schemes.

10.4 *Monitoring and Feedback*

- 10.4.1 As presented in Chapter 9, monitoring the recommended transport strategy is a very important task to guard against any unexpected deterioration in environmental quality. Through monitoring and review, the environmental changes as well as the implementation of the proposed mitigation measures would be checked and more mitigation measures or vehicle restraint could be recommended if required. Facilitating agents should be identified to oversee the implementation of the mitigation measures. The facilitating agents could initiate feasibility studies to identify resources implications and the practicality of proposed mitigation measures in Hong Kong. The facilitating agents should develop an implementation schedule and report the progress of implementation through regular reporting.
- 10.4.2 Alternative options and alignments would be studied and optimised to avoid and minimise environmental impacts before and during the formal EIA process under the EIAO, during the feasibility study of any specific transport infrastructure project. This will address project specific issues such as the ecological resource, direct and indirect air and noise mitigation measures required, visual and landscape impacts and impact on sites of cultural heritage and other impacts arising from the proposed project through the EIA study. The environmental acceptability of the project should also be confirmed in the EIA. It should also be noted that preliminary environmental review (PER) during preliminary project feasibility study (PPFS) would also provide useful information to identify the best alignment before the commissioning of the EIA study.
- 10.4.3 Facilitating agents within the Government should be identified to undertake the various strategic environmental monitoring and auditing works. An overall auditing and review mechanism is recommended to ensure that the follow up work is properly conducted. This mechanism could also trigger further investigations, or initiate review of the strategy or its individual elements in response to any changes in circumstances detected or new information collected in the strategic monitoring and auditing exercise. The progress and findings of the strategic environmental monitoring and auditing work could be recorded in an auditing and review report to be produced by the Government.