



## **Estimation of the effectiveness of tunnel air pollution control measure: A case study in Hong Kong**

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Traffic congestion has a strong association with the air pollution problem due to highly dense vehicular emissions. In Hong Kong, the government has been constructing an underground tunnel, the Central- Wan Chai Bypass and Island Eastern Corridor Link (CWB), to alleviate the serious traffic congestion of Central Business District of Hong Kong Island. The CWB is a 4.5 km long dual 3-lane trunk road with a 3.7 km long tunnel part in Hong Kong Island. This study aims to evaluate the environmental impact of the CWB from the air quality improvement perspective by comparing the air pollution concentration level of Hong Kong before and after the operation of CWB by means of spatial-temporal analysis via multi-layered model incorporating Multi-agent Transport Simulation (MATSim), Emission FACTors (EMFAC) model version 3.4 (HKEPD, 2018) and Atmospheric Dispersion Modelling System (ADMS-Urban). MATSim, large-scale activity-based microscopic traffic model, has been used to simulate the influences of CWB on traffic alleviation. An emission modelling framework has been developed based on the MATSim's modelling results (Lee, 2017) and emission factors have been compiled by EMFAC version 3.4 (HKEPD, 2018). MATSim has been integrated with EMFAC to generate an estimation of the vehicular emissions with high spatial and temporal resolutions. The estimation can then be modelled for before-and-after comparisons on traffic-related air pollution concentration assesment by ADMS-Urban (CERC, 1999). 16 air quality monitoring stations, consist of 3 roadside stations and 13 ambient stations, have been used for model validation in which the correlation coefficient of the observations and finds that the model is higher than 0.6. This study demonstrated that the hourly  $\text{NO}_2$  and  $\text{PM}_{2.5}$  concentration levels in Hong Kong as a whole, particularly in Hong Kong Island, were decreased after the commission of CWB, indicating a significant reduction effect through the implementation of vehicular emission control infrastructure in tackling local air pollution problem.

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