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論文題目	Model Simulation and Health Risk Assessment on Traffic Induced Air Pollution in Urban Environment: A Case Study of Kyoto City, Japan (都市環境における交通起源大気汚染のモデルシミュレーションと健康リスク評価：京都市でのケーススタディ)		
<p>(論文内容の要旨)</p> <p>This research discusses the traffic induced air pollution in Kyoto City, Japan in terms of emission, dispersion, risk-based assessment and management. This research was completed in seven chapters as follows:</p> <p><b>Chapter 1 Introduction</b></p> <p>Chapter 1 presents the overview of background, problem statements, research objectives and scopes, and outline of the dissertation.</p> <p><b>Chapter 2 Literature review</b></p> <p>Chapter 2 reviews the previous studies on traffic characteristics, vehicle emission model (Computer Program to Calculate Emissions from Road Transport; COPERT model), air dispersion model (Operational Street Pollution Model; OSPM model), health risk assessment and framework of risk assessment and management.</p> <p><b>Chapter 3 Traffic characteristics and pollutant emission from urban road transport</b></p> <p>Chapter 3 presents the prediction of traffic characteristics and emissions of air pollutants for two vehicle classifications (passenger cars and trucks) at the roadways in Kyoto City, Japan. The roadways are categorised into five functional classes such as highway under jurisdiction of Ministry of Land, Infrastructure, Transport and Tourism (H-MLIT), highway administered by prefectural authority (H-P), main municipal road (MM), prefectural road (P) and general municipal road (GM). A vehicle emission model, known as the Computer Program to Calculate Emissions from Road Transport (COPERT), was utilised to compute the emission factors (EFs) and total emissions of air pollutants (exhaust particulate matter (<math>PM_{Exh}</math>), benzene, carbon monoxide (CO) and nitrogen oxide (<math>NO_x</math>)) and fuel consumption. H-MLIT with the most congested road segment (degree of congestion; min: 0.28, max: 2.52, mean: 1.38) has intensified vehicle numbers (min: 6,415 units/day, max: 58,810 units/day and mean: 38,651 units/day) and the slower traffic flow movement (min: 7.2kmph, max: 55.0kmph and mean: 22.0kmph). Benzene (passenger cars: 0.007g/km, trucks: 0.007g/km) and CO (passenger cars: 1.079g/km, trucks: 0.671g/km) emissions are obviously more emitted from the passenger cars whereas the trucks are responsible for the greater emission of <math>NO_x</math> (passenger cars: 68.882g/km, trucks: 310.048g/km), <math>PM_{Exh}</math> (passenger cars: 0.006g/km, trucks: 0.041g/km) and fuel consumption (passenger cars: 0.007g/km, trucks: 0.007g/km). The EFs of pollutants were compared with the Japanese Emission Standards through JE05 and JC08 chassis dynamometer test cycles. The estimated EFs of <math>NO_x</math> for both vehicle classification showed inconsistency with the EFs derived from the test cycles. These results are supposed to be deployed as the input in air quality dispersion modelling in urban areas for designing the air pollution abatement strategy.</p> <p><b>Chapter 4 Dispersion of pollutants in street canyon of urban environment</b></p> <p>Chapter 4 discusses the use of Operational Street Pollution Model (OSPM) to predict the pollutant concentration (<math>NO_2</math>, CO, ozone, benzene, <math>PM_{2.5}</math>, <math>PM_{10}</math> and suspended particulate matter (SPM)) in the urban street canyon of Kyoto City, Japan. The input such as meteorological condition, urban configuration, traffic characteristics, urban background concentration and emission factor of pollutants. The findings reveal that all modelled concentration of pollutants is permitted to the environmental quality standard. The road no. 9 under category of highway administrated by Ministry of Land, Infrastructure and Transport (MLIT) can be classified as the most polluted road. The correlation analysis exhibits that the pollutant concentrations are positively</p>			

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<p>strong correlated to the traffic volume, wind speed, wind direction and aspect ratio (height/width) of urban street canyon. Otherwise, travel speed indicates the negative correlation to the pollutant concentration. The OSPM performance was tested by the statistical indicators in terms of root mean square error (RMSE), mean absolute error (MAE), bias, index of agreement (IA) and coefficient correlation (<math>R^2</math>). Most of pollutants such as <math>\text{NO}_2</math>, CO, ozone, benzene, <math>\text{PM}_{2.5}</math> and SPM reveal good agreements to the model due to higher <math>R^2</math> (0.77-0.91) and IA (0.86-0.91), lower RMSE (0.01-3.77), MAE (0.04-3.28) and bias (3.4%-19.2%). However, model performance indicator for predicting <math>\text{PM}_{2.5}</math> indicates moderate coefficient correlation (0.47) and IA (0.60), lower RMSE (5.28), MAE (4.57) and bias (18.59%). The OSPM model was overestimated the modelled concentration due to positive value of bias. Overall, the OSPM model had proven to be an applicable model for predicting the pollutant concentration in urban environment of Kyoto, Japan.</p>			
<p><b>Chapter 5 Health risk assessment of traffic induced air pollution in Kyoto City, Japan</b></p>			
<p>Chapter 5 assesses the health risks associated with exposure to traffic induced air pollutants (nitrogen dioxide (<math>\text{NO}_2</math>), carbon monoxide (CO), ozone (<math>\text{O}_3</math>), benzene, suspended particulate matter, <math>\text{PM}_{10}</math> and <math>\text{PM}_{2.5}</math>) via inhalation to infants, children and adults. Assessment of inhalation risk is based on the method proposed by US Environmental Protection Agency (US EPA) by means of hazard quotient (HQ) for non-carcinogenic effect and cancer risk (CR) for carcinogenic effect. HQ value for acute, intermediate (normal and worst-case) and chronic intermediate (normal and worst-case) exposure was determined for each pollutant, while cancer risk was calculated for chronic exposure of <math>\text{PM}_{2.5}</math> and benzene. Results reveal that the HQ value for all pollutants for acute and intermediate normal exposure were lower than 1.0 and CRs for <math>\text{PM}_{2.5}</math> and benzene were lesser than <math>10^{-7}</math>. Infants and children have higher tendency to be affected compared to adults against pollutants exposure, excluding the chronic worst-case condition. Nevertheless, the potential health risks with different severity may be posed by the exposed groups when they inhale the pollutants for long-term exposure. The study population have a negligible risk for short term-exposure and vice-versa for the long-term chronic exposure.</p>			
<p><b>Chapter 6 Development of a holistic framework of risk-based assessment and management for traffic induced air pollution in urban area</b></p>			
<p>Chapter 6 develops a holistic risk management approach for traffic induced air pollution in urban environment. This approach incorporates the concept of urban sustainability and risk management proposed by United Nation Department of Economic and Social Affairs (2013) and the 2018 International Standard Organization (ISO) risk management 31000, respectively. The risk management approach integrates the principles, framework and process as one component and is solely synchronized with the findings of this research. It is intended to be a reference document to help policy makers, urban development departments and environmental practitioners to prepare, implement, and review the issue of transport and air pollution in the urban area.</p>			
<p><b>Chapter 7 Conclusion and Future Recommendation</b></p>			
<p>Chapter 7 brings together the conclusion from each the preceding chapter and suggestion of promising area for future research.</p>			