Proceedings of the 7th World Congress on Civil, Structural, and Environmental Engineering (CSEE'22)
~~Lisbon, Portugal~~ Virtual Conference – April 10 – 12, 2022
Paper No. ICEPTP 174
DOI: 10.11159/iceptp22.174

Traffic Related Air Pollution Severity Assessment in South-East London Schools

Ho Yin Wickson Cheung [1], Liora Malki-Epshtein [1]
[1]University College London
Gower Street, London, WC1E 6BT, United Kingdom
ho.cheung.20@ucl.ac.uk; l.malki-epshtein@ucl.ac.uk

Extended Abstract

Outdoor air quality (OAQ) presents a significant challenge for public health globally, especially in urban areas [1], with road traffic acting as the primary contributor to air pollution. Several studies have documented the antagonistic relation between Traffic-Related Air Pollution (TRAP) and the impact on health, especially to vulnerable members of the population, particularly young pupils. Generally, TRAP could cause damage to their brain functionality, restricting the ability of schoolchildren to learn and, more importantly, causing detrimental respiratory disease in their later life [2,3]. But little is known about the specific exposure of children commuting to school and during the school day and the impact this may have on their overall exposure to pollution at a crucial time in their development. This project has set out to examine the air quality across primary schools in South-East London (Due to their massively increasing amount of re-development and population) and assesses the variability of data found based on their geographic location and surroundings. Nitrogen Dioxide, PM contaminants (2.5 and 10) and Carbon Dioxide were collected with diffusion tubes and portable monitoring equipment for eight schools across three local areas, that are Greenwich, Lewisham and Tower Hamlets.

This study first examines the geographical features of the schools surrounding (E.g., coverage of urban road structure and green infrastructure), then utilizes two different methods to capture pollutant data (Passive monitoring, field observations). Moreover, comparing the obtained results with existing data from monitoring stations and London Air Quality Network (LAQN) to understand the differences in air quality before and during the pandemic. Most studies in this field have unfortunately neglected human exposure to pollutants and calculated referring to values from fixed monitoring stations. This paper introduces an alternative approach by calculating human exposure to air pollution from real-time data obtained when commuting around selected schools (Driving routes and field walking).

It is found that schools located highly close to motorways are generally not exposed to the highest air pollution contaminants. However, the school with the worst traffic congested routes nearby might also result in poor air quality. Monitored results also indicate that the annual air pollution values have slightly decreased during the pandemic. However, the majority of the data is currently still exceeding the WHO guidelines. Finally, the total human exposures for NO_2 during commuting in two selected routes were calculated for morning and afternoon commutes. Results illustrated the total exposure for route 1 in the morning and the afternoon were, respectively, 22,947.18 $\mu m/m^3$ and 28,422.43 $\mu m/m^3$, and for route 2 were 30,641.91 $\mu m/m^3$ and 16,493.67 $\mu m/m^3$. This variability might be due to duration of the commute and the difference in traffic volume exposure en route. Exposure to NO_2 during commuting was plotted with detailed timesteps that have shown the highest values usually occurred whilst driving. These have supported the initial assumption of the significance of TRAP.

To conclude, this paper has yielded significant benefits to understanding air quality across schools in London with the new approach of capturing human exposure on walking and driving routes, confirming the severity of air pollution exposure and promoting the necessity of considering environmental sustainability for policymakers during decision making to protect the future pillars of society.

References

[1] Chin, A.T., 1996. Containing air pollution and traffic congestion: transport policy and the environment in Singapore. Atmospheric Environment, 30(5), pp.787-801.

[2] Khreis, H., Ramani, T., de Hoogh, K., Mueller, N., Rojas-Rueda, D., Zietsman, J. and Nieuwenhuijsen, M., 2019. Traffic-related air pollution and the local burden of childhood asthma in Bradford, UK. International Journal of Transportation Science and Technology, 8(2), pp.116-128.

[3] Mayor of London, 2013. AIR QUALITY IN TOWER HAMLETS A GUIDE FOR PUBLIC HEALTH PROFESSIONALS. [online] Available at: <https://www.london.gov.uk/sites/default/files/air_quality_for_public_health_professionals_-_lb_tower_hamlets.pdf> [Accessed 11 August 2021].