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4. **Topic of research** : Study on Spatial Pollutant Concentration Distribution in the Close Vicinity of Urban Roadways Intersection and Models Validation

ABSTRACT

The concentration of CO greatly varies at urban traffic intersections and junctions as there is often a sudden change in the traffic flow pattern. Vehicles that queue up at an intersection spend more time in idle driving mode generating more pollutant leading to higher pollutant concentrations. Moreover, the modes of vehicular operation, i.e., idling, accelerating, decelerating and cruising are variable at intersections which affect the emission pattern and resulting variation in spatial CO concentrations distribution in the close vicinity of urban roadway traffic intersections. The monitoring and prediction of CO concentration in the close vicinity of urban roadways and intersections is of foremost importance in order to improve ways to mitigate the harmful effects. Therefore, present study aims at to study the temporal and spatial CO concentration distribution in the close vicinity of urban intersection. The validation of Caline 4 has been carried out through CO prediction using real types of model input parameters. Furthermore, statistical analysis of monitored and predicted CO prediction at various roads links forming intersection has been carried out.

The intersection has been divided into four approach roads and CO monitoring has been carried out at 44 locations using portable online CO monitor. The CO concentration has been monitored from 8:00 AM to 8:00 PM at each location for the months of March, April and May, 2011. The average hourly CO concentrations data have been analyzed using MS excel spread sheet for temporal variation and surfer software for visualization of spatial CO distribution at each approach road.

The relevant information necessary for model run (Caline 4) such as traffic volume, composite emission factor and meteorological parameters as well as train conditions

have been collected. Thereafter, input files as per model requirement have been prepared and the model run has been performed for CO Prediction and model validation. The statistical analysis has been performed for measured and predicted values of CO data considering relevant statistical parameters such as mean, Index of Agreement (IA), Normalized Mean Square Error (NMSE), Pearson's Correlation Coefficient (COR), the Fractional Bias and the Factor-of-Two (F2). The statistical analysis has been done at 95 % confidence level for all the independent parameters. The MS excel spread sheet has been developed for the following standard statistical equations and used for the evaluation of these parameters.

The average hourly concentration of monitored CO concentration at all receptors locations shows two peak CO concentration values (i.e., the morning peak and evening peak) throughout the monitoring programme (March to May, 2011). The comparison of monitored values of average 1 hourly CO concentration levels as well as 8 hourly average concentration levels of CO showed non compliance with the prescribed standards (4000 $\mu g/m^3$ average hourly and 2000 $\mu g/m^3$ average 8 hourly CO concentration). The temporal CO concentration at various approach roads making roadway intersection shows non-uniform. The highest CO concentration has been observed to be towards high rise building and vice-versa. The least CO concentration has been observed towards either low rise building or open area. The spatial CO concentration distribution at various approach roads making roadway intersection shows non-uniform. The highest CO concentration (7825 $\mu g/m^3$) has been observed to be towards high rise building and vice-versa. The least CO concentration has been observed towards either low rise building or open area. The CO concentration variability at various approaches roads concluded the shifting and built up of pollutant towards high rise building irrespective of traffic volume.

Mean, Index of Agreement (IA), Normalized Mean Square Error (NMSE), Pearson's correlation coefficient (COR), the Fractional Bias and the Factor-of-Two (F2) show good correlation between monitored and predicted values. However, the values of predicted CO concentration have been found to be less than that of measured values. However, the model predicts very close to the average hourly monitored CO concentration.