Abstract

William H. Schneider IV. Ph.D. Defense, Purdue University. December 2003. Development of an Empirical Based Air Quality Traffic Management Tool and Strategies for the Borman Expressway Advisor: Robert B. Jacko.

The purpose of this study is to monitor the impact of traffic congestion along the Borman Expressway, Interstate 80/94, on local ambient $PM_{2.5}$ flux. The duration of this study is from January 15, 2002 to June 1, 2002, which includes two different traffic data locations, milepost 2.5 and 5.9, and one ambient environmental station, milepost 4.1. Milepost 2.6 records five-minute average occupancies for both eastbound and westbound lane directions. The second traffic location, a weigh-in-motion (WIM) station is located at milepost 5.9, records real time truck speeds, weights, classifications, and equivalent single-axle load (ESAL) parameters. The mobile ambient air sampling laboratory located 45.7 meters (150 feet) south of the Borman Expressway at milepost 4.1 monitors with a ten-second integrated average eight different environmental parameters including: $PM_{2.5}$, CO, wind speed, wind direction, cumulative rainfall, relative humidity, wet and dry bulb temperatures.

Over the duration of this study the final dataset includes 30,000 five-minute intervals. This dataset is used to develop a classification decision tree, which characterizes the impact of different traffic levels on local ambient air quality. This tree contains 16 different traffic clusters and shows 87.4% change in air quality between normal operating and heavy congestion levels along the Borman Expressway. In addition to the development of the decision tree, transitional probabilities are calculated for each of the 16 clusters. The results of these probabilities indicate the need for transitional clusters between free flow conditions and heavy congestion. Also, for each cluster, by increasing the frequency for the most probable traffic improvement, while at the same time decreasing the frequency for the most probable traffic degradation, on average will yield an immediate improvement of 18.9% ambient $PM_{2.5}$ flux adjacent to the expressway.