



INDOT Research

# TECHNICAL *Summary*

Technology Transfer and Project Implementation Information

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## ***Continuation of Research to Determine the Effectiveness of ITS on Borman Expressway***

### **Introduction**

The Borman Expressway in Northwestern Indiana is one of the most heavily traveled freeways in the United States especially among heavy duty diesel vehicles such as semi tractor trailers. Heavy duty diesel vehicles are a major source of fine particulate matter, or PM<sub>2.5</sub>, and with the revisions in the National Ambient Air Quality Standards focusing on PM<sub>2.5</sub>, vehicles with diesel engines as well as other mobile sources will be targets for significant PM<sub>2.5</sub> emissions reductions. Intelligent Transportation Systems (ITS) present one method of reducing emissions from all vehicles including those that are diesel powered. By smoothing out traffic flow, reducing traffic congestion, and minimizing accident response and clearance times ITS could reduce vehicle acceleration and deceleration cycles which are associated with increased pollutant emissions.

An environmental monitoring station adjacent to the Borman Expressway in Northwestern Indiana has been collecting data on PM<sub>2.5</sub>, Carbon Monoxide (CO), and meteorological parameters since September of 1999. Data was collected at a 10 second, integrated

averaging interval to resolve short term events associated with the rapidly changing conditions on the Borman expressway. Limited traffic data, averaged at 5 minute intervals, became available in June of 2001. The general objective of the Borman Expressway project was to correlate the local air quality to events on the Borman and determine the overall effect of the ITS on the local air quality. An “event” on the Borman is defined as anything that impairs traffic conditions on the Expressway. Construction delays, lane restrictions, accidents, weather, and excessive demand are all capable of creating congestion and impairing the utility of the expressway.

The purpose of this phase (which lasted from April 1, 2002 to April 30, 2004) was to classify the traffic conditions along the Borman Expressway in terms of the ambient air quality levels in order to further quantify the relationship between traffic conditions and local air quality levels, hence, enhance the decision making ability using the ITS protocols.

### **Findings**

Earlier phases of this project found that the Borman Expressway supplied on average 77% of the CO and 72% of the PM<sub>2.5</sub> as determined by modeling and regression analysis of traffic and environment data (SPR-2338). More over, it has been shown that the Carbon monoxide and PM<sub>2.5</sub> concentrations and flux can increase by a factor of 2 to 3 over pre-incident / pre – congestion conditions during accident / congestion events (SPR-2338). This shows that any means that can prevent or reduce oversaturated traffic conditions should substantially reduce the presence of pollution in the local environment.

The consequent descriptive model which characterized the impact of different Borman-traffic levels on the local ambient air quality has shown a 46% improvement in local air quality from the worst-case congestion levels along the Borman Expressway to the best-case ones. The classification tree was based on the following factors:

1. Time of Day
2. Westbound Class-Nine Average Speed
3. Westbound Occupancy
4. Eastbound Class-Nine Average Speed
5. Eastbound Occupancy

6. Westbound Class-Nine Truck Count
7. Eastbound Class-Nine Truck Count
8. The Total Eastbound and Westbound Truck Counts

The developed descriptive model has the advantage of being based on robust measured data from the Borman Expressway, hence; provided more realistic output and consequently offers a pragmatic methodology for improving local air quality as a function of traffic considerations.

## Implementation

ITS is expected to be a unique tool for accomplishing improvements in the local air quality levels near the Borman Expressway. By monitoring real time traffic conditions, the Borman ITS system will optimize the smooth flow of traffic, and consequently, the Borman ITS program should result in improvement of the local air quality. By providing information about real-time traffic conditions, faster response by the Hoosier Helpers and emergency vehicles, will thereby shorten traffic backups and subsequently prevent or reduce incidents-pollution productions.

Follow up projects on the Borman Expressway will produce empirical models correlating air quality and the different traffic parameters. These models will be developed and verified based on data from the current site, plus other site locations. This model and other work associated with the follow-up phase will be incorporated into a set of tables and/or a decision matrix that will assist planners and operators in making environmentally sound decisions regarding not only the Borman expressway but other expressways as well.

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