

INVESTIGATION OF NITROGEN OXIDES EMISSIONS FROM A MAJOR ROADWAY

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The objective of the proposed research is to develop a model to predict pollutant concentrations near major roadways and validate the model with real-time pollutant concentration, traffic and meteorological data. Despite recent advances in the automobile industry in reducing emissions from individual vehicles, because of the regional increases in the traffic volumes, air pollution in those localities still persist at problematic levels. Vehicular emissions are the major contributors to atmospheric NO_x constituting about half of all anthropogenic emissions. The secondary species formed in the atmosphere as the result of the reactions of NO_x with other species, are known to cause a wide variety of health and environmental problems.

Measurements done at the air pollution monitoring stations provide regional data with some temporal resolution but their numbers are too few to provide a detailed spatial resolution. Air pollutant concentrations can be significantly higher close to major roadways. This makes the local pollutant concentration measurements and finding ways to predict concentrations with a much higher spatial resolution essential in making decisions about locating buildings that will house sensitive populations, such as hospitals, day care centers, elementary schools, retirement homes and assisted living facilities. Therefore, there is a need for more data on NO_x concentrations especially near major roadways, and for models, which can predict NO_x concentrations with more accuracy and more spatial resolution.

Therefore, to address these issues, in this research project we are proposing

1. To build a mobile NO and NO₂ measurement unit with the associated weather monitoring instrumentation.
2. To obtain coordinated measurements of NO and NO₂ concentrations and meteorological conditions at varying distances from the roadway, together with the traffic volume and vehicle type data.
3. To use CALINE4 to estimate the NO₂ concentrations at receptors located at the measurement points.
4. To analyze the data obtained to elucidate the adequacy of CALINE4 in predicting the local NO₂ concentrations near roadways and perform a sensitivity analysis on the input variables, which are not directly measured, to suggest possible improvements.

MODELING TRAFFIC ACCIDENTS AT SIGNALIZED INTERSECTIONS IN THE CITY OF NORFOLK, VA

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The objective of the proposed research is to develop statistical predictive models for vehicular traffic accidents at signalized intersections in the City of Norfolk, VA. The current studies show that traffic accidents are largely caused due to traffic volume and driver actions. However, the reviewed literature indicates that intersection topography/design factors and traffic management rules may also contribute significantly to traffic accidents. A pilot study conducted in the City by Hampton University's Transportation Center in 2005-2006 showed that these factors contributed to the traffic accidents at signalized intersections. Hence, there is a need to conduct further investigation of these controllable factors that cause traffic accidents at the intersections. The proposed research will expand upon the work completed in the pilot study, in order to delineate significant controllable factors contributing to traffic accidents at signalized intersections in the City.

The major deliverables from the proposed research will include the following:

- A list of intersection topographical/design and traffic management factors which show significant correlation with the traffic accidents in the City.
- A predictive statistical model for the traffic accident rate which would include the significant topographical/design and traffic management factors.

NON-DESTRUCTIVE BRIDGE TESTING WITH ACOUSTIC EMISSION (AE) SENSOR TECHNOLOGY

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The utilization of non-destructive test and monitoring technologies for bridge safety is one of the research focus areas of Hampton University's Eastern Seaboard Intermodal Transportation Applications Center (ESITAC). The objective of the proposed research is to utilize non-destructive testing technology (NDT), in collaboration with VDOT's District Structure and Bridge Engineering Department, for accurate, reliable and durable methods of structural health monitoring of highway bridges and to help prevent spread of structural failures. Two bridges have been identified as potential test candidates. The bridge on I-164 at the Coast Guard Blvd. in the City of Portsmouth was built in 1991. According to the 2004 data, the average daily traffic on the bridge is 11,337 with 4% truck traffic. The other bridge is in the city of Williamsburg (VDOT Display structure 018 – 1917). This bridge was built in 1939 and has an average daily traffic of 2230 but with 5% daily average of truck traffic. Metal and non-metal bridge structure components will be investigated using NDT of acoustic emission (AE).

The major deliverables from the proposed research will include the following:

- Establish inspection procedures and methodology based on the studies during lean and peak traffic intervals. Investigate the role of thermal factors and incorporate them in the inspection procedures.
- Provide analysis and research procedures including simple bridge health grading criteria.
- Simplify the AE technology application for VDOT data review and decision making such that if problems are identified with AE, a dedicated system could be put into place for online monitoring.