Acquiring and Developing a Fully-Instrumented City

The Blacksburg Instrumented City is a $1.9 million dollar project sponsored by the National Science Foundation (NSF), Virginia Department of Transportation (VDOT), Virginia Tech, Town of Blacksburg and several private vendors. The goal of the project is to develop a real-life and comprehensive data collection environment that can be used for the development and validation of transportation evaluation tools as well as for the evaluation of various emerging ITS and IVI technologies.

Objectives

- Develop a real-life test facility that can be used for the evaluation and enhancement of traffic flow theory. The test facility will also be utilized to develop, enhance, and test alternative traffic control strategies, as well as other ITS and IVI alternatives.
- Develop a database that can be utilized for research on alternative means of disseminating real-time traveler information to the public.
- Develop a real-life test facility for enhancing and developing tools for the evaluation of network-wide energy and environmental impacts of operational-level transportation projects.
- Develop a real-life test facility for enhancing and developing tools for quantifying the noise impacts of operational-level transportation projects.
- Develop a test facility to evaluate emerging ITS technologies that can benefit transit operations.
- Develop a test bed for the evaluation of emerging surveillance and communication technologies.
- Develop a unique educational tool that will allow practitioners, undergraduate students, and graduate students to access and analyze real-life traffic data.

Project Team

- Virginia Tech Transportation Institute (VTTI)
  - Center for Sustainable Mobility
- VDOT
  - ITS Division
  - Salem District
- Town of Blacksburg
- Virginia Tech
  - Charles E. Via Department of Civil and Environmental Engineering
  - College of Engineering
  - Engineering Research and Graduate Studies

Unique Instrumentation

- Traffic signal data acquisition system
- Dynamic Origin-Destination (O-D) and travel time system
- Environmental emission and noise modeling instrumentation
- Transit vehicle AVL system (Acquired by Blacksburg Transit)
- Wireless broadband network
- Virginia’s Smart Road

Traffic Data

Traffic Signal Data Acquisition System Objectives:

- Index and store traffic volume, traffic signal, and Measures of Effectiveness (MOE) data gathered by the traffic signal surveillance system
- Timings include detailed actuation, pre-emption, and priority impacts on signal timings
- Develop advanced search capabilities to extract data and establish typical traffic and signal timing patterns

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Conduct extensive data comparisons for the enhancement of signal timings.

**Origin-Destination and Travel Time System:**
- Field Deployment of 40 infrared cameras at 18 locations in the Blacksburg and Christiansburg Area
  - Record license plates of vehicles that pass specific locations
  - Discard 2 digits and encrypt license plate recordings
- Data Include:
  - Time stamp, Controller IP address, camera number, encrypted license plate and confidence level of reading
- Development of algorithms to match reads and estimate dynamic roadway travel times

**Environmental Equipment**

**On-board Vehicle Emission Modeling**
- OEM2100 on-board emission measurement device:
  - Uses two, five-gas analyzers, an engine diagnostic scanner, and an on-board computer
  - Gas analyzers:
    - Measure vehicle mass exhaust emissions of HC, CO, NOx, CO2, and PM in real-time
    - Measurements averaged over two readings
  - Engine diagnostic scanner:
    - Collects vehicle engine data from the On-Board Diagnostic (OBD) system
- Data are provided continuously on a second-by-second basis

**On-Street Emission Measurement:**
- RSD4000 emission measurement device
  - Records vehicle license plate
  - Vehicle instantaneous speed and acceleration levels
  - Instantaneous emissions of HC, CO, CO2 and NOx
- Weather station measures:
  - rain intensity, temperature, wind speed and direction, and humidity level.
- Equipment installed in a mobile traffic laboratory:
  - Retractable mast with autoscope camera on top

**Virginia’s Smart Road**
- The Smart Road is a unique, state-of-the-art, full-scale closed test-bed research facility managed by the VTTI and owned and maintained by VDOT.
- It is a 2.2-mile two-lane road that is intended to become a part of the public transportation system connecting Blacksburg, VA to Interstate 81.
- Thousands of hours of on-road research have been conducted on the Smart Road since March 2000.
- The Smart Road is the only facility in North America that can provide such a wide array of test environments in the field of transportation research.

**Product Development**
- The Instrumented City can be applied for the evaluation of different technologies including:
  - Emerging vehicle emission reduction technologies
  - Innovative ideas for traffic signal display
  - Emerging communication systems