



Logan Wallace

Virginia Smart Road

Smart Road Basics

The Virginia Smart Road is a unique, state-of-the-art, full-scale, closed test bed research facility managed by the Virginia Tech Transportation Institute (VTI) and owned and maintained by the Virginia Department of Transportation (VDOT). It is a 2.2-mile, two-lane road built to Federal Highway Administration (FHWA) specifications. More than 18,000 research hours have been logged on the Smart Road thus far, and it is currently the only facility in North America that can provide such a wide array of test environments in the field of transportation research.

Smart Road Features

Connected-vehicle Systems

Seven wireless roadside equipment units have been installed along the Smart Road at an approximate spacing of 2,000 feet. These units facilitate connected-vehicle communications between vehicles, infrastructure, and devices. Two mobile roadside equipment sites are also available at the Smart Road.

Weather Systems

The Smart Road features 75 weather-making towers capable of producing rain, snow, and fog. A 500,000-gallon water tank supplies the towers, which produce selected weather across a 0.5-mile stretch of roadway under suitable

temperature and wind conditions. Rain capacity is between .08 and 2.5 inches per hour, fog visibility varies from 10 to 300 feet, and snow can be produced at up to four inches per hour. Two weather stations with official National Oceanic and Atmospheric Administration weather are available within one mile of the Smart Road.

Lighting System

The Smart Road is equipped with variable lighting to study the effects of lighting technologies on visibility. Variable pole spacing is designed to replicate 95 percent of national highway lighting systems. Multiple luminaire heads are available, including light-emitting diode (LED) modules. Additional towers mounted on portable bases allow the simulation of other environments (e.g., crosswalks) as needed.

Visibility Testing System

Two road sections (static and dynamic) are used to test the visibility of pavement markings and other objects. A portable weather-making system can create a variety of visibility scenarios within these environments. Pavement markings can be reconfigured to simulate any roadway condition. Past research about pavement markings has included: UV-reflective markings, prototype reflective mixtures for markings, three-dimensional markings, and installation quality effects on marking visibility. Other visual objects

that have been used in research include pedestrians (both live and inanimate), signage, and test targets.

Other Features

- An optical fiber communication system
- Ethernet fiber transceivers and Ethernet switches
- Connected-vehicle-compatible intersection controller model
- Fourteen pavement sections, including an open-grade friction course
- In-pavement sensors that detect such factors as moisture, temperature, strain, vibration, and weigh-in-motion
- Zero-crown pavement section designed for flooded pavement testing
- An American Association of State Highway and Transportation Officials (AASHTO)-designated surface friction testing facility
- Wireless mesh network variable control
- Differential GPS base station for precise vehicle locating
- Signalized intersection with complete signal phase and timing using remote controls



The Bridge

The Smart Road Bridge is the tallest in Virginia, standing more than 175 feet above Wilson Creek and spanning 2,000 feet over Ellett Valley. The bridge is constructed of cast-in-place box girders; the inside of the bridge is hollow. Conduits follow the length of the inside of the bridge to allow power and communication lines to run the length of the road. This allows researchers to collect data about the wear and tear of the bridge infrastructure. The bridge weighs approximately 40 million pounds, has 9,647 cubic yards of high-strength concrete, steel cables that weigh more than 780,900 pounds, and reinforcing steel that weighs 1,565,321 pounds. Construction of the bridge itself cost \$17.4 million and began in August 1998. The bridge was a partnership between VDOT, FHWA, and VTTI. The bridge piers are also inset with Hokie stone from a local quarry, connecting the bridge with the Virginia Tech community.

Control Room/Laboratories

VTTI houses the Smart Road Control Room through which on-road research is scheduled and overseen 24 hours per day/seven days per week. The Control Room also acts as the 511 Virginia Data Quality Assurance/Quality Control (QA/QC) Center. Dispatchers located in the Control Room have the ability to manipulate lighting and all-weather testing systems on the road and can control access to the facility itself.

VTTI has several laboratories to aid in research objectives. These labs include driver-interface development, eye-glance data reduction, lighting research, accident analysis, accident database analysis, pavement research, and traffic simulation.

Advocacy and Outreach

National and international media outlets have covered research conducted at VTTI and on the Smart Road, including CBS, NBC, ABC, CNN, Good Morning America, NPR, BBC, Discovery Channel Canada, The Washington Post, C-Span, The Wall Street Journal, the National Geographic Channel, ABC World News with Diane Sawyer, the American Institute of Physics, the Weather Channel, and Dateline NBC.

Media events on the Smart Road are not limited to highlighting VTTI research. For example, on February 3, 2010, The Today Show filmed a segment on the test bed spotlighting the National Federation of the Blind's Blind Drive Challenge, an initiative to develop nonvisual interface technologies that will convey real-time information, thus allowing a blind person to safely and independently drive a car. Featured in the spot were Blind Driver Challenge partners Mark Riccobono (National Federation of the Blind), Dennis Hong and Paul D'Angio (Virginia Tech Department of Engineering), and Jesse Hurdus (TORC Technologies).

Tours and Open Houses

VTTI staff, in partnership with other employees from VDOT, annually host one public open house, one school day event, and multiple tours. VTTI annually hosts a spring Open House and School Day event. Attendees see a presentation about naturalistic driving studies, tour the Smart Road Control Room, view

instrumented vehicles, and take a ride on the Smart Road through a simulated rain shower created by specialized weather towers on the road. Please visit www.vtti.vt.edu/outreach/tours.html for more information.

Marketing Visits and Conferences

During Fiscal Year 2013, several potential sponsors, marketing groups, and conference groups took a tour of VTTI facilities and/or the Smart Road, including:

- Peer institutes
- Stakeholder groups
- Foreign dignitaries
- Driver's education instructors
- Crash investigation units
- Advocacy groups
- Local civic groups
- International university officials and students
- Civil and mechanical engineering student groups
- Visiting scholars from national and international universities
- Virginia Tech reunion groups
- Conference groups

