Innovative Technology in Construction and Work Zone Safety

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• Leader in transportation safety and human factors research
  • Twenty-five (25) years of transportation safety research
  • Largest group of transportation safety researchers in the world
    • Almost 300 employees (research, testing, teaching, training, administrative, support, outreach and public service)
    • 70+ active projects w/public and private customers
• Innovative and world-class capabilities
  • Pioneer and internationally recognized as the leader in Naturalistic Driving Assessment
  • Operator of the Virginia Smart Road
• Impact on national transportation policy
  • Driver distraction, truck driver fatigue, night visibility enhancement, ITS technology evaluation
VTTI Capabilities and Resources

- Expertise and experience
  - Driving data acquisition
  - Data storage and handling
  - Human Factors
  - Data analysis, mining

- Facilities
  - Virginia Smart Road
  - The Instrumented City (Blacksburg)
  - Crash simulation – Injury Biomechanics
  - National Tire Research Center – Virginia International Raceway
  - Truck simulator
  - Full mechanical and electronic fabrication labs
  - VT High Performance Computing Center 1.0 PetaByte, 100 Teraflop dedicated

- Resources
  - Vehicle fleet including trucks, buses, vans, pickups, SUVs, cars, motorcycle(s)
  - Data collection hardware, software, analysis programs
Outline

• Naturalistic Driving Research
  • Analysis of current databases for work zone related events
  • Data collection effort performed in work zones

• Virginia Smart Road
  • Platform for work zone related research
    • Example studies
  • Future research ideas

• Connected Vehicle Initiative
Naturalistic Data Collection

• “in the natural or original position or place”
• Collecting driver behavior and performance data in a naturalistic environment (e.g. several months to one year)
• Examples:
  • as light vehicle drivers commute to/from work (e.g., 100-Car Study)
  • as truck drivers operate their vehicles on revenue-producing runs
• Able to get detailed pre-crash/crash information along with routine driving behaviors (data sensors + video)
• Highly capable data acquisition systems (well beyond EDRs)
Naturalistic Driving Research

- Use current Naturalistic Driving Databases to investigate work zones
  - Locate by triggered events (e.g. crashes, near-crashes, or crash-relevant conflicts)
  - Locate by GPS for specific target areas
  - Evaluate work zone design
- Outfit work zones and/or construction equipment with Data Acquisition Systems and collect data in operating environments
Vehicle-width Measurement System for Work Zones

- VDOT/VCTIR tasked VTTI with investigating the feasibility of designing a vehicle-width measurement system.

Key system requirements:
- Identify over-width vehicle
- Accurate
- Portable
- Field deployable
- Driver warning/notification capability

Sensors evaluated:
- Rotary laser
- Ultrasonics
- Machine vision
Virginia Smart Road – Example Studies

Driving Transportation With Technology
Virginia Smart Road – Example Studies

• Warning Lights on Roadway-Operations Equipment
  • TRB tasked VTTI and the National Institute of Standards and Technology with developing guidelines for warning lights used on construction, maintenance and utility vehicles
  • Lighting configurations selected for Smart Road testing
    • Attention getting
    • Discomfort glare
    • Pedestrian detection
    • Vehicle identification
    • Urgency
    • Daytime/Nighttime
    • Clear, rainy, and foggy weather
Virginia Smart Road – Example Studies
Virginia Smart Road – Future Research

• Work Zone/Construction design can be evaluated by VTTI on the Smart Road
  • Zone Areas
    • Advance Warning Area
    • Transition Area
    • Activity Area
    • Termination Area
  • Targets of Evaluation
    • Driver performance
    • Driver perceptions
    • System testing
    • Guidelines, standards, protocol development
Vehicle connectivity provides a bi-directional ability to share information between:

- Vehicle to Vehicle (V2V)
- Vehicle to Infrastructure (V2I)
- Vehicle to Device (V2D)

Wireless communication channels are used:

- Cellular for general information
- Dedicated Short Range Communications (DSRC) for low-latency, robust, secure information

Various in-vehicle and roadside applications are enabled with the communicated information.
It’s All About Connectivity

- E-payment Transactions
- Signal Phase and Timing Information
- V2V Safety Messages
- Real Time Network Data
- Situation Relevant Information

“The Network”

Opportunity for Innovation

*Slide adapted from USDOT
Opportunity for Safer Driving

- **Greater situational awareness**
  - Your vehicle can “see” nearby vehicles and knows roadway conditions you can’t see

- **Reduce or even eliminate crashes thru:**
  - Driver Advisories
  - Driver Warnings
  - Vehicle Control

*IntelliDrive has the potential to address 82% of the vehicle crash scenarios involving unimpaired drivers*

*Slide adapted from USDOT*
Thank you!

Questions?

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