Connected Vehicle and Work Zone Activity in Northern Virginia

Overview

1/22/2019
Virginia Connected Corridors

**Mission:** Provide an open connected vehicle environment where concepts can be developed, tested, deployed, and evaluated in real world operating environments.
Northern Virginia Test Bed

DSRC Equipment
- Arterial/Intersection RSUs (30)
- Freeway RSUs (19)
VCC Cloud
- Application Processing
- Message Routing
- Data Archive

VCC Monitor

VCC Mobile

On-Board Unit (DSRC)

Road Side Unit (DSRC)

Signal Controller

Signal Timing Data

VCC Worker

VCC Work Zone Mapping

Work Zone Data

Public API
VDOT Data Sharing
SmarterRoads.org

Public Data Access

Application Data Sources

Traffic Operations Center

VCC Worker

VCC Work Zone Mapping

Situation Awareness

Custom App Data

End User Interface

Custom App Data

Wired
Cellular
DSRC

BSM, mBSM, SPaT, MAP, TIM

SPaT, MAP

WX Incidents, Work Zones, ATM, VDMS

Worker Activity, Location, Duty Status

Work Zones:

Traffic Operations Center

Cellular
Wired
DSRC
Recent VCC Activity

• Ongoing SPaT and MAP validation
  – Objective: Assess readiness to deploy signal related CV applications
  – 30 intersections along 3 major arterials
  – Latency and accuracy assessments

• RTK System Implementation
  – Objective: Deploy RTK system in NoVA to improve localization accuracy for signal and pedestrian applications
  – Initial base station in Merrifield, VA
  – Integration with VCC Cloud and RSUs to support RTCM broadcast

• Work Zone / Roadside Worker support
  – Objective: Create applications to support the flow of accurate and timely data for CAV consumption
  – Work Zone Builder Application
  – Smart Vest
  – SSP Application
Preparing for CAV Data Needs

• Temporary roadway configuration changes can be challenging for AVs
  – Work zones / temp traffic control
  – Traffic incidents
  – Vulnerable road users
  – Unusual / unplanned incidents

• We believe that a connected AV will be safer and more effective

• IOO sourced data could be more accurate, detailed, and real time

• VDOT is investing in solutions that can improve and facilitate infrastructure data

• Plans to provide broader, standardized data for CAVs to consume
Desired CAV Data Elements

**Approach**
- Lat / Lon Geo Position
- General Description
- Operational Restrictions

**Transition**
- Lat / Lon Geo Position
- Beginning of Taper
- End of Taper
- Required Actions
- Merge Direction
- Lanes Offsets / Alternate Paths
- Speed Reduction
- Maneuver Restrictions

**Activity Area(s)**
- Lat / Lon Geo Position
- Description
- Potential Hazards
- Barrier Type
- Active / Inactive

**Termination**
- Lat / Lon Geo Position
- Beginning of Taper
- End of Taper
- Resume Speed Limit

**Speed Limits**
- Approach Speed Limit: 45
- Activity Area 1 Speed Limit: 65
- Transition Speed Limit: 45
- Activity Area 2 Speed Limit: 65
- Termination Speed Limit: 65

**Hazards**
- Workers Near Roadway
- Uneven Pavement

**Additional Information**
- Workers Near Roadway
- Uneven Pavement
VCC Work Zone Components

VCC Cloud
Data and Processing Hub
Work Zone Server App

VCC Monitor
Situation Awareness

VCC Mobile
Driver Interface

VCC Worker/SSP
Dynamic Worker Location and Activity

VCC Vest

Work Zone Builder
Detailed Work Zone Definition
VCC Mobile
- Cellular or DSRC/OBE
- Dynamic Driver Messaging
- Work Zone Alerts
- Weather Advisories
- Traffic Incidents
- ATM/HOV Status and Alerts
- Pot Hole Detection and Road Surface Temp Monitoring
- Driver Reporting and Call for Help

VCC Monitor
- Realtime Situation Awareness Tool
- RSU Status and Performance Monitoring
- Message Flow Monitoring (BSM, BMM, PDM, TIM, etc.)
- SPaT Status Display
- Control Message Management
- Traveler Information Message Management
- Driver Report Location
Work Zone Builder Application

- Provide an app to produce work zone data suitable for use in CAVs
- Mobile, tablet-based application to support use in field
- Designed for contractors and VDOT inspectors
- Align software with VDOT process flows
- Design, Management, and Field Modes
WZB – Design Mode

- User taps out activity area and selects template type
- App positions work zone features based on MUTCD / VA Work Area Protection Manual
- User edits features based on local conditions
- WZ design captured in high resolution in JSON data format and saves to VCC Cloud
- App creates inventory of work zone devices required to setup the zone
- Feature palette allows designer to add / modify additional components as necessary
WZB – Management Mode

- Submit design for review, revision, approval
- Work flow notifications to end user based on status and dates
- Facilitates real time status updates based on local conditions
- Loosely integrated with other VDOT systems
WZB – Field Mode

- Localization support for setup
- Real time distance measurement
- Drive/walk through feature position verification
- Adjust features to local conditions
- Upload design updates as built
Smart Vest System

• Migrate worker app from cell phone to more rugged and “automatic” platform
• Cellular communications
• RTK corrected GPS localization
• Provides location and activity info, log workers into and out of active zones
• Warnings sent to **drivers** through mobile apps
• Warnings provided to **workers** via flashing LEDs, audio, and/or haptic cues
• Vest system delivery: Q3 2019
• VCC integration complete: Q4 2019
Safety Service Patrol App

- Rapid identification and notification of temporary roadway changes
- Cellular-based application uploads location and status to VCC Cloud / TOC
- Auto-generate advisory TIM messages to notify connected and automated vehicles of location and activity
- Real time updates to TOC and public data portal
Work Zone Server App

- Cloud-based work zone data manager
- Consumes all available inputs from static and dynamic work zone data sources
- Computes conflict assessment and messaging requirements
- Manages outgoing CAV data flows
  - Traveler information messages
  - Localized MAP messages (Roadside Safety Messages)
  - Streaming location data for dynamic actors
  - Conflict alerts
  - Public data portal
- Process and distribute work zone and incident data to various consumers in a variety of formats
Next Steps

- Publish initial deployment results Q2 2019
  - SPaT, MAP validation assessments
  - RTK positioning accuracy results
- Complete remaining individual component projects by end of Q2 2019
- Full system integration and test Q3 2019
- “Putting it all together” demo Q4 2019
- End user application and NDS evaluation 2020 and beyond

Questions?

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