Leveraging Technology to Enhance the Driver Experience in Virginia

Charles A. Kilpatrick, P.E.
Chief Deputy Commissioner

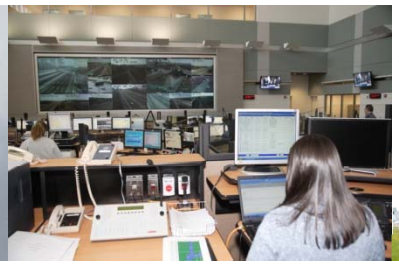
Enhancing Driver Experience through Technology

VDOT currently leverages technology to enhance the driving experience in Virginia

- VDOT's 511 Traveler Information System
- Adaptive Signal Control
- Bluetooth-Based Traffic Data Collection

Also aggressively pursuing cutting edge concepts

- Active Traffic Management (ATM)
- Connected Vehicle Technologies



Transportation Video & Data (TVD) Services

VDOT's 511 Program

VDOT's New 511 Service

- New 511 service launched May 18, 2012
- New website offers free streaming video to the public
- Service disseminates traffic info through several outlets:
  - Web and mobile applications (iPhone and Droid)
  - Interactive Voice Response (IVR) phone system
  - Information displays at Welcome Centers
  - Twitter and email alerts
  - Travel Time road signs in NOVA and Hampton Roads

www.511Virginia.org

VDOT's New 511 Service
Key Features

511 Phone Service (IVR)

- New voice recognition engine
- Travel times

511 Website & Mobile App

- Live streaming video (15 frames/sec)
- Mobile app with live traffic information
- Travel times

Video / Data Sharing

- Free video access through web service
- Includes attribution to VDOT
- Operations data publicly available

Sponsorships

- Sponsorship acknowledgements will be added to 511 signs and Safety Service Patrol (SSP) Vehicles

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VDOT

511 Virginia Traffic Information

Click here to see the different, free ways to use 511.

VDOT Please call responsibly

My 511 ▾ Map Views ▾ Text Views ▾ Resources ▾ Reach the Beach Contact Us Help ▾

Weather Log in to Customize

Traffic Alerts +20 New

Info

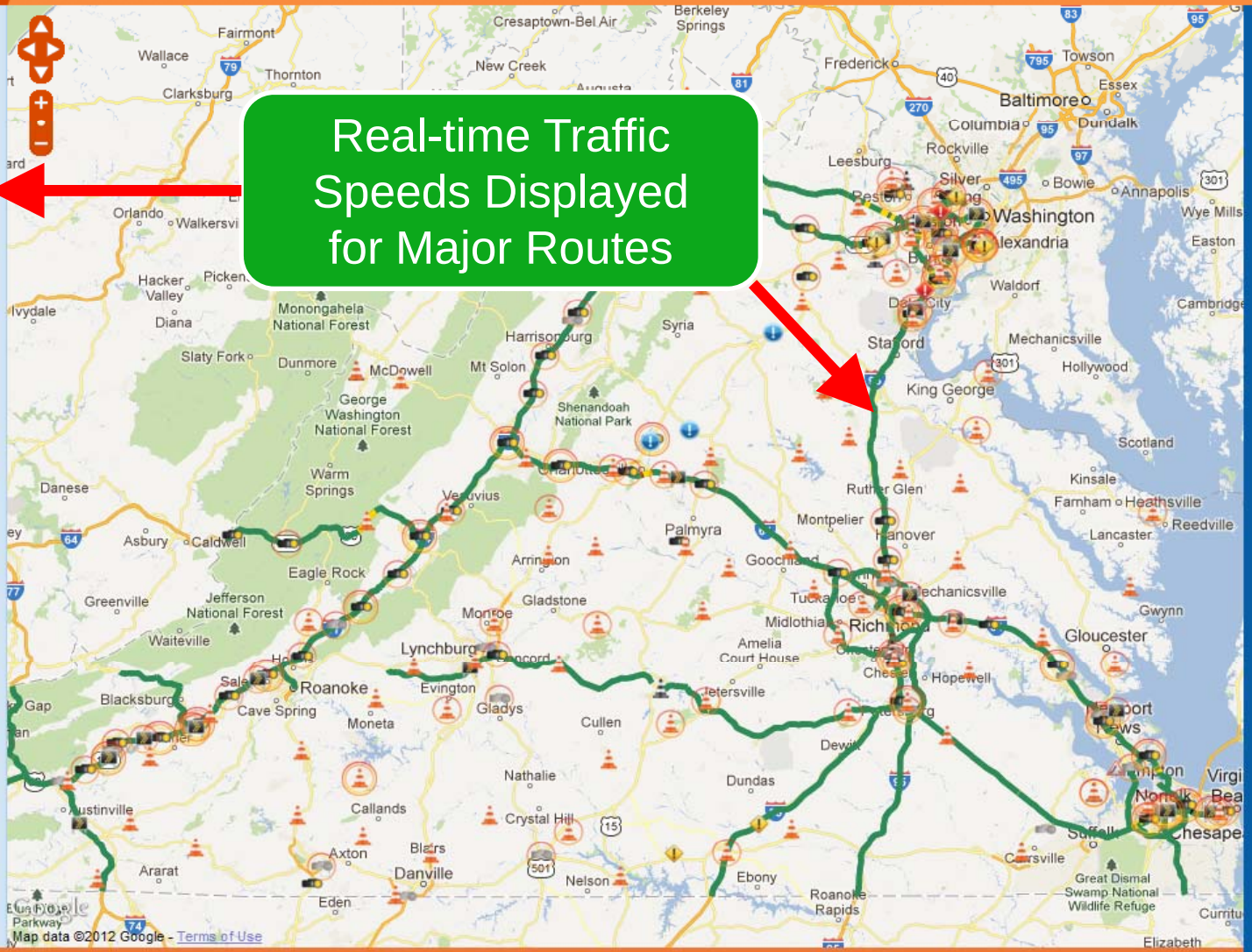
I-95

Northbound Lane		Southbound Lane	
Speed	65 mph	Speed	65 mph

I-95 from Plank Road Fredericksburg to The Capital Beltway (41.2 miles)

Northbound Lane		Southbound Lane	
Speed	60 mph	Speed	30 mph
Travel Time	40 min	Travel Time	72 min

Legend more info



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Traffic Alerts +20 New

Info

I-95S from MM 163.0 to MM 166.0
Description:
On I-95 in the County of Fairfax from mile marker 163 to mile marker 166, motorists can expect potential delays in this area from 05/11/12 at 8:00 AM until 05/11/12 at 7:00 PM due to construction activities. The south right shoulder is a mobile closure.
Last updated:
Fri 05/11/2012 9:22 AM EDT

Rt. 641E (Prince William County) at Old Bridge Rd
Description:
On Rt. 641 (Old Bridge Rd) in the County of Prince William from Rt. 2410N (Prince William County) to Smoketown Rd; Rt. 2000E (Prince William County), motorists can expect potential delays in this area from 05/11/12 at 9:00 AM until 05/11/12 at 3:00 PM due to maintenance activities. The east left lane is closed. The west left lane is closed.
Last updated:
Fri 05/11/2012 9:03 AM EDT

I-95N at MM 161.3
Description:
On I-95 in the County of Fairfax at mile marker 161.3, motorists can expect potential delays in this area from 05/11/12 at 9:00 AM until 05/11/12 at 12:00 PM due to construction activities. The north left lane is closed.
Last updated:
Fri 05/11/2012 9:22 AM EDT

US-1N at Richmond Hwy
Description:
On US-1 (Richmond Hwy) in the County of Fairfax from Forest Pl; Rt. 3710E/W (Fairfax County) to Rt. 3191N/S (Fairfax County), motorists can expect potential delays in this area from 05/11/12 at 9:30 AM until 05/11/12 at 1:00 PM due to

Legend more info

Incident and Workzone Info List

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Traffic Alerts +20 New

Info

I-295 south at MM 36.1

BRIDGE WORK
THIS
WEEKEND
I-64 WEST
NEAR EXIT 193
EXPECT DELAYS

I-64 west at MM 194.4

BRIDGE WORK
THIS WEEKEND
NEAR EXIT 193
EXPECT MAJOR
DELAYS

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Active DMS Messages

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Info

I-95

Northbound Lane		Southbound Lane	
Speed	65 mph	Speed	65 mph

I-95 from Plank Road Fredericksburg to The Capital Beltway (41.2 miles)

Northbound Lane		Southbound Lane	
Speed	60 mph	Speed	30 mph
Travel Time	40 min	Travel Time	76 min

Camera Viewer - I-95 / MM 169 / NB / Exit 169 Route 644 - Old Keene Mill Rd

- Springfield Pkwy
- I-95 / MM 169 / NB / Exit 169 Route 644 - Franconia Rd
- I-95 / MM 169 / NB / Exit 169 Route 644 - Old Keene Mill Rd
- I-95 / MM 163 / SB / Exit 163, Route 642 - Lorton Rd/Pohick Rd Ovp
- I-95 / MM 163 / NB / Exit 163, Route 642

Traffic closest to the camera is **northbound**.

Log in to select favorite cameras.

Streaming Video Provided for VDOT's 800+ Cameras

Legend more info

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Reach the Beach
Info
Demo
Legend

Trip-Planning Tools
- Origin Point
- Reach the Beach Sign
- Fastest Route
- Slower / Alt. Route

Road & Weather Info
- [x] Road Work
- [x] Inactive Road Work
- [x] Message Sign
- [x] High Priority Incidents
- [x] Other Incidents
- [x] Open Bridges
- [x] Special Events
- [x] Weather Closures
- [ ] Other Weather Events
- [x] Cameras
- [ ] Inactive Cameras

"Reach the Beach" tool provides Travel Times for alternate Routes to VA Beach

City of Richmond

to Virginia Beach Oceanfront

64 E - 264 E	1 hr, 46 min
64 E - 664 S - 264 E	2 hr, 0 min
I-64 E - 295 S - 460 E - 664 S - 264 E	2 hr, 27 min
I-95 S - 460 E - 664 S - 264 E	2 hr, 22 min

to exit 291 - OBX Expressway

Hover your mouse over a set of directions for a visual representation.

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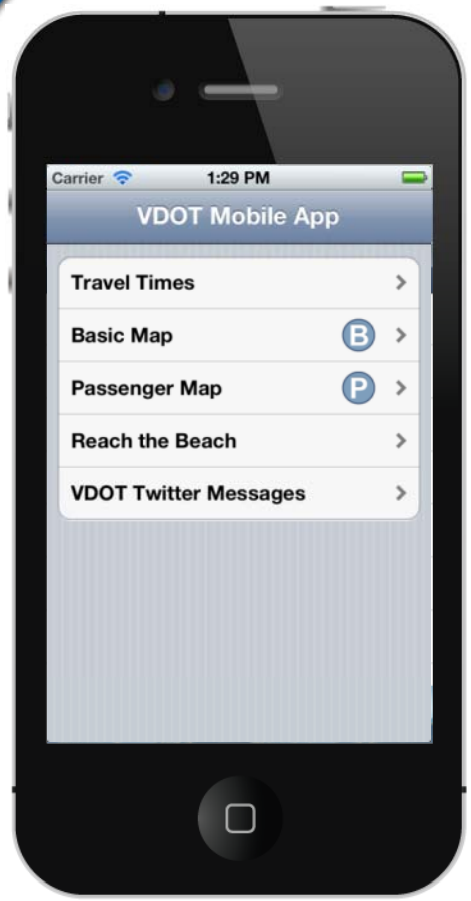
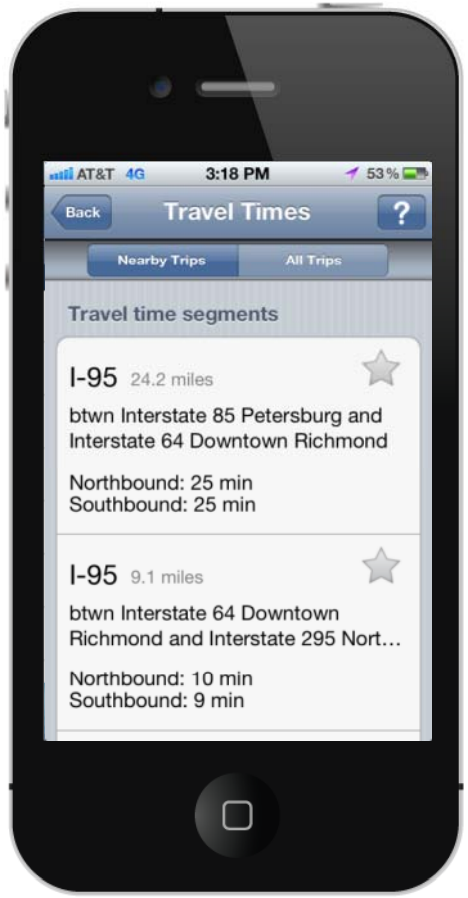
Transportation Video & Data (TVD) Services
"Reach the Beach"

- **Initiative launched with roll-out of new 511 service**
- **Provides real-time actionable information for alternate routes to VA Beach**
- **Travel Times based on INRIX and Bluetooth data**
- **The service provides travel times through:**
  - **VDOT's 511 phone service**
  - **VDOT's 511 Website**
  - **Mobile Application(s)**
  - **Dynamic Message Signs (DMS)**
  - **Information Displays at Rest Areas**

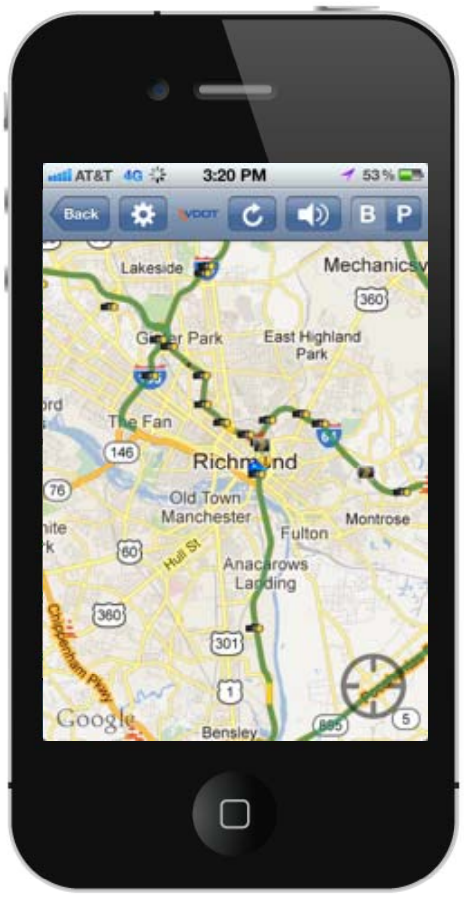
511 Mobile App – New Feature for VDOT



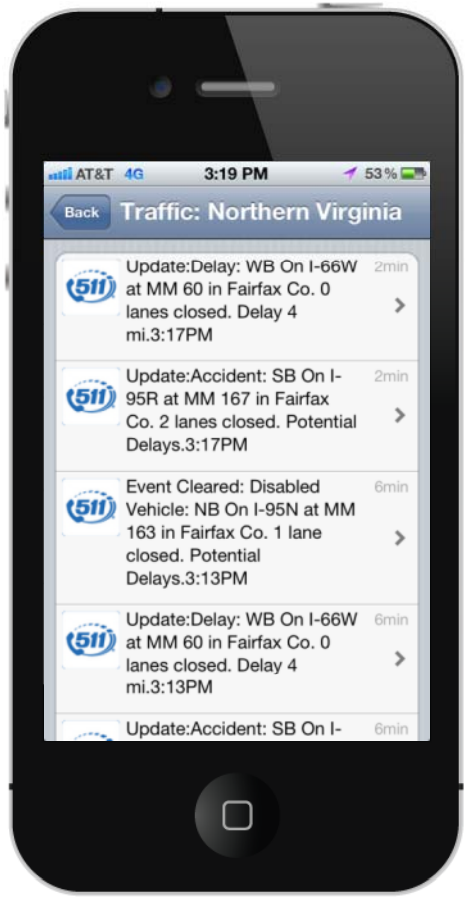
Home Screen



List of Travel Times



Map



Twitter Feed

Transportation Video & Data (TVD) Services
Revenue Generation and Sponsorship

- **Sponsor acknowledgement signs placed with VDOT 511 signs**
- **Sponsorship revenues will offset 511 O&M costs**
- **Coordination with other sponsorship opportunities:**
  - **Safety Service Patrol vehicles**
  - **SAVE (rest areas)**
  - **Roadway / Facility naming rights**

Adaptive Signal Control

Adaptive Traffic Signal Control

- Adaptive traffic signals use advanced computing to optimize signals on the fly at individual intersections or along a corridor

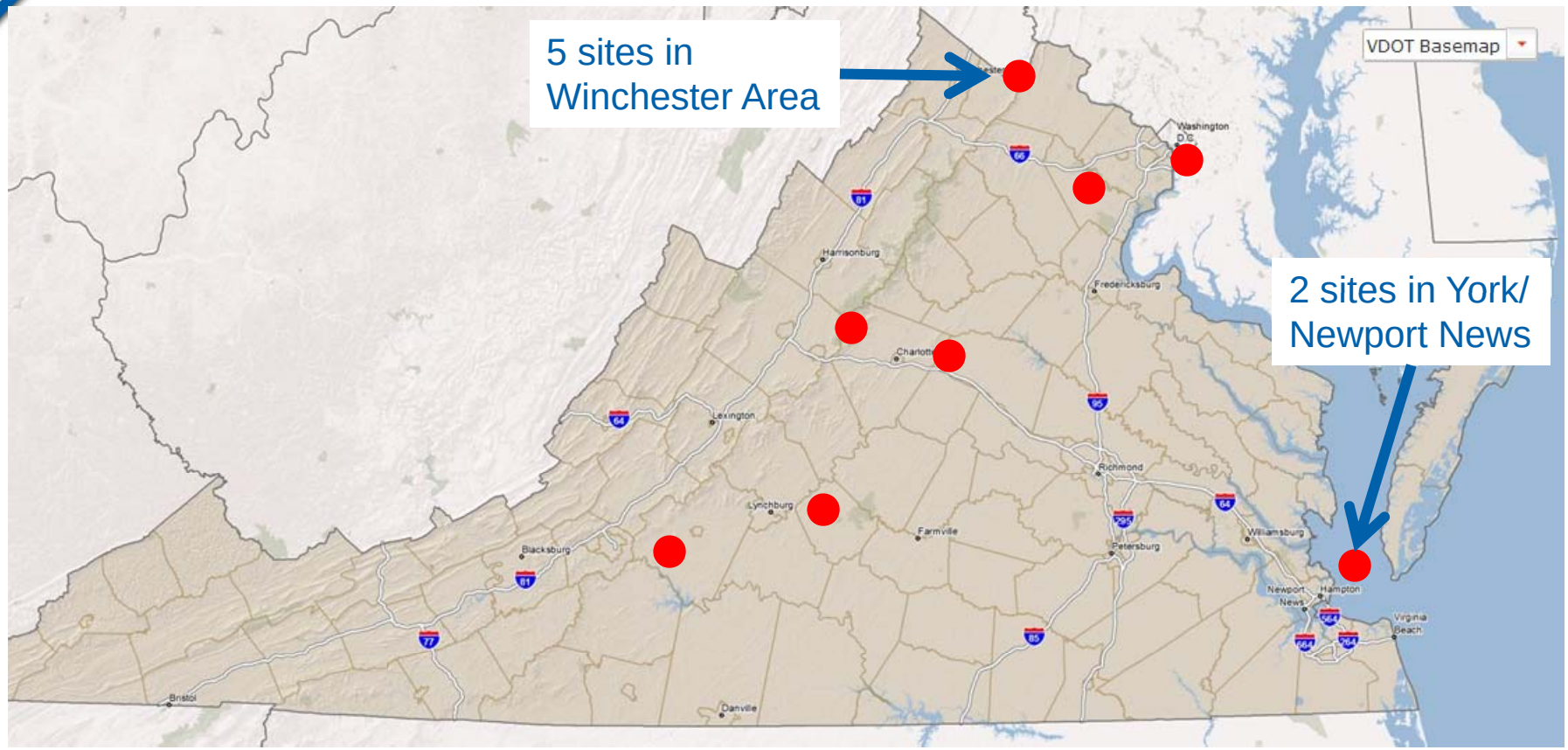
- No fixed timing plans

- Can adapt to variations in flow
  - Seasonal variations (shopping, tourism)
  - Crashes or incidents

Adaptive Traffic Signal Control
VDOT Pilot Project

- VDOT is piloting adaptive traffic signal control technology along several corridors across Virginia
- System functions as a plug-in for existing controller hardware
- Requires Ethernet communication between intersections
  - Leveraging Fiber Optic Resource Sharing where available
- Total cost ~$40k per intersection (equipment + communications)

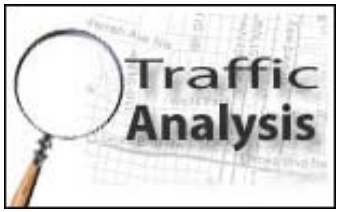
Adaptive Traffic Signal Control
Pilot Project Corridors



- **13 pilot corridors selected**
- **Mix of site characteristics**

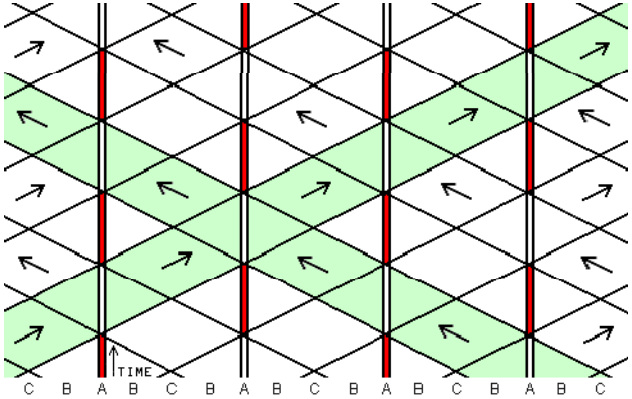
Adaptive Traffic Signal Control Evaluation

- **Virginia Center for Transportation Innovation & Research (VCTIR) is performing before/after evaluations of pilot deployments**



- **Objectives:**
  - **Assess system effectiveness**
  - **Determine situations where adaptive control provides the most benefit**

- **Will complete evaluation by Q2 2013**



Adaptive Traffic Signal Control Results to Date

- **Most corridors experienced significant improvements**
- **Preliminary results encouraging:**
  - Improved travel times
  - Reduced number of stops
  - Fuel consumption savings

US 250 - Charlottesville			
Period	Direction	Travel Time Decrease	Mean # Stops Decrease
AM Peak	EB	31.0%	61.3%
	WB	42.1%	64.6%
Midday	EB	27.6%	64.2%
	WB	15.5%	44.4%
PM Peak	EB	42.0%	80.0%
	WB	24.7%	56.5%

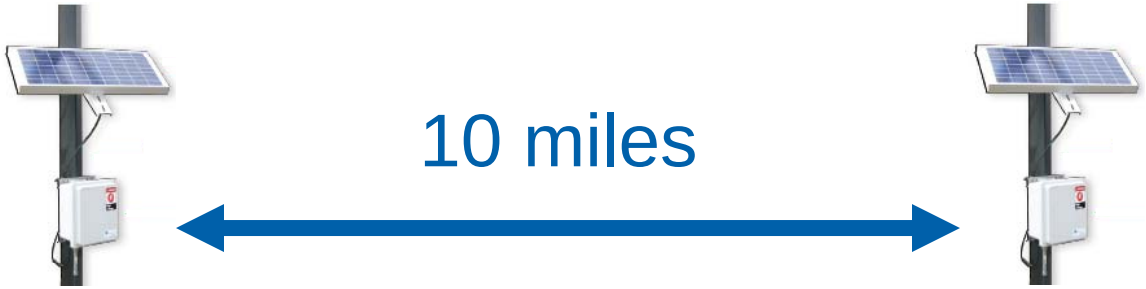
- **Effectiveness may be limited when:**
  - Intersections are oversaturated
  - Corridor already functions well
  - Spacing between intersections is long
  - Communication between intersections is unreliable

Bluetooth-Based Traffic Data Collection

Bluetooth-based Data Collection
How it Works

MAC Address
00:1E:E2:F4:CC:4E
12:01:00 PM

MAC Address
00:1E:E2:F4:CC:4E
12:12:30 PM



10 miles traveled in 11.5 minutes
10mi/(11.5min / (60min/hr) = 52.2 mph

*** Courtesy Mike Fontaine - VCTIR**

How VDOT uses Bluetooth-based Data

- Bluetooth data used to validate other traffic data sources that support VDOT's dissemination of travel times
- Also used as primary source of speed/travel time data where other sources lack sufficient quality
- Data used to monitor travel times through significant workzones on I-81
- Placed on Adaptive Signal Controlled Corridors to validate effectiveness

Active Traffic Management (ATM)

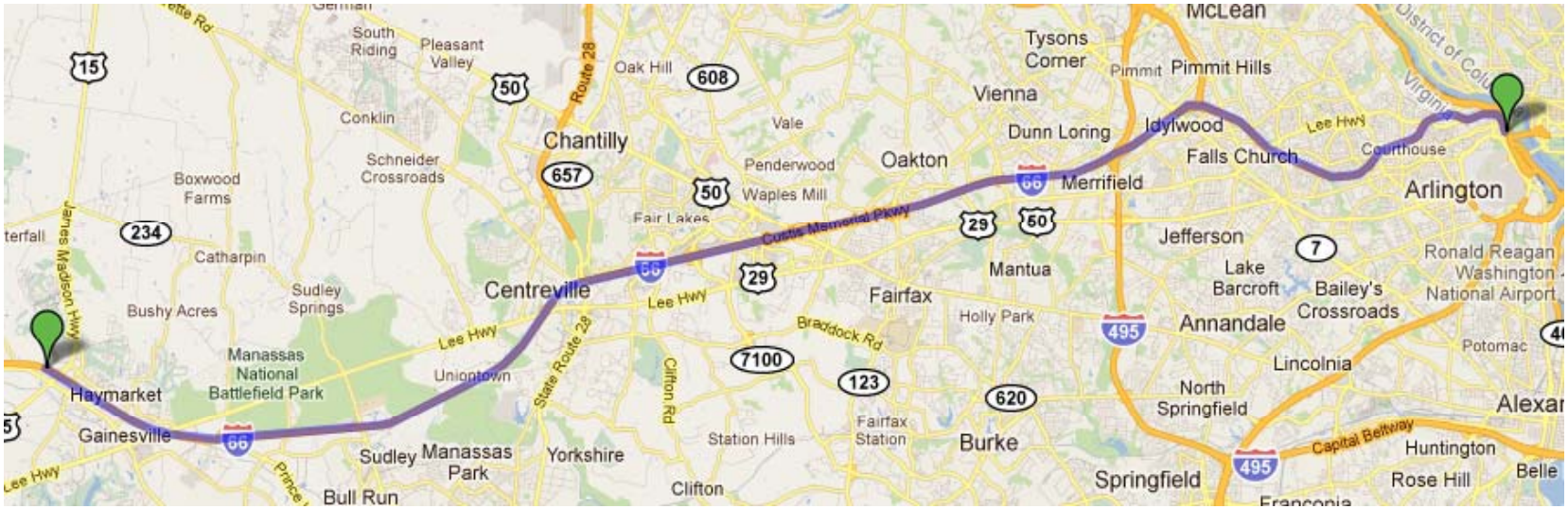
What is Active Traffic Management (ATM)?

- The ability to dynamically manage traffic based on current conditions to increase throughput and safety
- Techniques include: variable speed limits, hard-shoulder running, queue detection/warning, lane management and ramp-metering
- ATM has been implemented in Germany, Denmark, the Netherlands, England, and the US

Application of ATM to I-66 Corridor

Project Scope

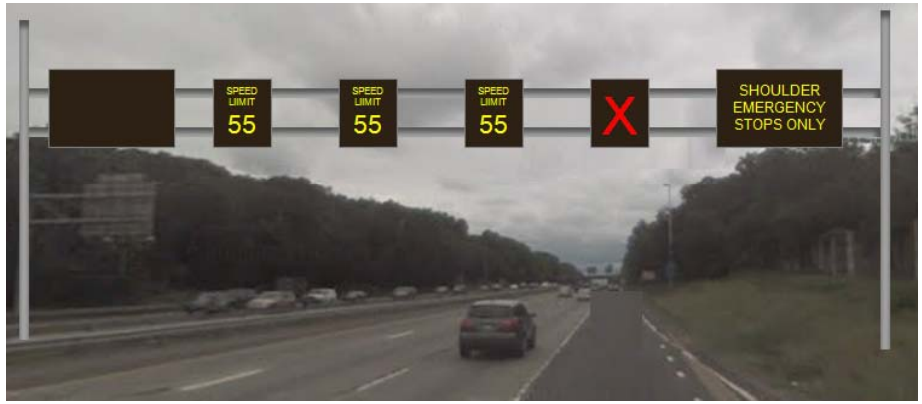
- District of Columbia (Exit 74) to Gainesville (US-29)
- 32 mile corridor with diverse needs and characteristics including suburban, urban, bidirectional peaks, transit, HOV, and ride sharing
- Assortment of ATM treatments proposed for different segments
- Two stage design-build procurement process



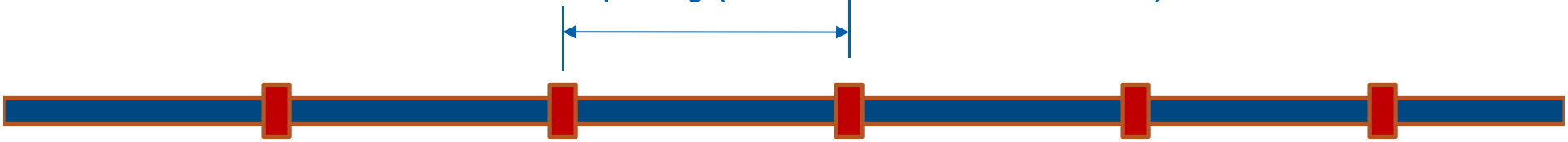
ATM Display Concept

Example with HOV Lane and Shoulder Running

Example with HOV Lane, No Shoulder Running



Between ½ mile to 1 mile spacing (1 Kilometer to 1.5 Kilometer)

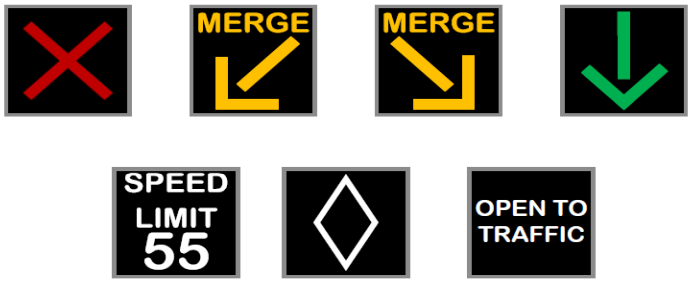


I-66 Active Traffic Management

Illustrative Video

I-66 ATM Timeline

- Received Statements of Qualifications from eight teams
- Short listed three teams and released RFP in early April
- Anticipating award this month
- Design and construction: Winter 2012 – Fall 2014
- ATM full Start-Up: Dec 2014
- Supplemental info available at: *www.virginiadot.org*



I-64 & I-77 Active Traffic and Safety Management System

I-64 Afton Mountain

I-77 Fancy Gap Mountain

<u>Primary goal</u>: Improve safety of travel along Afton and Fancy Gap Mountains

<u>Secondary goal</u>: Increase operational efficiency of travel along the corridors

I-64 Active Traffic and Safety Management System

Illustrative Video

I-64 & I-77 Active Traffic and Safety Management System

- **Next Steps Toward Implementation**
  - Development of System Requirements
  - Development of High-Level Design Document
  - System Verification and Validation Plans
  - Detailed Design Plans, Special Provisions and Estimates
  - Procure through Design-Build contracts

Connected Vehicle Technologies

Cooperative Transportation Systems Pooled Fund Study

- Partnership of 13 transportation agencies committed to the development and evaluation of Connected Vehicle applications
- VDOT has managed the program the last four years with assistance from UVA
- Program will prepare state and local transportation agencies for the deployment of Connected Vehicle technologies
- Members determine areas of interest to be investigated

Cooperative Transportation Systems Pooled Fund Study – Projects

Multi-Modal Traffic Signal System (April 2013 Completion)

- Concept of Operations, Requirements and High-level Design and Test Plans for a comprehensive traffic signal system for complex arterial networks including pedestrians and passenger, transit, freight and emergency vehicles

Traffic Management Centers in a Connected Vehicle Environment (in procurement)

- Investigation of how the Connected Vehicle environment will change TMC operations in the future

DSRC Vehicle Based Road and Weather Condition Application (in procurement)

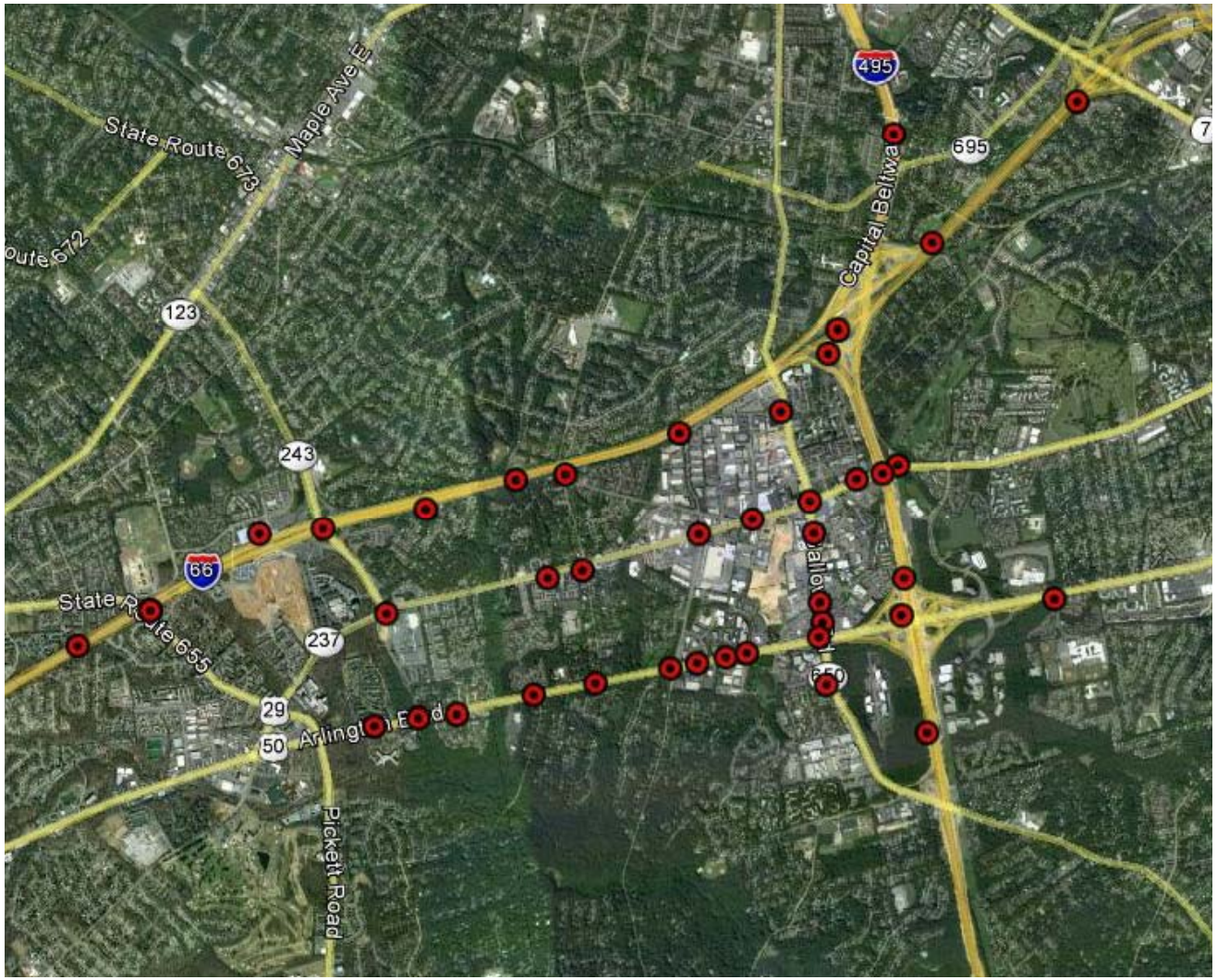
- Develop and test a maintenance vehicle equipped with 5.9 GHz dedicated short range communication (DSRC) applications to collect road and weather condition data for the Clarus system

Five previous projects completed

Virginia Connected Vehicle Test Bed

- In cooperation with Virginia Tech, UVA and Morgan State University, VDOT is establishing Connected Vehicle Test Beds at the Smart Road and along I-66 & major primaries in NOVA
- Test Beds will include roadside equipment, communication networks, and servers
- Connected Vehicle applications will be piloted at Smart Road first (includes signalized intersection)
- NOVA routes selected based on congestion, high crash rates and multimodal characteristics (I-66, US 50, US 29, Gallows Rd)

Proposed Road Side Infrastructure Sites
Northern Virginia



Equipment and Vehicles at Test Beds

- 47 Dedicated Short Range Communication Transmitters
- 200 Portable Aftermarket Safety Devices (Android-type)
- 10 instrumented cars
- 2 instrumented heavy vehicles (Semi, Motorcoach)

Leveraging Technology to Enhance the Driver Experience

Transform Unpleasant Driver Experiences…

Leveraging Technology to Enhance the Driver Experience

…into Pleasant Driver Experiences