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Virginia's Adaptive Traffic Signal Control Pilot Program

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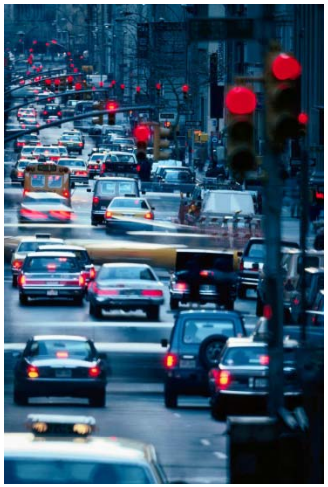
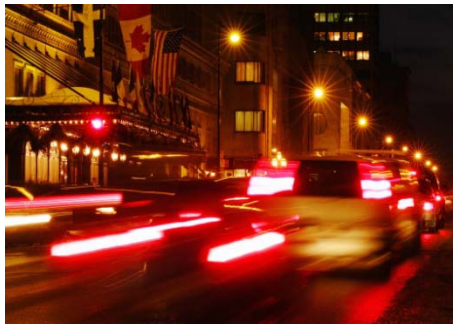
Traffic Signal Control: Current Practice

- Traffic signal timings are currently set based on historic traffic counts
- Timing plans developed for different days of the week and times of day
- Drawbacks:
  - Regular retiming is necessary to deal with changes in traffic patterns
  - Cannot adapt well to unexpected changes (crashes, special events, etc.)



Adaptive Traffic Signal Control

- Adaptive traffic signals use advanced computing to optimize signals on the fly at individual intersections or along a route
- No fixed timing plans
- Can adapt to variations in flow
  - Seasonal variations (shopping, recreational traffic)
  - Crashes or incidents



InSync Adaptive Signal Control

- VDOT is piloting Rhythm Engineering's InSync adaptive traffic signal control technology
- System functions as a plug-in for existing controller hardware
- Requires Ethernet communication between intersections
- Total cost averages around $40k per intersection (equipment + communications)

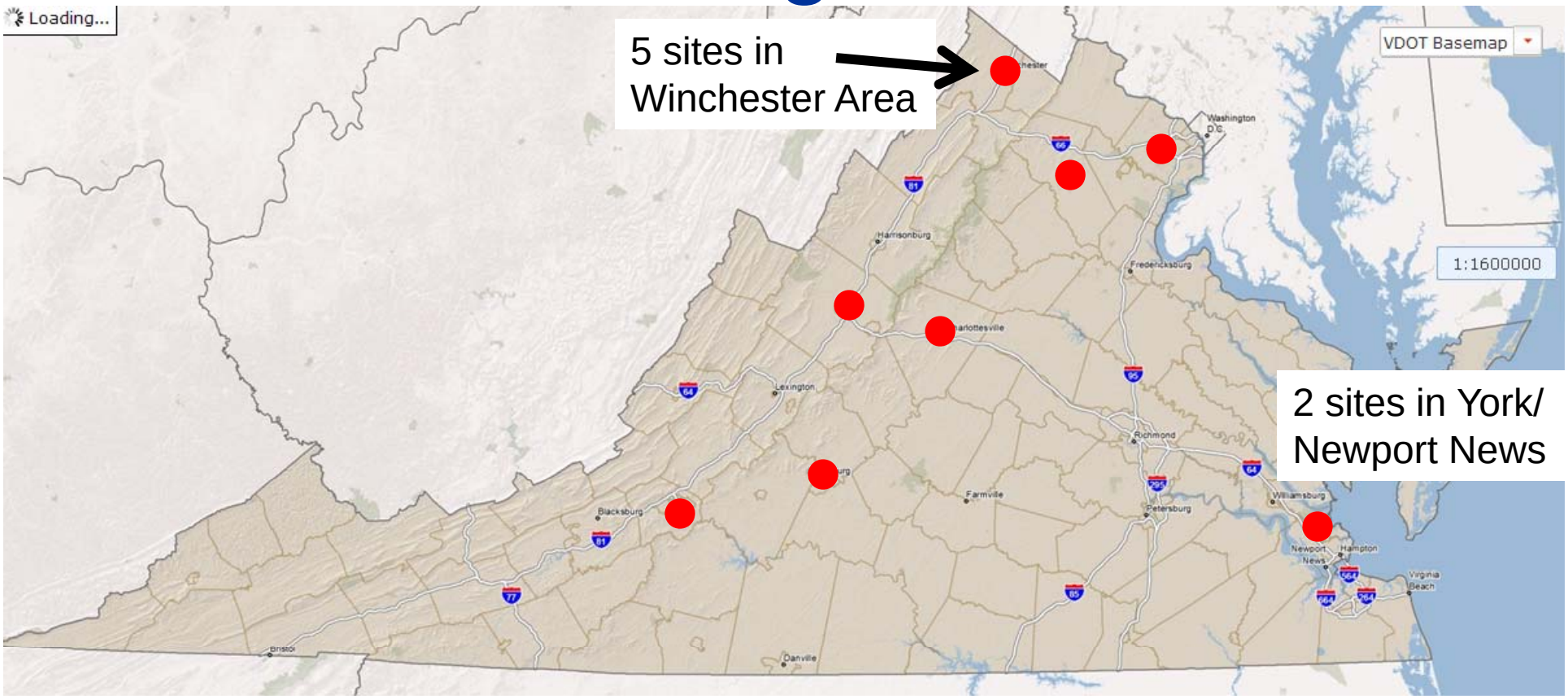
VCTIR Research Overview

- VCTIR is performing before/after evaluations of system
- Objectives:
  - Assess system effectiveness
  - Determine situations where adaptive control provides the most benefit
- Project to be completed in 2nd quarter of 2013

Pilot Corridor Selection

- Corridors selected by VDOT Central Office and Regions
- Daily and weekly fluctuations in traffic flow
  - Heavy traffic volumes
  - Highly variable traffic patterns
  - Special events and non-recurring traffic congestion
- Heavy side street traffic flow (but not oversaturated for extended periods of time)
- Conflicts with other traffic modes (peds, transit, etc.)
- Support from local authorities

VDOT Pilot Program Corridors



- 13 pilot corridors selected
- Mix of site characteristics

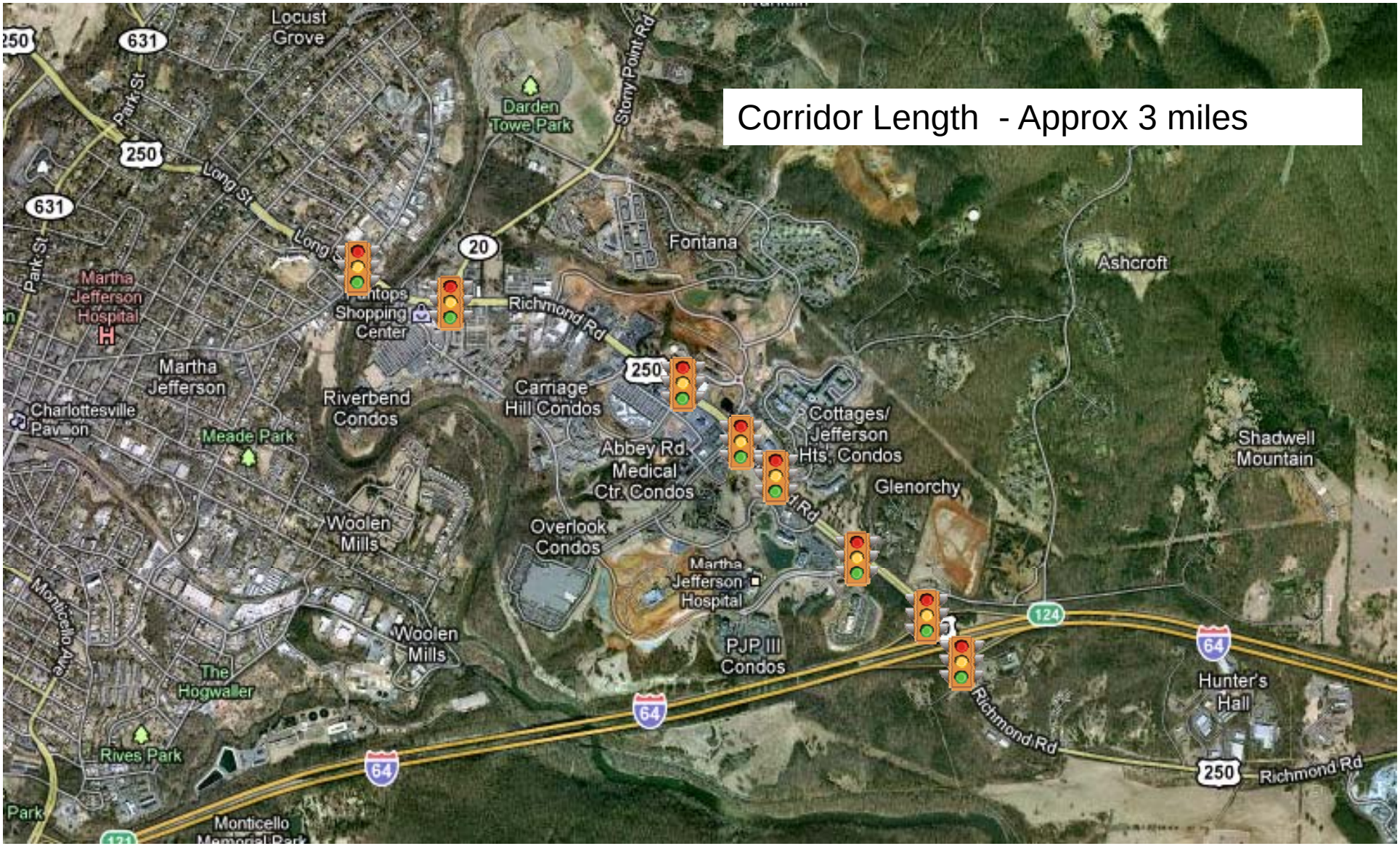
Evaluation

- Mainline operations
  - Travel time, speed, stops, queue lengths
- Side street operations
  - Delay, queue lengths
- Emissions and fuel consumption

Sample of Results

- US 250 in Charlottesville
- SR 7 in Winchester

US 250 Pantops Deployment



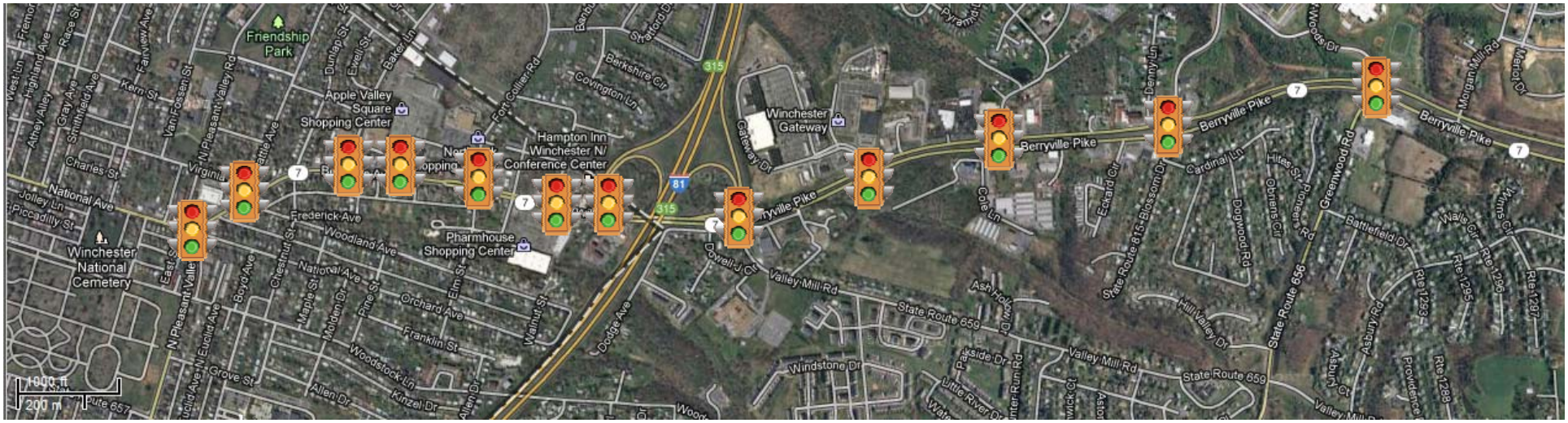
Results – Mainline Travel Time

Time Period	Direction	Before	After	Change
AM Peak	EB	7:06	4:54	-2:12 (-31.0%)
	WB	11:10	6:28	-4:42 (-42.1%)
Midday	EB	7:01	5:05	-1:56 (-27.6%)
	WB	7:46	6:34	-1:12 (-15.5%)
PM Peak	EB	9:08	5:18	-3:50 (-42.0%)
	WB	7:41	5:47	-1:54 (-24.7%)

Results – Mean # of Stops

Time Period	Direction	Before	After	Change
AM Peak	EB	4.00	1.55	-2.45 (-61.3%)
	WB	7.83	2.77	-5.06 (-64.6%)
Midday	EB	3.52	1.26	-2.26 (-64.2%)
	WB	4.55	2.53	-2.02 (-44.4%)
PM Peak	EB	5.55	1.15	-4.40 (-80.0%)
	WB	4.60	2.00	-2.60 (-56.5%)

SR 7 Winchester



- 12 signals
- Approximately 2.3 miles
- Frequent access points and I-81 interchange

Results – Mainline Travel Time

Time Period	Direction	Before	After	Change
AM Peak	EB	6:26	5:17	-1:09 (-17.9%)
	WB	7:56	6:47	-1:09 (-14.5%)
Midday	EB	6:34	5:04	-1:30 (-22.8%)
	WB	6:56	6:50	-0:06 (-1.4%)
PM Peak	EB	7:24	5:52	-1:32 (-20.7%)
	WB	8:20	7:26	-1:54 (-22.8%)

Results – Mean # of Stops

Time Period	Direction	Before	After	Change
AM Peak	EB	4.1	2.2	-1.9 (-46.3%)
	WB	4.6	2.7	-1.9 (-41.3%)
Midday	EB	4.6	2.3	-2.3 (-50.0%)
	WB	3.0	3.3	+0.3 (+10.0%)
PM Peak	EB	4.9	2.8	-2.1 (-42.9%)
	WB	3.8	3.2	-0.6 (-15.8%)

Results – Fuel Consumption

Time Period	Direction	Before	After	% Change
AM Peak	EB	0.1488	0.1299	-12.7%
	WB	0.1848	0.1651	-10.7%
Midday	EB	0.1565	0.1311	-16.2%
	WB	0.1753	0.1802	+2.8%
PM Peak	EB	0.1618	0.1396	-13.7%
	WB	0.1869	0.1807	-3.3%

Summary of Results to Date

- Most corridors saw significant operational improvements
- Preliminary results are encouraging:
  - Up to 40% reduction in travel time
  - Up to 80% reduction in number of stops
  - Significant fuel consumption savings

But Adaptive Control is Not a Silver Bullet…

- Effectiveness may be limited when:
  - Intersections are oversaturated
  - Corridor already functions well
  - Spacing between intersections is very wide, causing platoons of traffic to break up
  - Communications are unreliable

Next Steps

- Continue to examine performance on additional corridors
- Evaluate crash impacts
- Generate final guidelines on where system should be deployed
- Project to be complete in Spring 2013

Acknowledgements

- Mike Clements, VDOT Traffic Engineering Division
- VDOT Northwest, Southwest, Eastern, and Northern Regions

Questions?