Multimodal Coordination for Bus Priority Hotspots

Presentation to TPB Technical Committee

July 6, 2012

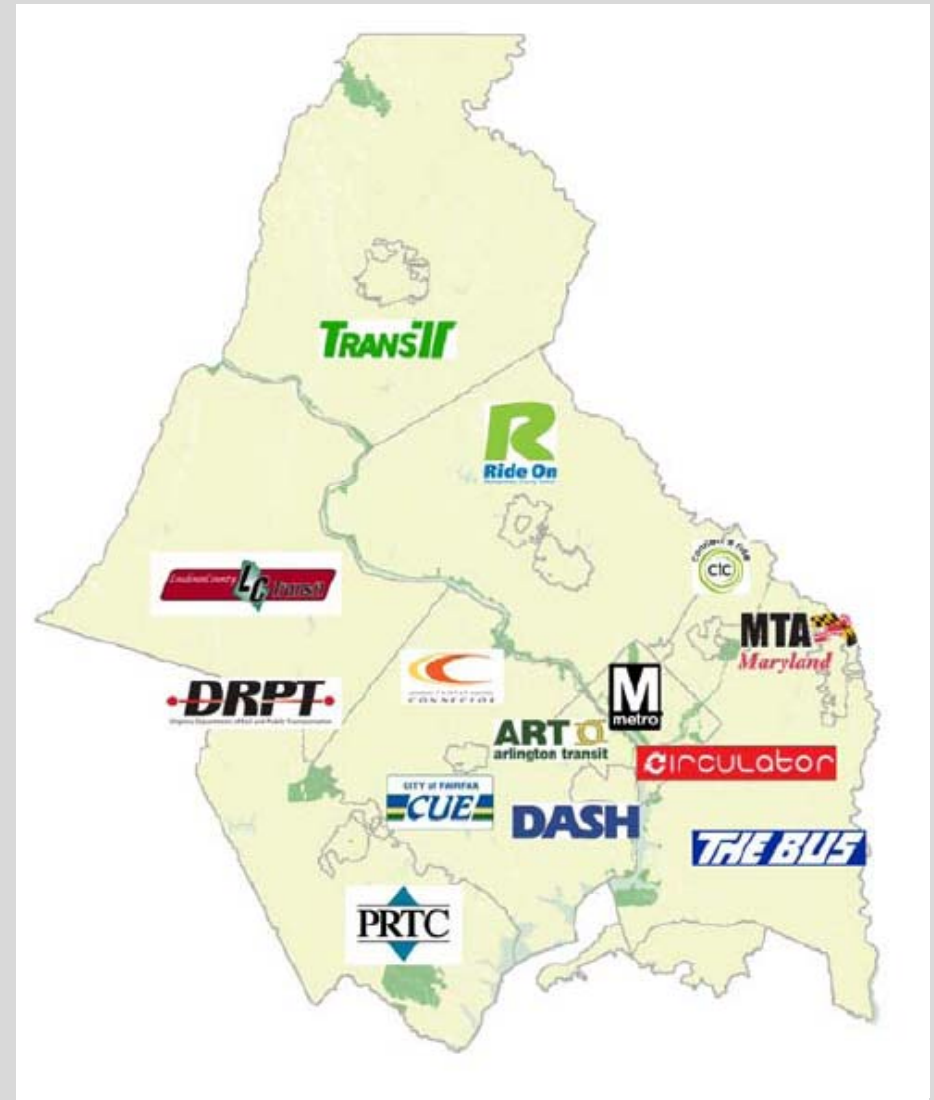Eric Randall & Andy Meese

Study Objectives

- Identify opportunities for roadway improvements that could increase average bus speed and on-time performance.
  - Builds on previous Priority Corridor Network (PCN) study, with its 20 year vision for surface transit enhancements.

- "Hot Spots" are specific intersections or segments in which modest investments in bus priority improvements could improve bus operations and reduce operating subsidies.
  - Builds on previous WMATA work for the Metrobus network, by including regional transit information.

- Study goal is to develop a prioritized list of Top 10 Hot Spots, providing input on implementation of bus priority treatments, and scoping possible costs, savings, and impacts.

Study Participants

- Coordination - TPB
- Technical Advisor – WMATA Office of Long-Range Planning
- Data and Observations – Regional Transit Providers
- Direction & Feedback – Regional Stakeholders
- Data Analysis, Field Verification, Reports – Consultant Team
  - Parsons Brinckerhoff – Prime, Hot Spots Verification, Design Concepts
  - Foursquare ITP – Database Development, Hot Spots List
  - Sabra, Wang & Associates – Traffic Analysis

Regional Bus Systems

- **Core Agencies**
  - Metrobus
  - Ride On
  - Fairfax Connector
  - DASH
  - DC Circulator
  - ART
  - CUE
  - The BUS

- **Commuter Bus**
  - MTA Commuter Bus
  - Omni-Ride
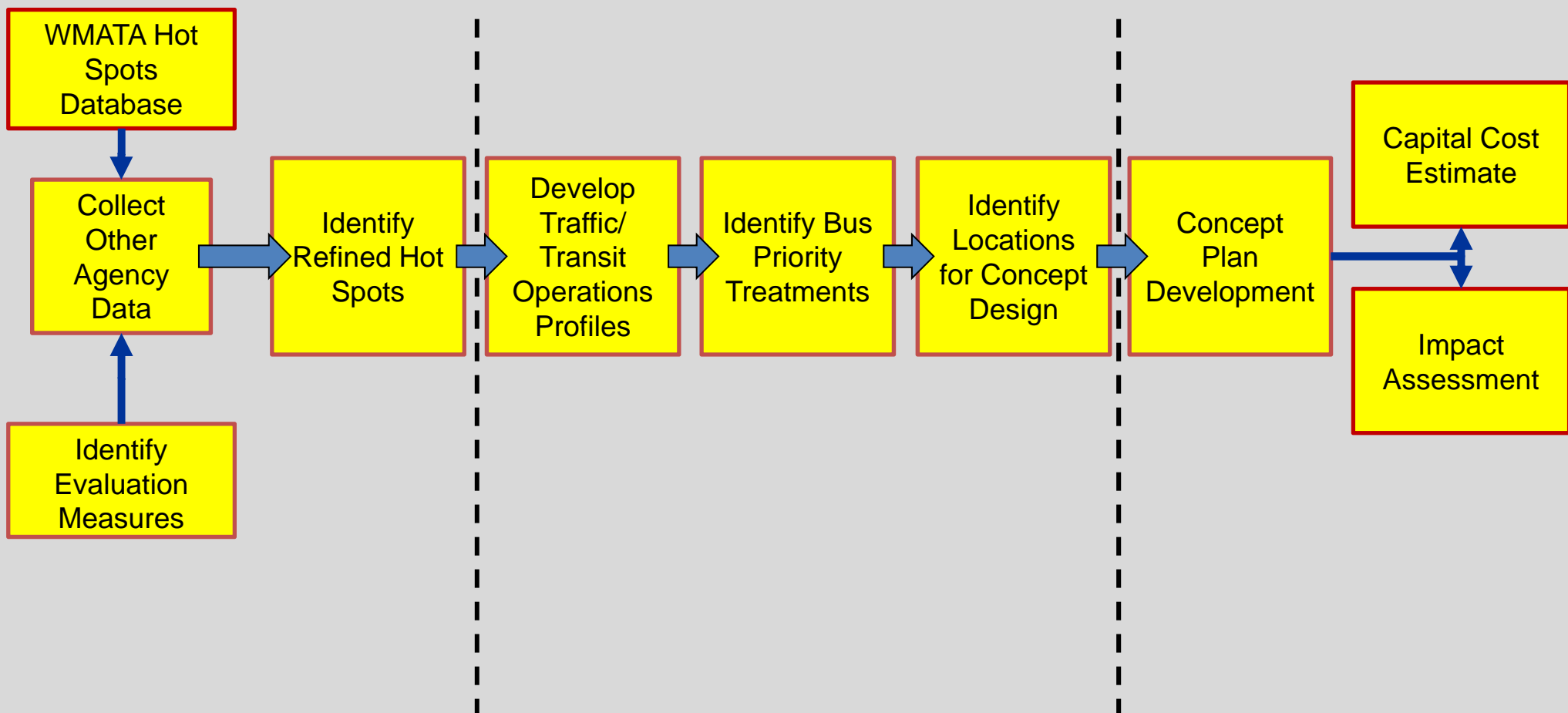 - LC Transit

- **Non Core Agencies**
  - TransIT
  - Connect-a-Ride

Study Approach

Task 2 – Develop "Top 15" Lists

Task 3 – Field Visits

Task 4 – Preliminary Design

WMATA Hot Spots Database

Collect Other Agency Data

Identify Evaluation Measures

Identify Refined Hot Spots

Develop Traffic/ Transit Operations Profiles

Identify Bus Priority Treatments

Identify Locations for Concept Design

Concept Plan Development

Capital Cost Estimate

Impact Assessment

Task 2 – Develop "Top 15" Lists / Initial Hotspot Database

- Top 15 sites initially identified in each jurisdiction: three lists
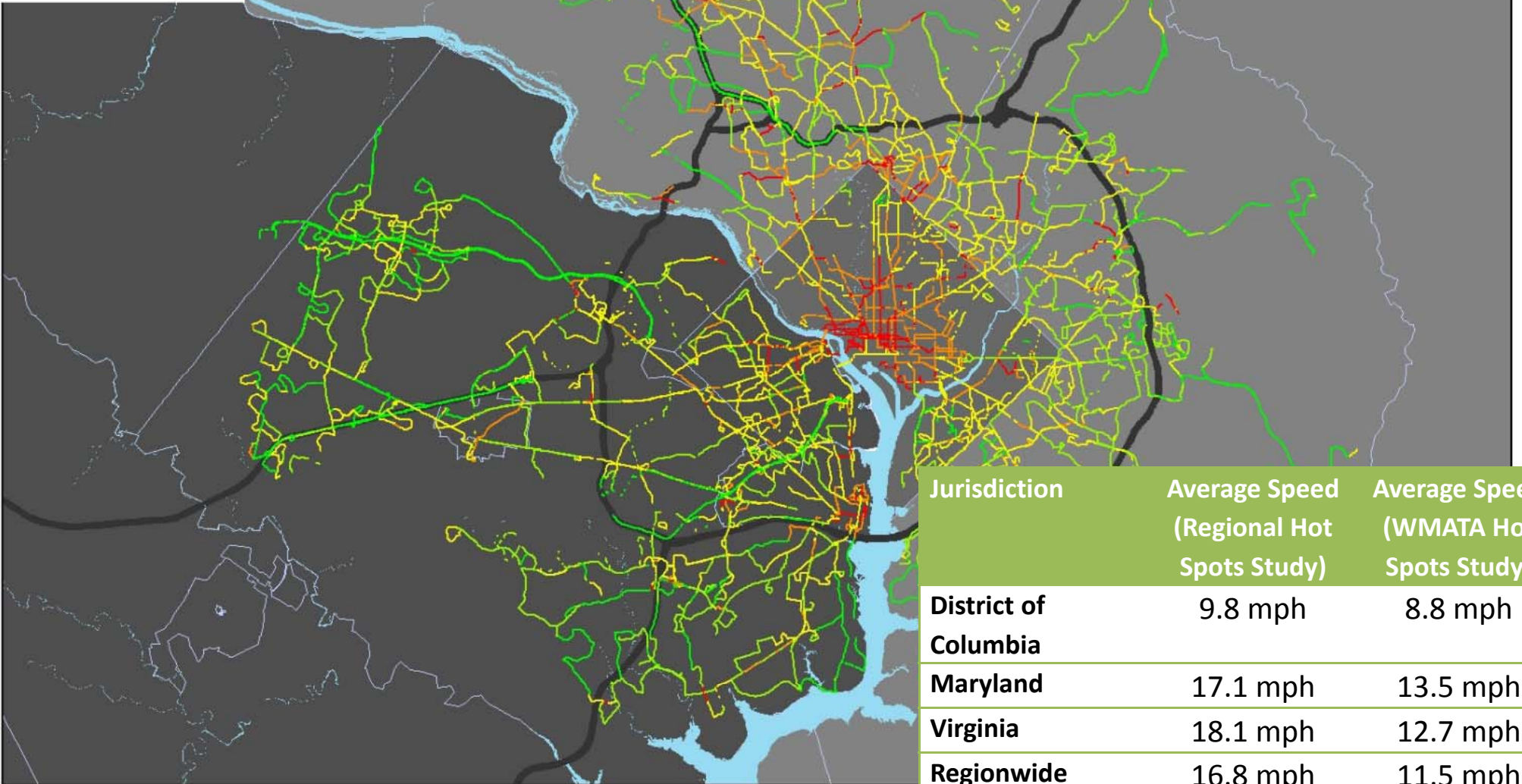 - AM peak delay, PM peak delay, All-day delay

Process:

1. Utilized existing bus speed data from and other agencies for locations without WMATA data
   - Input into NavTeq data layers on a road segment basis

2. Used number of bus trips for all agencies to weight roadway segments

3. Developed Hot Spots list based on scores
   - Segment Score = (15mph – speed) x Number of Buses in time period

Regional Bus Speeds

Legend

All Day Speed
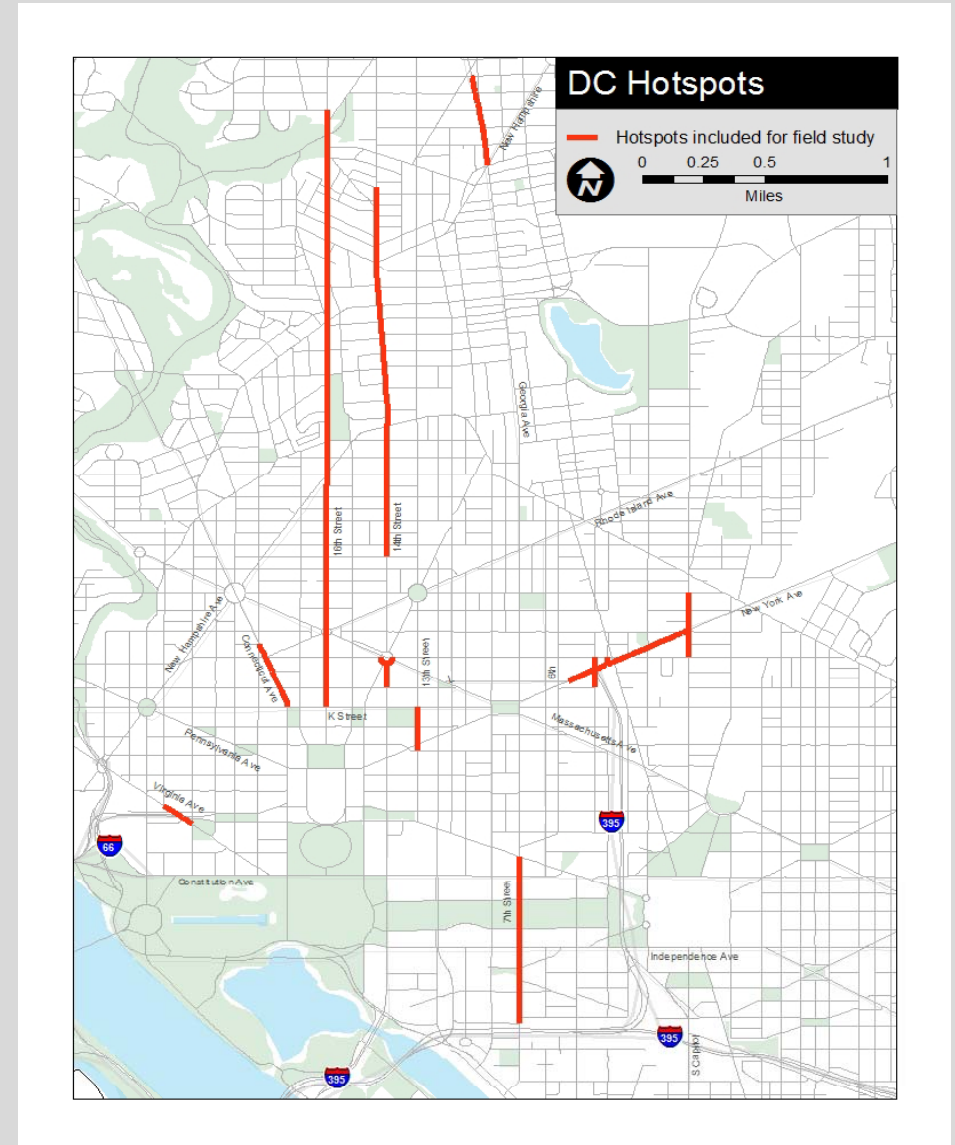
- 0 - 7.5 mph
- 7.6 - 10 mph
- 10.1 - 15 mph
- 15.1 - 20 mph
- 20.1 - 75 mph
- Interstate

| Jurisdiction	Average Speed (Regional Hot Spots Study)	Average Speed (WMATA Hot Spots Study)
District of Columbia	9.8 mph	8.8 mph
Maryland	17.1 mph	13.5 mph
Virginia	18.1 mph	12.7 mph
Regionwide	16.8 mph	11.5 mph

Top 10 DC Hotspots

- Virginia Ave. NW – E St. to D St.
- Georgia Ave. NW – Upshur St. to New Hampshire Ave.
- Wisconsin Ave. NW & Q St.
- 7th St. NW/SW – I-395 to Pennsylvania Ave.
- Connecticut Ave. – K St. to Jefferson Pl.
- 14th St. NW – Corcoran to Otis Sts.
- Thomas Circle (southern half) &14th St. NW (to L St.)
- New York Ave./N. Capitol St.
- 13th St. NW – H St. to K St.
- 16th St. NW – K St. to Shepherd St.

Top 10 Maryland Hotspots

- Georgia Ave. – 13th St. to Colesville Rd.
- River Rd. at Paint Branch Dr.
- Veirs Mill Rd./Reedie Dr./Amherst Ave.
- Fenton St. – MD 410 to Colesville Rd.
- East-West Hwy. – Georgia Ave. to Connecticut Ave.
- Piney Branch Rd. – MD 193 to Sligo Ave.
- Carroll Ave. – Maple St. to Ethan Allen Rd.
- Hungerford Dr. – Washington St. to Ivy League Ln.
- Annapolis Rd. – Finns Ln to Riverdale Rd.
- Wayne Ave. – Georgia Ave. to Colesville Rd.

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Top 10 Virginia Hotspots

- Wilson Blvd. – Ft. Myer Dr. to Moore St.
- Lynn St. – Key Bridge to 19th St.
- Joyce St. – Columbia Pike to Army-Navy Dr.
- Gallows Rd. – Belleforest Dr. to Inova Hospital
- Army Navy Dr. – Eads St. to Joyce St.
- Van Dorn St. – Eisenhower Ave. to Franconia Rd.
- SB Glebe at Arlington Blvd.
- Patriot Dr. – Lafayette Forest Dr. to Heritage Dr.
- Eisenhower Ave. – Van Dorn St. to Van Dorn Metrorail station
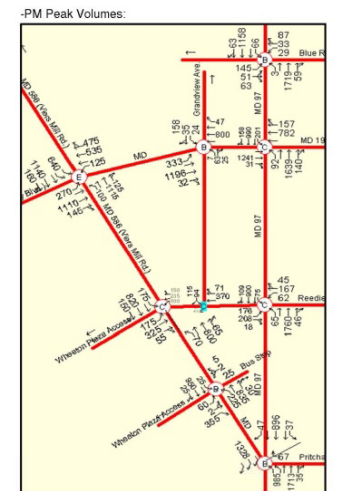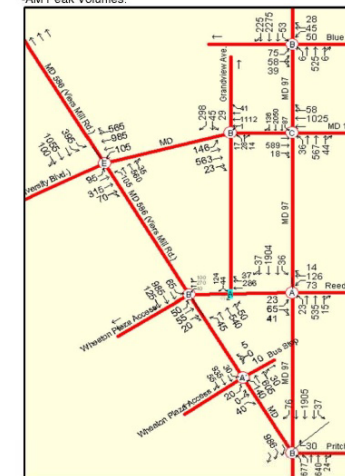- Route 123 – Jermantown Rd. to Folin Ave.
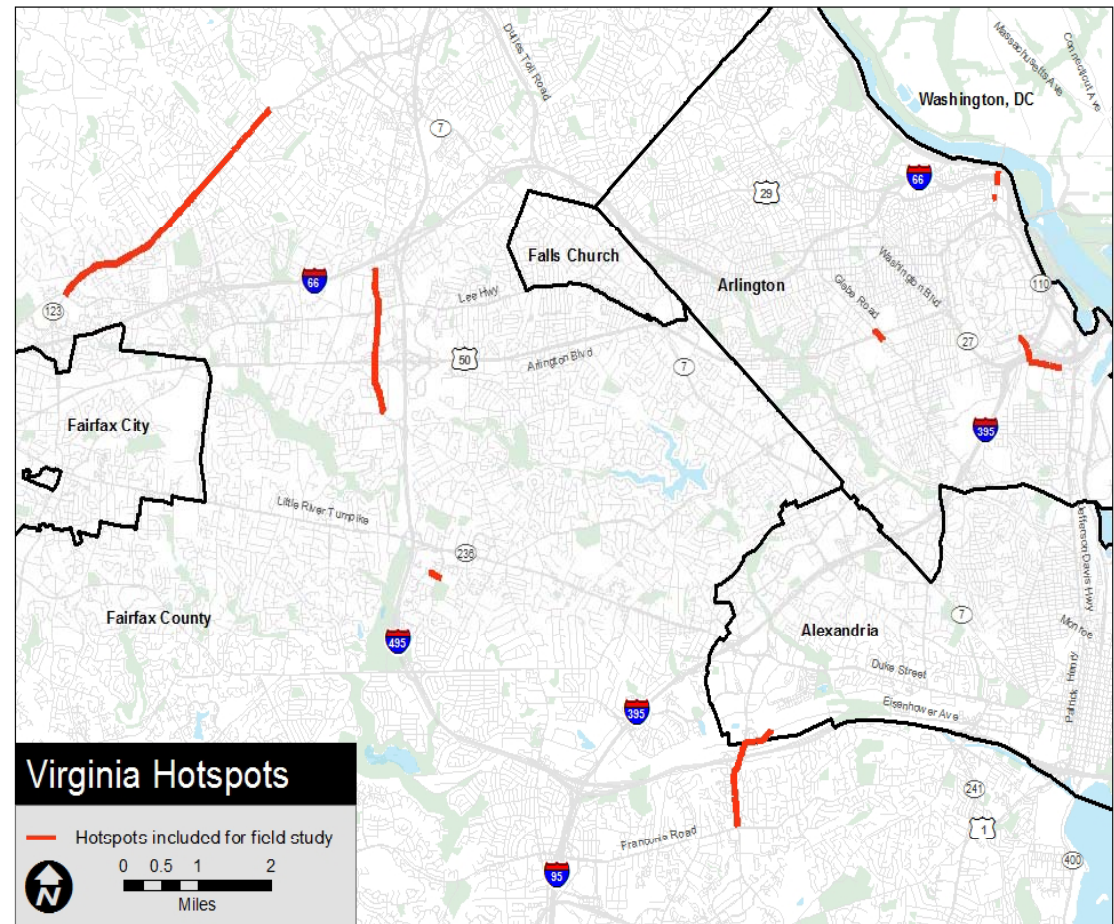
Task 3 – Field Verification Process

- Initial desktop inventory and traffic assessment
    - Turning movements
    - Intersection level of service
    - Lane configuration
    - Bus stop locations
    - Bus routings
- Data collection worksheet
    - Sidewalks, curb ramps, and crosswalks
    - Traffic and pedestrian signals
    - Bike lanes
    - Parking restrictions
    - Roadway width
    - Posted speed limits
- Identified critical peak period for hot spot site evaluation

Field Visits – Overall Considerations

- Each hot spot observed by a team including transit planners & traffic engineers:
  - Bus operations should experience significant delay.
  - Buses should not be at layover location.
  - Number and location of bus stops – too many? In right location?
  - Pedestrian/bicycle access and safety.
  - Locations where traffic signal timing appears to be inadequate.
  - Right-of-way constraints to any infrastructure improvements.
- Field visits recorded using video camera

Identify Bus Priority Treatments

- ## Corridor/Segment-Level
  - Exclusive Lanes
  - Signal priority – system application (TSP)
  - Passive Signal Coordination
  - Stop Consolidation

- ## Intersection-Level
  - Isolated TSP
  - Queue-jump signal
  - Bypass Lane
  - Curb Extension
  - Stop Relocation

SOURCE: TCRP Report 118 (5)
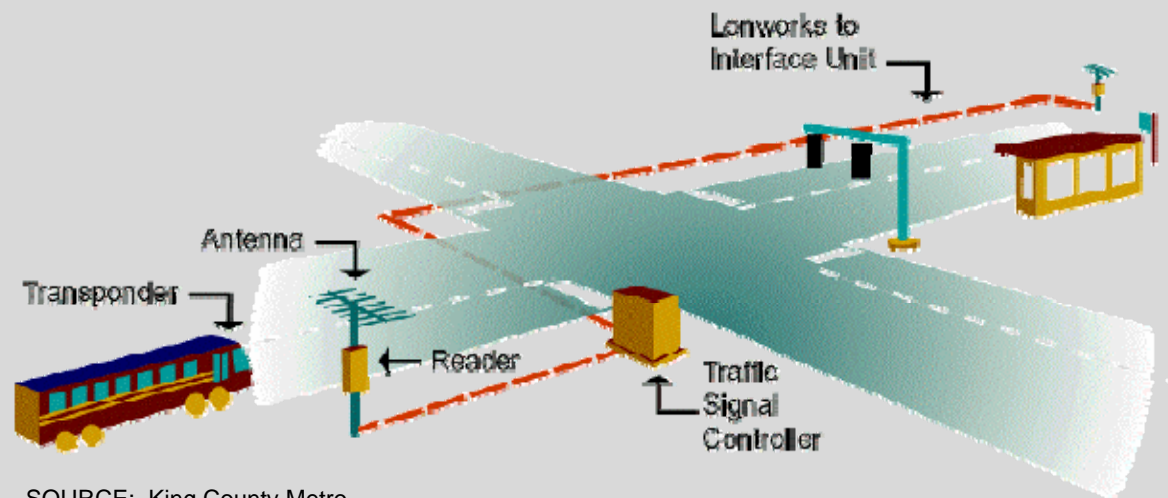
SOURCE: King County Metro

Task 4 – Concept Plan Development

- Concept Layouts with infrastructure improvements
  - Six locations (two each: DC, MD, VA)
  - Minimal or no ROW impact
  - 15% level of design
  - Use of scaled aerial photography

- Capital Cost Estimates
  - Limited number of quantities
  - Prior approval of unit costs
  - Could translate to FTA SCC format

Example: Field Verification Summary - DC

Street(s)	Rankings			Potential for Improvements			
	Daily	AM	PM	Physical	Transit	Signal	Long-Term
Virginia Ave. NW	1	2					
Wisconsin Ave. NW	9			x	x		
7th St. NW/SW	10	14	3			x	
Connecticut Ave.	11		2				
14th St. NW	13	10	8	**X**	**X**		
Thomas Circle & 14th St. NW	15		9				
New York Ave./N. Capitol St.				**X**		**X**	
13th St. NW		4	5	x			
Georgia Ave. NW		9		x		x	
16th St. NW		12			**X**		

x = Some potential for improvements
X = Strong potential for improvements
= Recommended for concept design

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Example Design: DC #2 – N. Capitol St.

- Problems Observed

  – Six-lane undivided section heavily congested
    - AM queues spill back to 4th St past Florida Ave.

  – Significant bus congestion on N. Capitol St. service roads
    - Very busy stops
    - Buses in SB service lane significantly delayed by 5 - 8 minutes (max delay 11 minutes).
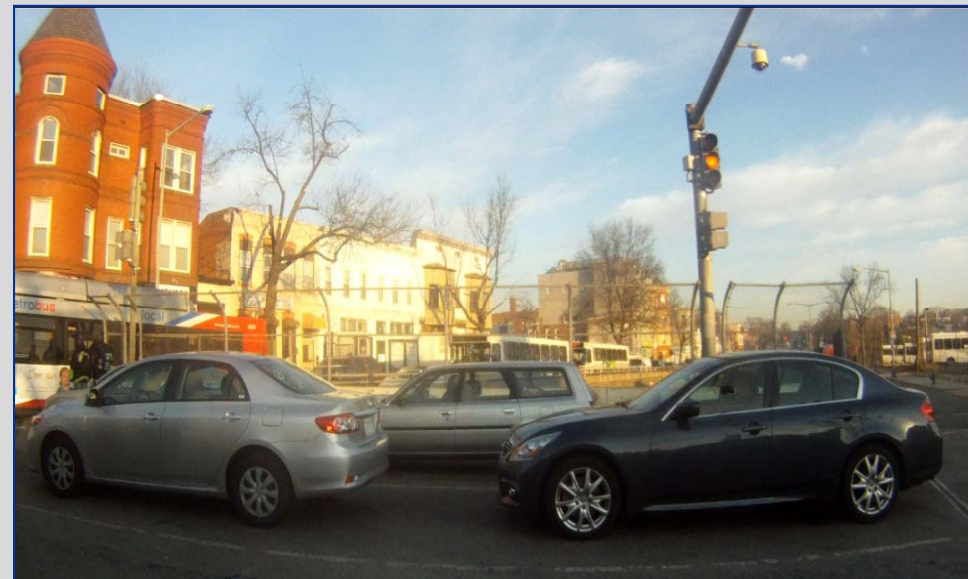
Example Design: DC #2 – N. Capitol St.

- ## Potential physical improvements

  - Bus lanes along N. Capitol St. service roads

- ## Potential signal timing improvements

  - Review signal timing at New York Ave./N. Capitol St. to reduce SB queuing

  - Deploy point control traffic officer to reduce intersection blockage

Hot Spot: North Capitol Street

P Street NW | P Street NE

North Capitols Street NW | North Capitols Street NE

O Street NW | O Street NE

New York Avenue NE

New York Avenue NW

LEGEND
- Daily Bus Volume
- Bus Stops
- Signalized Intersection

Comparison of Capital Costs

Chart legend:
- DESIGN & ENGINEERING
- DEMOLITION
- MOBILIZATION
- PAVEMENT/EARTHWORK
- TRAFFIC
- CONSTRUCTION - OTHER
- CONTINGENCY

Y-axis: $0, $200,000, $400,000, $600,000, $800,000, $1,000,000, $1,200,000

X-axis categories: 14th Street - Option 1, 14th Street - Option 2, North Capitol Street, Wheaton, Piney Branch Road, Van Dorn Street, Glebe Road
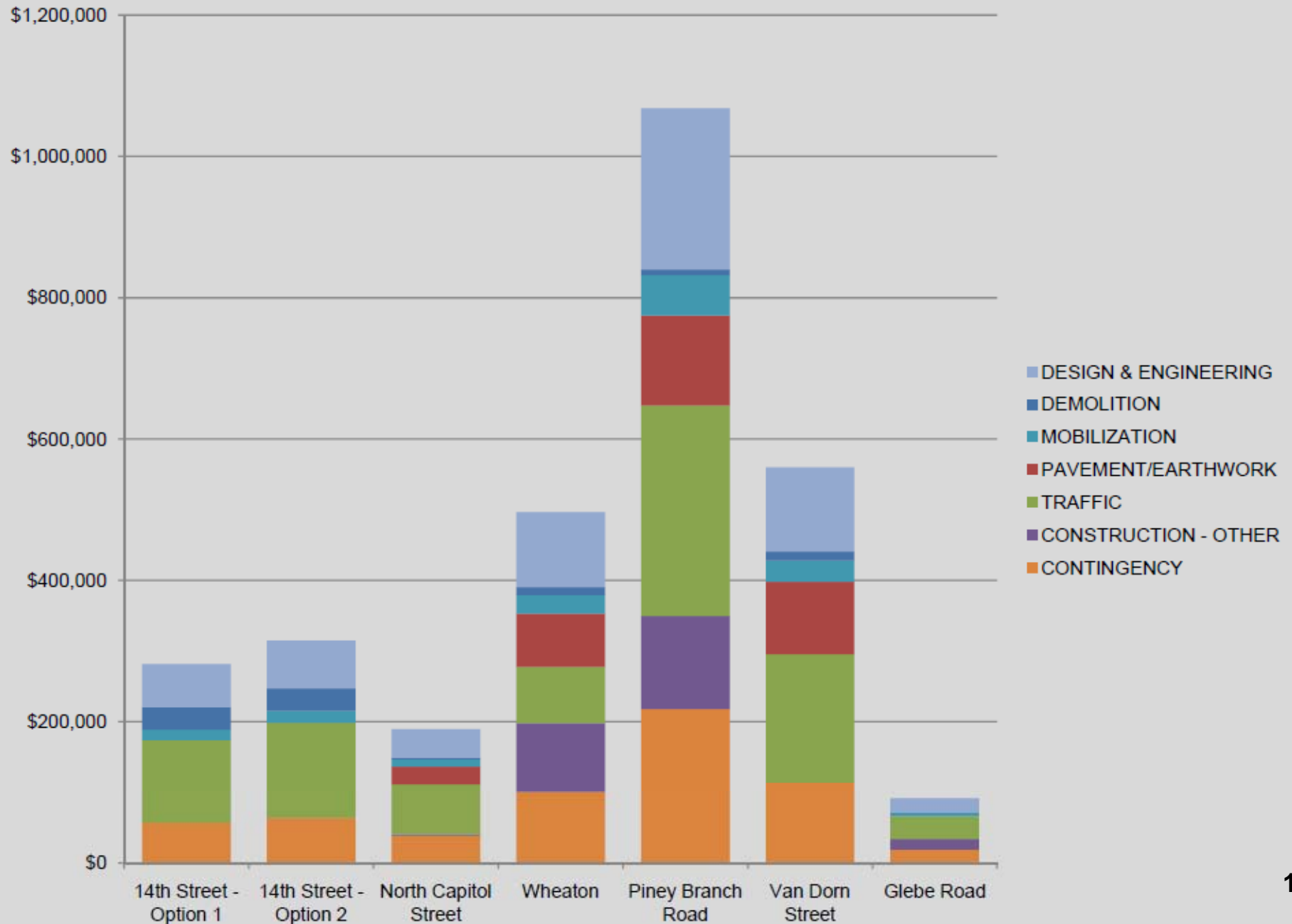
Task 4 – Impact Assessment

- Transit Operations
  - Unit travel time savings
  - On-time performance
  - Estimated bus operating cost savings – 5 & 20 years
  - MWCOG PCN Study and TCRP Synthesis 83
- Traffic Operations
  - Intersection LOS
  - Arterial Speeds
  - Queues
- Before and after impact summary

Example: DC #2 – N. Capitol St.

Traffic Impacts

- Queues and delays for vehicles and buses along New York Ave and North Capitol Street are related to downstream congestion

NY/N. Capitol SB RAMP	HCM Avg. Control Delay	HCM V/C Ratio	HCM LOS	SB Approach LOS
Existing AM	9	0.61	A	D
Queue Jump & Bus Lane Conversion AM	11.6	0.67	B	D
Split Adjustment AM	8.9	0.61	A	D
Existing PM	14.2	0.75	B	D
Queue Jump & Bus Lane Conversion PM	16.9	0.87	B	D
Split Adjustment PM	61.3	0.8	E	D

NY/N. Capitol NB RAMP	HCM Avg. Control Delay (Sec.)	HCM V/C Ratio	HCM LOS
Existing AM	9.7	0.61	A
Queue Jump & Bus Lane Conversion AM	12	0.66	B
Split Adjustment AM	9.6	0.61	A
Existing PM	14.3	0.83	B
Queue Jump & Bus Lane Conversion PM	9.3	0.82	A
Split Adjustment PM	65.7	0.89	E

Preliminary Operating Cost Savings

- Highly conservative estimate
- Time savings of individual improvements applied to bus volumes & multiplied by WMATA FY13 *non-regional service* platform hour cost
  - Bus lane time savings calculated from TCRP Report 118
  - Queue-jump & TSP time savings derived from Synchro outputs
- Based on 7 weekday peak hours only
  - 6-9 AM; 3-7 PM
  - "Shoulders" of peak discounted at 80% of time savings

Example: MD #2 – Piney Branch Road
Preliminary Bus Ops Impacts

- For some locations, able to estimate potential operating benefits and resulting cost savings

	Annual Time Savings (pl hr)	Annual cost savings	5-year cost savings (discounted)	20-year cost savings (discounted)
Queue-Jumps	173.0	$19,058	$89,743	$289,817
TSP	466.3	$51,378	$241,933	$781,301
Total	639.2	$70,436	$331,676	$1,071,118

- However, the Synchro model only works for medium-scale priority treatments, not single locations. More costly microsimulation would be needed to assess single locations.

Multimodal Coordination and Bus Hot Spots Study – *Conclusions / Final Steps*

- Overall, specific bus priority improvements are fairly modest
  - Minimal or no impact on general traffic LOS
  - Capital costs are sizable: ~$100K per intersection
    - However, costs are reduced if integrated with other work, such as re-paving, signal upgrades, etc.
  - Benefits are also modest; indeterminate for single locations

- Noteworthy that many Hot Spots locations already under study (i.e., corridor studies) or have planned improvements (e.g., Glebe Rd).

- Final deliverables received from consulting team. Final comments received from regional participants.
  - TPB Staff will conduct final review and distribute.

Multimodal Coordination and Bus Hot Spots Study – *Further Application*

- The findings of this study offer both:
  - For some locations, an independent assessment of potential improvements and the associated costs and impacts.
  - More broadly, the study provides a general process for assessing bus hot spots and their potential costs and impacts that can be used for future efforts.

- Task #2 developed a list of "Top 15" Hot Spots for DC, MD, and VA (AM, PM, and all-day)
  - Prioritized locations provide an opportunity for further analysis of potential bus priority treatments by jurisdictions.