INTEGRATED CORRIDOR MANAGEMENT

Enhancing personal mobility for all travelers

presented by
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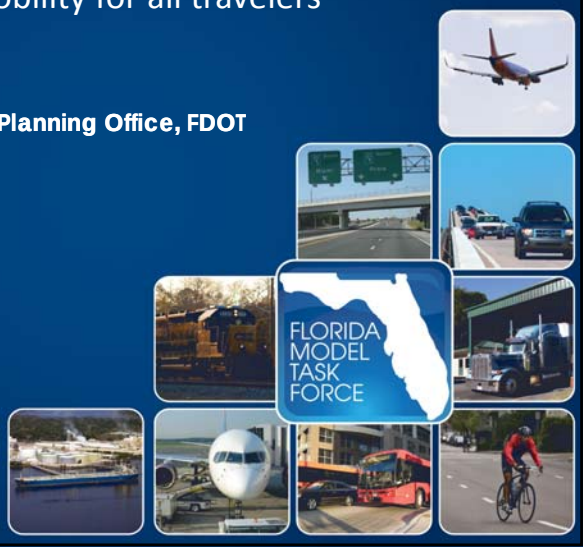
March 26, 2014



VA I-95 Corridor Vision

- **VDOT Secretary/Commissioner's New Technology Initiative**
  Application of new and emerging concepts and technologies to address regional mobility needs
- **Application Concepts**
  Integrated Corridor Management (ICM) and ATM/HSR/Q-Warning Systems, Connected Vehicle (CV)
- **Treatment for HOV Lane Terminations**
  Problem: Bi-directional HOV lane creating large vehicle queues at its terminations and hazardous situations for drivers when they are un-expectantly encountered
  Solution: Deploy hazard detection and warning system at both HOV termination locations. Queue warnings will be relayed through variable message signs along with mile marker location of the queue.
- **Real-time Inclement Roadway Warning System**
  Problem: Hazardous weather related situations for drivers when they are un-expectantly encountered
  Solution: Real-time inclement roadway warning system employing weather sensors at critical locations will relay hazardous information to approaching drivers including high-wind and frozen roadway conditions
- **Technologies for Optimal Multimodal Route Selection**
  Proposed technologies focus on optimizing the roadway network capacity through effective route decisions. Suite of technologies will monitor travel times for each multimodal option from a given location – Information at all ICM nodes such as transit stations, park and ride locations, and truck related elements - overnight parking availability, height and weight restrictions, and roadside inspection stations
- **Connected Vehicle (CV) Ready**
  Proposed technologies produce data elements used within CV environment - travel times, parking availability, and stopped queue ahead are applications envisioned for CV.

Today's Corridors: Independent Systems

Arterial Signal Systems	Freeway Systems	Rail Systems	Bus Systems	Parking Systems

- Efforts to date to "reduce congestion" have focused on optimization of individual systems
- Significant investments in ITS Technologies
- Tremendous opportunities to integrate operations to manage total corridor capacity

With Integrated Corridor Management

Significant Congestion	*ICM Systems*	*Managing All Corridor Capacity*

multi-agency collaboration and coordination

ICM Benefits

❖ Congestion management tool combining advanced technologies and innovative practices.

❖ Proactively manages available capacity across modes along a corridor optimizing the use of transportation infrastructure assets.

❖Corridor is managed as a system— multi modal, multi agency, multi-jurisdictional

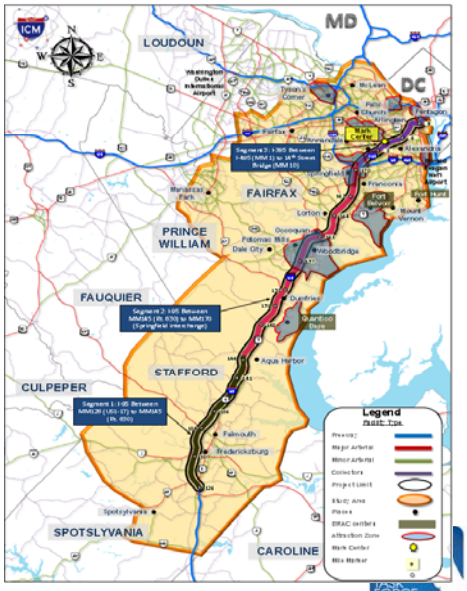
accessibility, flexibility, reliability

Purpose of VA ICM Initiative

- Address multi-modal commuting and through traffic issues in I-95/I-395 corridor, including:
  - Auto, carpool, rail, bus, other options
  - Connectivity between modes
- Identify innovative technologies to facilitate multi-modal local, regional and national corridor travel
- Identify tools to provide real-time traveler Information related to travel times and parking
- Address tools to enhance capacity and safety such as hard shoulder running, Q-Warning and other active traffic management schemes

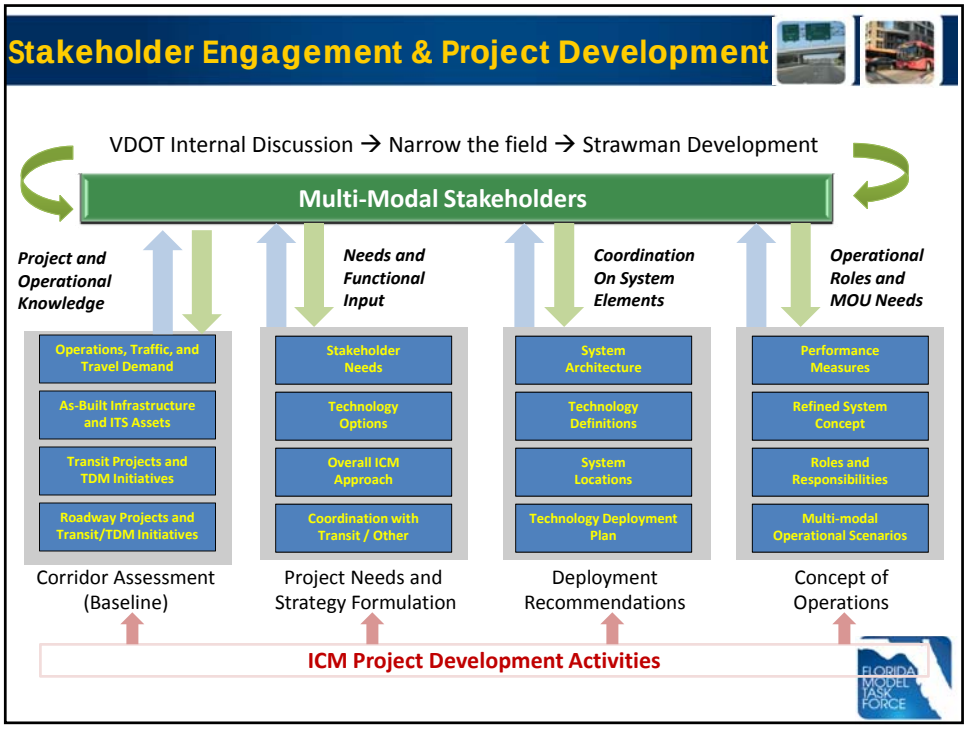
I-95/I-395 Project Details

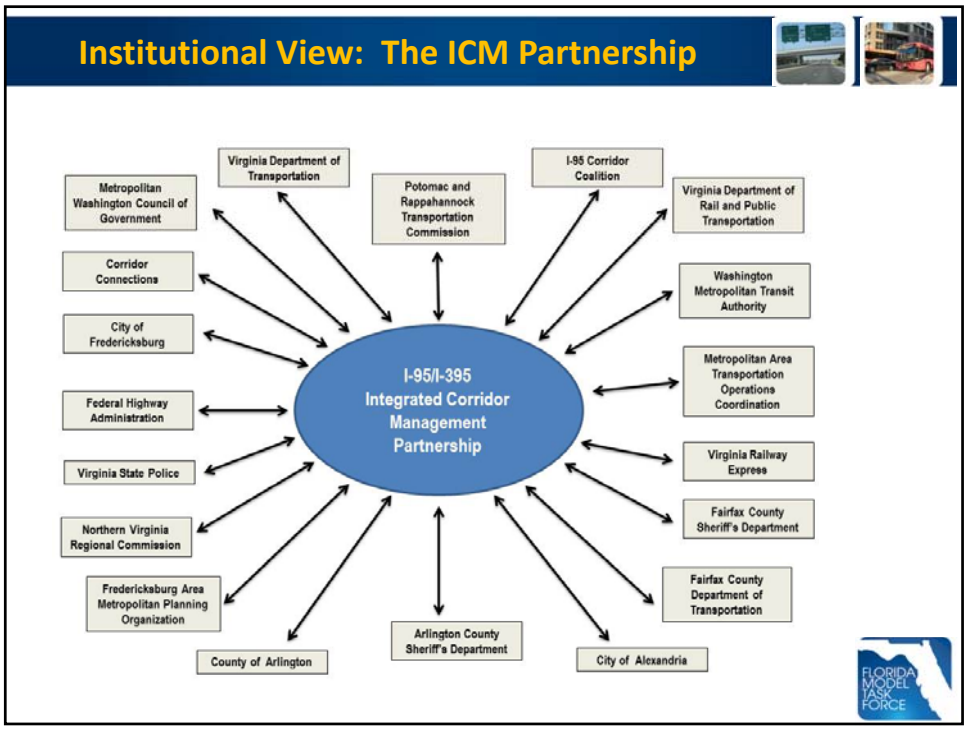
- I-95 / I-395 ICM ConOps & Project Development Task began in October, 2011
- Project Limits - Spotsylvania Interchange to 14th Street Bridge
- Project Segments
  - I. US 1/17 to Rt 610 (MM126-144)
  - II. Rt 610 to I-495 (MM144-170)
  - III. I-495 to 14th St Br (I-395, MM0-8)
- Develop ICM application strategies, and technology-based solutions



Key ICM Deliverables

- Concept-of-Operations
- ICM Architecture and Systems Engineering Management Plan
- Deployment Plan - Technology Bundles/ Project Works Packages (Corridor-wide and Segment-based)
- ICM Partnership - Institutional Framework for ICM Implementation


Stakeholder Engagement & Project Development
VDOT Internal Discussion → Narrow the field → Strawman Development
Multi-Modal Stakeholders
Project and Operational Knowledge
Needs and Functional Input
Coordination On System Elements
Operational Roles and MOU Needs
Operations, Traffic, and Travel Demand
As-Built Infrastructure and ITS Assets
Transit Projects and TDM Initiatives
Roadway Projects and Transit/TDM Initiatives
Stakeholder Needs
Technology Options
Overall ICM Approach
Coordination with Transit / Other
System Architecture
Technology Definitions
System Locations
Technology Deployment Plan
Performance Measures
Refined System Concept
Roles and Responsibilities
Multi-modal Operational Scenarios
Corridor Assessment (Baseline)
Project Needs and Strategy Formulation
Deployment Recommendations
Concept of Operations
ICM Project Development Activities
FLORIDA MODEL TASK FORCE


Institutional View: The ICM Partnership
Metropolitan Washington Council of Government
Virginia Department of Transportation
Potomac and Rappahannock Transportation Commission
I-95 Corridor Coalition
Virginia Department of Rail and Public Transportation
Corridor Connections
Washington Metropolitan Transit Authority
City of Fredericksburg
Metropolitan Area Transportation Operations Coordination
Federal Highway Administration
I-95/I-395 Integrated Corridor Management Partnership
Virginia State Police
Virginia Railway Express
Northern Virginia Regional Commission
Fairfax County Sheriff's Department
Fredericksburg Area Metropolitan Planning Organization
Fairfax County Department of Transportation
County of Arlington
Arlington County Sheriff's Department
City of Alexandria
FLORIDA MODEL TASK FORCE

State-of-Play & Activities Integration

- Freeway / Reversible HOV Operations
- Parallel/Connecting arterial Operations
- HOT Operations (under development)
- Commuter rail, express and local bus, Metro rail Operations
- 40,000+ parking spaces (VDOT, transit)
- 1000 vanpools, 4000 carpools daily
- 6450 “slugs” daily (2009 VDOT)
- Real-time Ridesharing Pilot
  - Est. 500 riders, 1000 drivers

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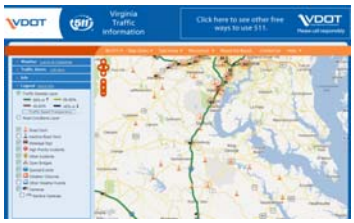
Corridor Transportation Needs

Freeway Needs	Expand real-time traffic data and monitoring capability south of MM145 (limited or no detection)
	Improve warnings of mainline and off-ramp queuing to reduce crash potential
	Make better / more efficient use of road capacity to reduce / eliminate bottlenecks
	Improve alternate route and mode information to improve traveler awareness of route/mode options under congestion / incident conditions
	Improve incident management coordination between VDOT and counties outside Fairfax (i.e., PW, Stafford, City of Fredericksburg, Spotsylvania)
Arterial Needs	Optimize signal operations to handle rerouted traffic
	Optimize signal operations and interchanges to reduce off-ramp queuing
	Prioritize express transit services along corridor as well as between park-and-ride lot and I-95
	Obtain comparative travel time data on alternate routes
	Improved incident management coordination for arterials
Transit Needs	Reduce bus operational delay due to signal operations
	Coordinate diverse, separate sources for transit information (real-time and static)
	Provide accurate travel time information for express bus and rail transit services
	Provide next bus / train info for drivers in order to help decide whether mode shift is appropriate
	Enhanced parking information in support of more efficient use of park-and-ride capacity and increased traveler convenience
	Next bus / train info at stops (VRE, buses) to reassure users
Parking Needs	Improve use of available parking capacity at park-and-ride lots (some are full all the time, others are relatively empty)
	Inform drivers of parking status / availability at VDOT lots for park-and-ride, express bus, carpool / rideshare activities
	Support traveler/driver mode choice or mode shift decisions by coordinating parking availability with next train/bus information
Travel Demand Management	Need to improve information to travelers on options – many resources, no one portal that integrates them
	Integrate trip planning functions to include rideshare / carpool / slug-line options and plan for park-and-ride use to support this
	Tie together / integrate currently unconnected multiple resources and services for different types of real-time traffic, travel, TDM information, etc.

Needs Highlight

- Need real-time, multi-modal, end-to-end, traveler information data and services
- Need a single access point to an integrated multi-modal trip planning to include TDM options
- Need real-time parking availability
- Need enhanced incident management
  - Local incident info from local police CAD
  - Arterial incident coordination
- Need optimized signal operations
- Need to address Mark Center traffic impact



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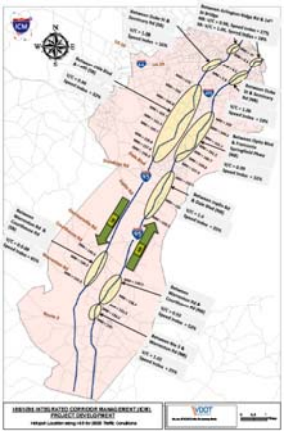
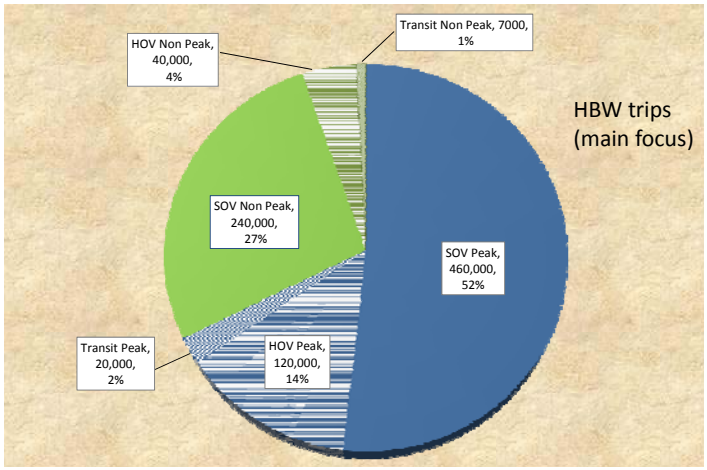
Opportunity Definition



- Challenges
  - Shifting demand to available seat capacity
  - Reducing number of peak vehicles
  - Making better use of capacity at park-and-ride facilities
  - Multiple sources of information on travel within corridor
- What's promising…
  - Many initiatives underway
  - Strong interest in developing a multi-modal corridor solution!
  - High-level support and encouragement

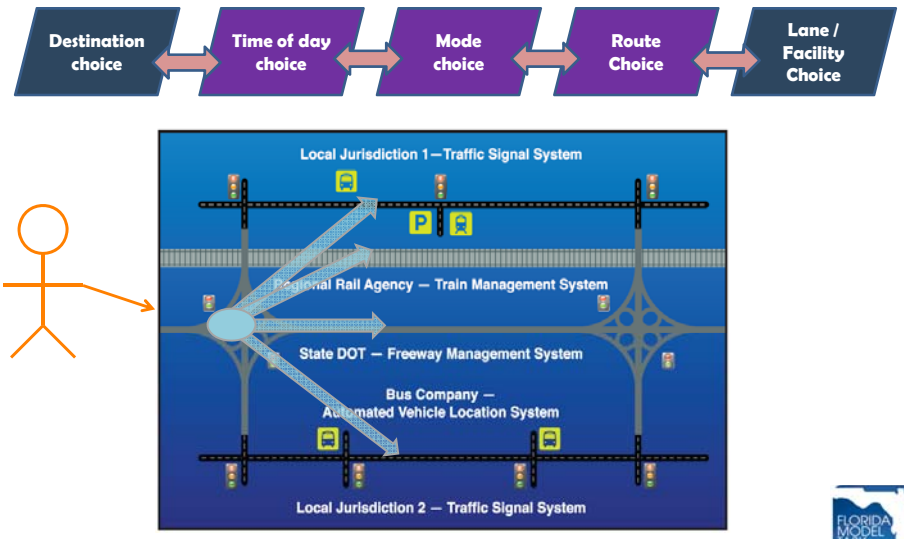
Trip View: Entire Corridor
(I-95/395 and surrounding / connecting routes)

(885,000 home-based work trips daily)

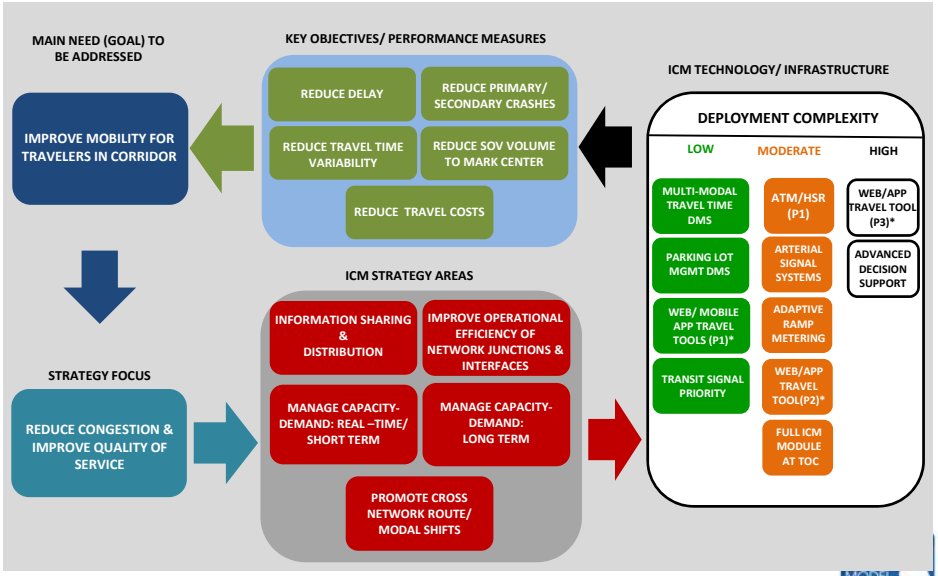


HBW trips (main focus)

The Commuter's View of ICM



ICM Vision for I-95 / I-395 Corridor



ICM Applications in I-95/395

- **Travel Time Information for All Travel Modes**
  - Pre-trip and en-route travel time information for multiple travel modes along the corridor (95/395. HOT, US1, bus, train)
  - Delays, congestion, restrictions at bases / work locations
  - Personal trip planning tool (end-to-end, compare/mix travel modes)
  - Address road and transit options and available parking should transit, carpool or slugging option be considered by the traveler

- **Real-time Parking Management and Guidance**
  - Park-and-ride space and guidance information (VDOT, VRE, WMATA parking facilities near I-95) for travelers entering the corridor via arterials, where they may have two or more options relative to parking and either carpooling, slugging or using transit.
  - Comparative travel time information for transit options (including next bus / train departure) would be presented along with parking space availability.

Supporting ITS Technologies

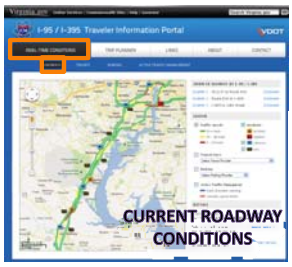
- Vehicle Detection Systems
- CCTV Cameras
- Video Incident Detection Systems
- Full-Matrix DMS
- Fiber Optics Communications
- High-Speed Wireless Communications
- Roadside Wireless Networks
- Bluetooth Probe Readers

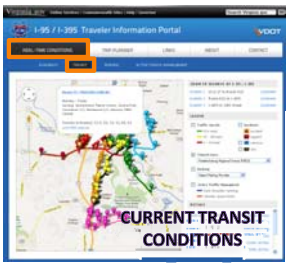
Integrated Multimodal ITS

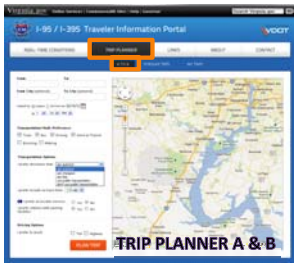
- Real-time traffic signal timing, control, and coordination, Transit signal priority
- Adaptive ramp metering
- ATM Tools – HSR, DLM, QW
- Multimodal traveler information / Actionable traveler information
- Integrated electronic payment
- HOT lanes/congestion pricing

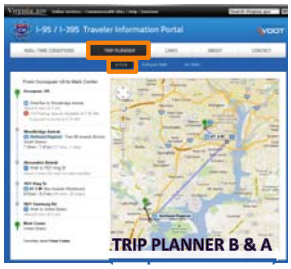
connectivity is key

Multi-Modal 511 Interface Approach







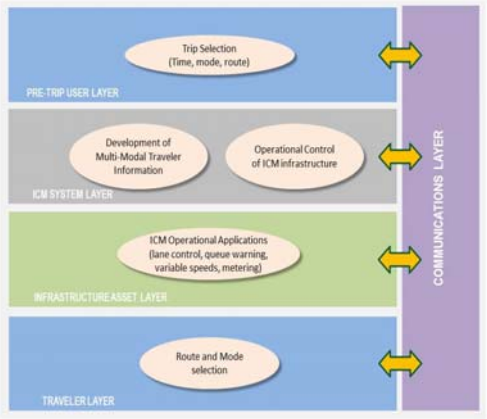


Deployment View:
Project Packages Derived from "Building Blocks"

	ICM Infrastructure		ICM Traveler Information	ICM Decision Support
Phase 2-3	Arterial Enhanced Signal Operations	Freeway Active Traffic Management	Personalized Multi-Modal Real-Time Trip Planning	Modeling and Decision Support
Phase 1	Multi-Modal and Parking Information Systems		Expanded Multi-Modal & Parking Information for 511	Performance Management
Early Start	Integrated Single Info Gateway (including kiosks)			

Existing Traffic Data | Existing Transit Data

Concept of Operations: Functional View



- Five distinct layers of activities:
  - Pre-Trip User Interface
  - System Layer
  - Infrastructure Asset Control
  - Traveler Interface (en-route)
  - Communications
- To enable these operational activities, consider specific ICM building blocks categorized into:
  - Infrastructure-Based ITS Services (typically operations-oriented)
  - Traveler Information Services
  - Decision Support

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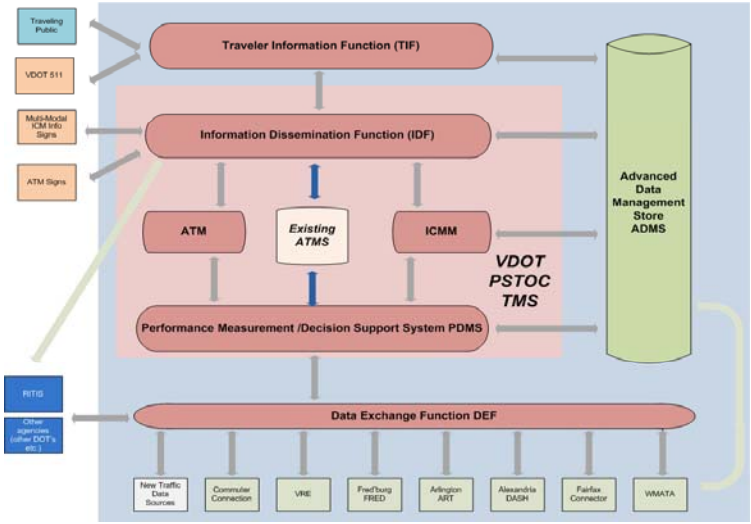
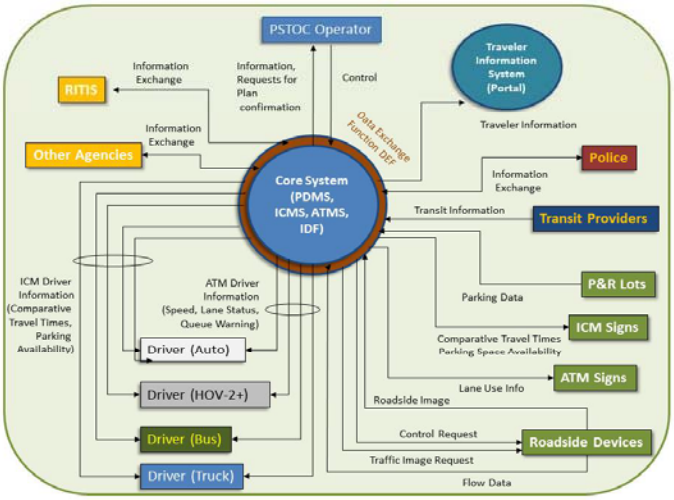
I-95/I-395 ICM System (ICMS) Architecture



Functional System Architecture Core Elements

ICM System (ICMS) Context Diagram



ICM Success Factors

- Success of ICM depends on
  - End-to-End Trip Making Guidance
  - Intra and Inter Modal Shifts
- TDM Strategies are the Drivers
  - Intra Modal – SOV to HOV
  - Inter Modal – Highway to Bus, Rail
- TDM Enablers
  - Dynamic Ride Share,
  - Flex Hours/Telework
  - Ingress Opportunities – Real Time Travel Conditions, Parking Information (P&R), Transit Info (Next Bus/Rail)/BRT
  - Last Mile Opportunities – Shuttle/Zip Car/Bike/Walk
- ICM Partnership
  - Operations Integration (Data/Information Exchange)
  - Inter-Agency Coordination

ICM – A Paradigm Shift?

- From moving vehicles to moving people and freight
  Accessibility to Facilities and Services, Reliability, Flexibility
- From Individual Modes and Facilities to End-to-End Trips focusing on multiple modes and connectivity
- From Individual Jurisdictions to Multiple adopting a more balanced approach meeting local, regional and national transportation needs
- Intermodal ITS - opportunities to structure freeway, arterial, and transit operations where modes can work together and thrive in a corridor

managing demand and supply dynamically

Desired Outcome

the freedom to move where you want to, when you want to, and how you want to

[mobility]

that's what people want

For more information….

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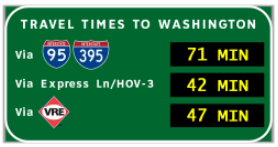
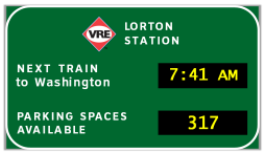
ICM Deployment Concept Examples

Multi-Modal and Parking Information Systems



Comparative Travel Times

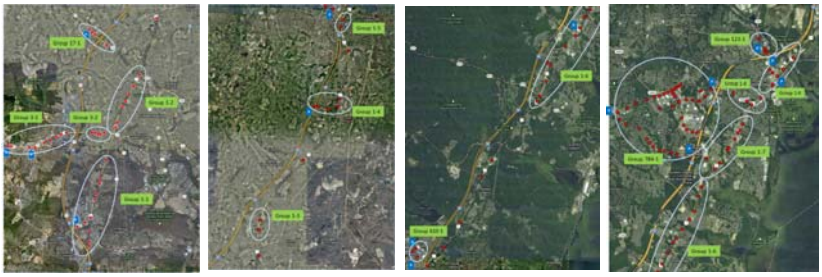


Next Train / Parking Information

Park and Ride Space Availability (Freeway signage)

Arterial / Transit Signal Priority

CANDIDATE SIGNAL GROUPS



- Transit signal priority along express bus routes
- Adaptive control along:
  - Arterial alternate routes (incidents, congestion)
  - Key routes between park-and-ride and I-95

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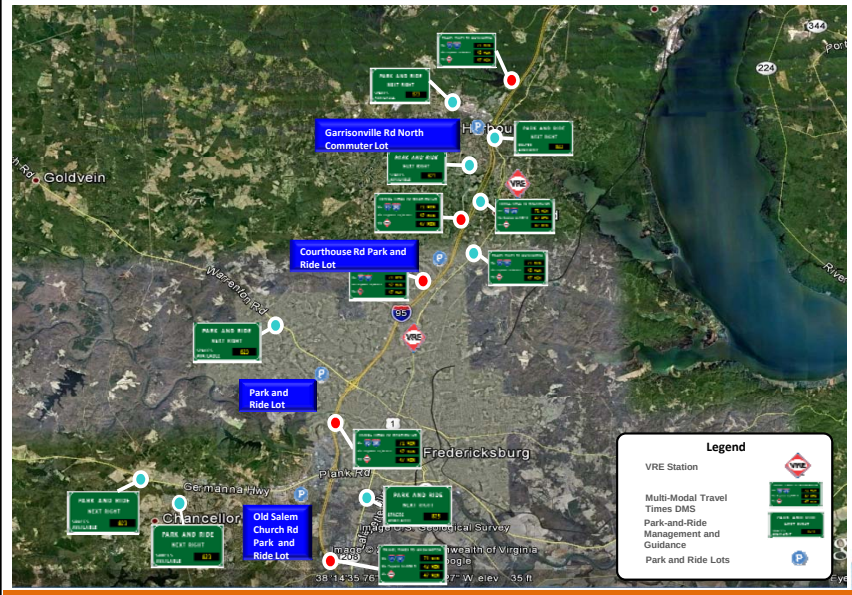
ParkNRide Guidance/Travel Time Signage Layout



Park & Ride Management & Guidance Systems/ Comparative Travel Time signage (MM 126-145)

Ramp Metering (PW and Fairfax Counties)


Active Traffic Management Strategies
Major Gantry (1/2 mile Spacing) HSR (left shoulder), Speed Restriction)
Major Gantry (1/2 mile Spacing) Normal Operation, No HSR
Mini-Gantry (between Major Gantries HSR)
Mini-Gantry (between Major Gantries No HSR)
MM145
MM139
I-95 HOT Lanes (Proposed)
Proposed HSR and ATM Implementation (Phase 1)
Proposed Hard Shoulder Running (MM 139 to MM 145)
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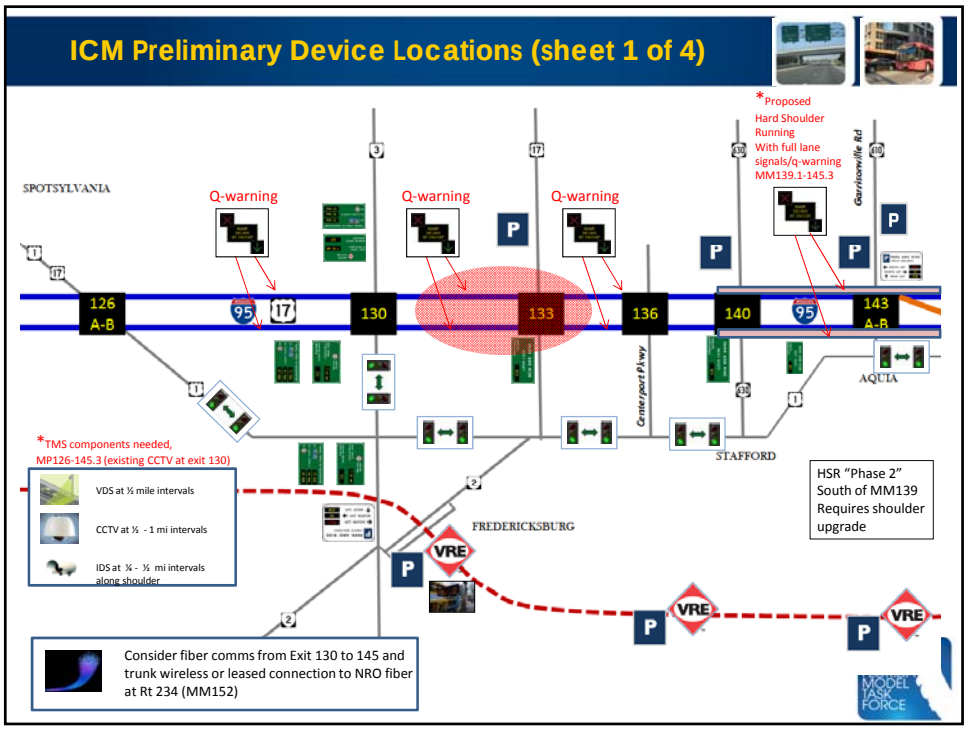
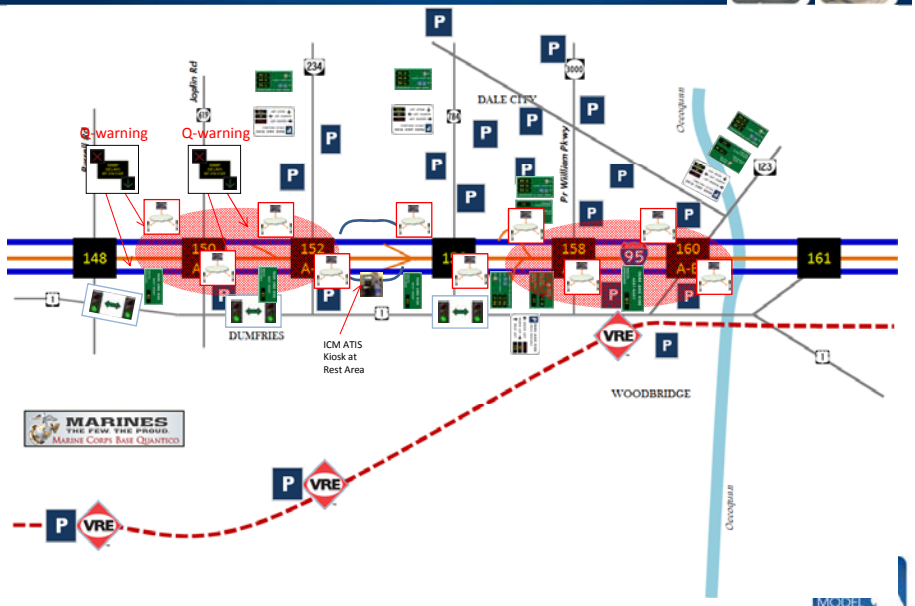
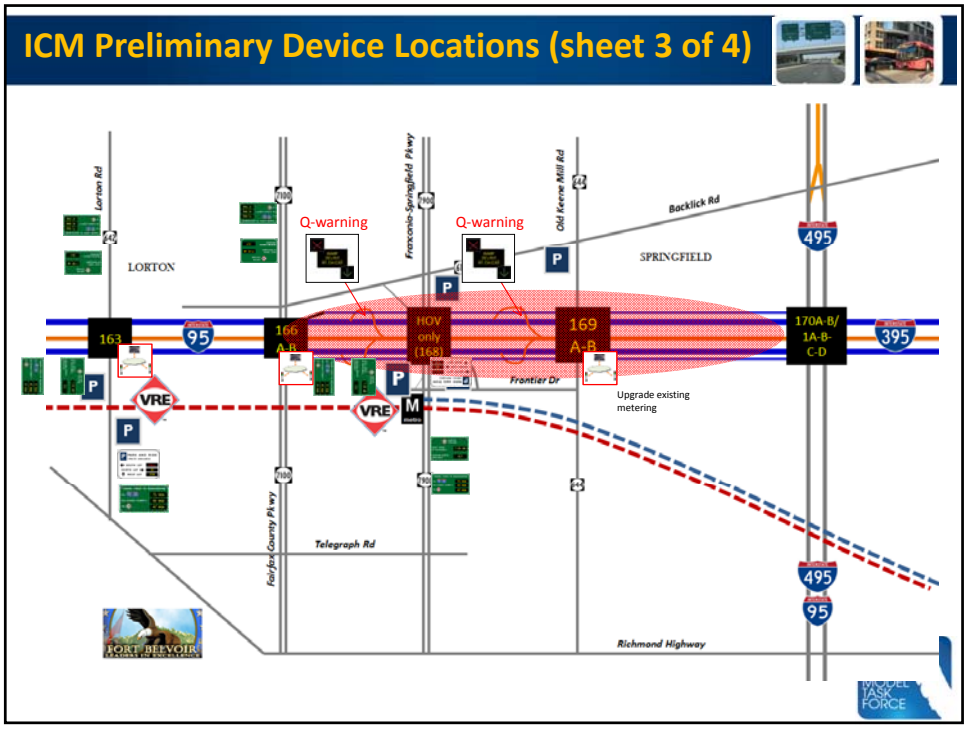

ICM Preliminary Device Locations (sheet 1 of 4)
*Proposed Hard Shoulder Running With full lane signals/q-warning MM139.1-145.3
SPOTSYLVANIA
Q-warning
Q-warning
Q-warning
126 A-B
130
133
136
140
143 A-B
Garrisonville Rd
Centerport Pkwy
AQUIA
STAFFORD
FREDERICKSBURG
*TMS components needed, MP126-145.3 (existing CCTV at exit 130)
VDS at ½ mile intervals
CCTV at ½ - 1 mi intervals
IDS at ¼ - ½ mi intervals along shoulder
HSR "Phase 2" South of MM139 Requires shoulder upgrade
Consider fiber comms from Exit 130 to 145 and trunk wireless or leased connection to NRO fiber at Rt 234 (MM152)

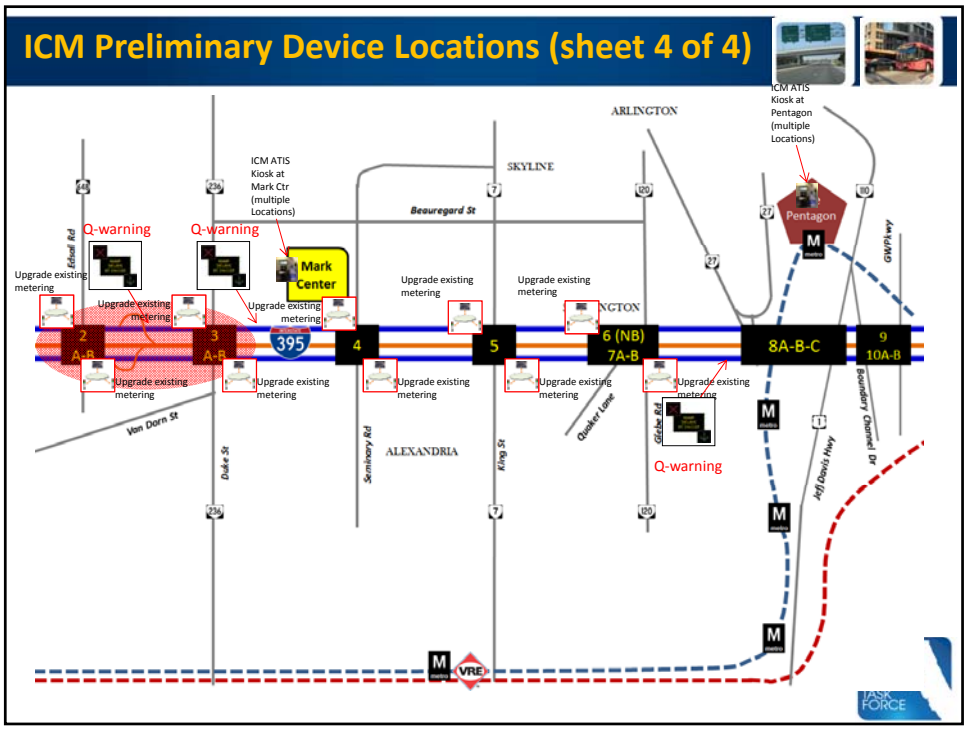
ICM Preliminary Device Location Legend

- Hard Shoulder Running
- Dynamic Traffic Management
- Multi-modal Travel Time Sign
- Transit Departure Info and Parking Sign
- Park-and-Ride Advance Info Sign
- Parking Guidance Sign
- Traffic Hot Spot
- Enhanced Real-Time Signal Coordination
- Adaptive Ramp Metering
- Park-and-Ride Lot
- Metro Station
- VRE Station
- Vehicle Detection System
- CCTV Camera
- Incident Detection System
- Fiber Optics
- Traveler Info Kiosk With Corridor-Related Info

ICM Preliminary Device Locations (sheet 2 of 4)




ICM Preliminary Device Locations (sheet 3 of 4)
Q-warning
Q-warning
Lorton Rd
Franconia-Springfield Pkwy
Old Keene Mill Rd
Backlick Rd
LORTON
SPRINGFIELD
163
166 A-B
HOV only (166)
169 A-B
170A-B/ 1A-B-C-D
Frontier Dr
Upgrade existing metering
Fairfax County Pkwy
Telegraph Rd
Richmond Highway
FORT BELVOIR


ICM Preliminary Device Locations (sheet 4 of 4)
ICM ATIS Kiosk at Mark Ctr (multiple Locations)
ICM ATIS Kiosk at Pentagon (multiple Locations)
ARLINGTON
SKYLINE
Beauregard St
Q-warning
Q-warning
Q-warning
Edsall Rd
Mark Center
Pentagon
Upgrade existing metering
2 A-B
3 A-B
395
4
5
6 (NB) 7A-B
8A-B-C
9 10A-B
Van Dorn St
Duke St
Seminary Rd
ALEXANDRIA
King St
Quaker Lane
Glebe Rd
Jeff Davis Hwy
Boundary Channel Dr
GWMP

Proposed Working Group Structure


I-95/I-395 Integrated Corridor Management Partnership

Operations & Technology Working Group

- Facilitates implementation of interagency efforts related to corridor operations
- Establishes Standard Operating Procedures
- Provides guidance for and analysis of technology deployment on corridor and for ICMS

Support of ICM Strategic Areas

- Information Sharing and Distribution
- Improve Operational Efficiency of Network Junctions and Interfaces
- Accommodate/ Promote Cross-Network Route and Modal Shifts
- Manage Capacity – Demand Relationship within Corridor: "Real-Time"/ Short-Term

Travel Demand Management

Evaluate opportunities for modal and temporal demand shift in corridor

Coordinates between public and private entities to fill every seat available

Performance Management

Creates and updates corridor specific performance measures

Monitors performance of corridor operations against these measures

Policy Working Group

- Governs directions for corridor operational and institutional policies
- Sets Policies
- Approves Standard Operating Procedures

Support of ICM Strategic Areas

- Information Sharing and Distribution
- Improve Operational Efficiency of Network Junctions and Interfaces
- Accommodate/ Promote Cross-Network Route and Modal Shifts
- Manage Capacity – Demand Relationship within Corridor – "Real-Time"/ Short-Term
- Manage Capacity – Demand Relationship within Corridor: Long Term

FLORIDA MODEL TASK FORCE