Summary of Integrated Corridor Management (ICM) Development Efforts
- United States -

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Summary of ICM Efforts

| Corridor	Corridor Type	Lead Agencies	Activities
I-15 Diego	Suburban	SANDAG	• ConOps and System Requirements developed in 2008 • Simulation evaluation in 2009-2010 • System launched in spring 2013 • Currently in evaluation phase
US-75 Dallas	Suburban/urban	DART	• ConOps and System Requirements developed in 2008 • Simulation evaluation in 2009-2010 • System launched in spring 2013 • Currently in evaluation phase
I-80 Bay Area	Suburban/urban	MTC / Caltrans	• ConOps developed in 2010 • Project groundbreaking in October 2012 • Project expected to be completed summer 2015
I-95 / I-395 Virginia	Rural, Suburban & Urban	Virginia DOT	• ConOps development initiated in 2012 • Currently developing deployment plan & partnerships
I-394 Minneapolis	Suburban/urban	Minnesota DOT	• ConOps and System Requirements developed in 2008 • Simulation evaluation in 2009 • No apparent activity since 2009
I-270 Maryland	Suburban	Maryland DOT	• ConOps and System Requirements developed in 2008 • No apparent activity since 2008

3 | # I-15 San Diego

Corridor

- **21-mile section of I-15 corridor north of San Diego**
  - I-15 freeway
    - General-purpose traffic lanes
    - Barrier-separated 4-lane managed lane system with moveable barrier
    - Dynamic toll pricing on managed lanes
  - Parallel arterials
    - Center City Parkway (Escondido)
    - Pomerado Road (Poway/San Diego)
    - Black Mountain Road/ Kearny Villa Road (San Diego)
  - Transit services
    - MTS bus network
    - NCTD bus network
    - NCTD Sprinter Commuter Rail
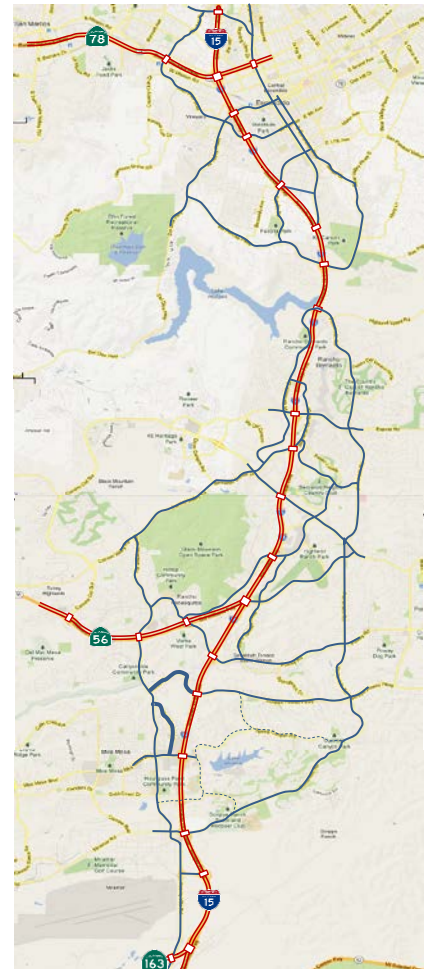
ICM Elements

- **Real-time monitoring systems**
  - Freeway
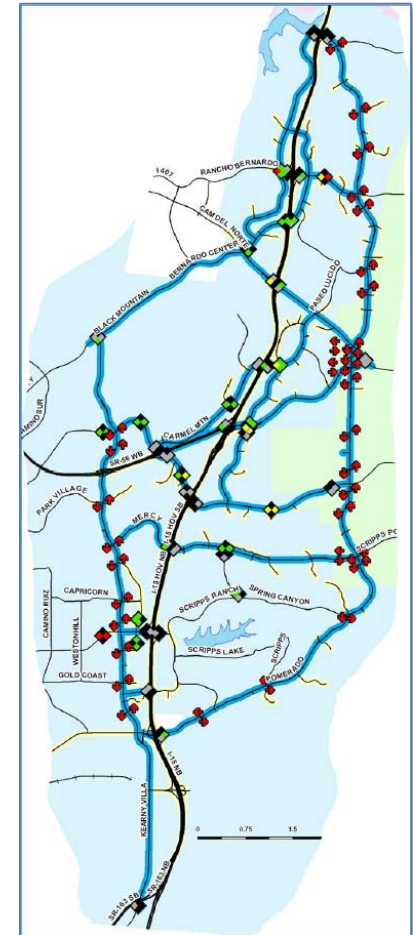   - Traffic detection stations (PeMS)
    - Ramp metering rates
  - Arterials
    - Traffic detection stations (Sensys)
    - Traffic signal status monitoring
  - Transit operations
    - Connection to Automatic Vehicle Location (AVL) system
  - Weather

ICM Elements

- **Freeway operations**
  - Traffic-responsive on-ramp metering
  - I-15 HOT Managed Lane System
    - Northbound/southbound lane configuration
    - Toll-free access policy

- **Arterial operations**
  - Traffic-responsive signal control
  - Arterial/freeway ramp traffic signal coordination

- **Transit operations**
  - Vehicle rerouting around incidents
  - Service increase in response to event/incidents

ICM Elements

- **Traveler information**
    - Integrated, multi-modal traveler information service
    - Comparative travel times along alternate routes
    - Real-time park-and-ride availability
    - 511 mobile applications
    - Changeable message signs along I-15
    - Trailblazer signs along arterials

Decision Support System

- **Development of response plans in response to observed congestion and/or identified events/incidents**

- **Response plans developed online using a rule-based decision process relying on sets of predetermined potential actions**

- **Evaluation of developed candidate response plans using simulation**

- **Control recommendations to system operators**
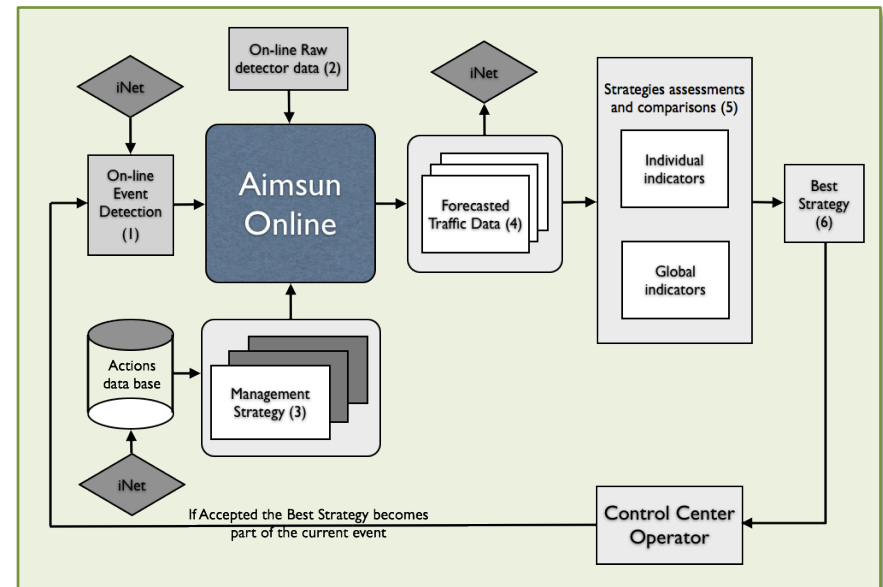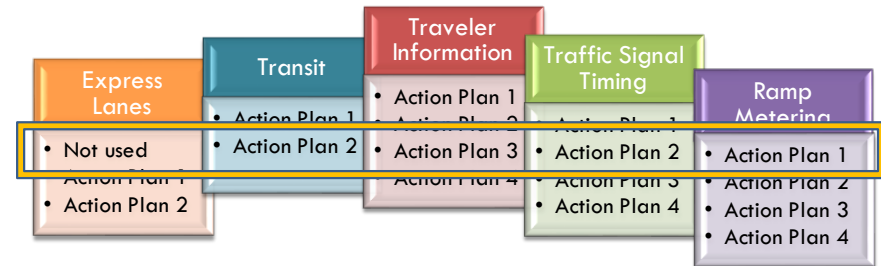
Decision Support System

- **Role of simulation**
  - Evaluation of current network conditions
  - Projection of network operations over next 15, 30, 45 and 60 minutes
    - Do nothing scenario
    - 6 to 12 alternate response plans

- **Simulation using Aimsun Online**
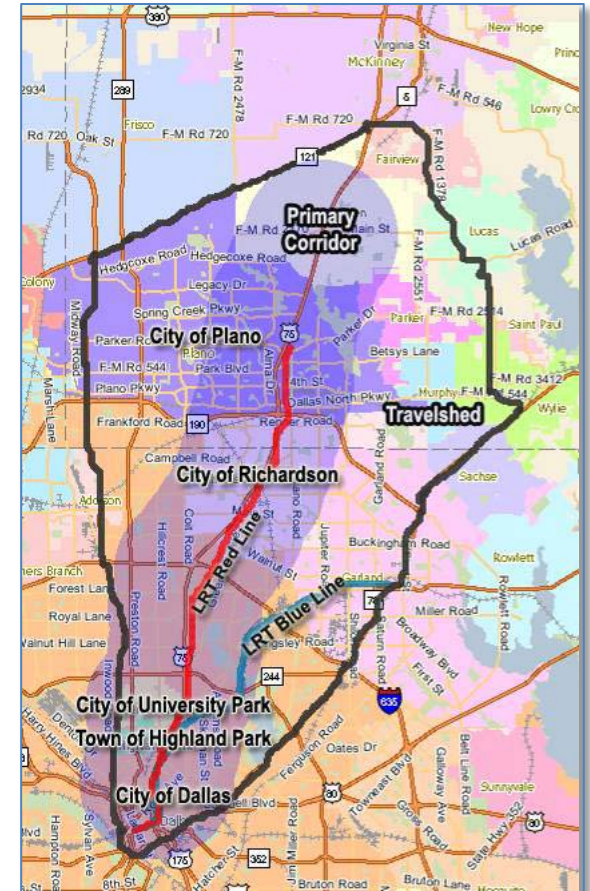 - Microscopic simulation model considering the behavior of individual vehicles
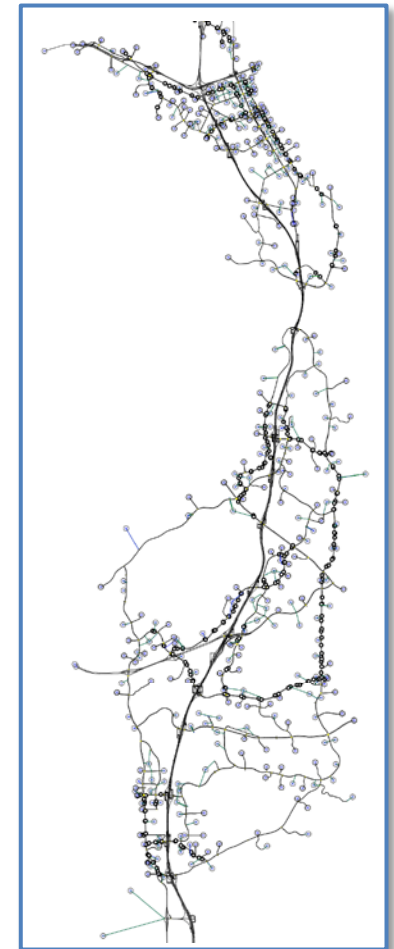
US-75 Dallas

Corridor

- **20-mile section of US-75 corridor northeast of downtown Dallas**
  - US-75 freeway
    - General-purpose lanes
    - HOV lanes north of I-635
  - Parallel arterials
    - Freeway frontage roads
    - Greenville Avenue
    - Coit Road
  - Transit services
   - DART Bus Network
    - DART Light Rail

ICM Elements

- **System monitoring**
  - Bluetooth sensors along freeway and two diversion routes (40 locations, every 1-2 miles)
  - Parking availability at 5 park-and-ride lots
  - Light rail train location and passenger count
  - Weather monitoring

- **Data sharing**
  - Implementation of regional information exchange network (SmartNET)

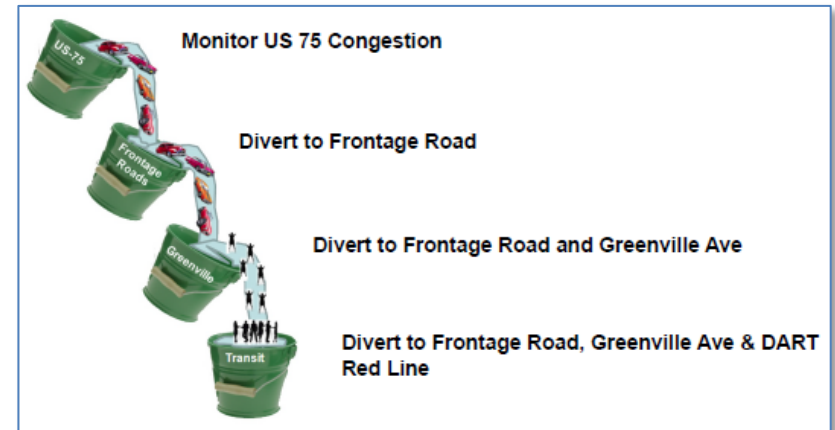*Traffic Detection Plan*
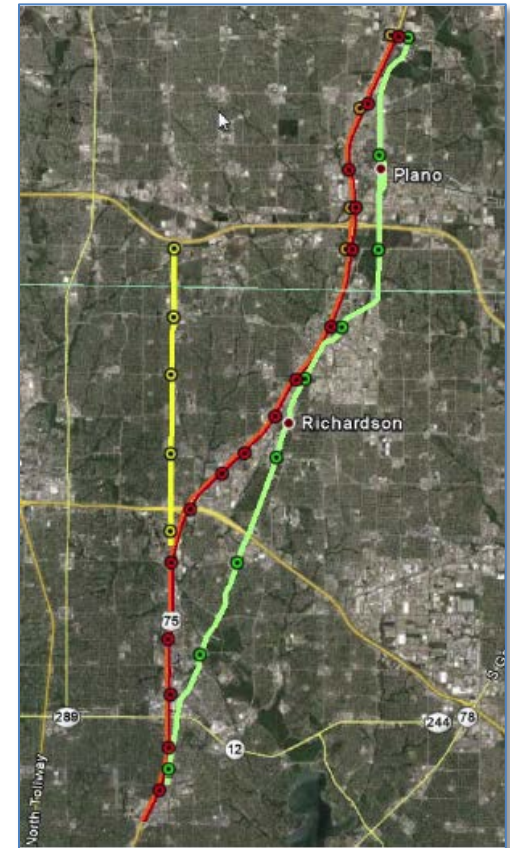
ICM Elements

- **Freeway operations**

  - Predefined diversion plans to local arterials and/or light-rail service in response to incidents

  - Management of HOV access restrictions during incidents

- **Arterial operations**

  - New signal timing plans for Greenville Avenue

  - Event-specific signal timing plans

  - Responsive traffic signal control

Monitor US 75 Congestion

Divert to Frontage Road

Divert to Frontage Road and Greenville Ave

Divert to Frontage Road, Greenville Ave & DART Red Line

ICM Elements

□ **Traveler information**

- □ First multimodal 511 system in Texas

- □ Real-time transit vehicle information

  - Vehicle location
  - Next stop arrival time
  - Available capacity

- □ Parking availability information on CMS signs and 511 systems

  - 5 park-and-ride lots along the LRT red line

- □ Links to social media (Facebook, Twitter)

- □ Exploration of sponsorship options

511 DFW BEGIN YOUR TRIP HERE.

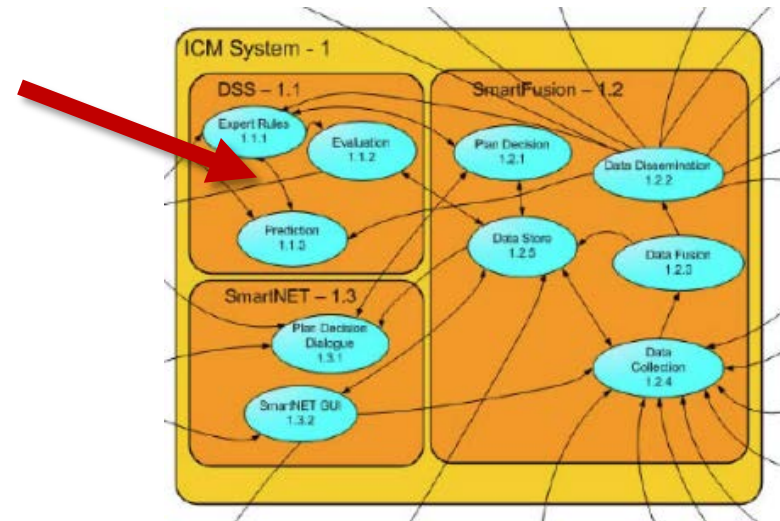| RSS for Media (Events, Link Data)	Interactive Voice Response (IVR)
ALERT System	My511 Mobile App
Public Website	Links to Social Medias

SmartFusion/SmartNet Systems

- **SmartNET**

  - Regional information exchange network

- **SmartFusion**

  - Data Fusion Engine

  - Receives and publishes data to the regional center-to-center and other external systems

  - Feeds data to the 511 Systems and Decision Support System
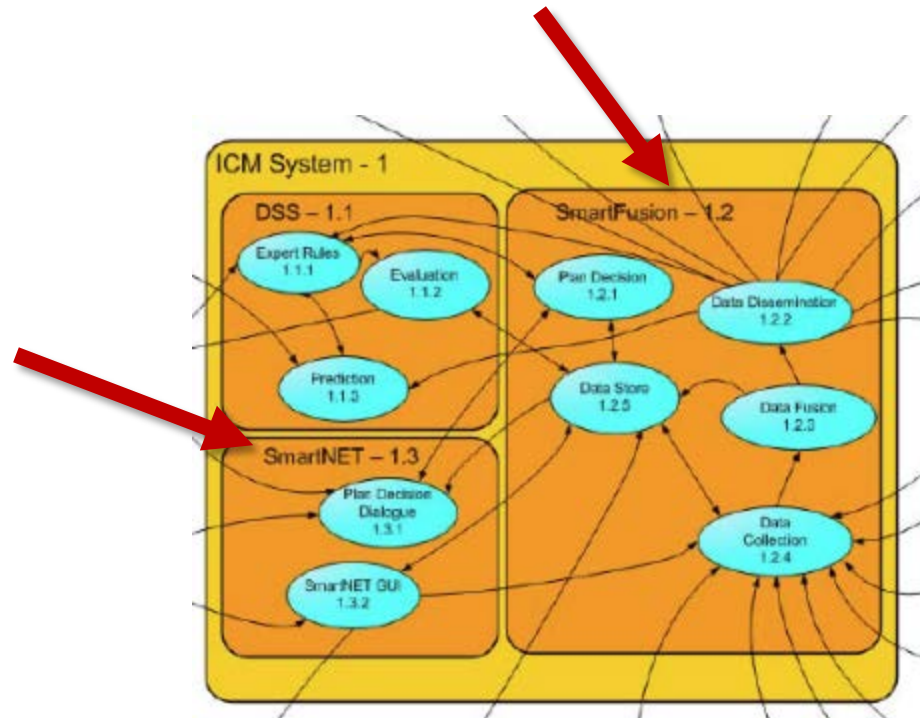
Decision Support System

- **Rule-based system designed to capture existing operational knowledge**

- **Uses travel time and speeds on diversion routes to select a recommended plan**

- **Evaluates trade-offs between alternate plans**

- **Sends recommendation to partner agencies for approval / implementation**

Decision Support System

- **Roles of simulation**
  - Evaluation of current network state
  - Prediction of network operations over the next 30 minutes
    - Do nothing scenario
    - Recommended control plan(s)

- **Simulation using the DIRECT model**
  - Mesoscopic dynamic traffic assignment model developed at Southern Methodist University
  - Model capable of capturing interactions between travel demand, network capacity and mode shifts under various control strategies
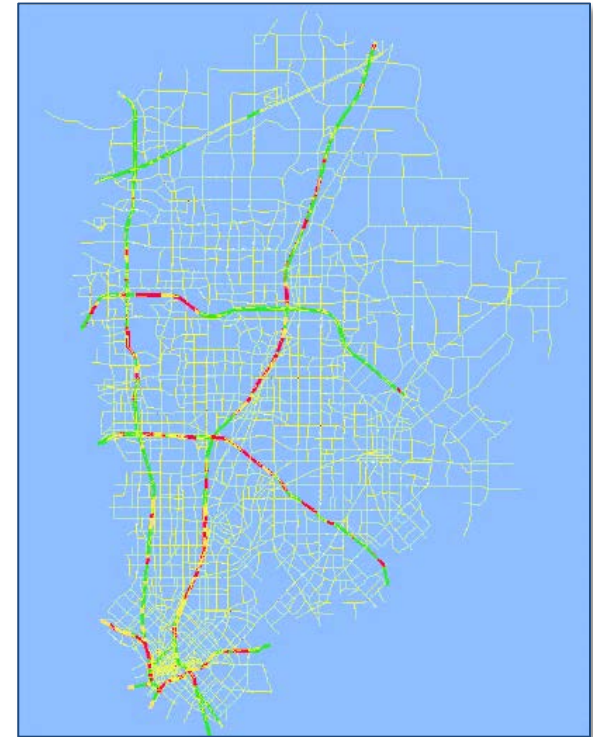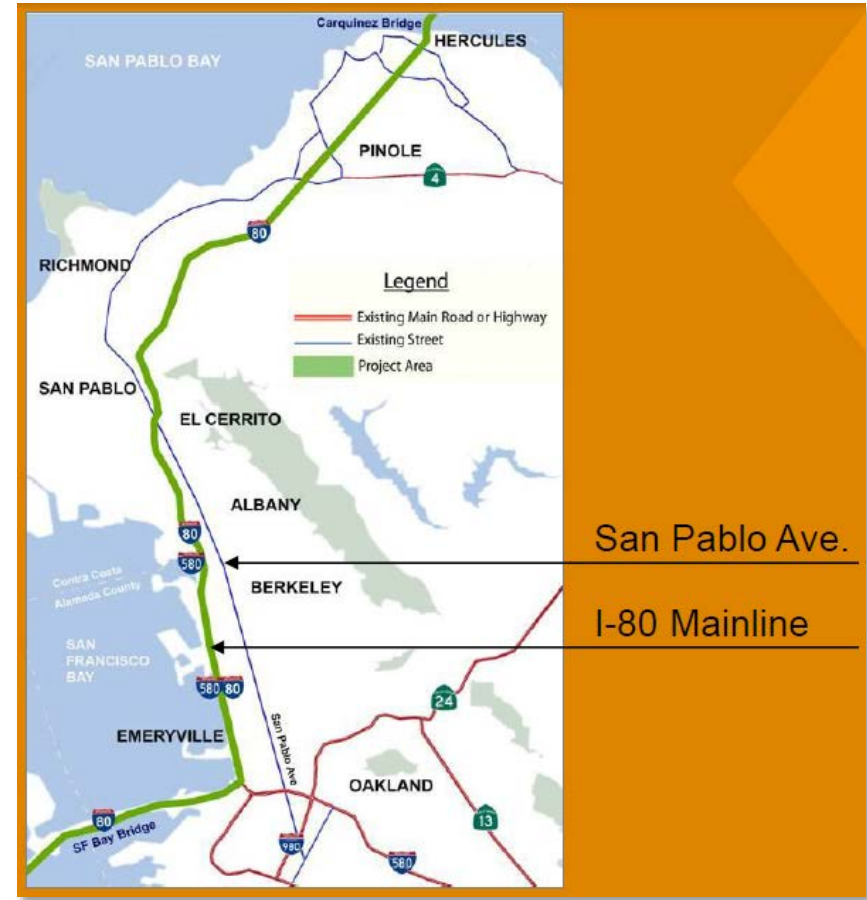
I-80 Bay Area

Corridor

- **20-miles section of I-80 from Bay Bridge to Carquinez Bridge**

- **Transportation networks**
  - I-80 freeway
    - General-purpose traffic lanes
    - HOV lanes
  - Parallel arterial
    - San Pablo Avenue
  - Transit services
    - AC Transit bus network
    - BART subway network

ICM Elements

- **Freeway operations**

  - Adaptive ramp metering

    - Coordinated ramp meters

    - Maximum queue detection

    - Meter bypass for HOV vehicles

  - Lane use management system

    - Ability to close lanes ahead of incidents

  - Variable advisory speed signs

    - Provision of speed recommendations ahead of incidents and congestion areas

  - Additional CCTV cameras

ICM Elements

- **Arterial operations**
  - Traffic signal system upgrade
  - Enhanced traffic detection along San Pablo Avenue
  - Signal synchronization/optimization
  - Implementation of traffic signal flush plan to improve capacity during major incidents/events
  - Trailblazer signs to help guide traffic naturally rerouting through San Pablo during incidents
  - Traffic signal preemption for first responders

- **Transit operations**
  - Transit signal priority at signalized intersections
 - Transit signal priority at HOV freeways on-ramps

ICM Elements

Traveler information

- Displaying of traffic and transit information on freeway dynamic display boards showing

- Trailblazer signs along arterials to help traffic go back to the freeway

- Highway advisory radio

- Integration with Bay Area 511 system and East Bay SMART Corridors

- Directions to transit facilities

- Real-time parking availability (future element)
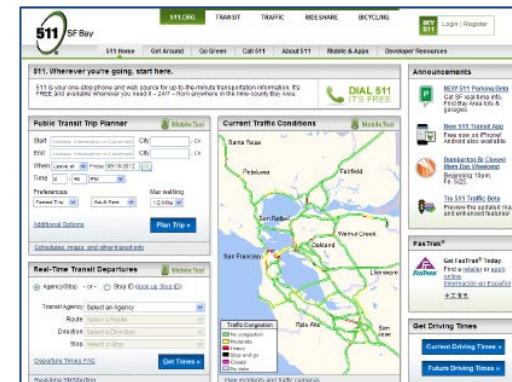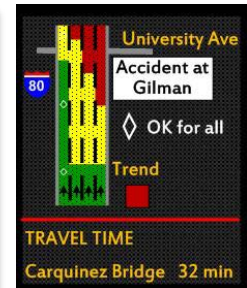
I-95/I-395 Virginia

Corridor

- **52-mile section of I-95/I-395 between Spotsylvania and 14th Street Bridge near Washington DC**
  - I-95/I-395 freeway
    - General purpose traffic lanes
    - Reversible two-lane HOV facility in middle of freeway north of Dumfries (northern half of corridor)
  - Parallel arterials
    - US-1 convenient alternate south of Woodridge
  - Transit services
    - Commuter rail along entire corridor
    - Various bus services
  - Park-and-ride
    - 40,771 spaces within corridor
  - Ridesharing services
    - Carpools / Vanpools
    - 6400 daily "slugs" (2008)
    - Real-time ridesharing pilot
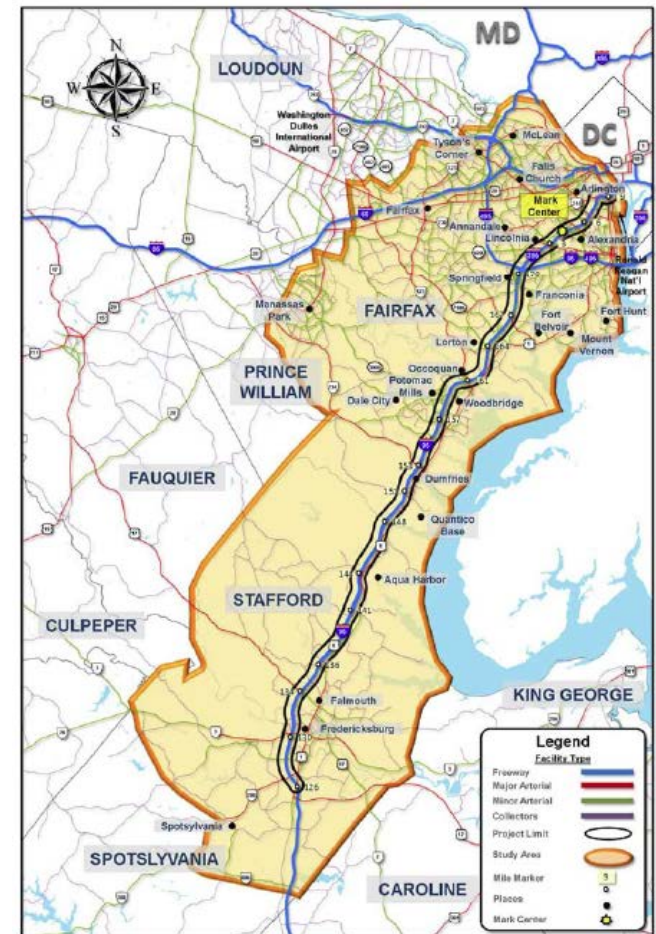
ICM Elements

- **Freeway operations**
  - Hard shoulder running
  - Ramp queue warning
  - Speed restrictions
  - Traffic-responsive ramp metering, some with HOV bypass

- **Arterial operations**
  - Traffic signal upgrades
  - Adaptive signal control
    - Freeway alternate routes
    - Routes connecting I-95 to park-and-ride lots

- **Transit operations**
 - Transit signal priority along express buses (future phase)

ICM Elements

□ **Traveler information**

- Integrated, multi-modal single information gateway

- Real-time park-and-ride space availability information on freeways and approach routes

- Comparative travel times for travel on freeway, arterials, transit

- Personalized multi-modal real-time trip planning

- Mobile applications

- Information kiosks
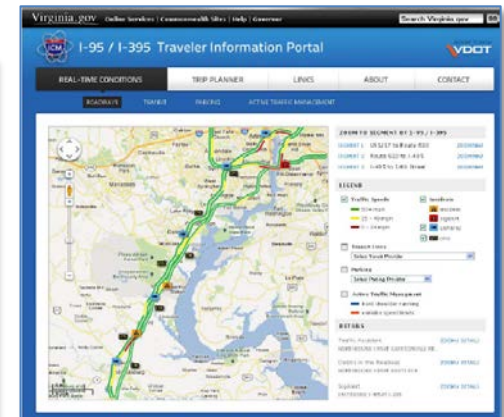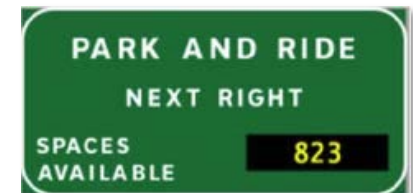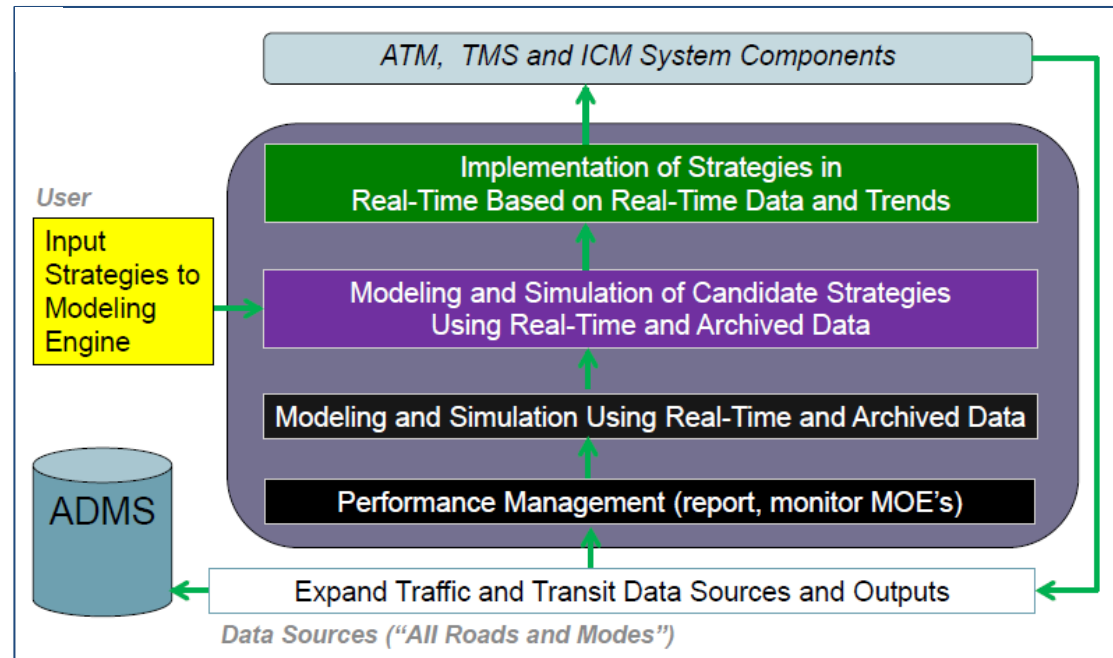
System Functional Architecture
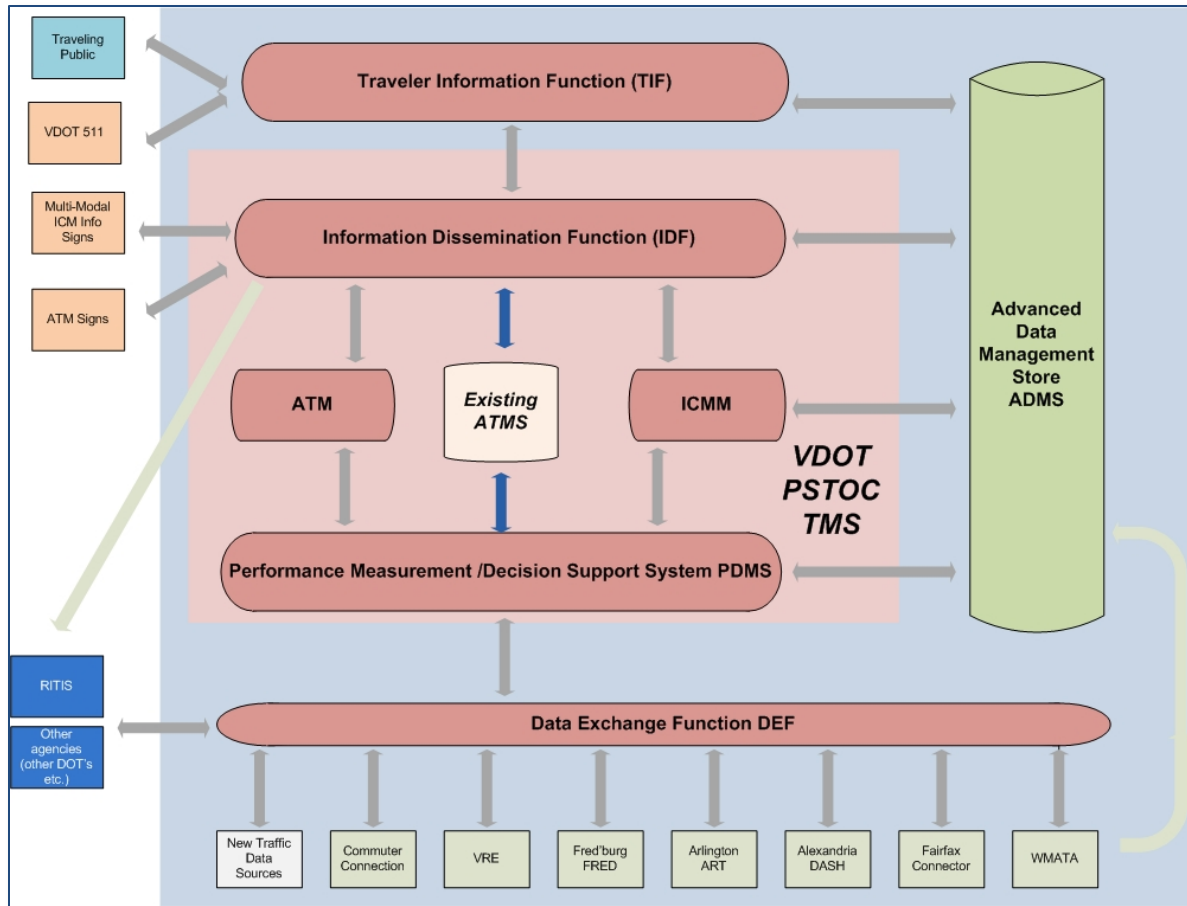
Performance Measurement/Decision Support System

- **Planned as a future system element**

- **Expected to use of simulation to assess the performance of alternate strategies**

System Deployment Strategy