



**Virginia ITS Architecture Stakeholder Needs  
Workshop – Updating the Central Regional  
Architecture**

June 2, 2011

# WELCOME AND INTRODUCTIONS

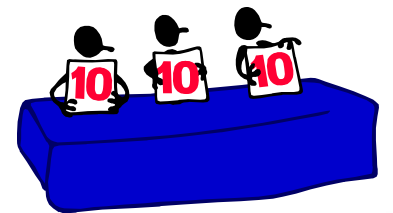
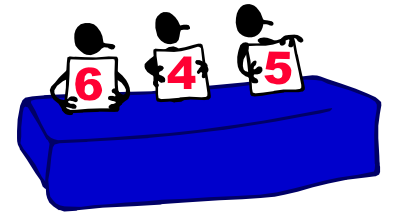
# Introductions

- **Name**
- **Organization/Role(s)**
- **Previous ITS architecture experience**
- **Workshop expectations**



# Workshop Outcomes

1. Better understand VA ITS Planning and Development
2. Review stakeholder needs survey results
3. Capture region's transportation/ITS needs
4. Review your ITS architecture and identify gaps



# Workshop Agenda

- **Welcome and Introductions**
- **ITS Planning and Development**
- **Stakeholder Needs Survey Result**
- **Transportation/ITS Needs Breakout Groups**
- **Lunch**
- **Needs Breakout Groups Recap**
- **Using ITS Architecture Presentation**
- **Identify Gaps and Suggested Architecture Changes**
- **Wrap-Up**

# Announcements

**Sign-in sheet  
Workbook  
Administrative and safety  
announcements**



# ITS PLANNING AND DEVELOPMENT



**Virginia ITS Architectures**  
**Stakeholder Needs Workshop**  
**Updating Central Region Architecture**  
June 02, 2011

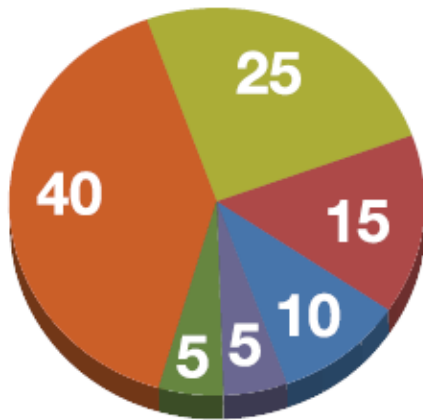
**Chris Francis**  
**ITS Program Development Manager**  
**Operations and Security Division**



**“  
.....more congestion, longer commutes, and  
missed economic opportunities.....That trend must  
”  
be reversed and this is the time to do it.**

**Governor Bob McDonnell**

# Congestion Costs and Issues



## The Sources of Congestion:

**40% Bottlenecks**

**25% Traffic Incidents**

**15% Bad Weather**

**10% Work Zones**

**5% Poor Signal Timing**

**5% Special Events/Other**

## Congestion Costs and Issues

- About \$200 billion in freight bottlenecks
- Depending on the product carried, congestion adds between \$25 and \$200 per hour to freight costs
- Average annual cost of congestion per traveler: \$794
- 4 billion hours wasted waiting in traffic jams
- 2 billion gallons of fuel wasted in traffic jams
- Greatest concentration of congestion is along critical urban transportation corridors that link residential and commercial/-business nodes
- Between 1980 and 1999, highway-route miles in the US increased 1.5% while vehicle miles traveled increased 76%
- Incident lane blockage:
  - Each minute of lane blockage creates 4 minutes of congestion
  - Blockage of one of three freeway lanes reduces capacity by 50%
  - Blockage of two of three freeway lanes reduces capacity by 80%
- Work Zones:
  - Average of one work zone every 100 highway miles
  - Average of one work zone lane closure every 200 highway miles
  - Average of 1,000+ fatalities and 40,000 injuries in work zone crashes

# Weather Management Transportation Operations



## Annual Transportation Impacts from Severe Weather

- 1.5 million motor vehicle crashes
- 800,000 injuries
- 7,400 fatalities
- \$42 billion in costs (injuries, loss of life, property damage) from weather-related crashes
- 500 million hours of delay from fog, snow, and ice
- 24% of all crashes occur in adverse weather conditions
- Weather delays add up to \$3.4 billion to freight costs annually



## Annual Emergency Challenges in the United States

- 400+ tropical storms, hurricanes, tornadoes, and highway hazmat incidents, requiring evacuations
- An extensive number of localized incidents in the form of winter weather, wildfires, multi-vehicle crashes, and security activities
- 72-hour warning for hurricane evacuations

# In-Motion Adverse Weather Warning

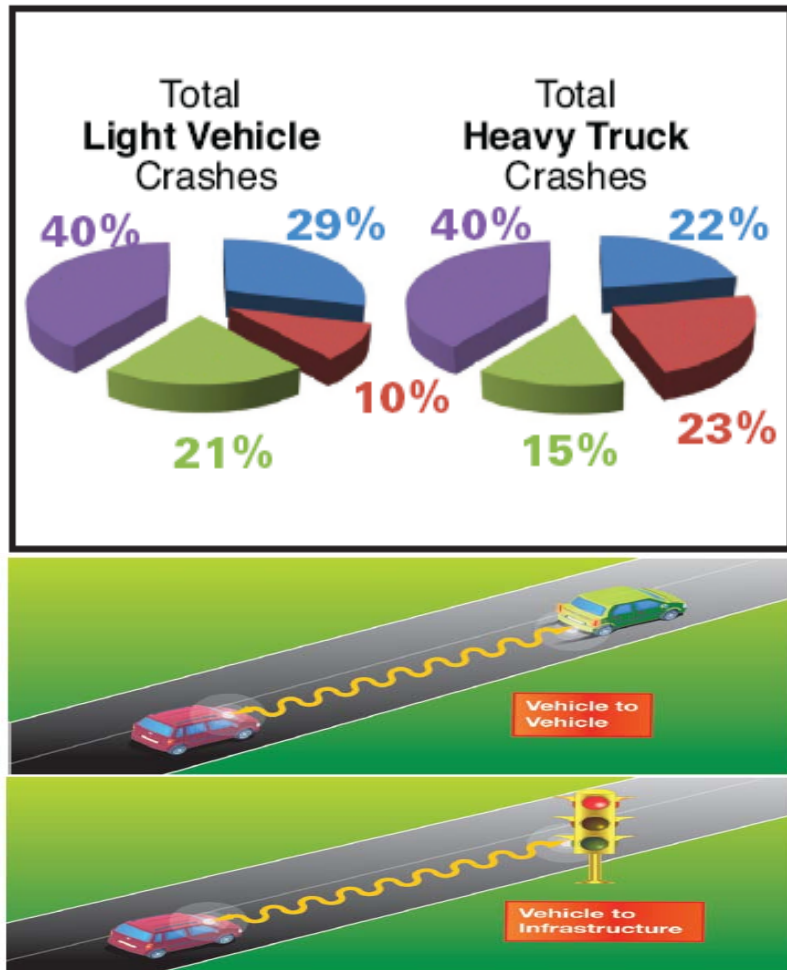


Roadside Technology



In-Vehicle Technology

# Integrated Vehicle Based Safety Systems (IVBSS)



## Awareness Provided

These illustrations show three types of prevalent crashes and the awareness provided to the driver by each safety system.



Forward-Looking Collision



Lane-Departure Warning



Lane-Change Collision Warning



# Real Time Traveler Information Signage



# Electronic Freight Management (EFM)



## Electronic Freight Management

Based on replication of initial tests, results include:

- 12% reduction in total shipment travel time
- 75% reduction in paper-work-entry labor per shipment
- 12% improvement in data accuracy
- 15% reduction in data-entry errors
- 10% improvement in customs-clearance processing

## International Trade Facts

- U.S. foreign trade rose from \$1.2 to \$2.6 trillion between 1990 and 2003
- In 2007, over \$3 billion in goods moved into and out of the country via freight transport
- The volume of trade moved on the U.S. transportation system in 2020 is expected to increase up to 70% from 1998 levels

# Commercial Vehicle Information System and Network (CVISN)



Weigh-in-motion Sensors

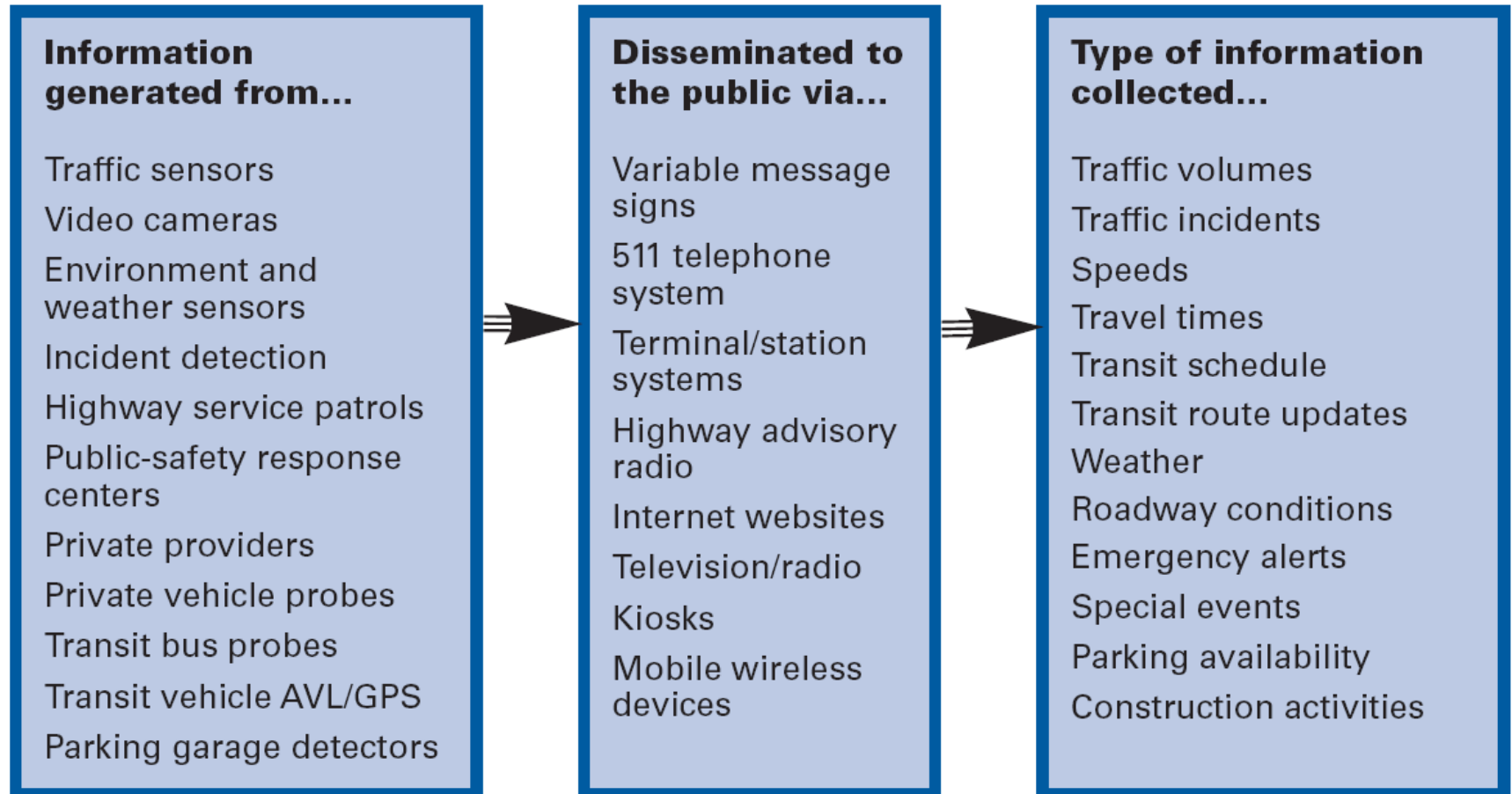


Electronic Toll Payment/  
Vehicle tracking transponder



# Advanced Traveler Information System (ATIS)

## Dissemination of Traveler Information

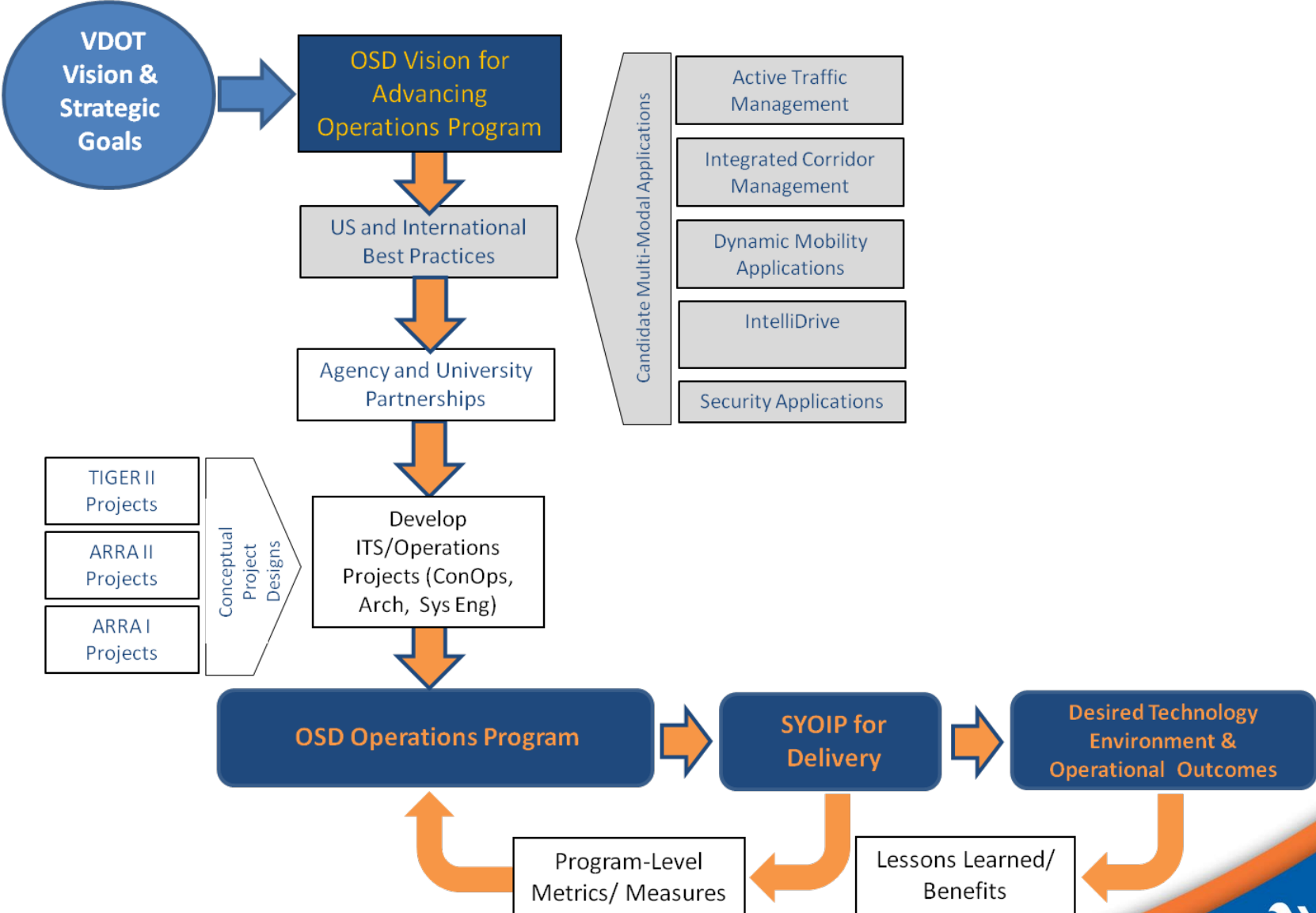


# Strategic Approach to New Technology Deployments

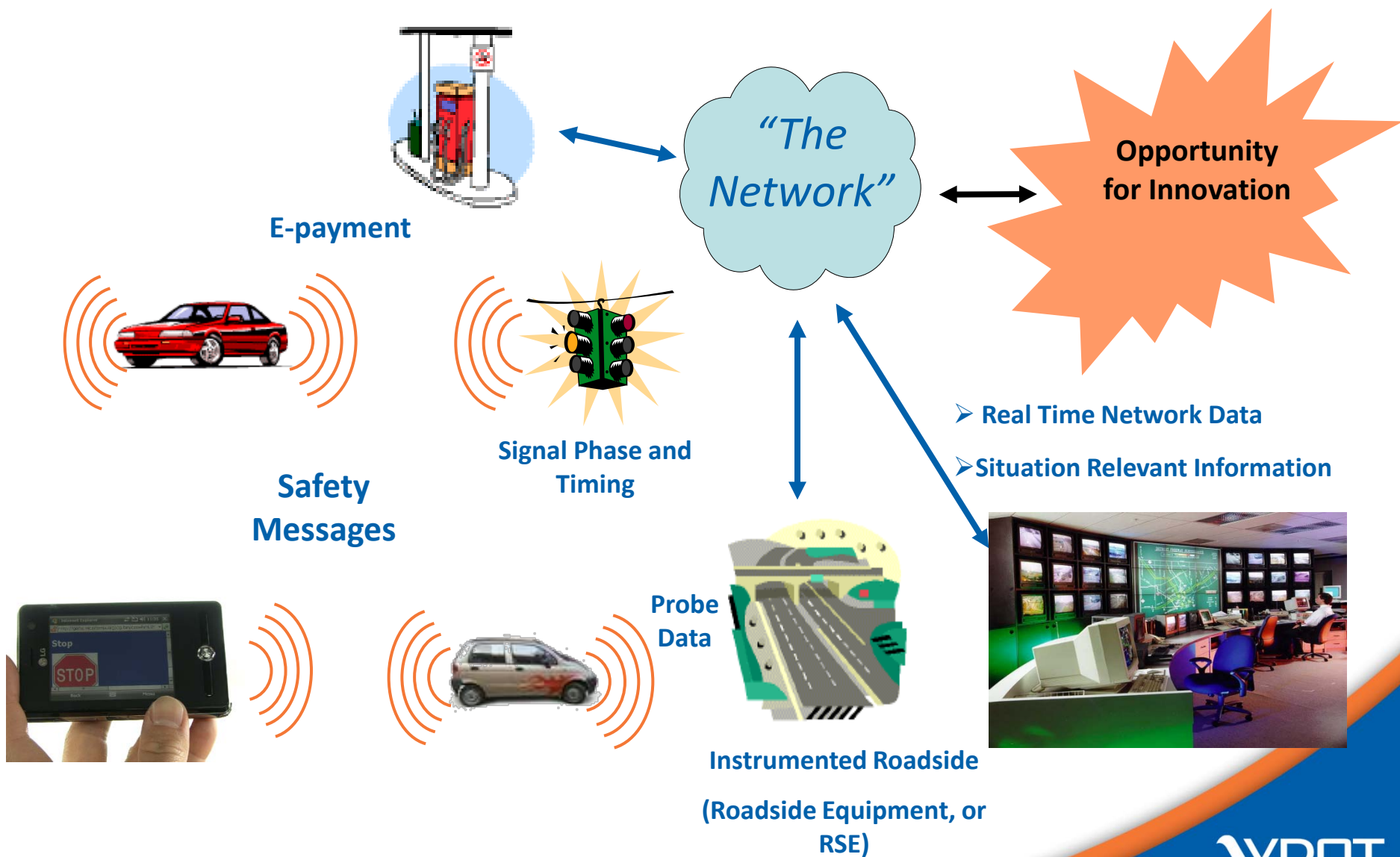
# Advancing VDOT's Operations Program

- **Address Recurring and Non-Recurring Congestion**
- **Approaches – Non-Pricing, Pricing, Context Sensitive**
- **Suite of Solutions - ATM, ICM, DMA, CV, Hybrid**
- **Candidate Multimodal Technology Applications**
  - **I-66, I-95, I-64, I-81**
- **Organizing Strategy: Network/Corridor Based**
- **SYOIP – Framework for Development & Delivery**

# New Technology Deployment Framework



# Preparing Virginia roads for Dynamic Mobility



## I-66: Haymarket to DC



# I-66 Technology Corridor: Haymarket to DC

**Project Objective** – Application of ATM/ICM strategies to facilitate dynamic transportation network management based on prevailing traffic conditions

**Context** – Very heavy vehicular traffic both east and west bound during on and off-peak periods – rated as the 2<sup>nd</sup> highest congested network in the Nation (TTI Mobility Rep)

**Technology Applications** - Active Traffic Management (ATM) and Enhanced Traveler Information

- **Speed Harmonization:** speed limits are dynamically changed based on observed traffic conditions
- **Queue Warning:** dynamic message signs inform travelers of approaching queues/bottlenecks
- **Hard Shoulder Running:** lane control signs manage the use of shoulders as a travel lane

**ICM Nodal Information** - Enhanced corridor-specific traveler information, such as real-time transit and parking information, and travel times. Provide parking availability via dynamic message signs along I-66. Park-and-ride lots to be retrofitted with advanced parking management system (APMS) which would track parking space availability and communicate directly with the parking information signs

**Dynamic Network Management** - The provision of real-time transit information in tandem with real-time traffic conditions would allow commuters to make informed modal choices based on prevailing traffic conditions. Proposed enhanced corridor specific traveler information system would incorporate real-time transit information from transit providers that operate along I-66 into VA511

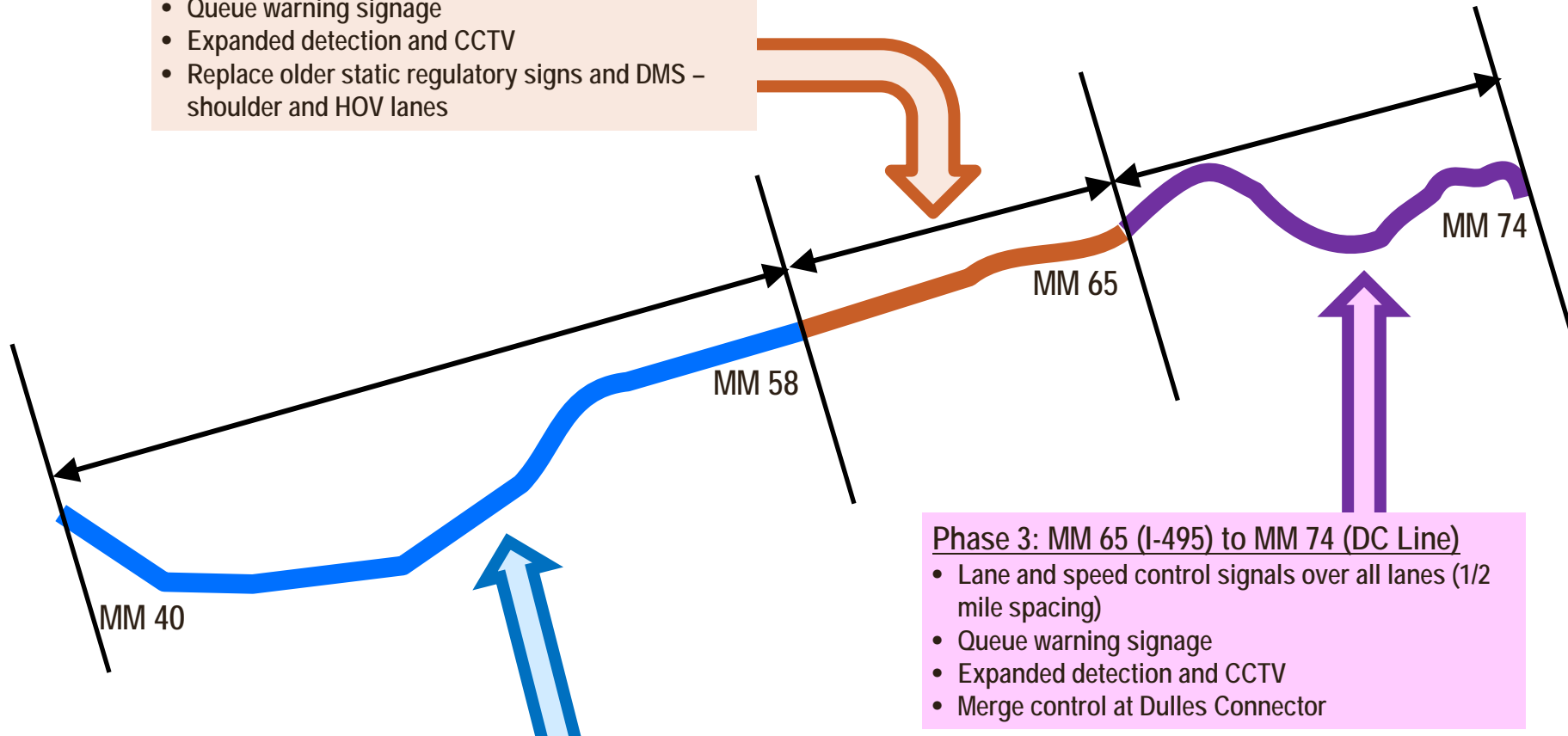
**Connected Vehicle Test Bed** - Outfit VDOT and transit vehicles with on-board equipment to support testing of various Connected Vehicle technology application (pavement assessment, SPat, safety). Planned deployment of Connected Vehicle roadside equipment (RSE) infrastructure



# I-66 ATM Project Phasing

## Phase 1: MM 58 (US-50) to MM 65 (I-495)

- Enhance existing shoulder running – operate based on congestion levels rather than time schedule
- Lane and speed control signals over all lanes (1/2 mile spacing)
- Merge control at US 50 eastbound ramp (EB I-66)
- Queue warning signage
- Expanded detection and CCTV
- Replace older static regulatory signs and DMS – shoulder and HOV lanes



## Phase 2: MM 40 (US-15) to MM 58 (US-50)

- Lane and speed control signals over all lanes (1/2 mile spacing)
- Queue warning signage
- Expanded detection and CCTV
- Replace older static regulatory signs and DMS –HOV lanes

## Phase 3: MM 65 (I-495) to MM 74 (DC Line)

- Lane and speed control signals over all lanes (1/2 mile spacing)
- Queue warning signage
- Expanded detection and CCTV
- Merge control at Dulles Connector



# I-66 ATM Project

- **Project Limits**
  - Mile Marker 40 (US-15) to Mile Marker 74.8 (DC Line)
- **ATM Applications**
  - **Enhanced Shoulder Lane Control**
  - **Dynamic Lane Management** (Lane Tapers in advance of Closures, HOV-2 Lane Status, Shoulder Lane Operations Status)
  - **Queue Warning** (due to congestion, incidents, weather, etc.)
  - **Dynamic Ramp Metering and Merge Control**
  - **Speed Harmonization**
- **Phasing**
  - **Phase 1:** MM 58 (US-50) to MM 65 (I-495)
  - **Phase 2:** MM 40 (US-15) to MM 58 (US-50)
  - **Phase 3:** MM 65 (I-495) to MM 74 (DC Line)

# Display Options

## Separate Lane and Queue Warning (similar to Washington State, Europe)



## Integrated Full-Color Displays (using MUTCD-based sign graphics)



# Regional Concept for Transportation Operations (RCTO) – FHWA-FTA Initiative

## **Goal:**

To make transportation planning and transportation operations work together better for the benefit of transportation users and the community.

## **Common Operations Vision:**

- ❖ Real-time information on transportation system performance is shared across agencies.
- ❖ Road users to have the ability to adjust their routes based on *timely weather and traffic reports delivered seamlessly across jurisdictions, agencies, and modes.*
- ❖ Hazardous materials moving through an urban area electronically identified and monitored by traffic management and public safety agencies to ensure their safe, secure, and efficient intermodal movement.

# RCTO Regional Architecture and Focus Areas

## **Serves three important purposes:**

- Operations vision and direction for the future of transportation systems management and operations
- Garner commitment from agencies and jurisdictions for a *common regional approach* to transportation systems management and operations
- Strengthen *linkage between regional planners and operations managers* - develop a coherent operations strategy to be part of the planning process

## **RCTO and Regional Architectures:**

Regional ITS Architectures enable Relationships and Information Sharing by providing key components such as:

- ☐ Operations concepts
- ☐ Agreements
- ☐ Inventories
- ☐ Architecture flow
- ☐ Standards

# Smart Technologies for Communities Act

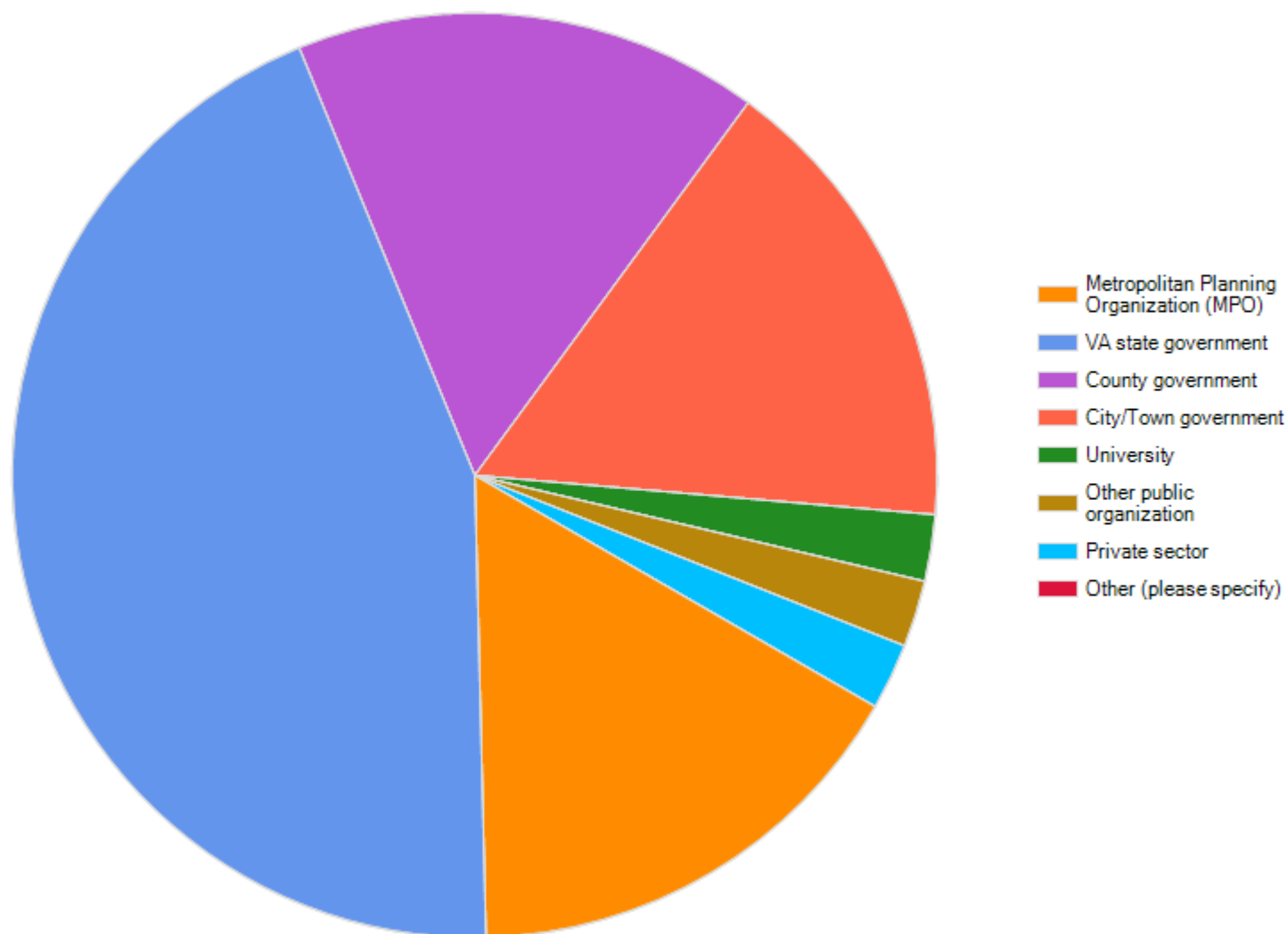
*“We cannot continue to simply build our way into a transportation system necessary for the demands of the 21<sup>st</sup> Century.....Technology and information exist today to cost-effectively, safely and effectively manage our nation’s roads and infrastructure”.*

**Mike Rogers and Russ Camahan**

# STAKEHOLDER NEEDS SURVEY RESULTS

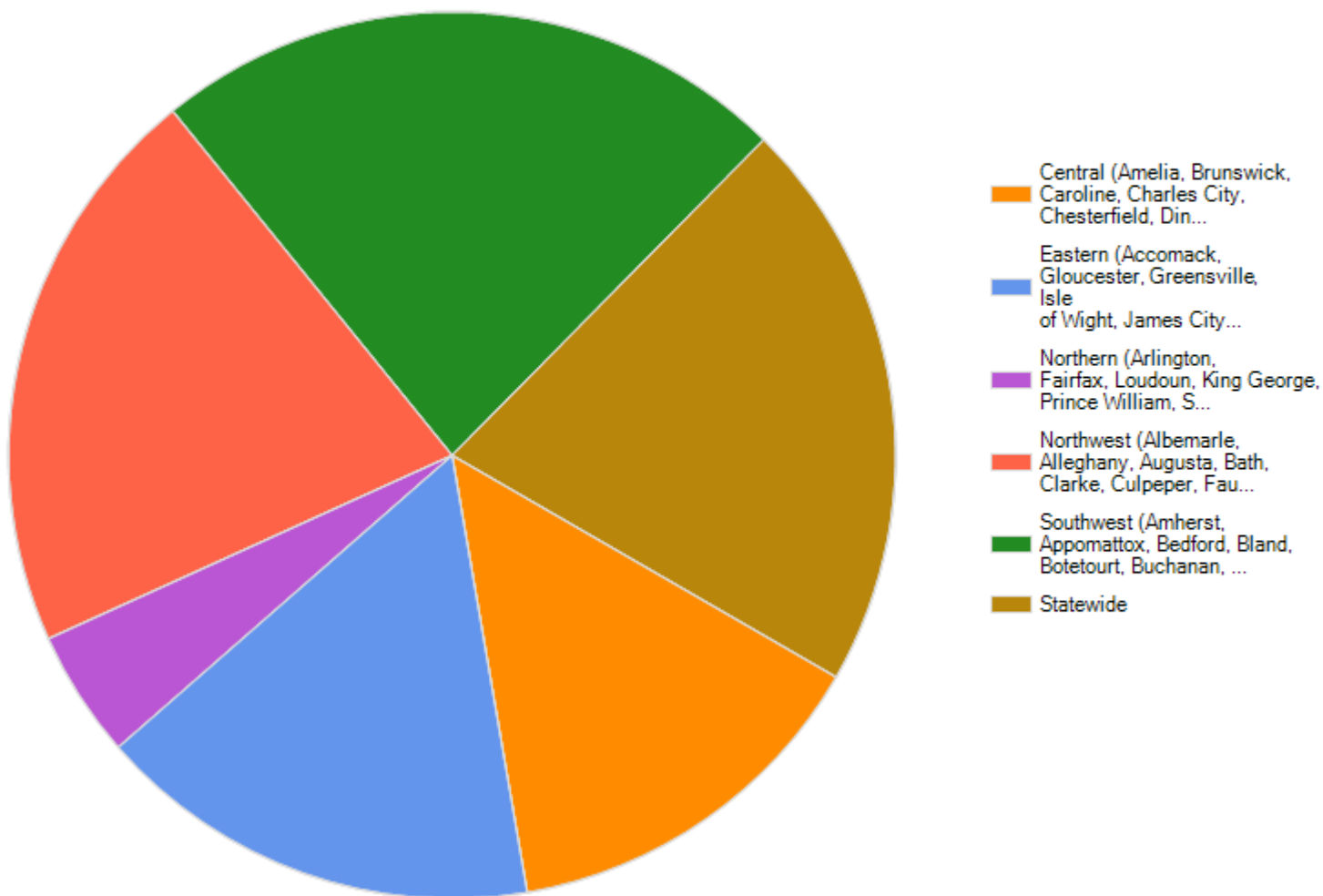
# Organizations responding

Is your organization represented as:



## Regions responding

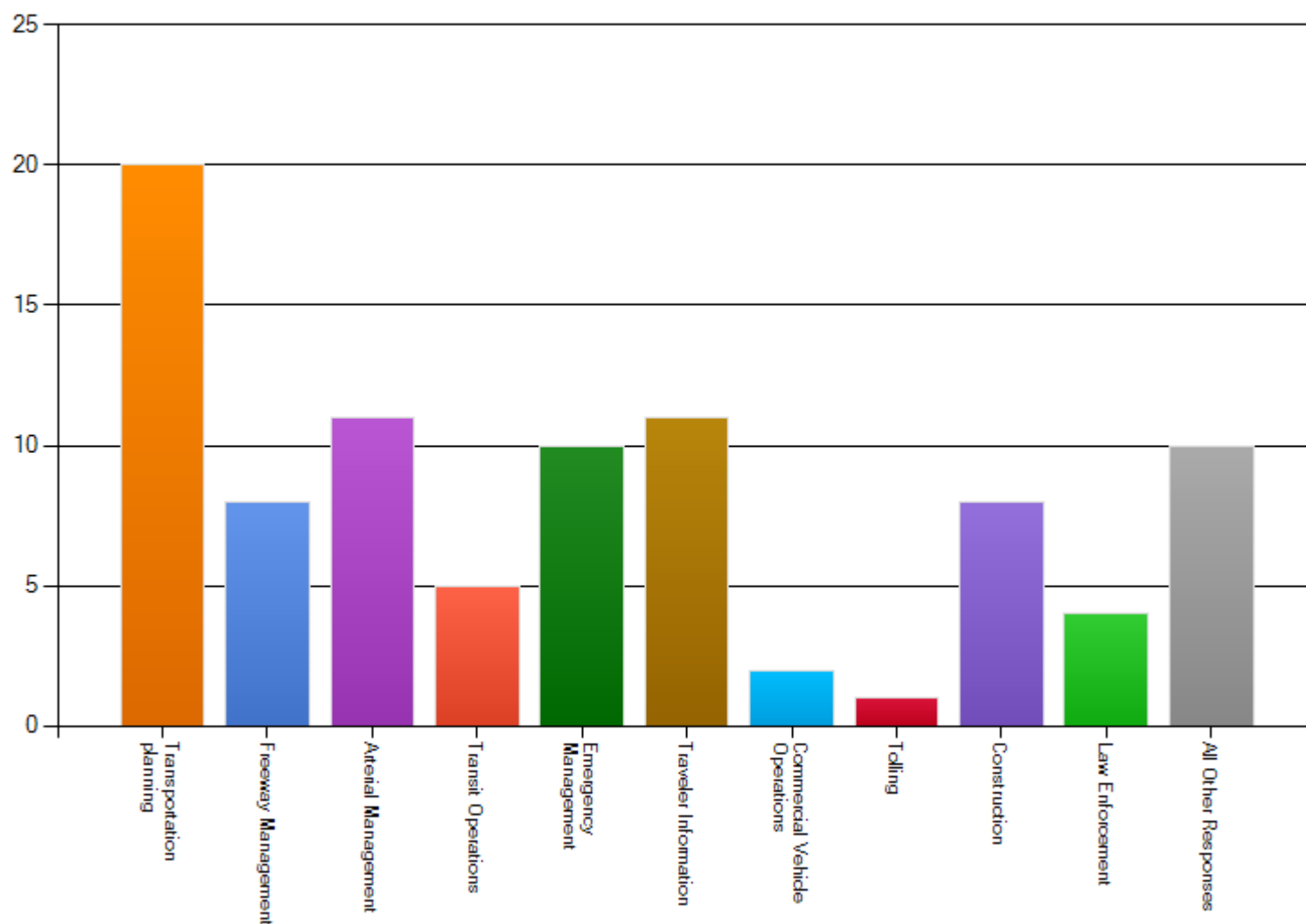
Select the region of Virginia to which your organization's responsibilities or interests apply (Counties identified with regions below):





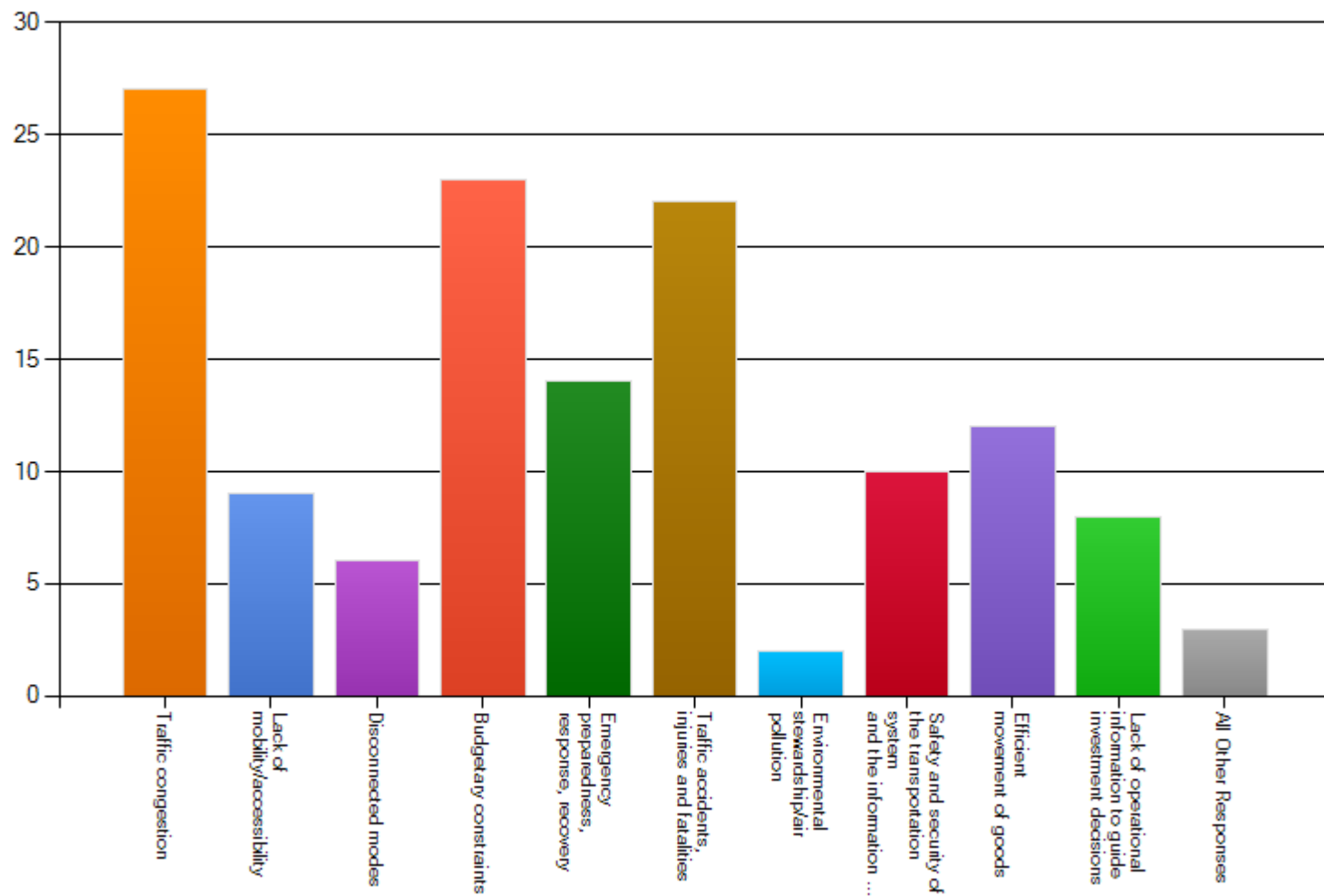
# Primary focus of organization

What is the primary focus of your organization? (Select all that apply.)



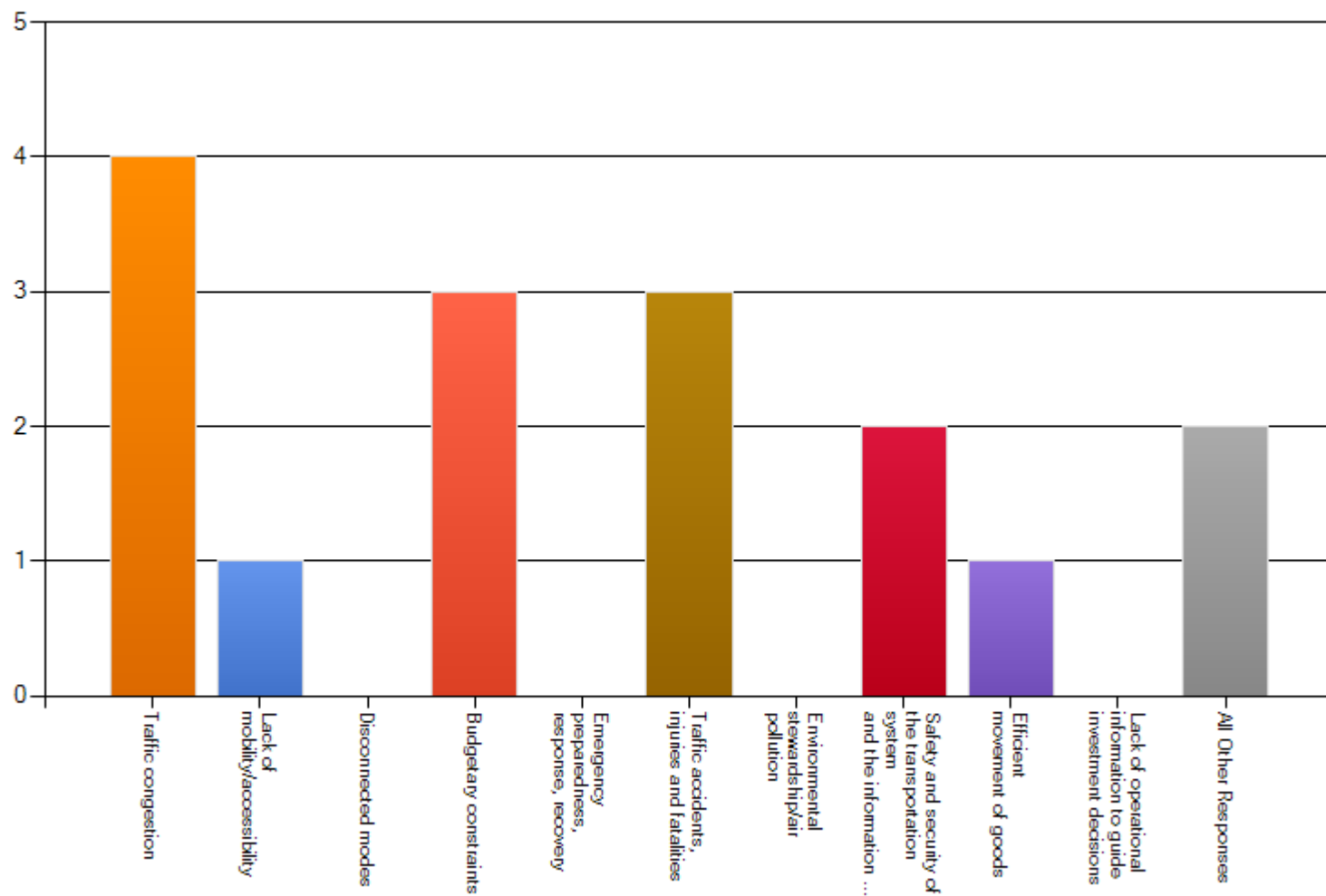
# Statewide transportation problems

What transportation related problems are you most challenged with? (Select all that apply.)



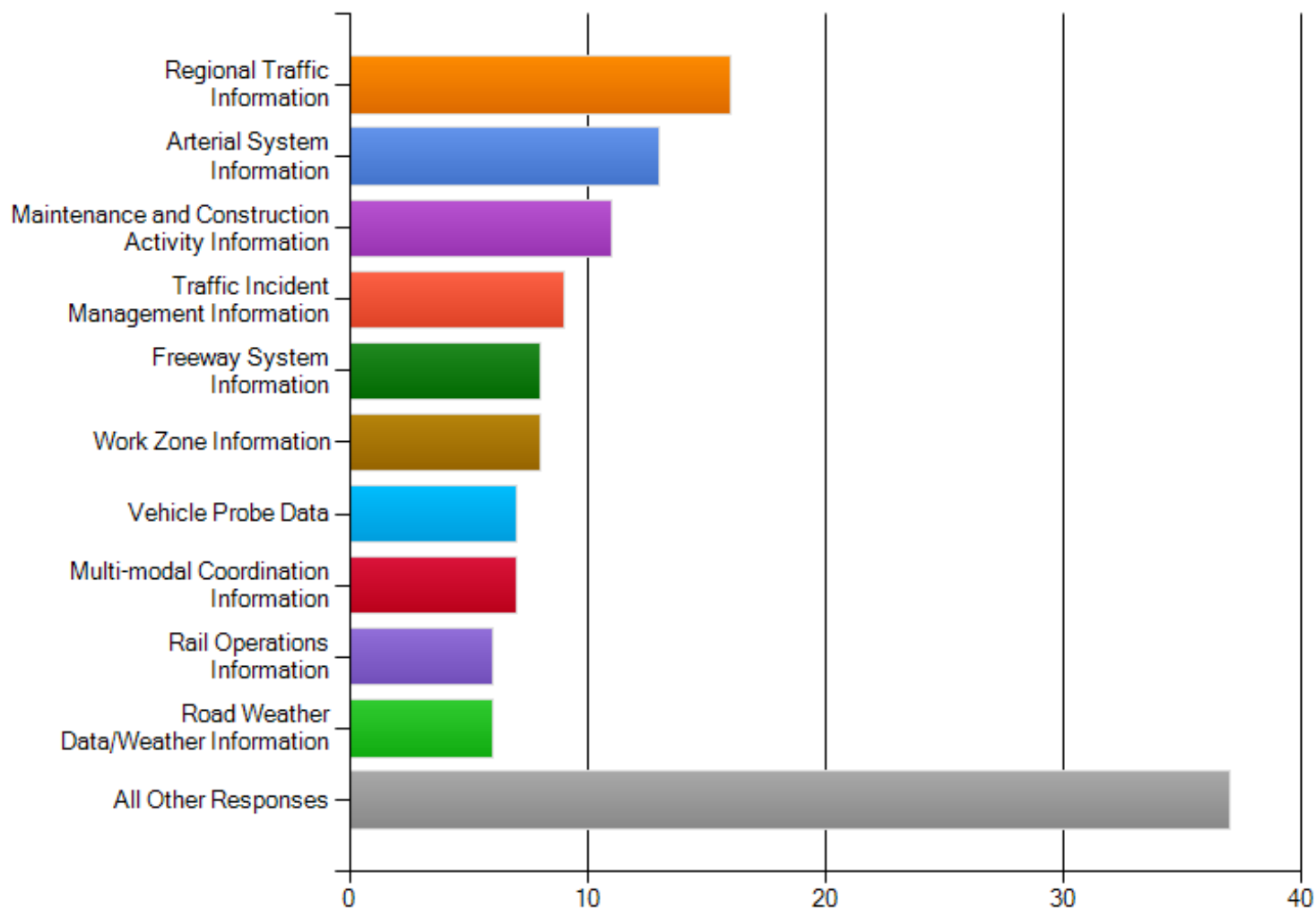
# Central region transportation problems

What transportation related problems are you most challenged with? (Select all that apply.)



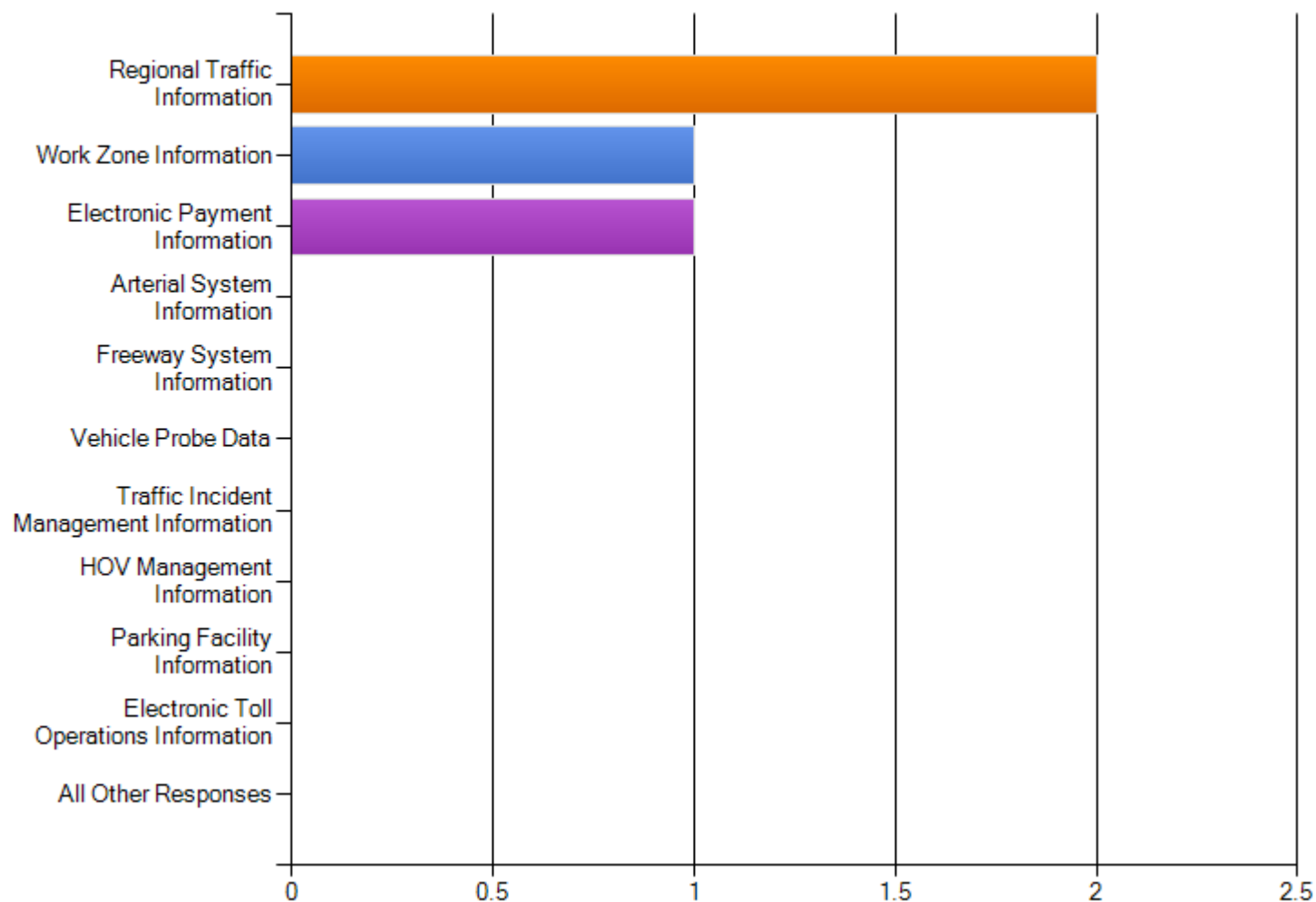
# Statewide information needs

What kinds of information do you need to address your transportation related problems but don't currently have access to? (Select all that apply.)



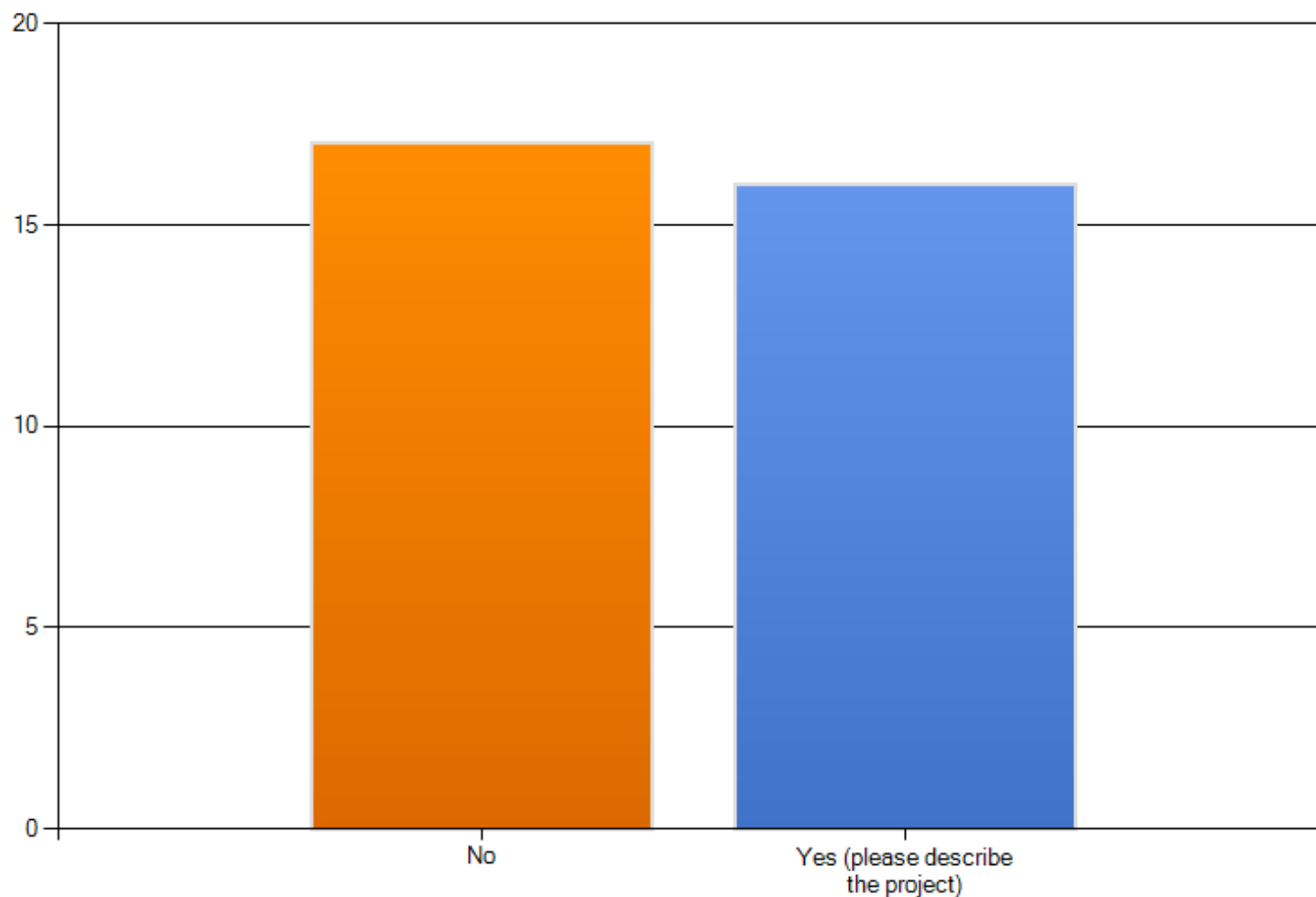
# Central region information needs

What kinds of information do you need to address your transportation related problems but don't currently have access to? (Select all that apply.)



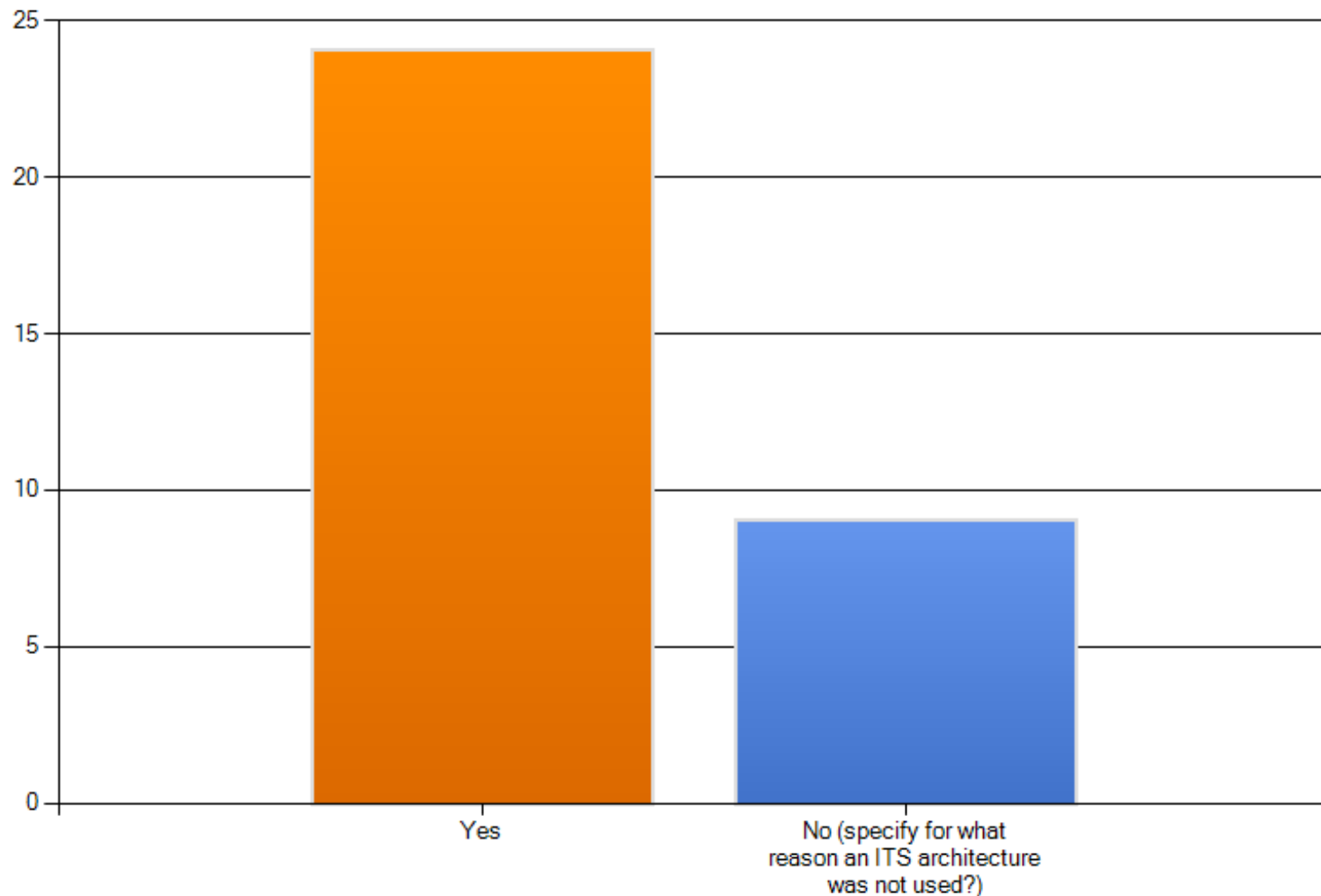
# New ITS projects

Has your organization deployed any new ITS projects within the past twelve (12) months?



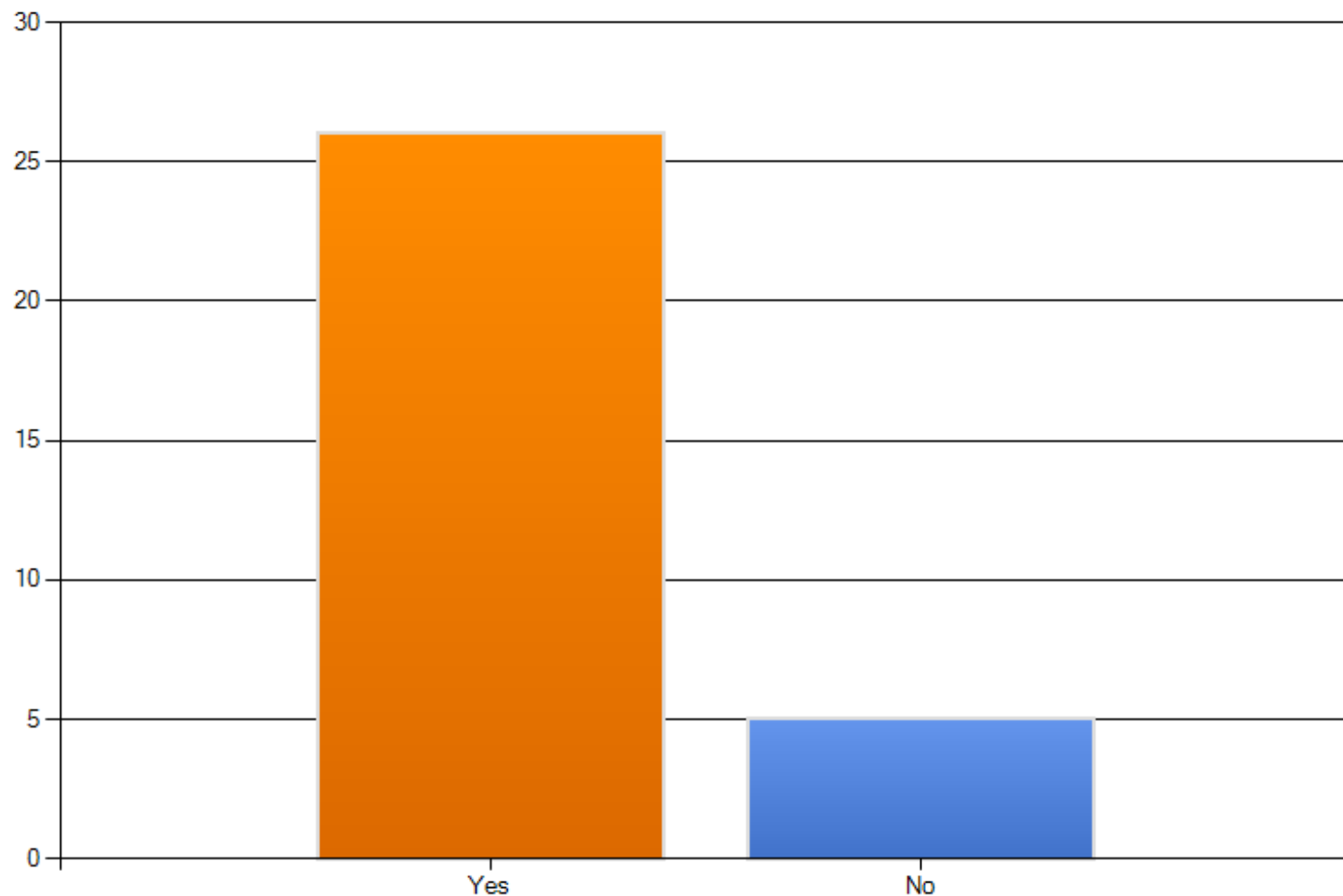
# Use of VA ITS Architectures

Have you used any of the Virginia ITS Architectures to plan, define, or develop your projects?



# Accuracy of VA ITS Architectures

Are your organization's Intelligent Transportation Systems (ITS) capabilities accurately represented in the Virginia suite of ITS Architectures ? If you would like to review your regional ITS architecture for your organization's interests, please go to the following site: <http://local.iteris.com/virginiaitsarchitecture/>.





# TRANSPORTATION/ITS NEEDS BREAKOUT GROUPS

# ITS

**Use of information and communications technologies to *meet* transportation needs**

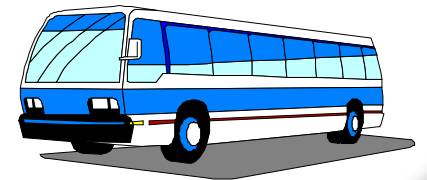
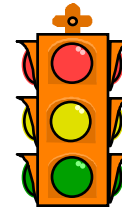


# ITS Architecture

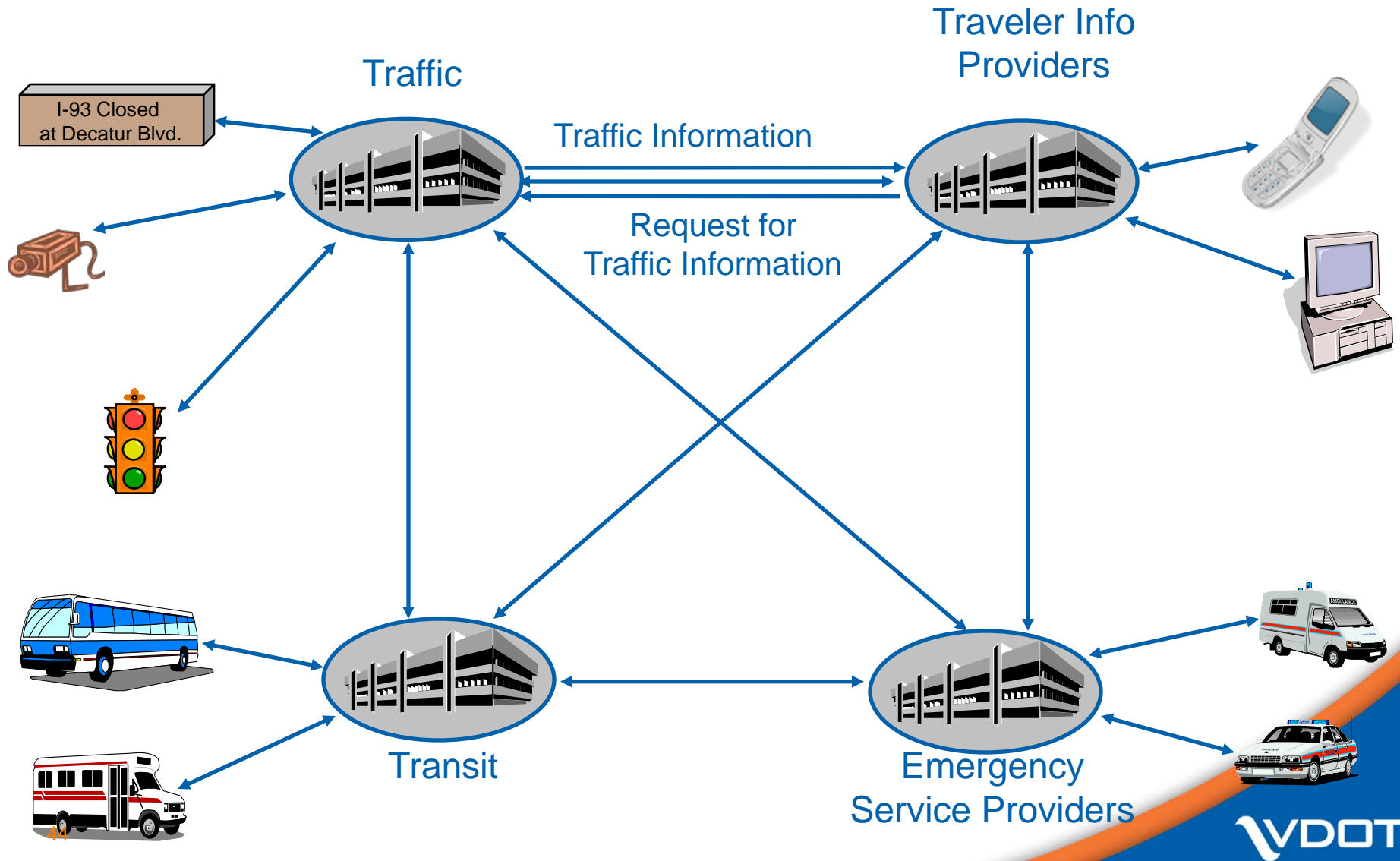
## Framework for Developing Integrated Transportation Systems

### Identifies:

- Organizations
- Systems operated
- Functions performed
- Communications
- Information exchanged



# ITS Architectures Provide a Framework for Integration



# An ITS Architecture Produces Real Benefits

**Reduce design costs and development time**

**Orderly and efficient deployments over time**

**Improve communications**

**Between people**

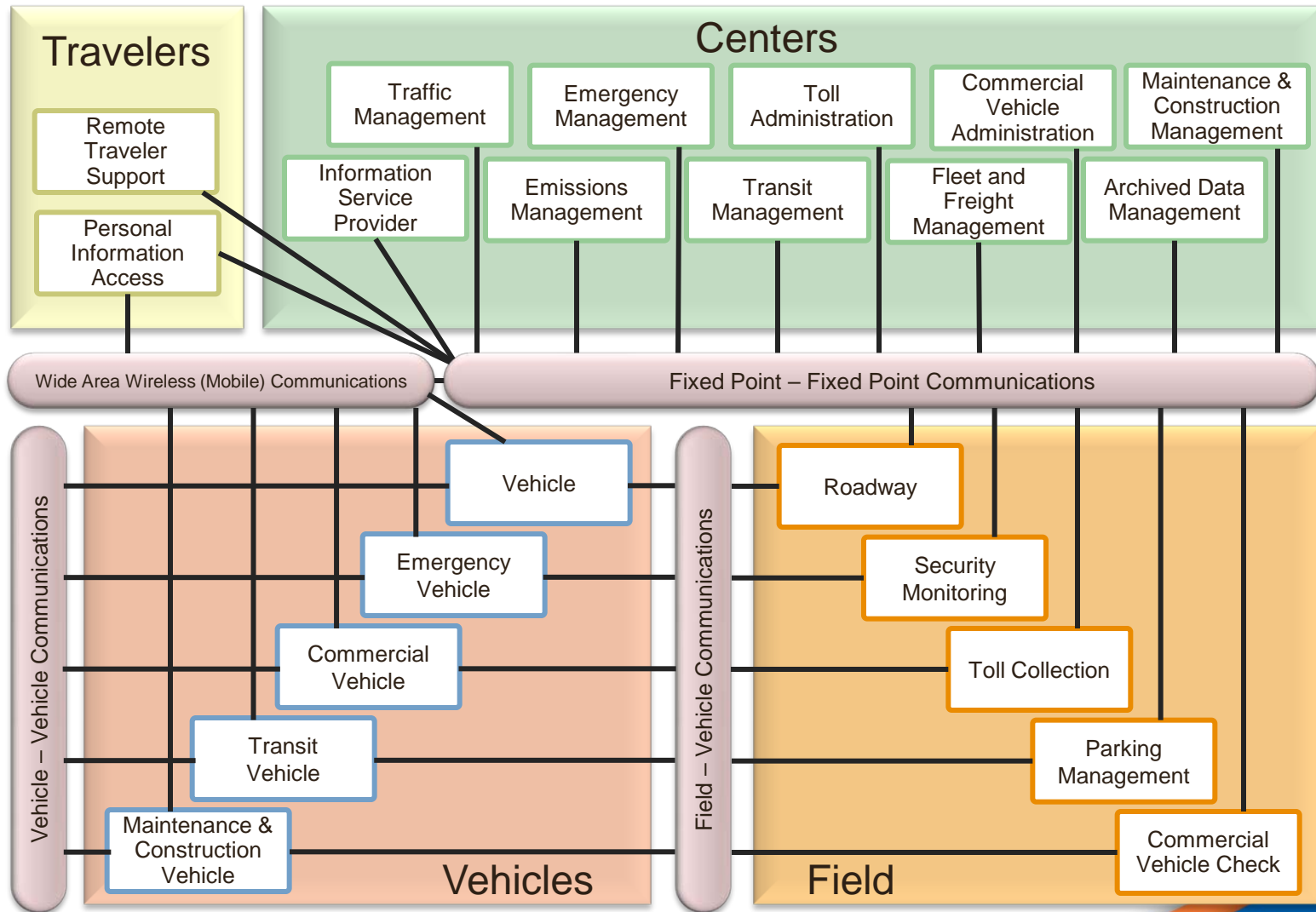
**Between systems**

**Reduce risk**

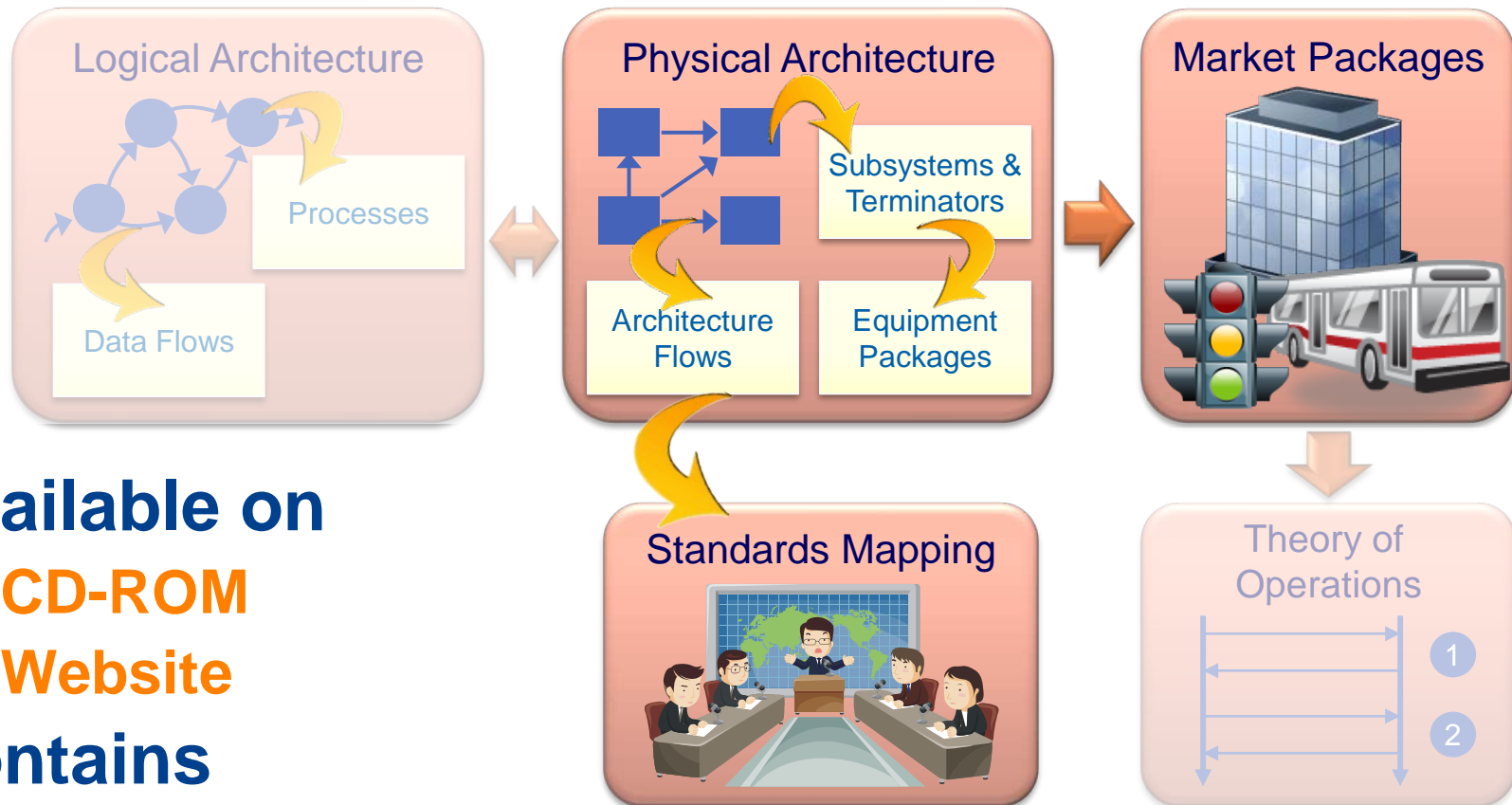
**Support compliance with ITS Architecture &  
Standards Rule/Policy**



# National ITS Architecture is a Framework and a Template



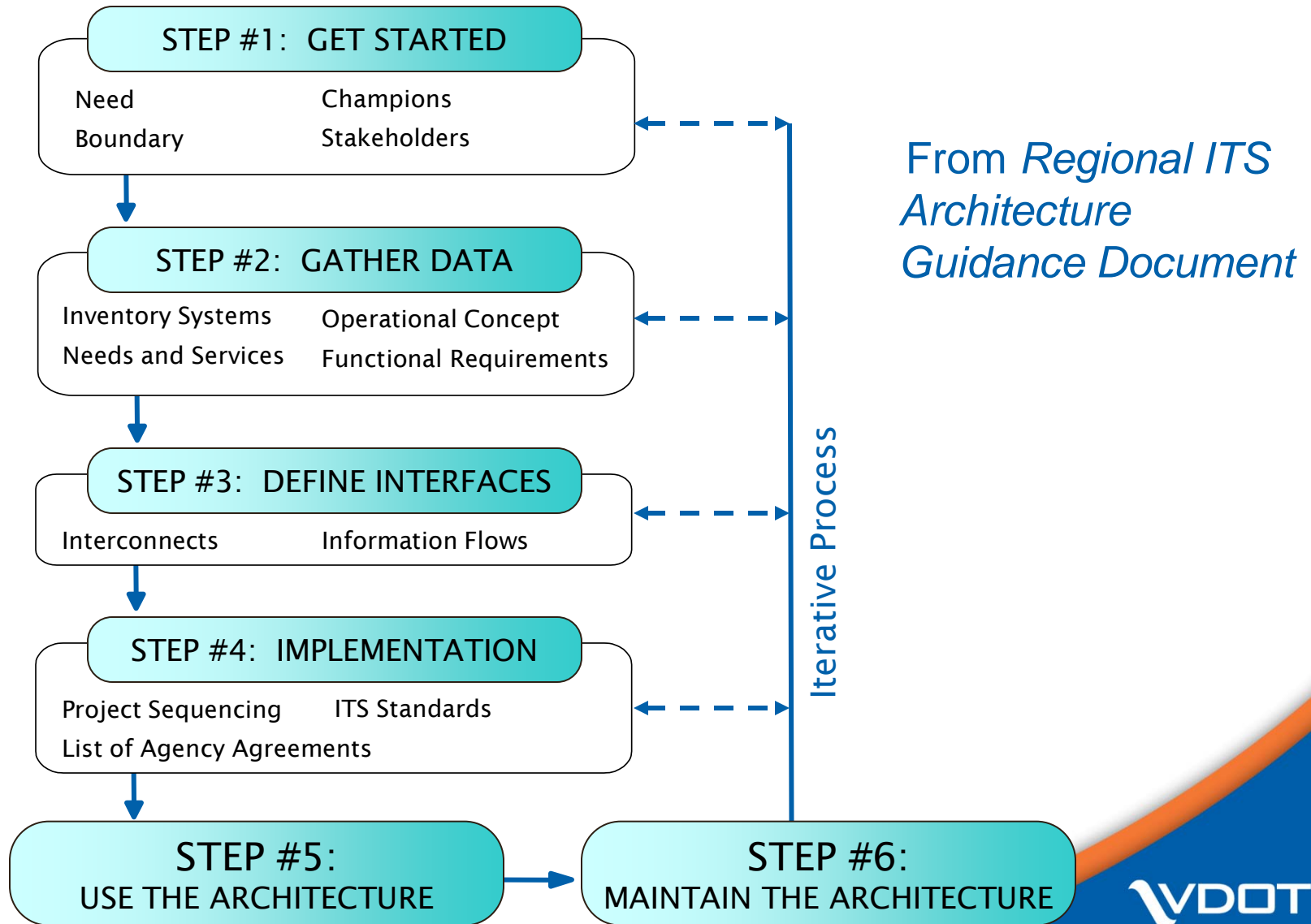
# National ITS Architecture Products



**Available on**  
**CD-ROM**  
**Website**  
**Contains**  
**Hypertext**  
**PDF documents**  
**Databases**



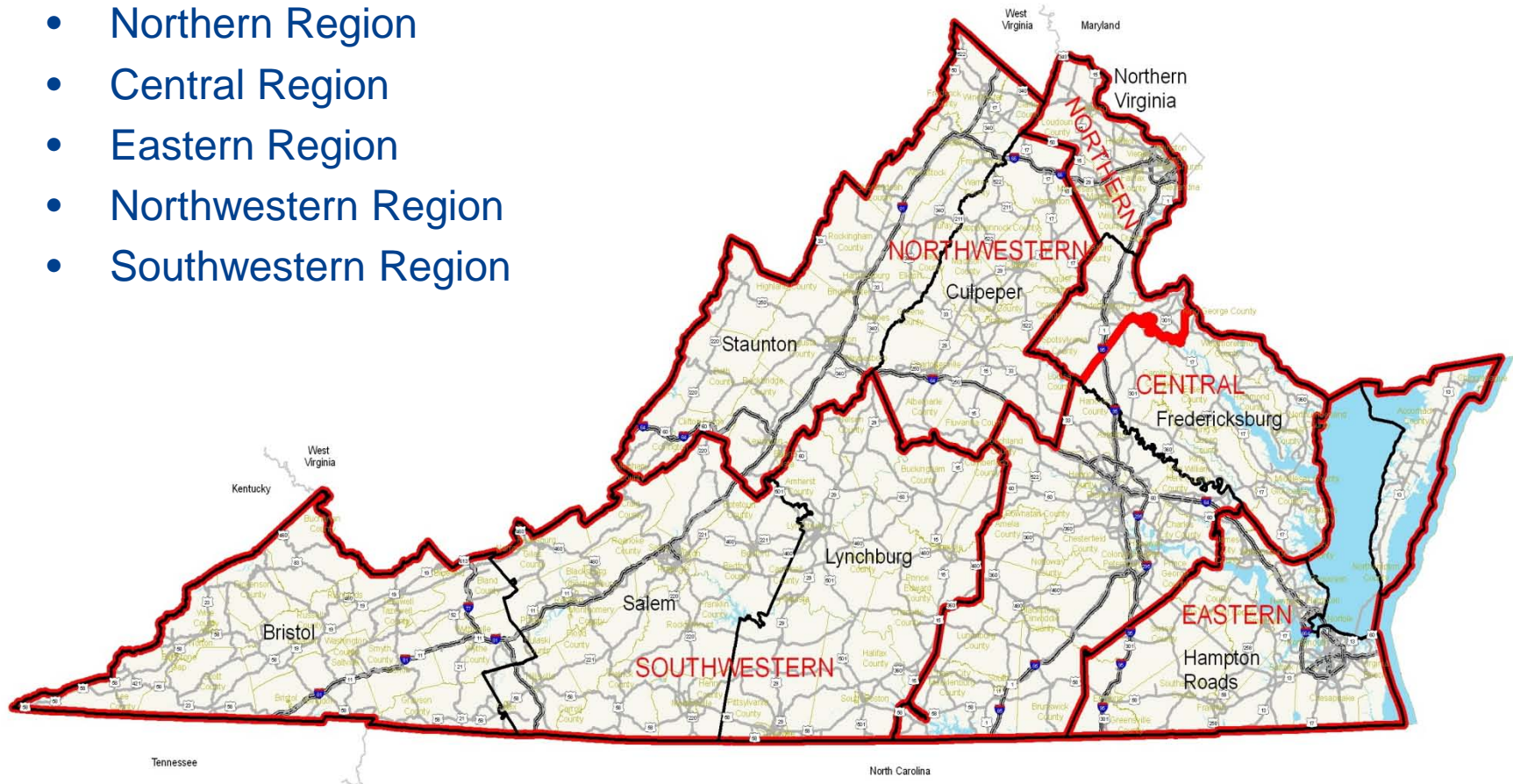
# Regional ITS Architecture Development Process





# VA ITS Architectures

- Statewide
- Northern Region
- Central Region
- Eastern Region
- Northwestern Region
- Southwestern Region



## Statewide vs Regional Scope

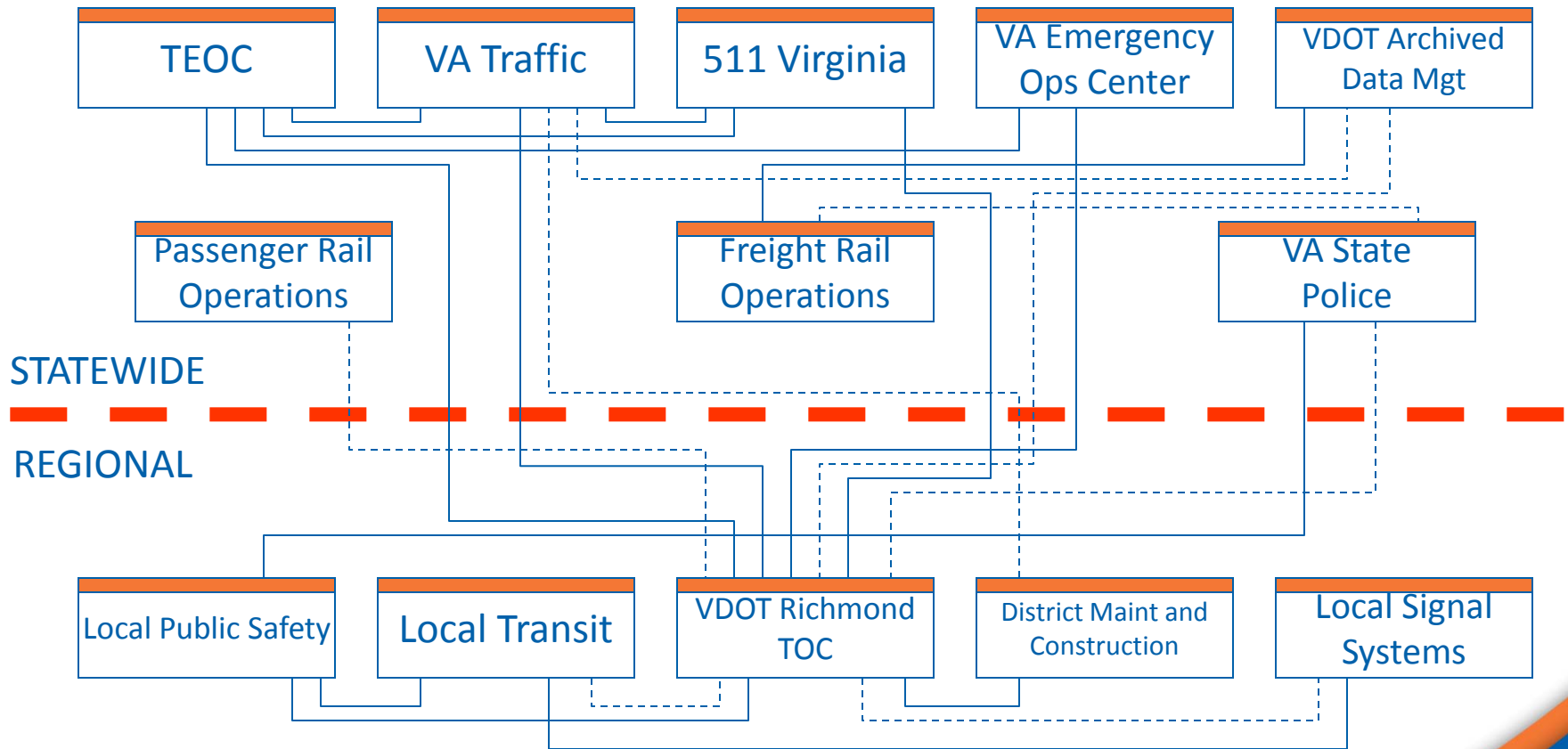
### **Statewide system functionality defined at statewide level in detail**

Statewide functionality definition not required at regional levels – interfaces to statewide systems is focus

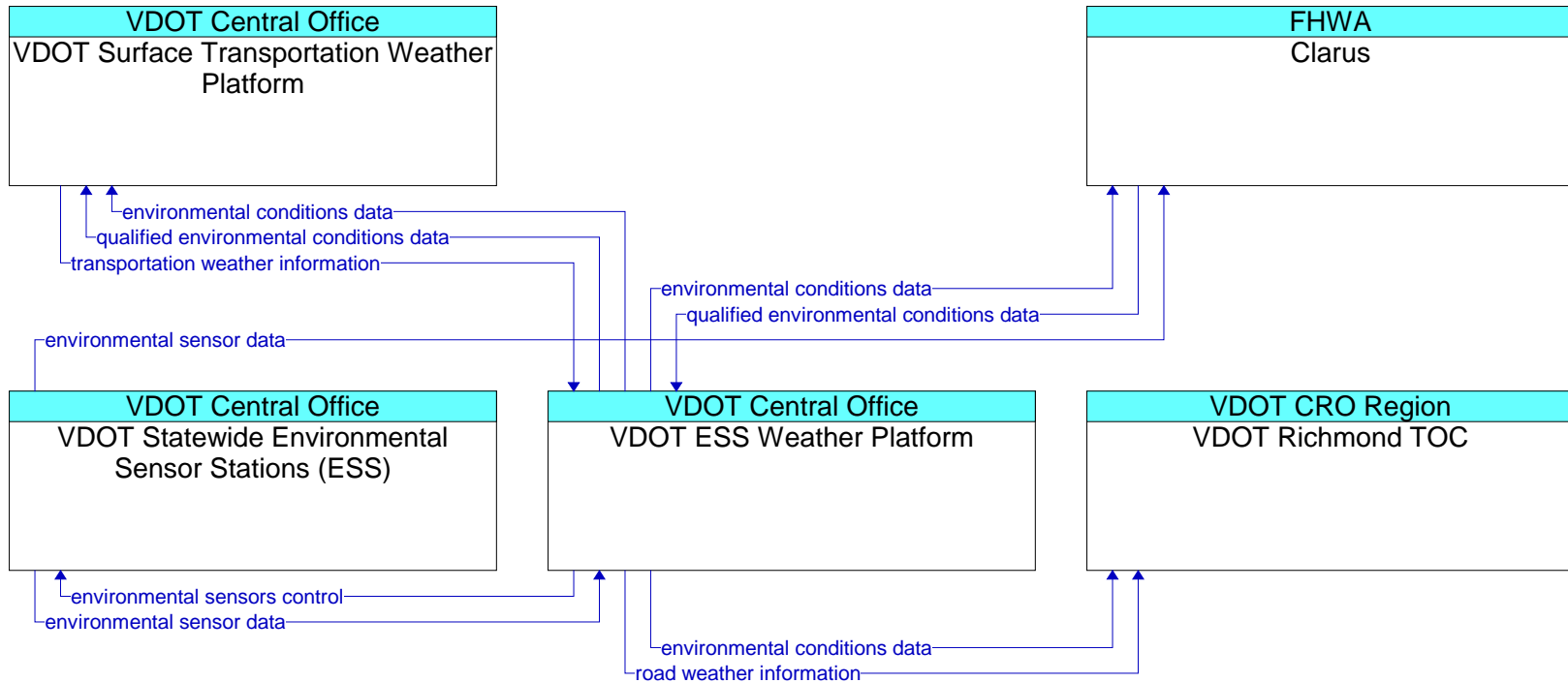
### **Regional system functionality defined at regional levels in detail**

Relationships and information exchanges included in regional to statewide but regional is less complex regarding statewide systems

# Statewide vs. Regional Interconnect Example

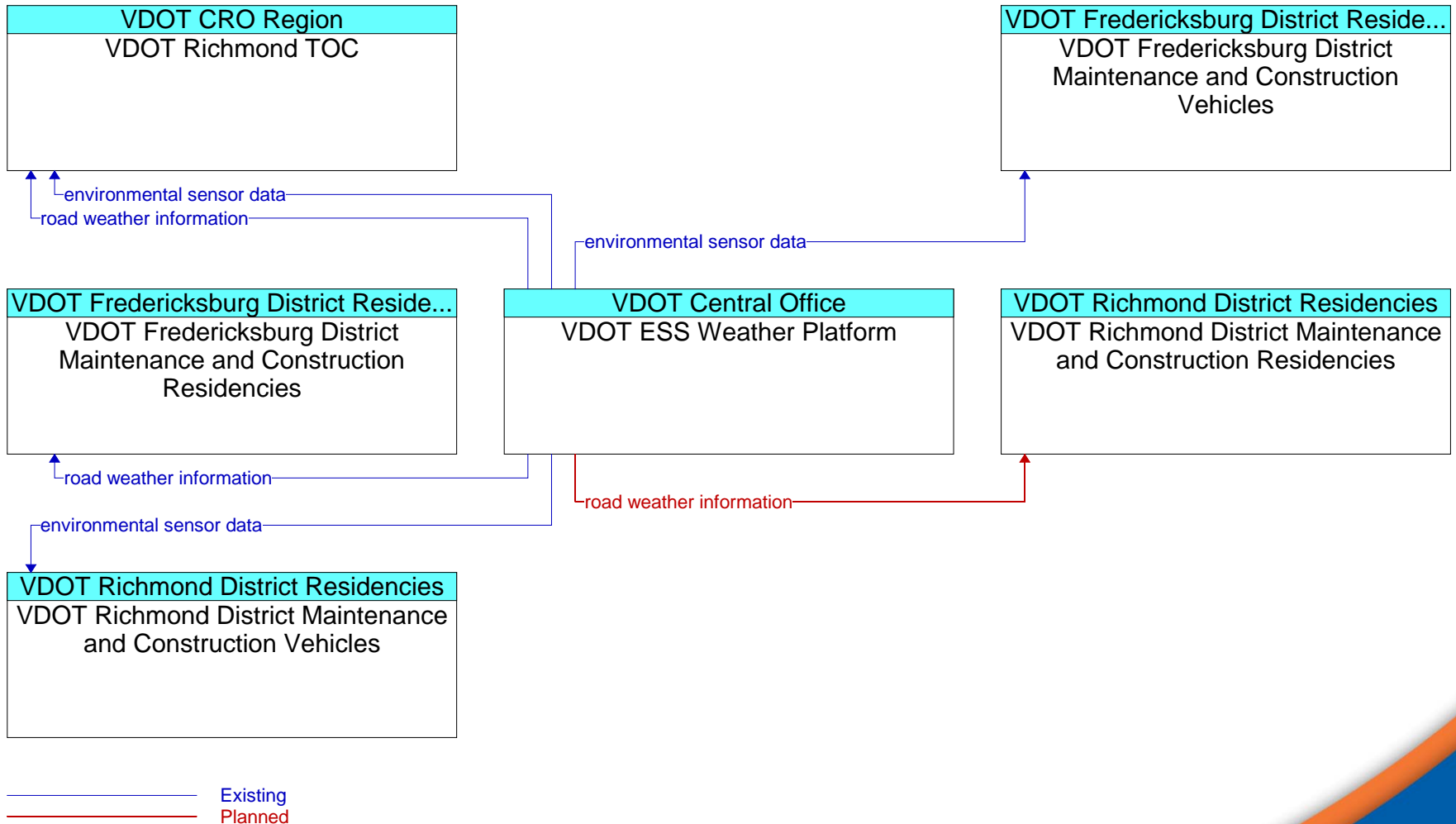


# Statewide Weather-Related ITS Information Flow Example

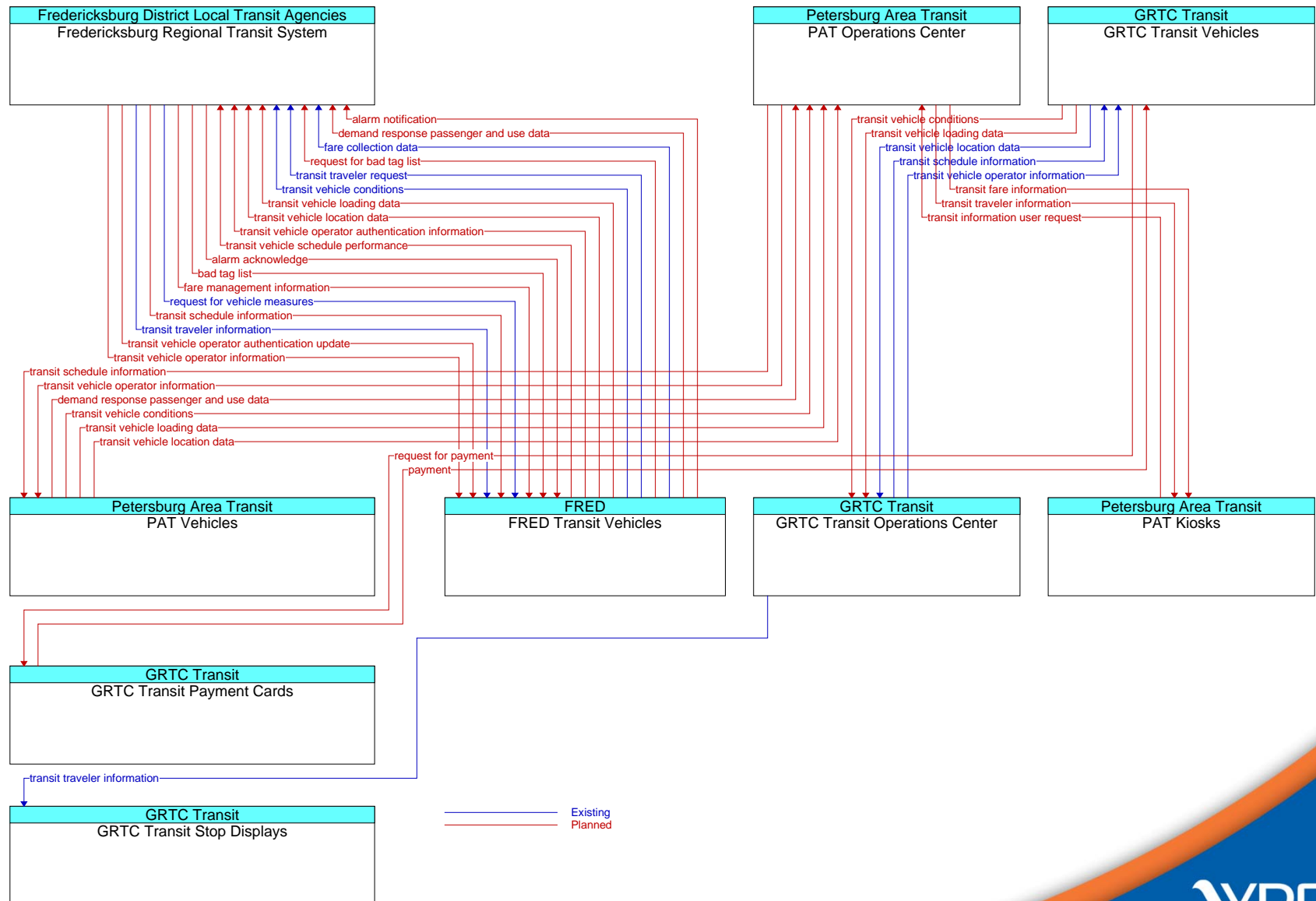


Existing

# Weather (Central Region) Information Flow Example



# Central Transit-Related ITS Information Flow Example



## Break-Out Groups

- **Find Your Breakout Session**
- **Each group will discuss topics particular to that domain along with general findings across all domains**

## Break-Out Group Assignments (Sample)

### Breakout Group

Transit, Traveler mobility, Traveler information,

Traffic management, Maintenance & construction, Road weather, Critical infrastructure, Environment

Planning

Public Safety



# Breakout Group Introduction

## Objective

**Capture User Needs – problems/solutions/rationale**

## Breakout Group – Key Questions

- **Who are you?**
- **What is the problem?**
- **Why is this a problem?**
- **What do you need to solve the problem?**
- **Why should ITS solve this problem?**

# Participant Notes

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# Participant Notes

# **TRANSPORTATION/ITS NEEDS BREAKOUT GROUPS RECAP**

# Breakout Group – Reports

## What did we learn?

**Someone from each group summarize key points**

**Problems**

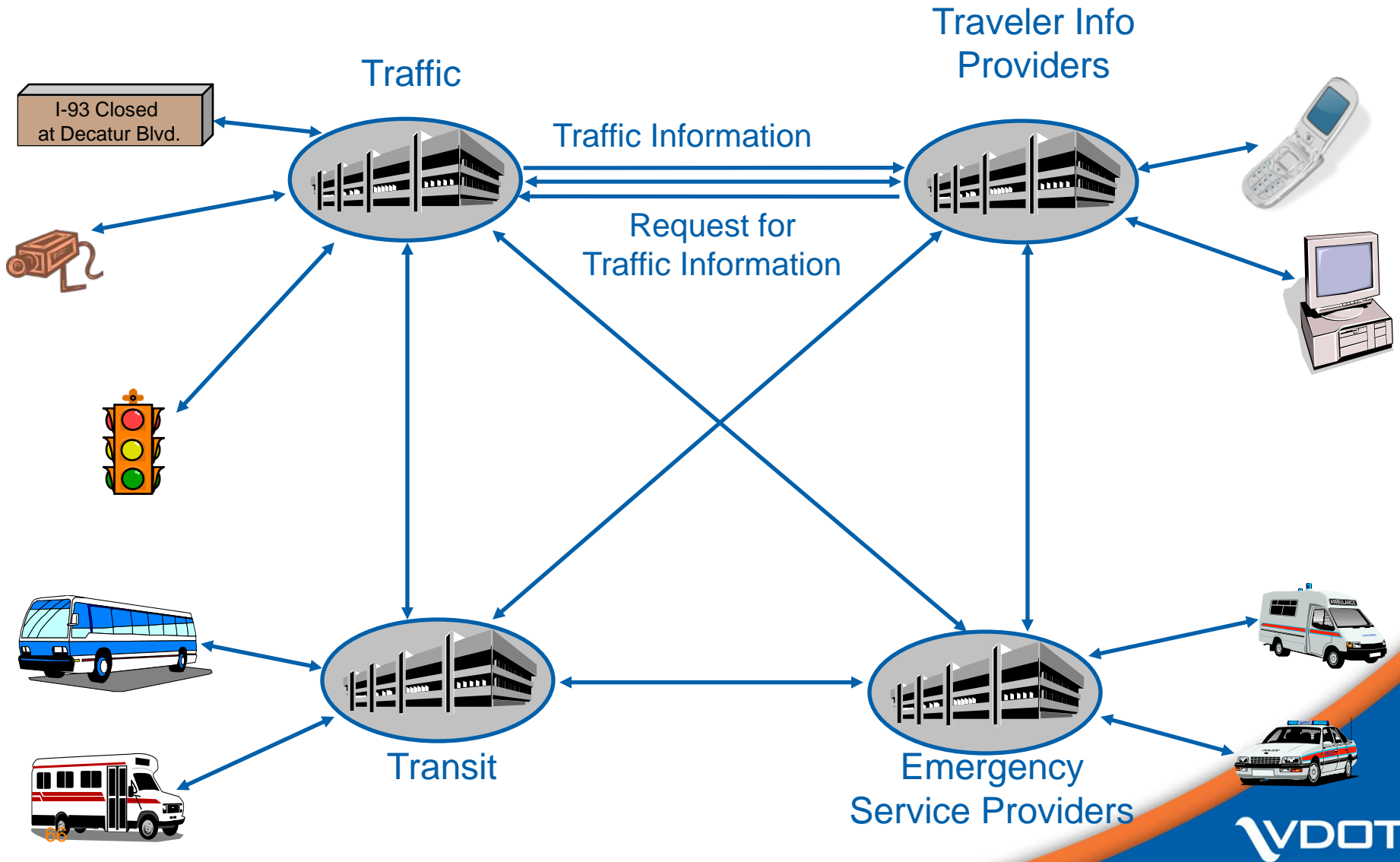
**Needs**

**Rationale**



# USING ITS ARCHITECTURE PRESENTATION

# Recall: ITS Architectures are a Framework for Integration



# Regional ITS Architecture

**A framework for ensuring institutional agreement and technical integration for the implementation of ITS projects in a particular region**



# Regional ITS Architecture Components

## ITS Architecture

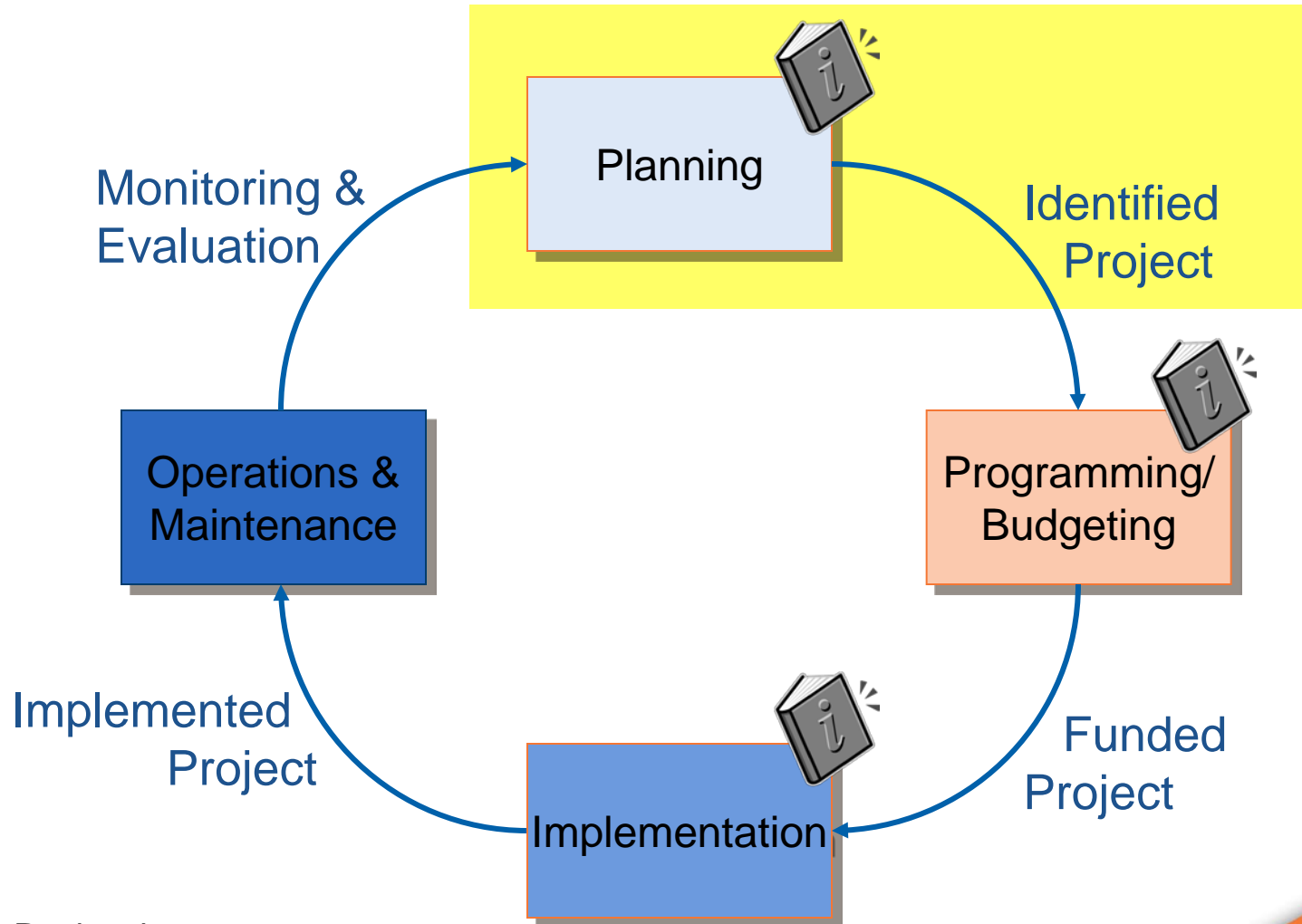
1. Region description
2. Stakeholder identification
3. ITS elements
4. ITS services
5. Operational concept
6. Functional requirements
7. Interfaces / Information flows
8. Standards identification
9. Project sequencing
10. Agreements
11. Maintenance plan

# Turbo Architecture

*Turbo Architecture* is a software tool that automates use of the National ITS Architecture



# Architecture Use in Project Life Cycle



# Reasons for Architecture Use in Transportation Planning

**Architecture represents a consensus vision of Operations and Planning stakeholders for deployment of ITS systems**

**Addresses both short range projects and long range strategies**

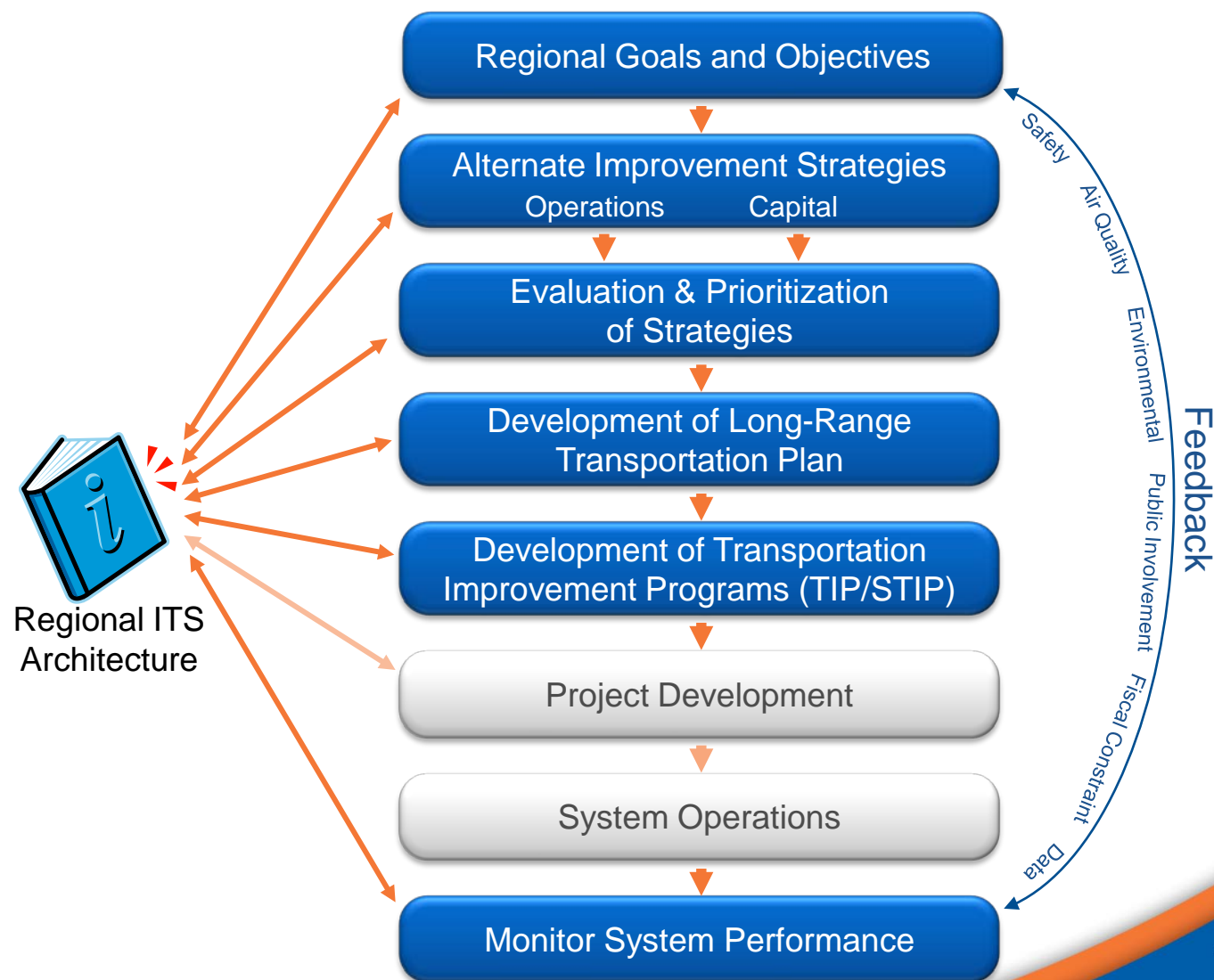


# Transportation Planning Process





# Regional Architecture and Transportation Planning



# Strategy Evaluation and Prioritization

Potential  
Strategies

Evaluation and  
prioritization

Selected  
Strategies

Included in

Long Range  
Plan

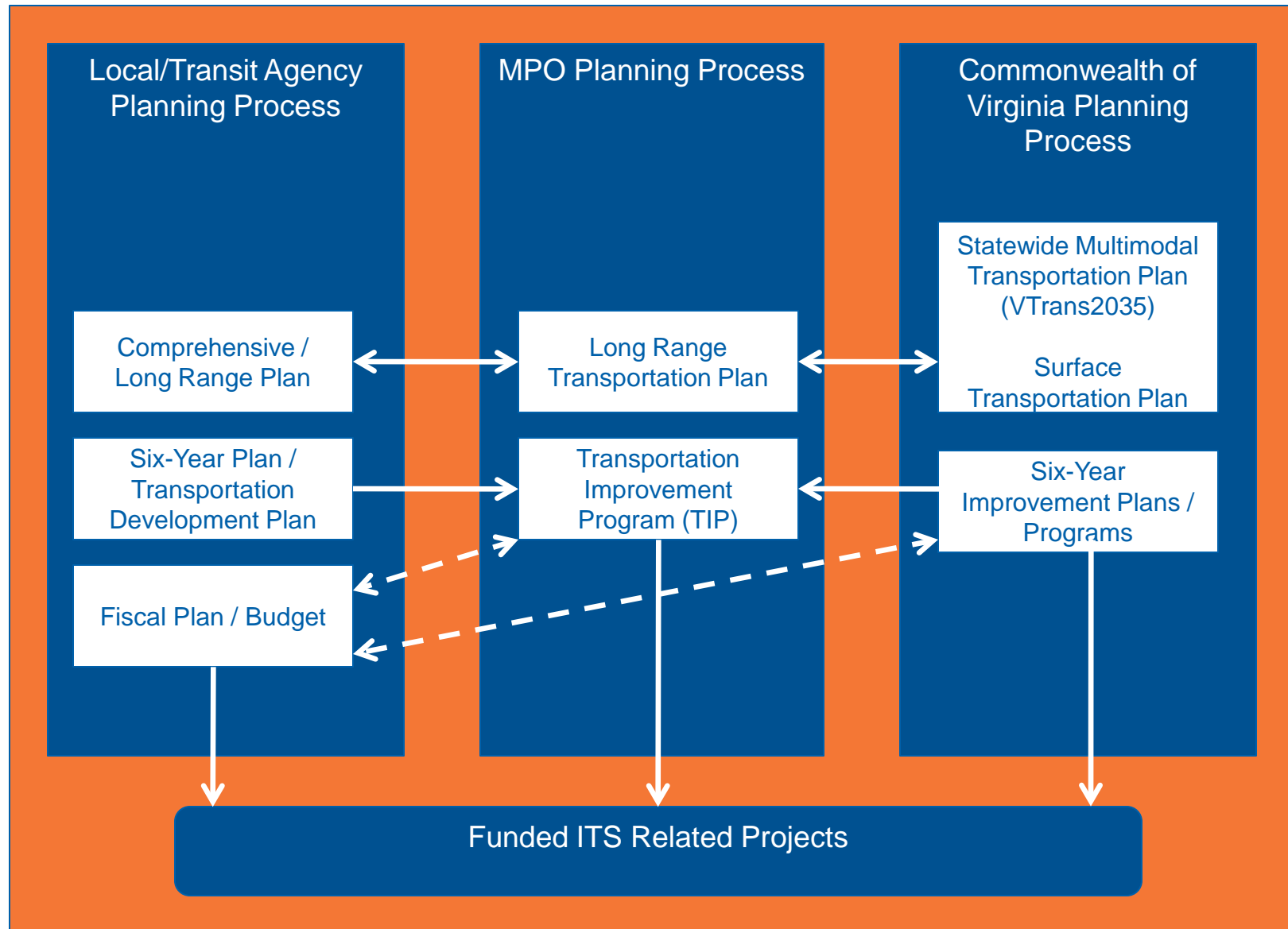
Regional Goals and Objectives

Alternate Improvement Strategies  
Operations Capital

Evaluation & Prioritization  
of Strategies

Evaluation and prioritization of  
strategies are key planning  
activities

# Using the Virginia Central Region ITS Architecture for Planning



# Architecture in Long Range Planning

## Services/Market Packages – insight to needs, relationships, project scope

- Goals and Objectives

- Transportation Needs Definition

- Travel Conditions Forecasting

- Candidate Strategies/Projects

- Project/Strategy Costs and Benefits estimates

## Inventory – on-going operations and maintenance needs

- Transportation Needs Definition

## Project Sequencing – project dependencies and project scope

- Candidate Strategies/Projects

- Project/Strategy Costs and Benefits estimates

# Architecture in Programming and Budgeting

## Use by Project Sponsors

**Services** – insight into project element relationships and institutional partnerships

**Interfaces/Information Flows** – project element relationships and issues

**Project Sequencing** – system and project dependencies

## Use by Transportation Planners

**Operational Concept** – Roles and Responsibilities related to project

**Services**

**Interfaces/Information Flows** – Regional system impacts

**Project Sequencing** – Project timelines and dependencies, evaluation and prioritization

# Promoting Architecture in Planning

## Monitor for architecture implementation in planning – VDOT and DRPT

- Identify architecture checkpoints in planning process

- Provide guidance on architecture in planning

- Evaluate project compliance with architecture during planning process

- Point of contact for questions on architecture application

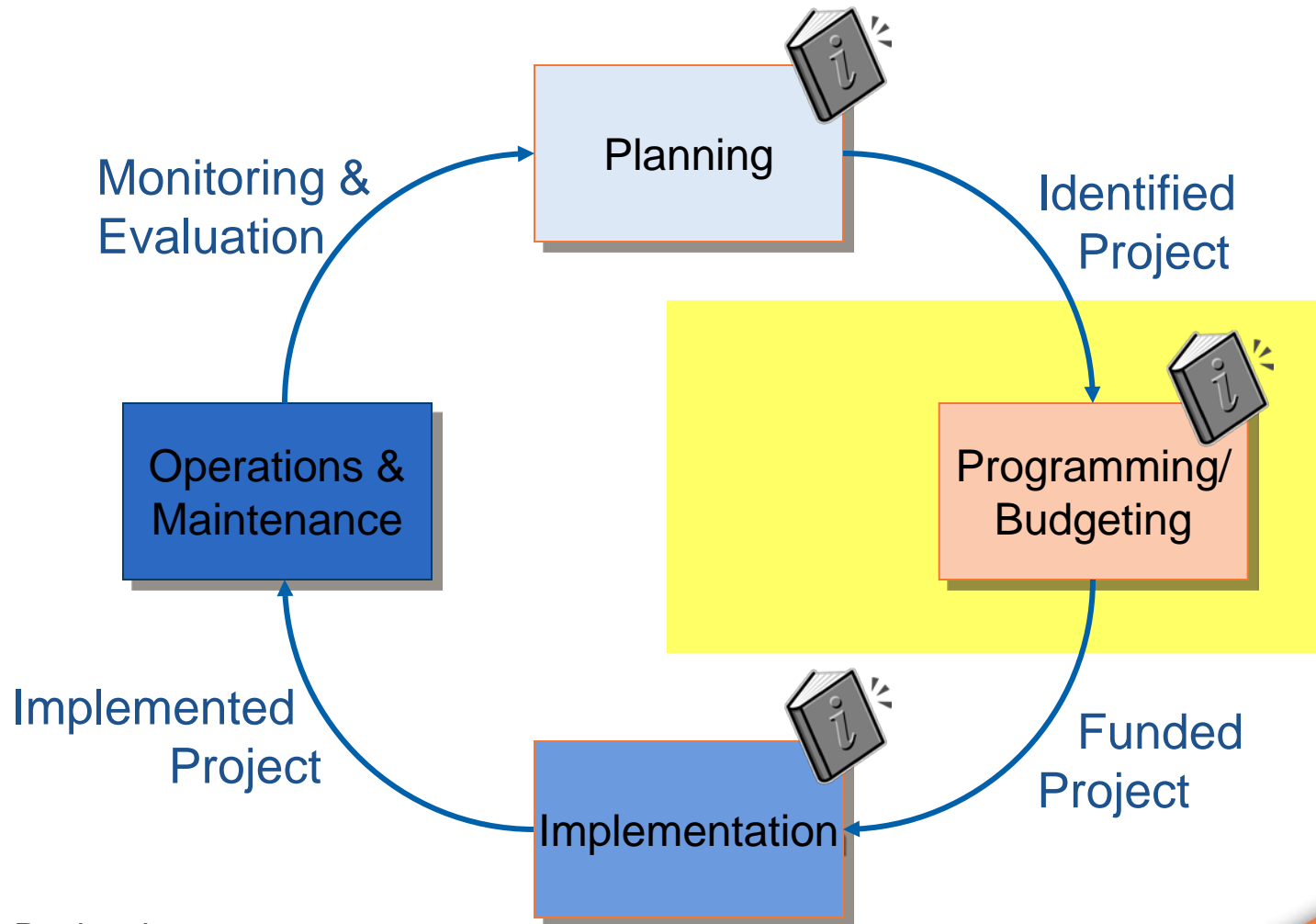
- Liaison between MPOs and other planning organizations

## MPOs and other Planning Organizations

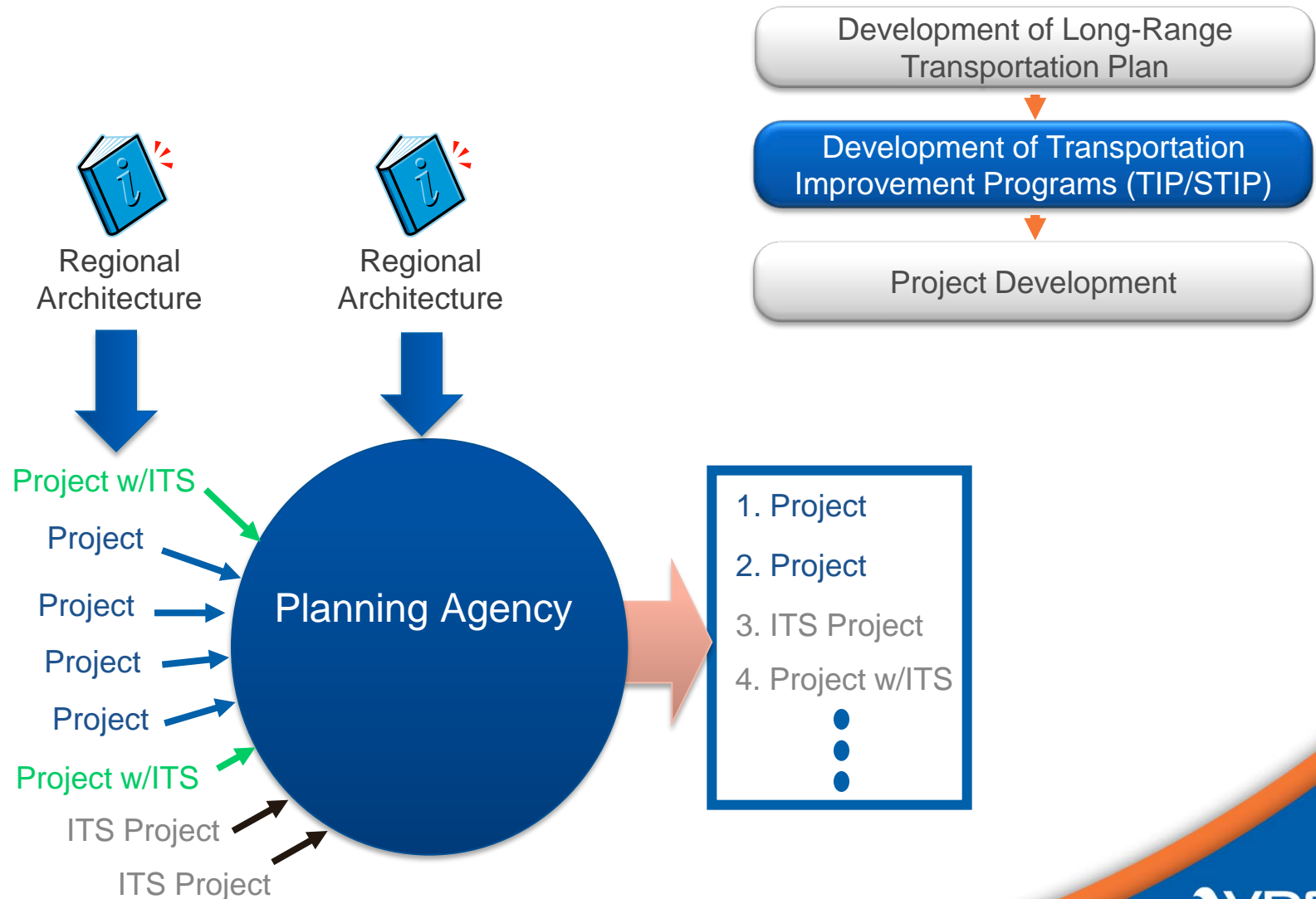
- Evaluate planning processes for inclusion of architecture

- Coordinate with VDOT

# Architecture Use in Project Life Cycle



# Architecture Use in Programming/Budgeting





## **Benefits of Architecture Use in Programming/Budgeting**

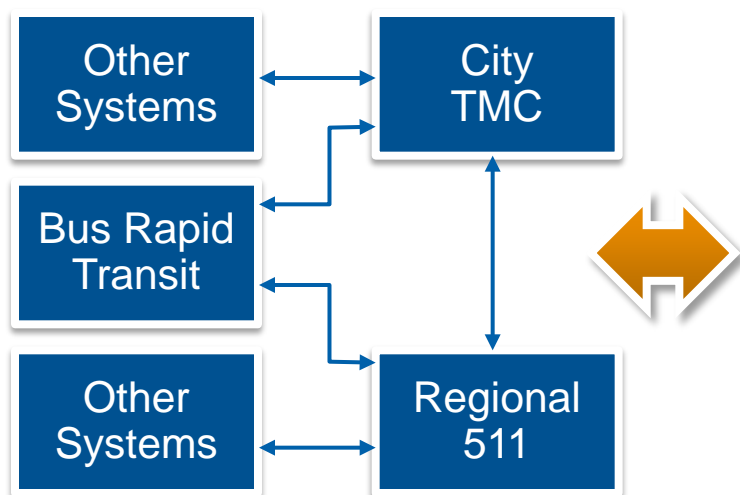
**Link objectives and needs of the region with ITS  
deployed in the field**

**Take a regional view**

**Begin coordination of projects of various organizations  
by defining from the same reference point**

# Architecture Provides a Regional Context for Planned Projects

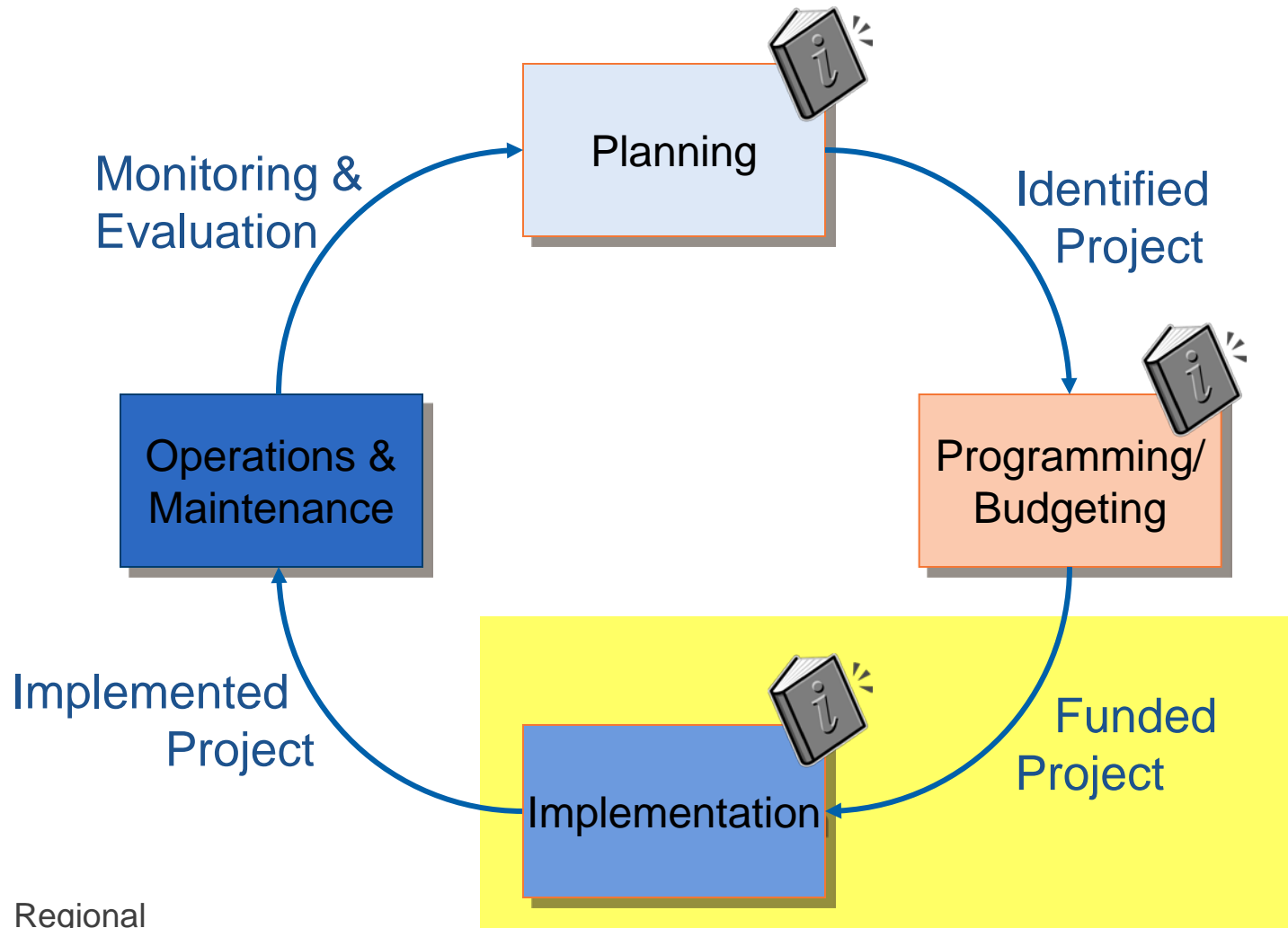
## Regional Architecture



## Transportation Improvement Program

Agency	Number	Project	Funding
City	C11-321	City TMC	\$400K
CTrans	T12-023	Bus Rapid Transit Ph1	\$1.4M
DOT	D11-843	Regional 511 Ph2	\$600K

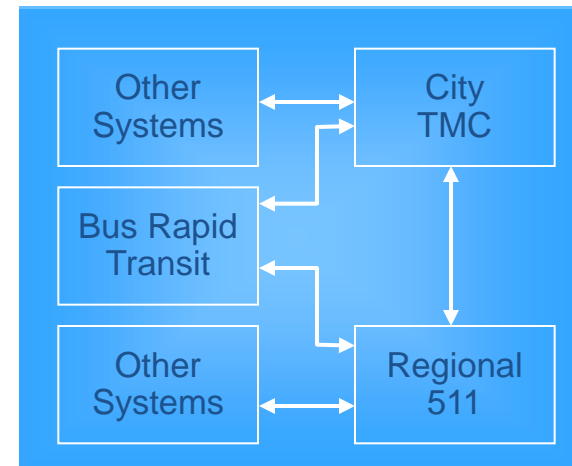
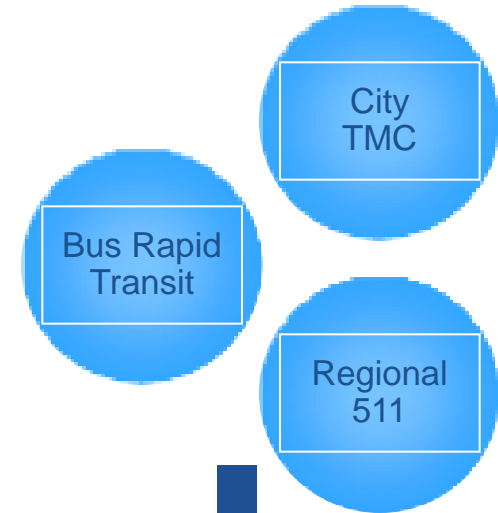
# Architecture Use in Project Life Cycle



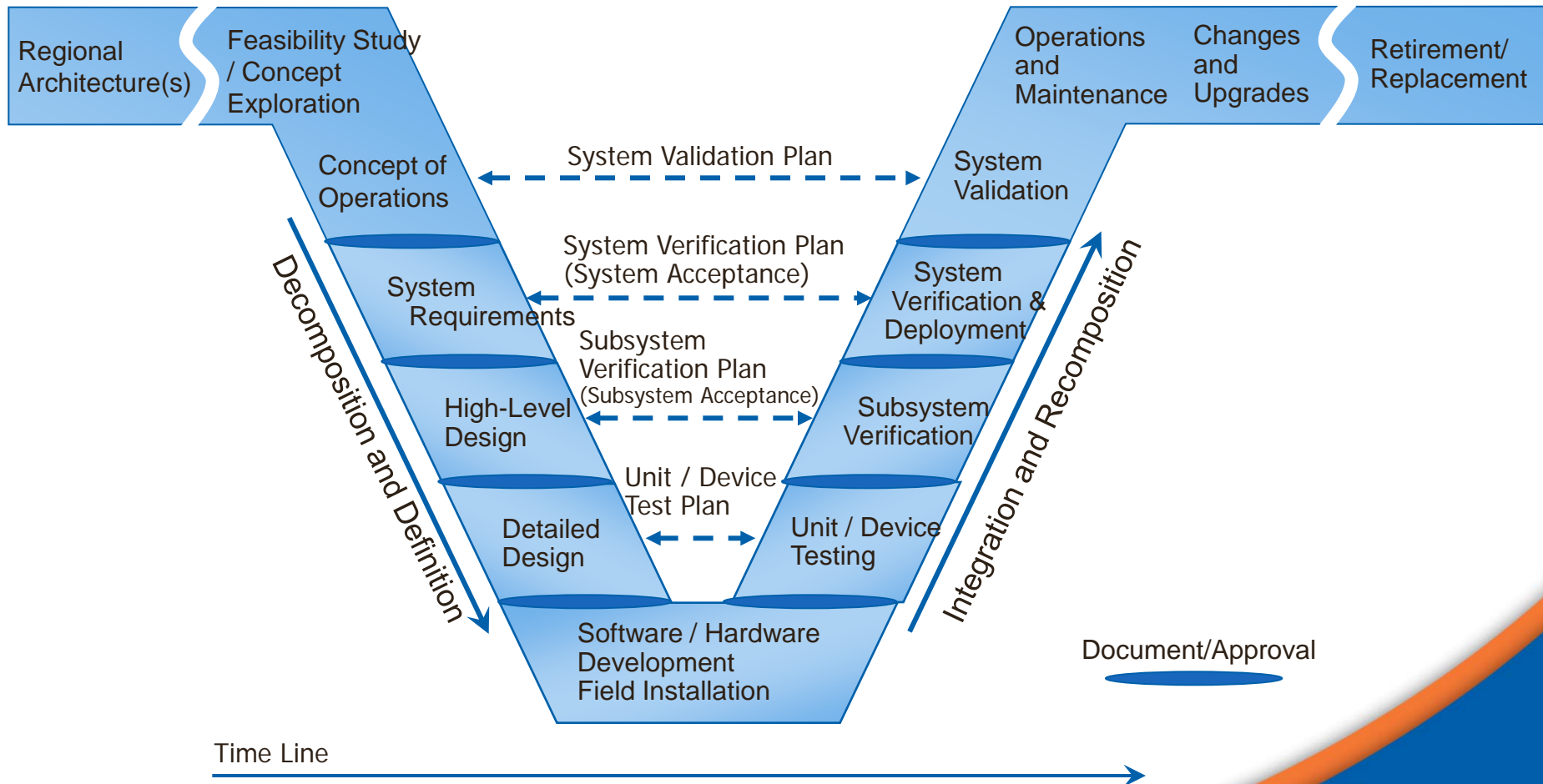
# Reasons for Architecture Use in Project Implementation



**Blueprint**  
**Integration Opportunities**  
**Efficiency**  
**Rule/Policy**

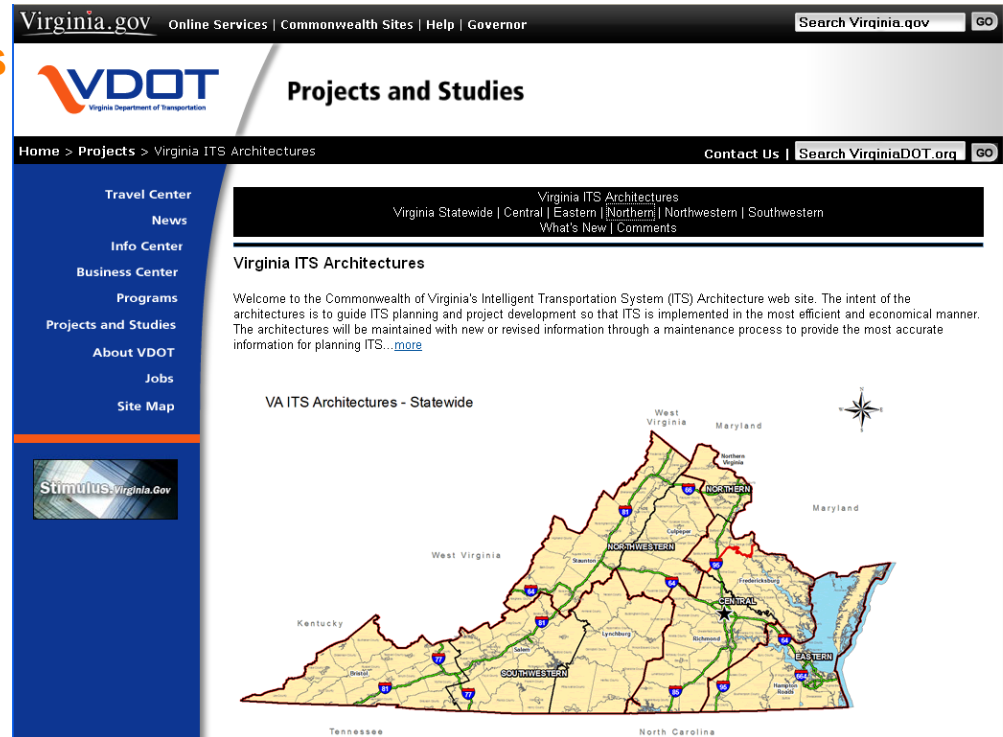


# Systems Engineering Process



# Architecture Tools

- **Common level of detail across all architectures**
  - ✓ **Tightly coupled - Facilitates inter- regional and corridor coordination**
- **CD / Website**
  - ✓ **All architectures on 1 site**
  - ✓ **No paper documents – all electronic products**
- **Nomenclature Guide**
  - ✓ **Captures common nomenclature**
- **Centerpiece of initiatives**
  - ✓ **Establishes functional framework**



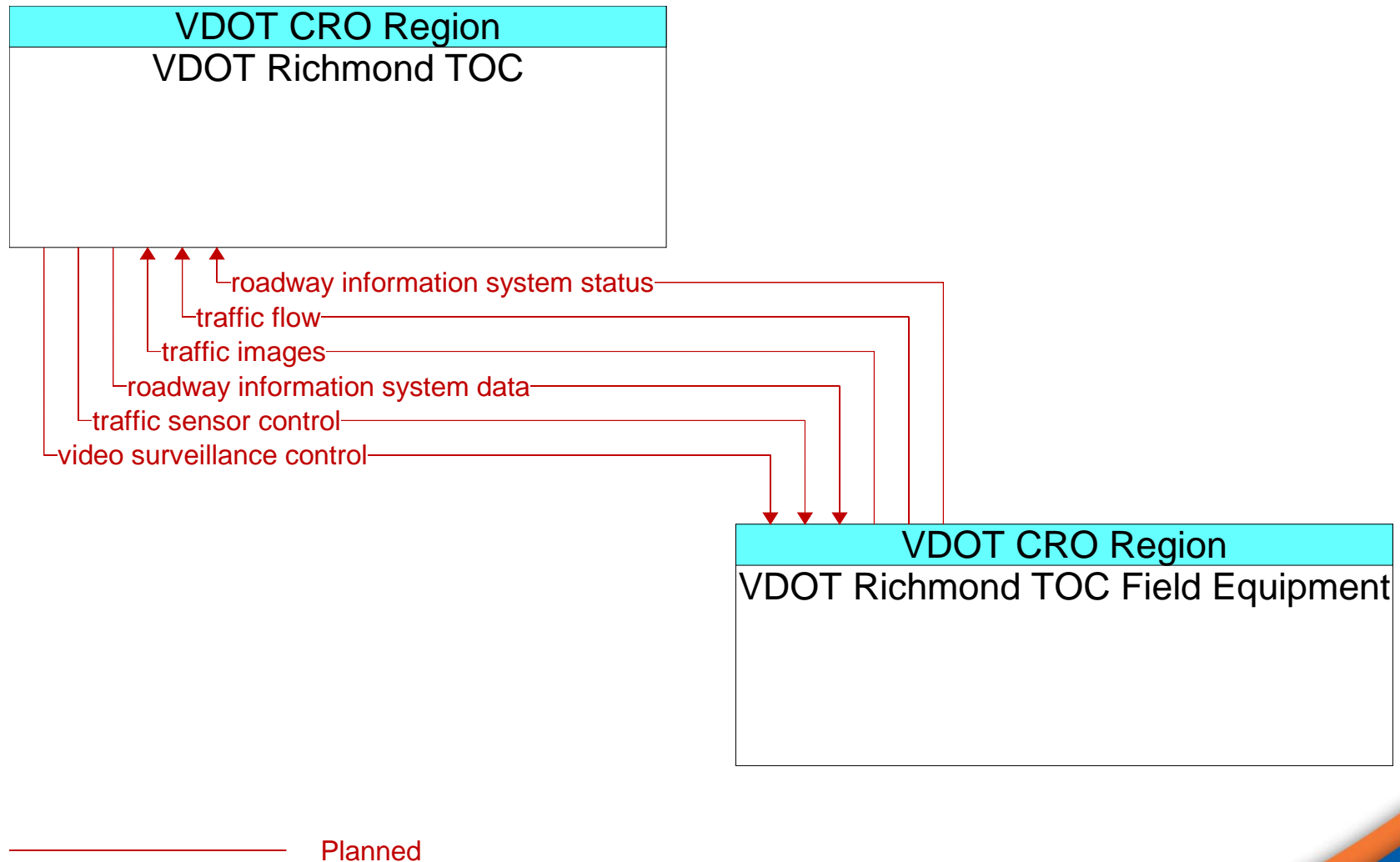
# **VDOT Central Region I-295 Project**

**Addresses Emergency and Traffic Management needs on I-295 between US 301 (MM 42) and the terminus of I-295 at I-64 (MM 53)**

**2 CMS**

**5 CCTV with integrated VDS**

# VDOT I-295 MM42-53 CMS/CCTV/VDS Project ITS Architecture





# Queue Warning and Speed Management Project for Eastbound I-66 / Dulles Connector

**Addresses congestion resulting from merging traffic at the eastbound I-66 / Dulles Connector (Route 267) junction along with queue delays at the downstream exit ramps from I-66 to Westmoreland St and Washington Blvd.**

## **Project Equipment**

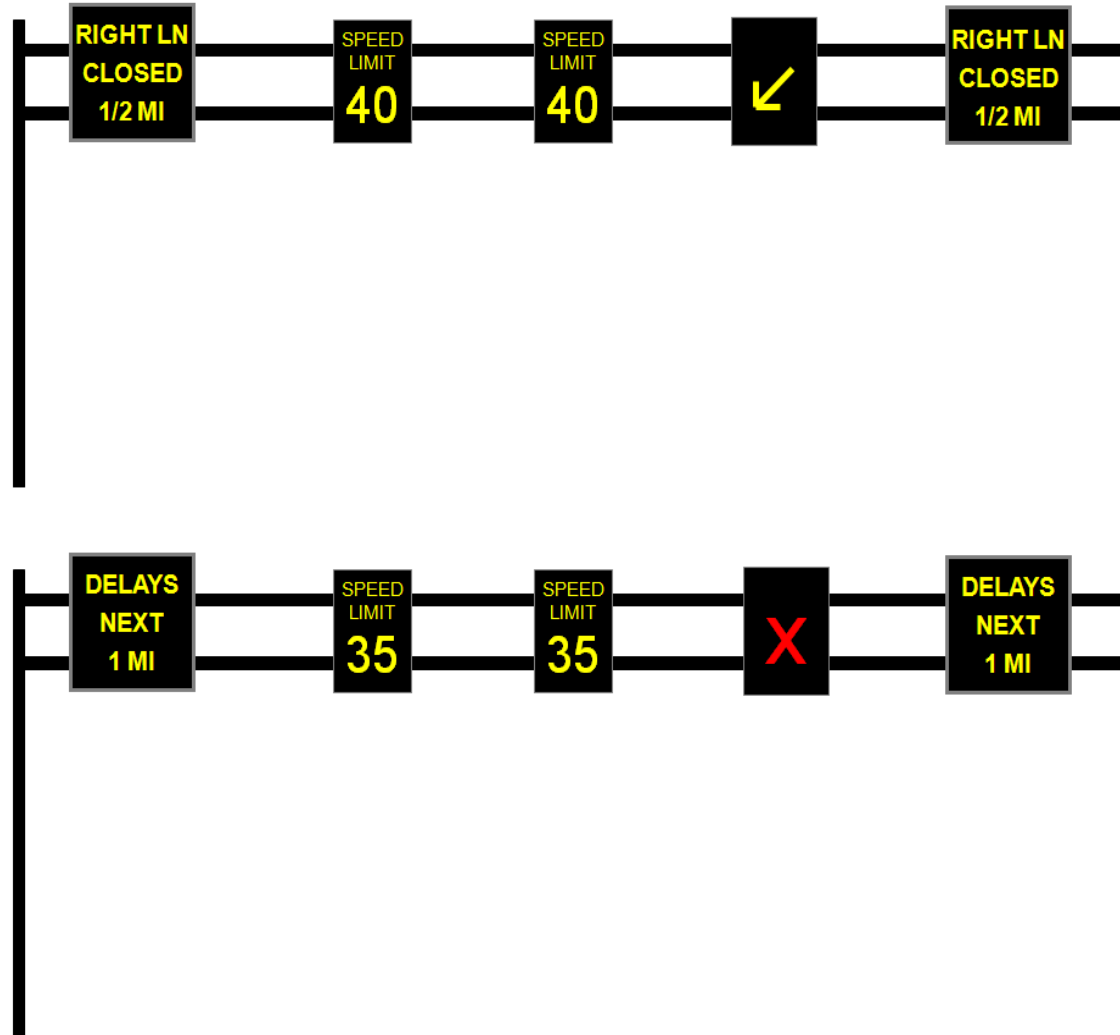
**10 Overhead Lane Management Systems (OLMS)**

**13 VDS (Vehicle Detection Systems) (11 mainline, 2 off-ramp)**

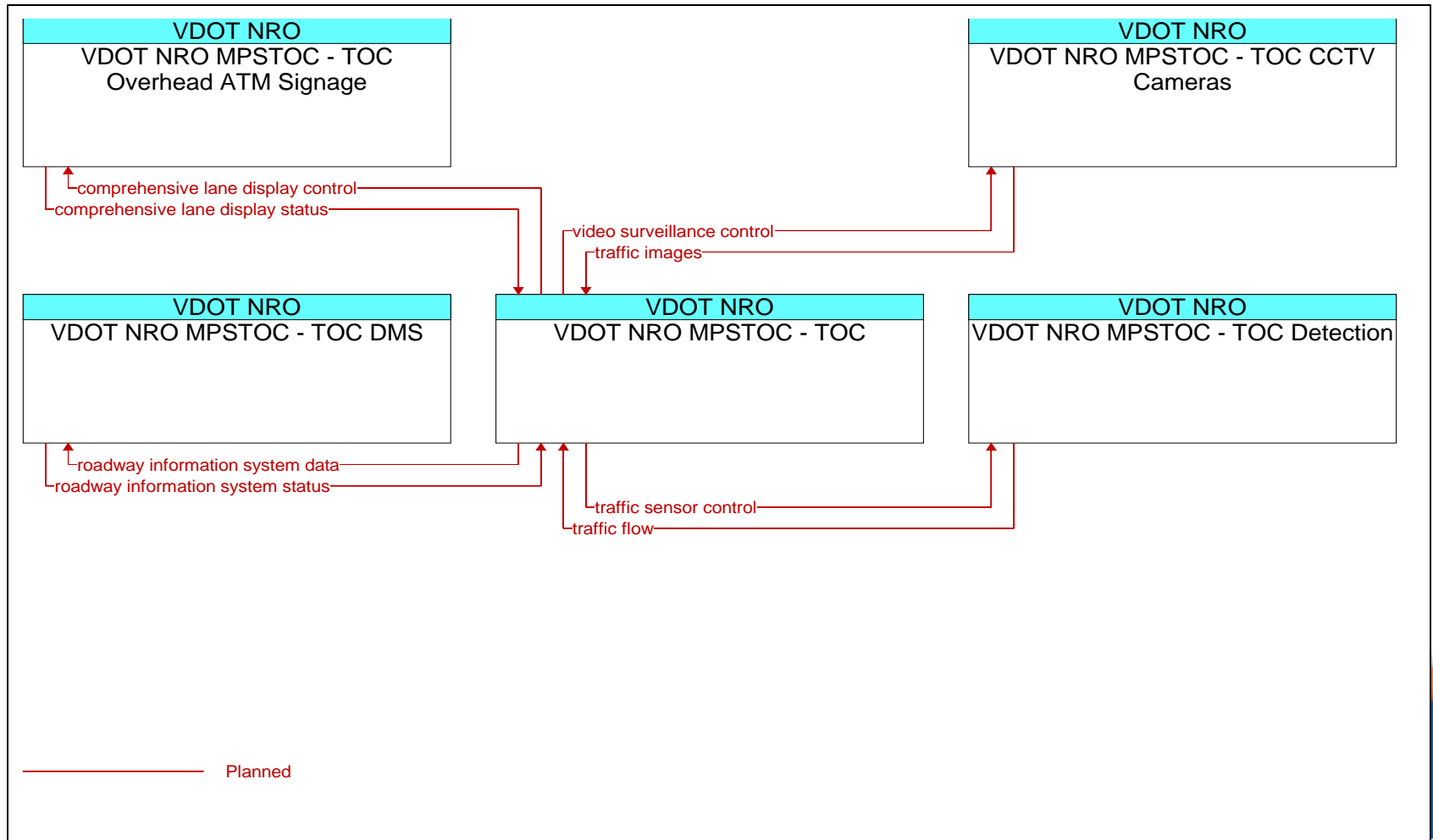
**4 CCTV (Closed Circuit Television)**

**2 DMS (Dynamic Message Signs)**

# Typical OLMS Display



# Project ITS architecture

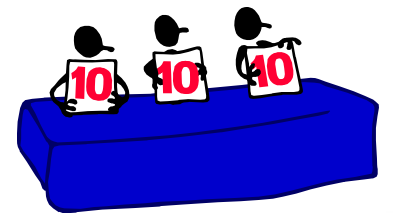
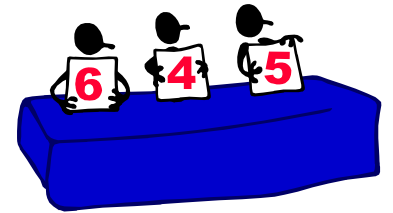


# IDENTIFY GAPS AND SUGGESTED ARCHITECTURE CHANGES

# WRAP-UP

# Workshop Outcomes

1. Better understand VA ITS Planning and Development
2. Review stakeholder needs survey results
3. Capture region's transportation/ITS needs
4. Review your ITS architecture and identify gaps



# THANK YOU!

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