Virginia ITS Architecture Stakeholder Needs Workshop – Updating the Southwestern Regional Architecture

May 25, 2011

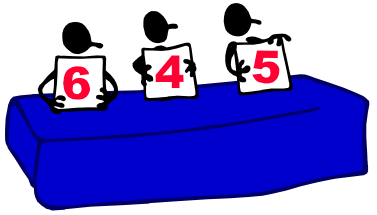
WELCOME AND INTRODUCTIONS

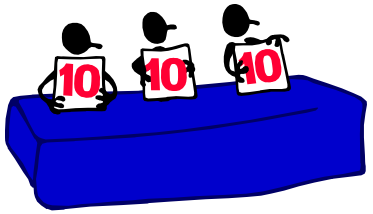
Introductions

- 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 Southwest Region Architecture

May 25, 2011

Chris Francis

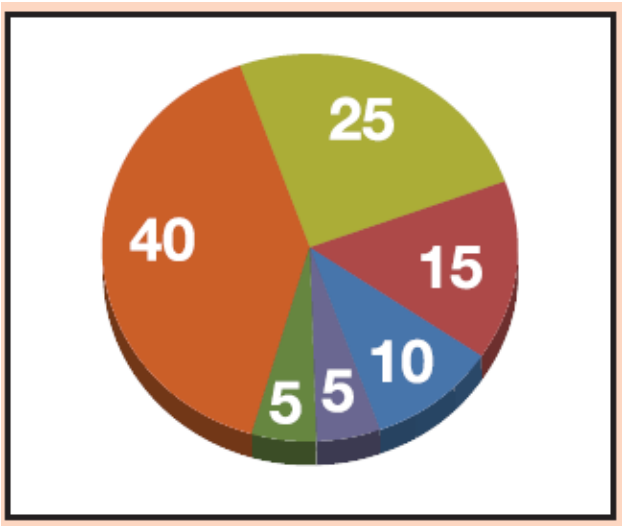
ITS Program Development Manager

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

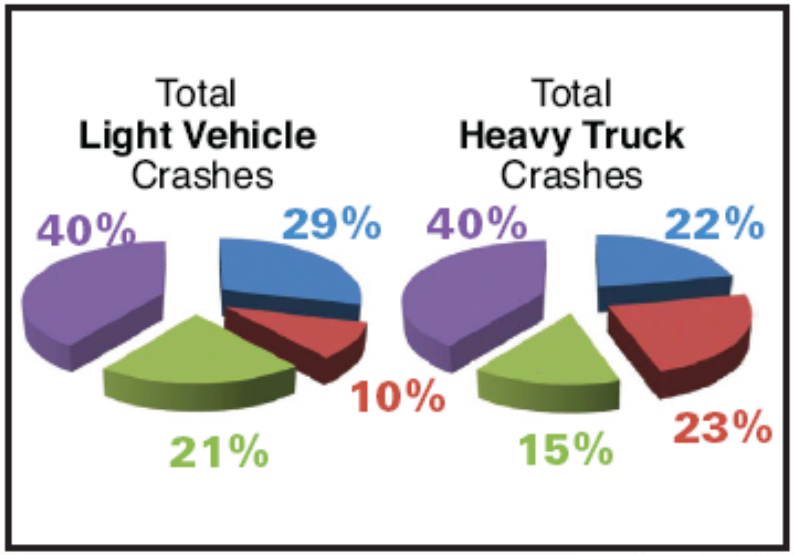
- 400+ tropical storms, hurricanes, tornadoes, and highway hazmat incidents, requiring evacuations
- An extensive number of localized incidents in the form of winter weather, wildfires, multi-vehicle crashes, and security activities
- 72-hour warning for hurricane evacuations

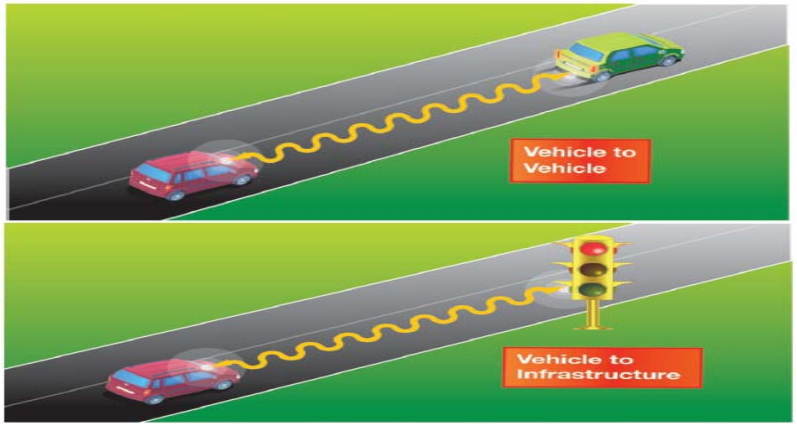
In-Motion Adverse Weather Warning

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

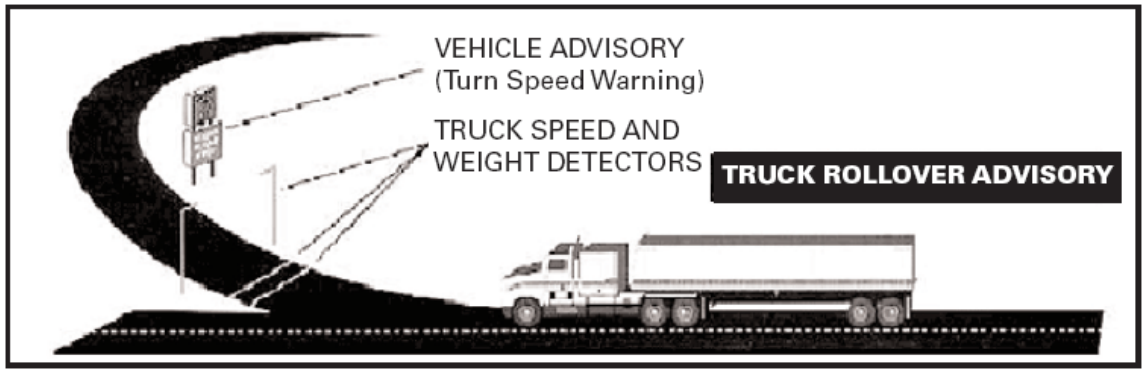
Real Time Traveler Information Signage

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

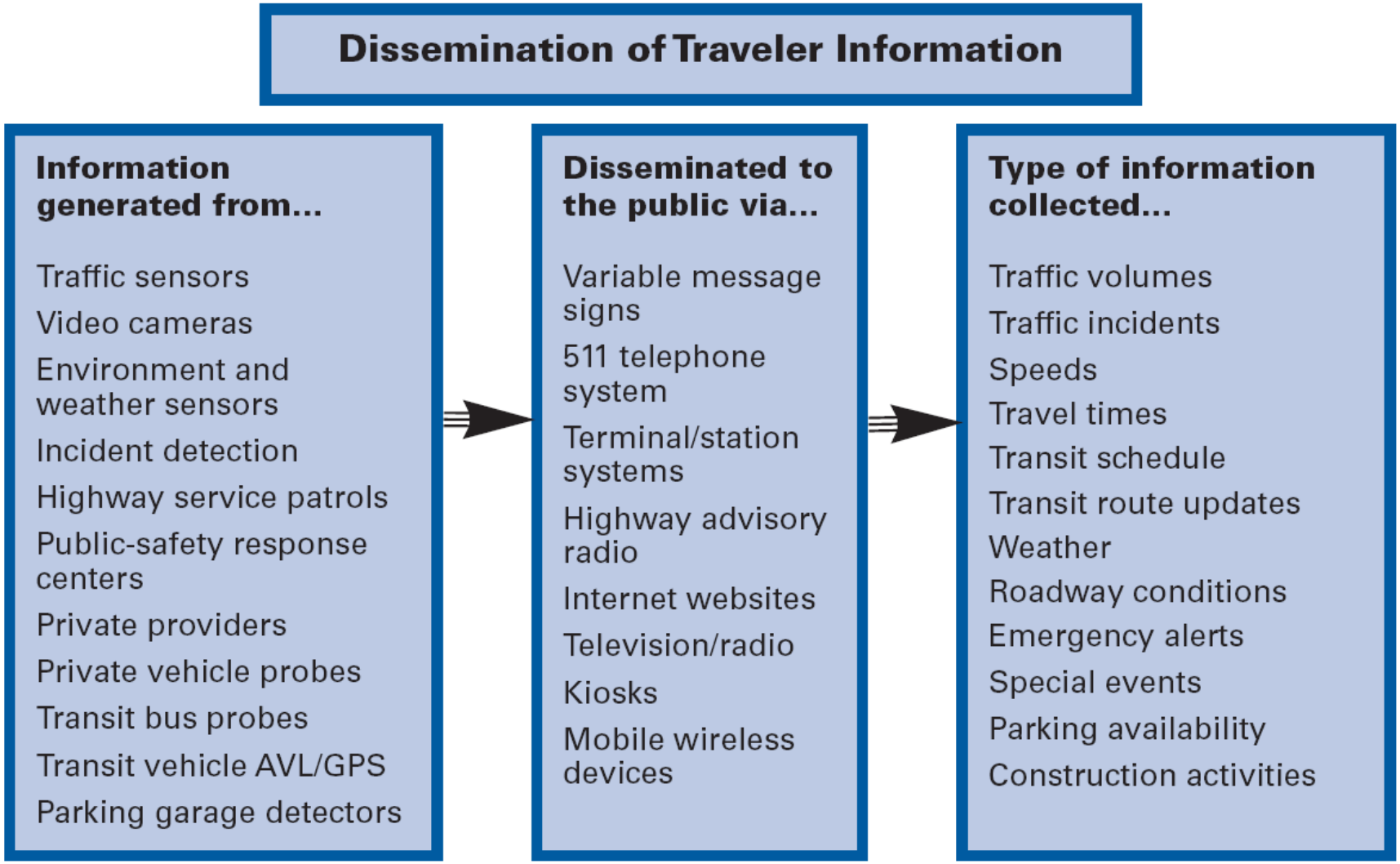
- U.S. foreign trade rose from $1.2 to $2.6 trillion between 1990 and 2003
- In 2007, over $3 billion in goods moved into and out of the country via freight transport
- The volume of trade moved on the U.S. transportation system in 2020 is expected to increase up to 70% from 1998 levels

Commercial Vehicle Information System and Network (CVISN)

Weigh-in-motion Sensors

Electronic Toll Payment/
Vehicle tracking transponder

Advanced Traveler Information System (ATIS)

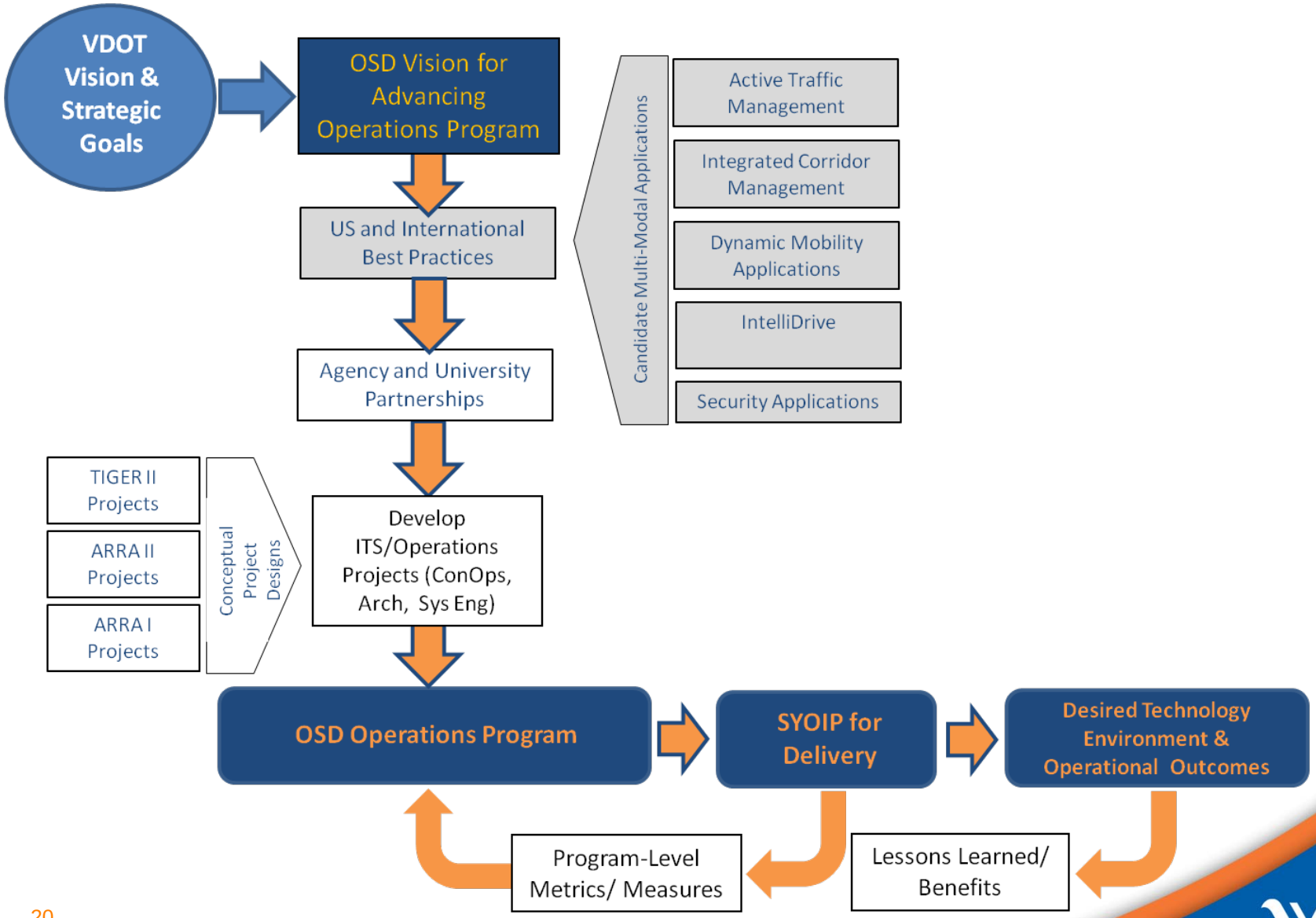


Strategic Approach to New Technology Deployments

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

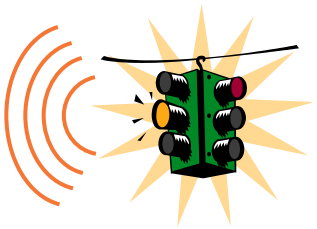


Preparing Virginia roads for Dynamic Mobility

E-payment

"The Network"

Opportunity for Innovation

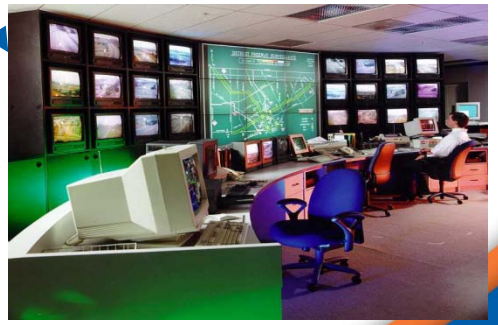


Signal Phase and Timing

Safety Messages

- Real Time Network Data
- Situation Relevant Information

Probe Data



Instrumented Roadside

(Roadside Equipment, or RSE)

VDOT

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 2nd highest congested network in the Nation (TTI Mobility Rep)

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

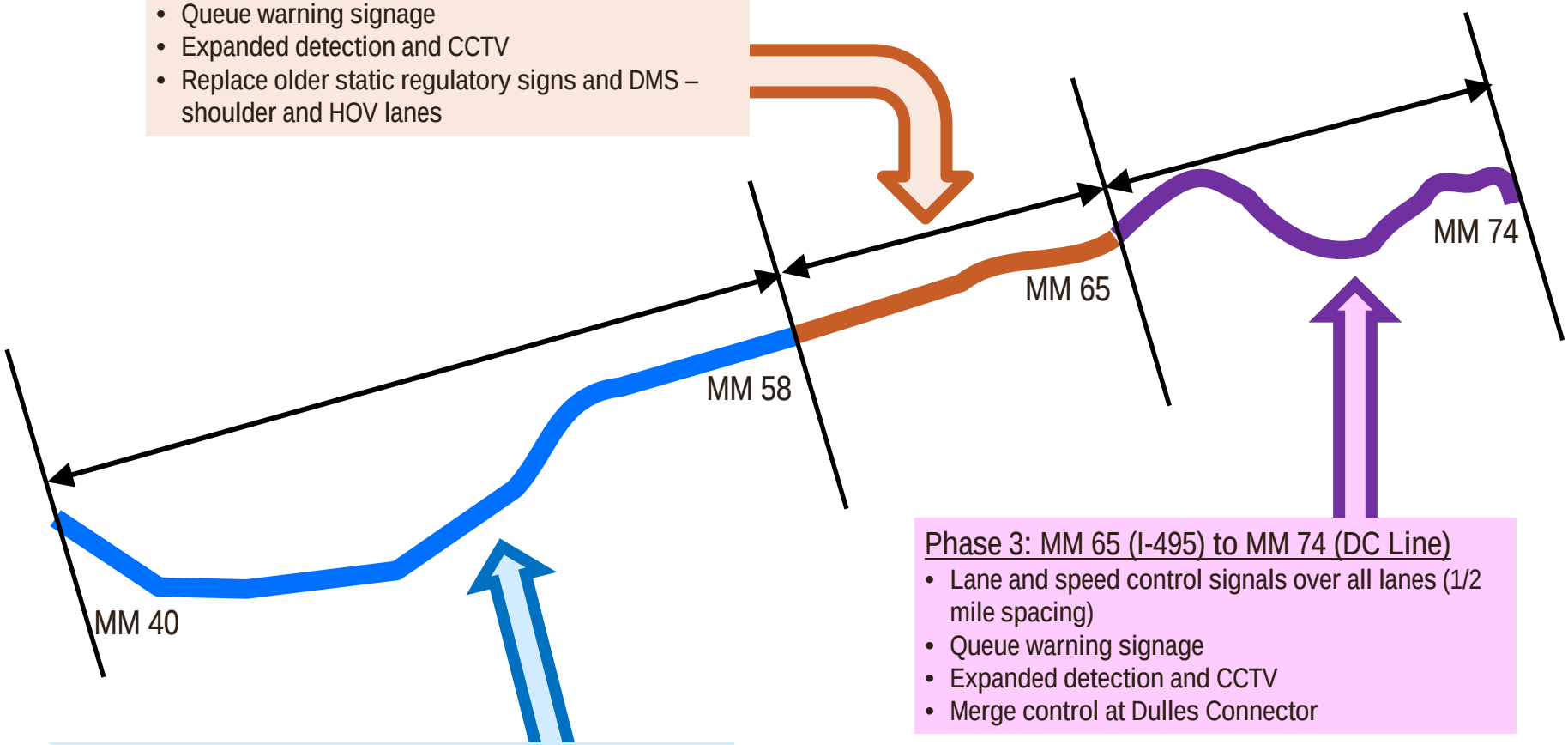
- **Speed Harmonization:** speed limits are dynamically changed based on observed traffic conditions
- **Queue Warning**: dynamic message signs inform travelers of approaching queues/bottlenecks
- **Hard Shoulder Running:** lane control signs manage the use of shoulders as a travel lane

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

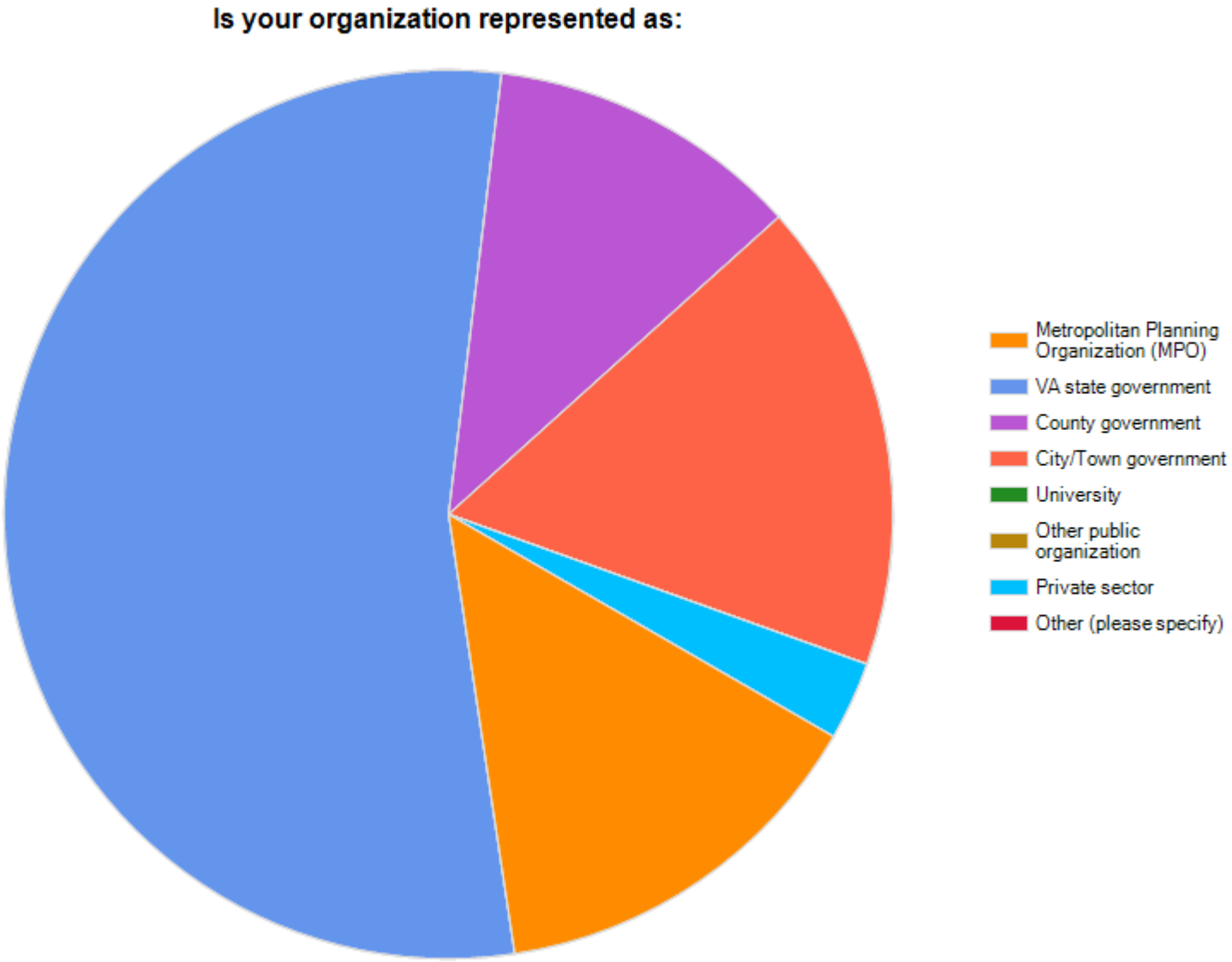
Smart Technologies for Communities Act

"We cannot continue to simply build our way into a transportation system necessary for the demands of the 21st Century…..Technology and information exist today to cost-effectively, safely and effectively manage our nation's roads and infrastructure".

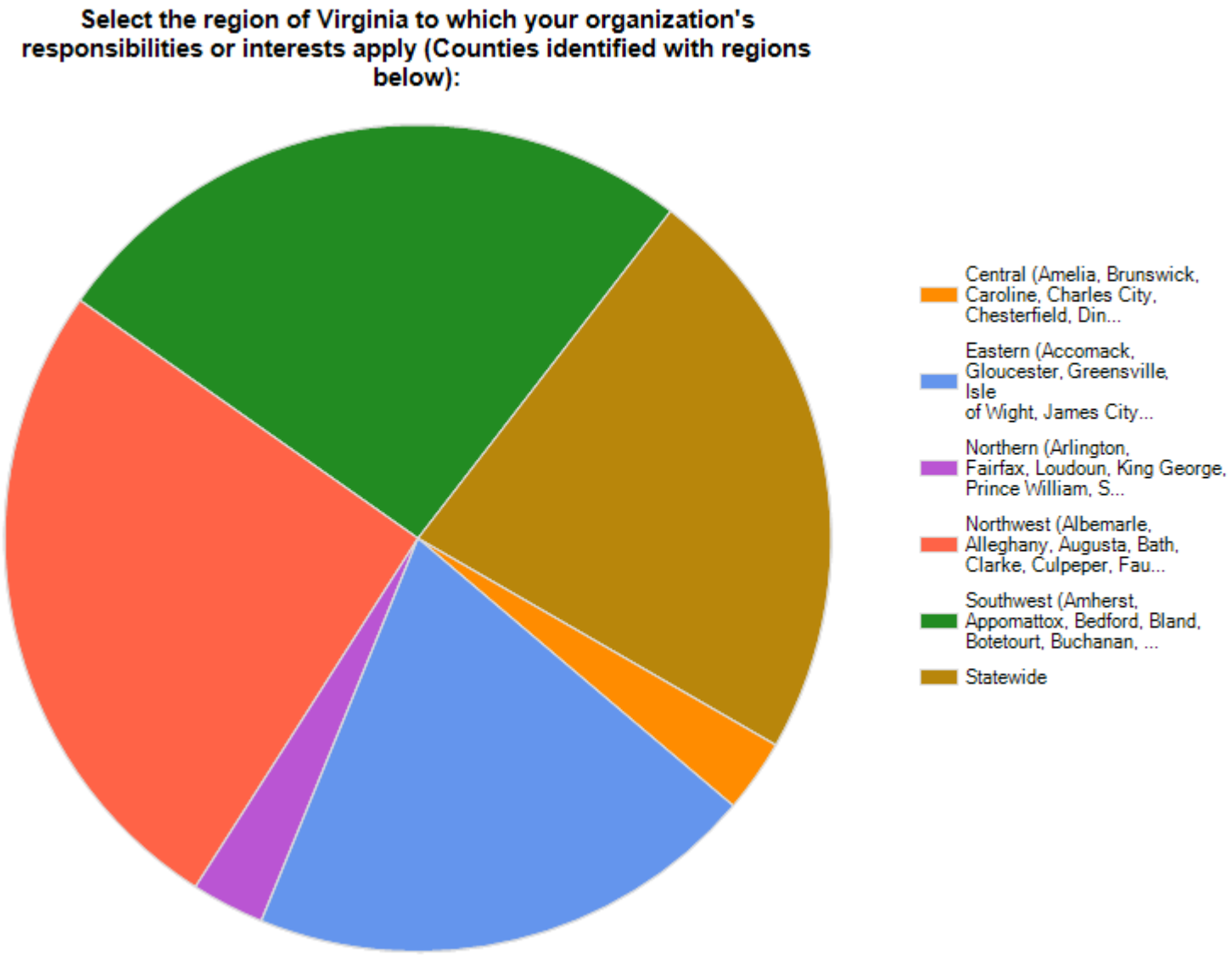
Mike Rogers and Russ Camahan

STAKEHOLDER NEEDS SURVEY RESULTS

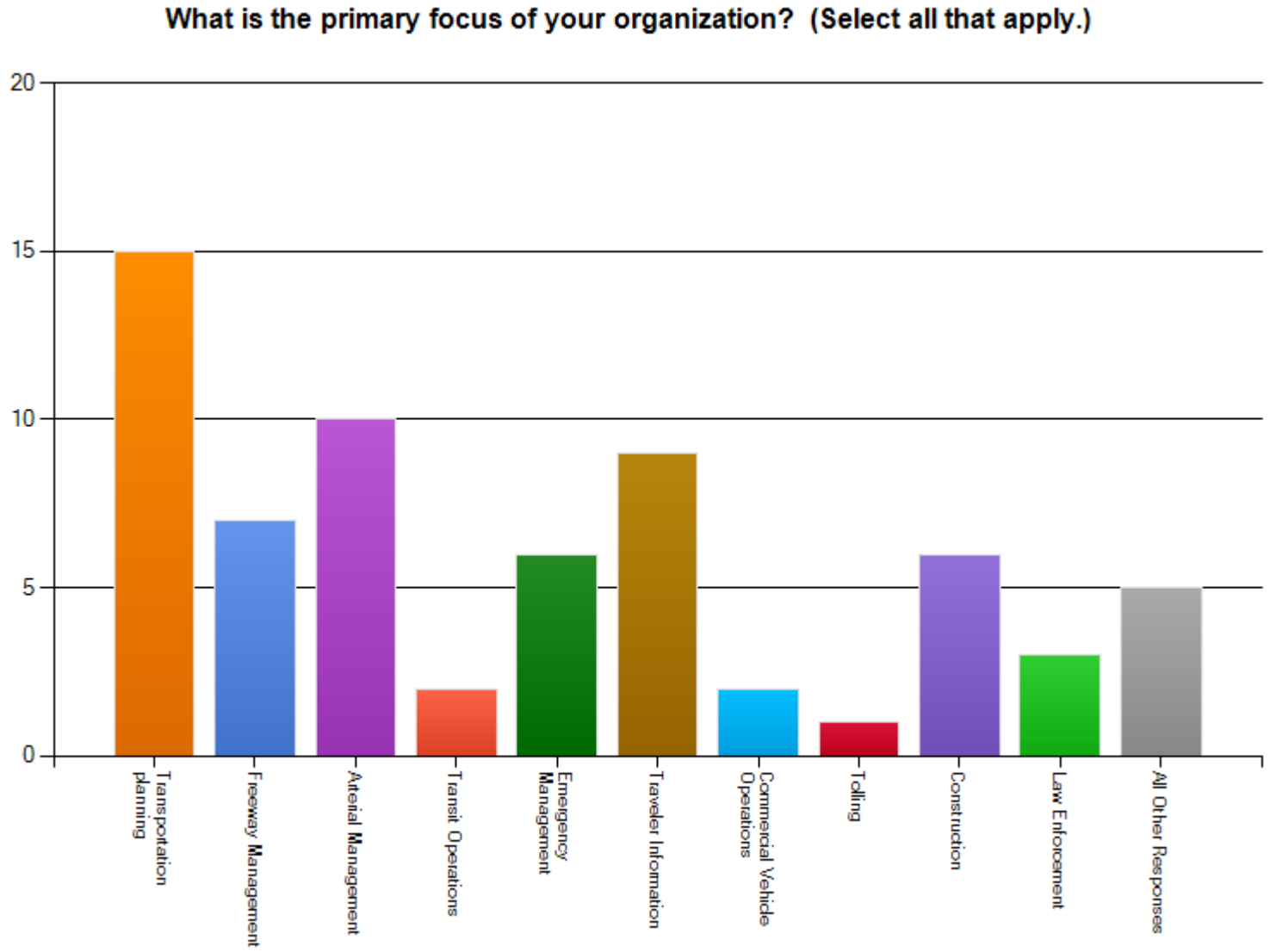
Organizations responding



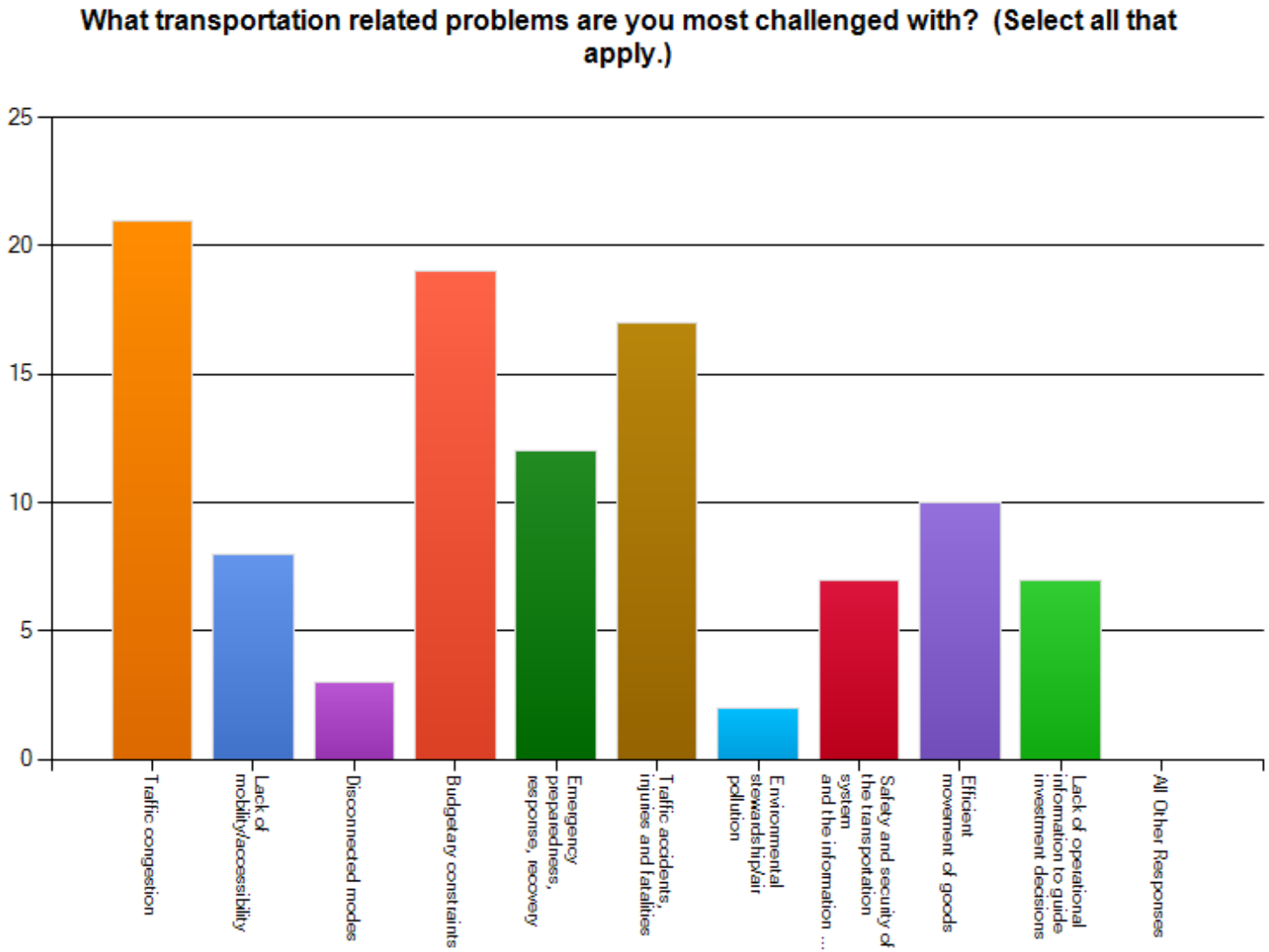
Regions responding



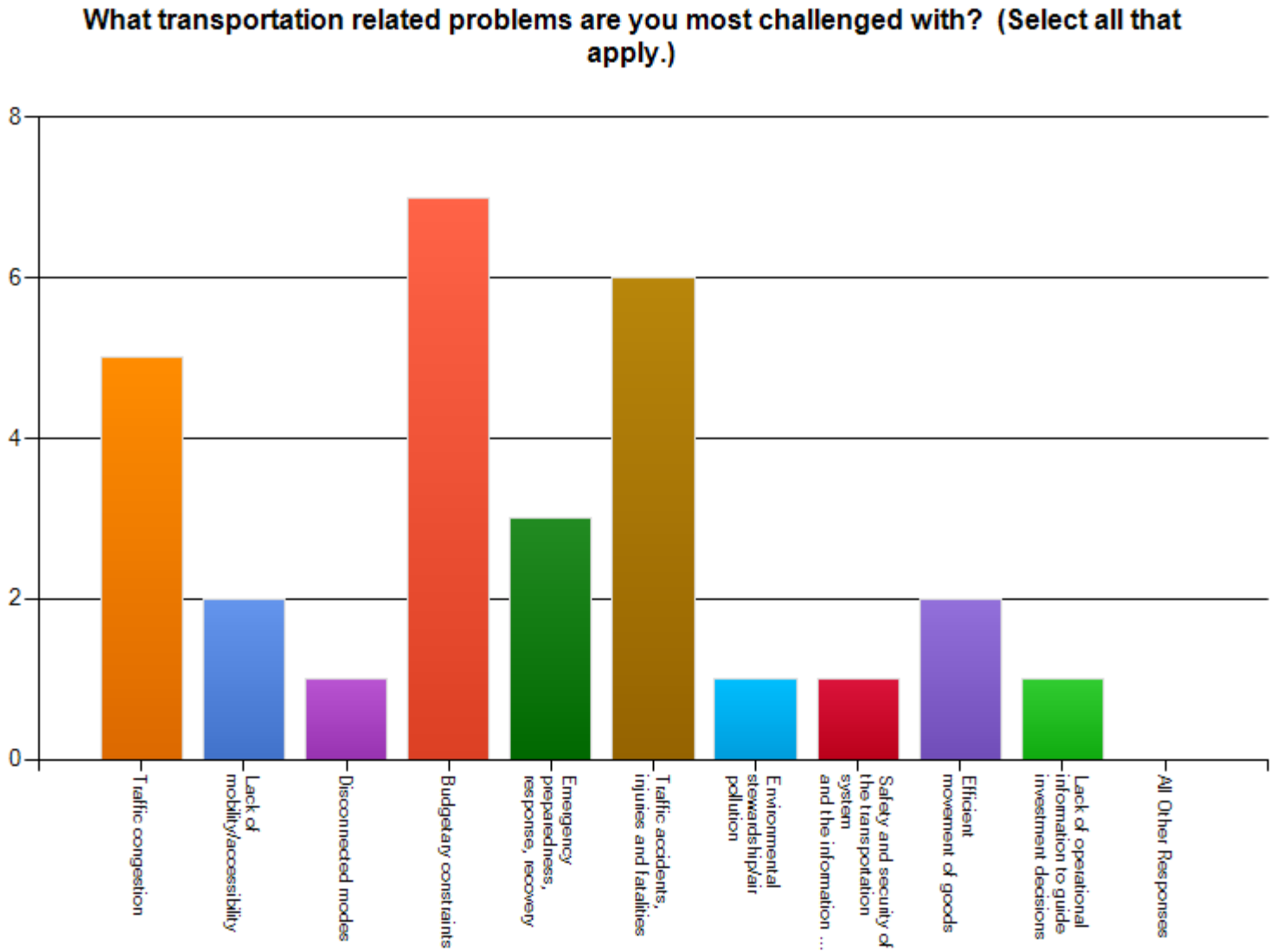
Primary focus of organization



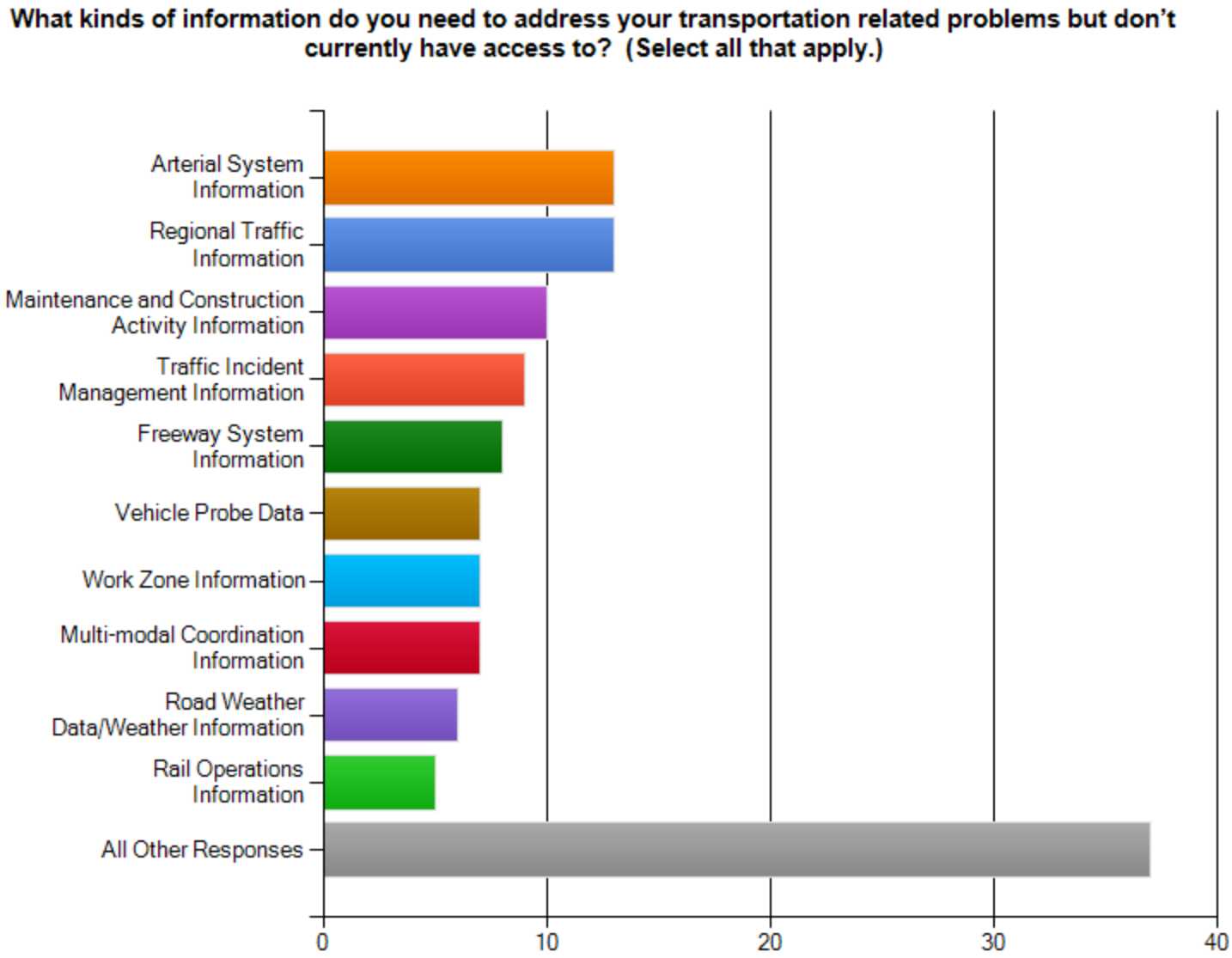
Statewide transportation problems



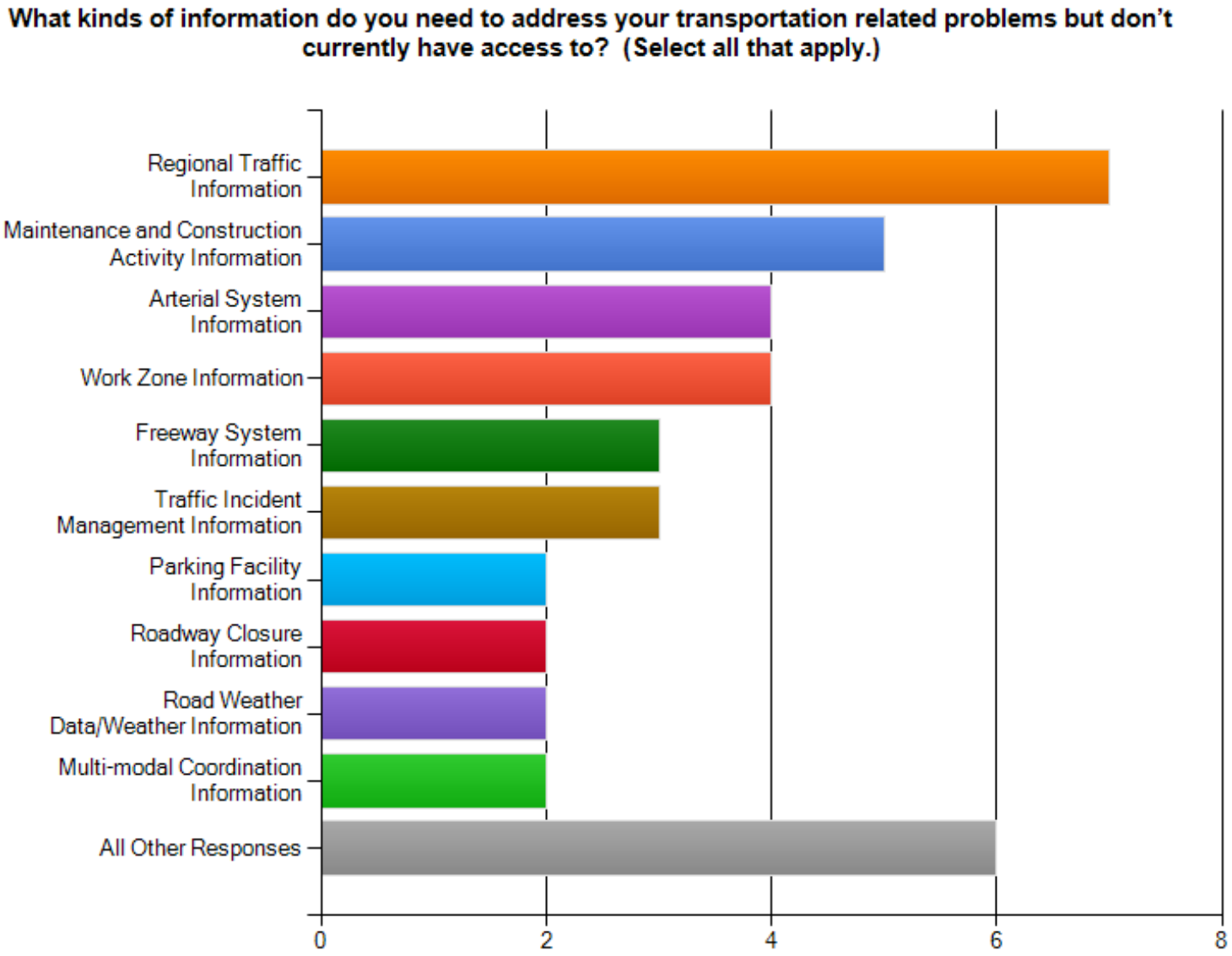
Southwestern region transportation problems



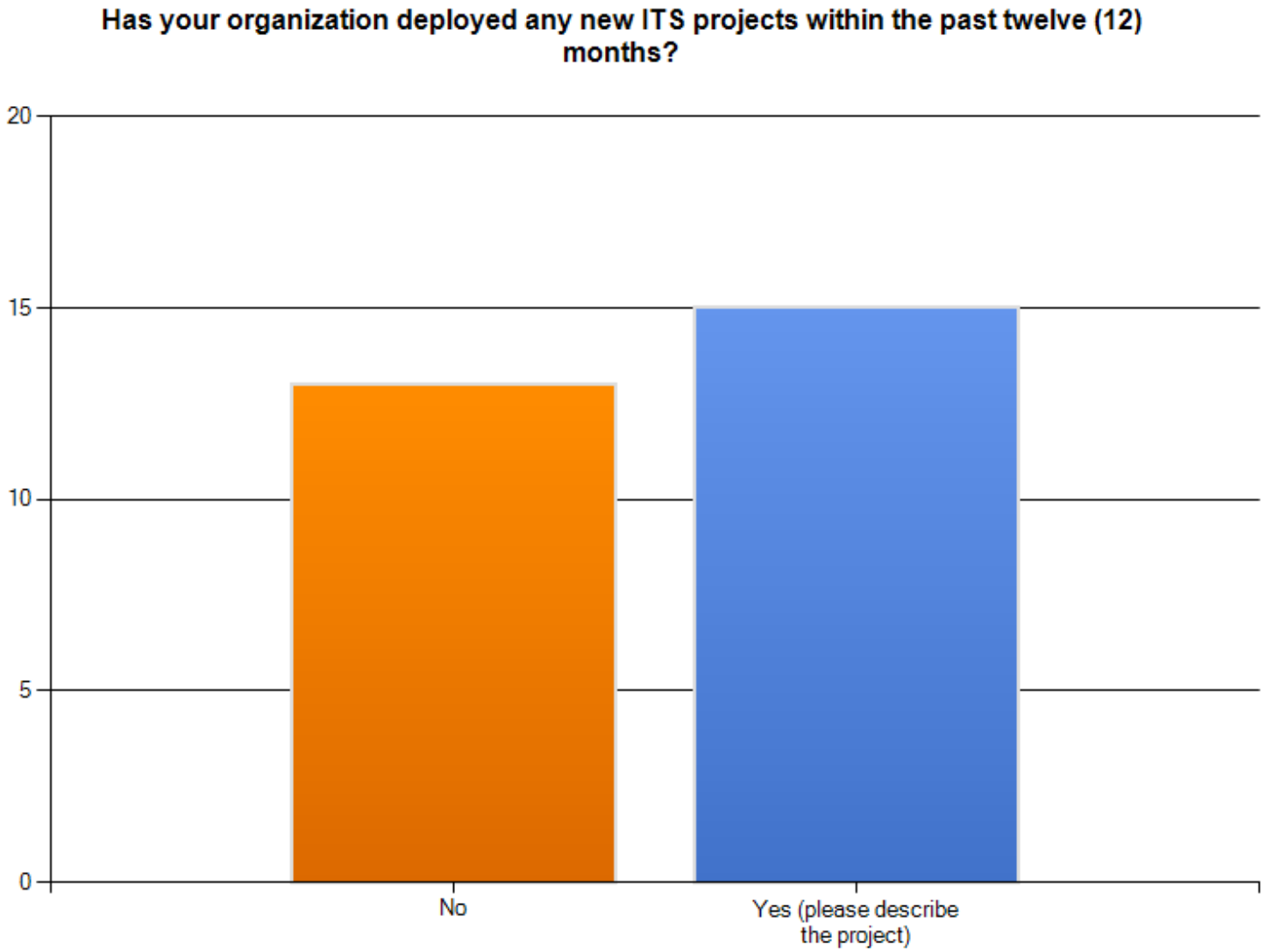
Statewide information needs



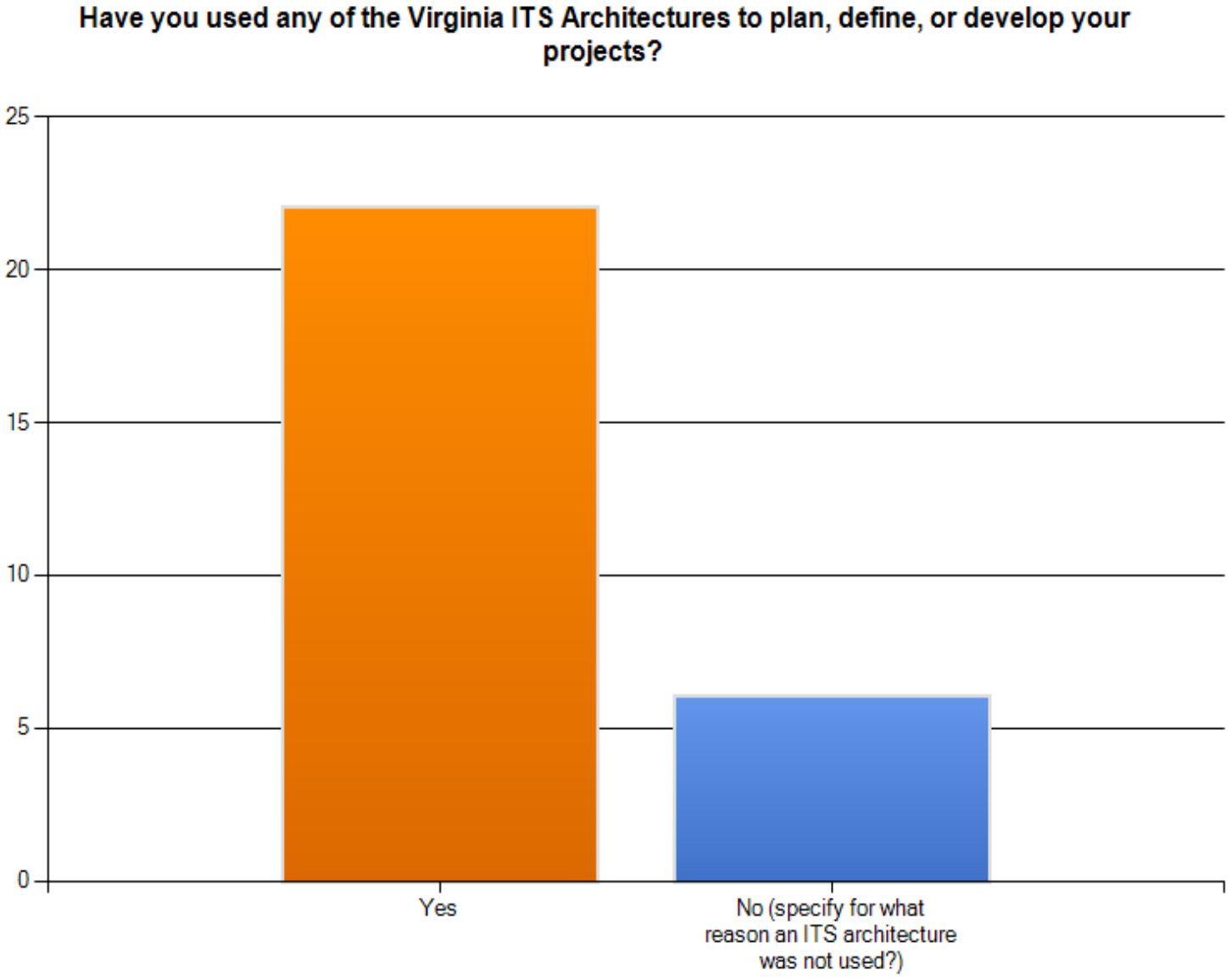
Southwestern region information needs



New ITS projects

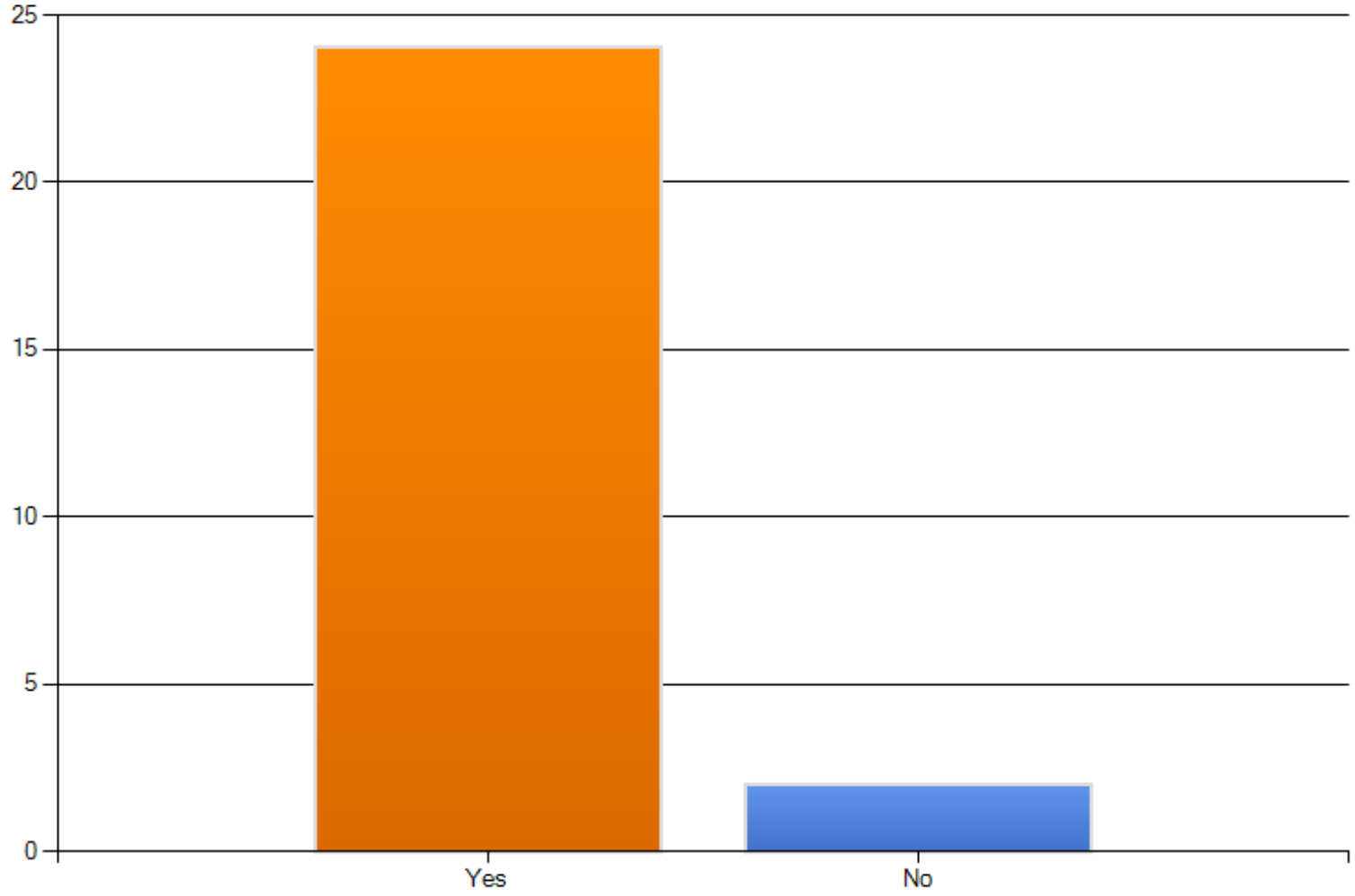


Use of VA ITS Architectures



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

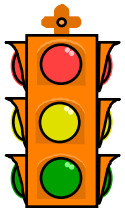
Use of information and communications technologies to *meet* transportation needs

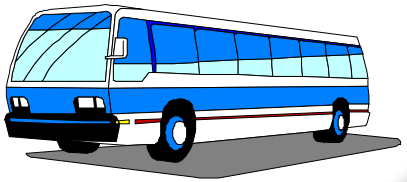
ITS Architecture

Framework for Developing Integrated Transportation Systems

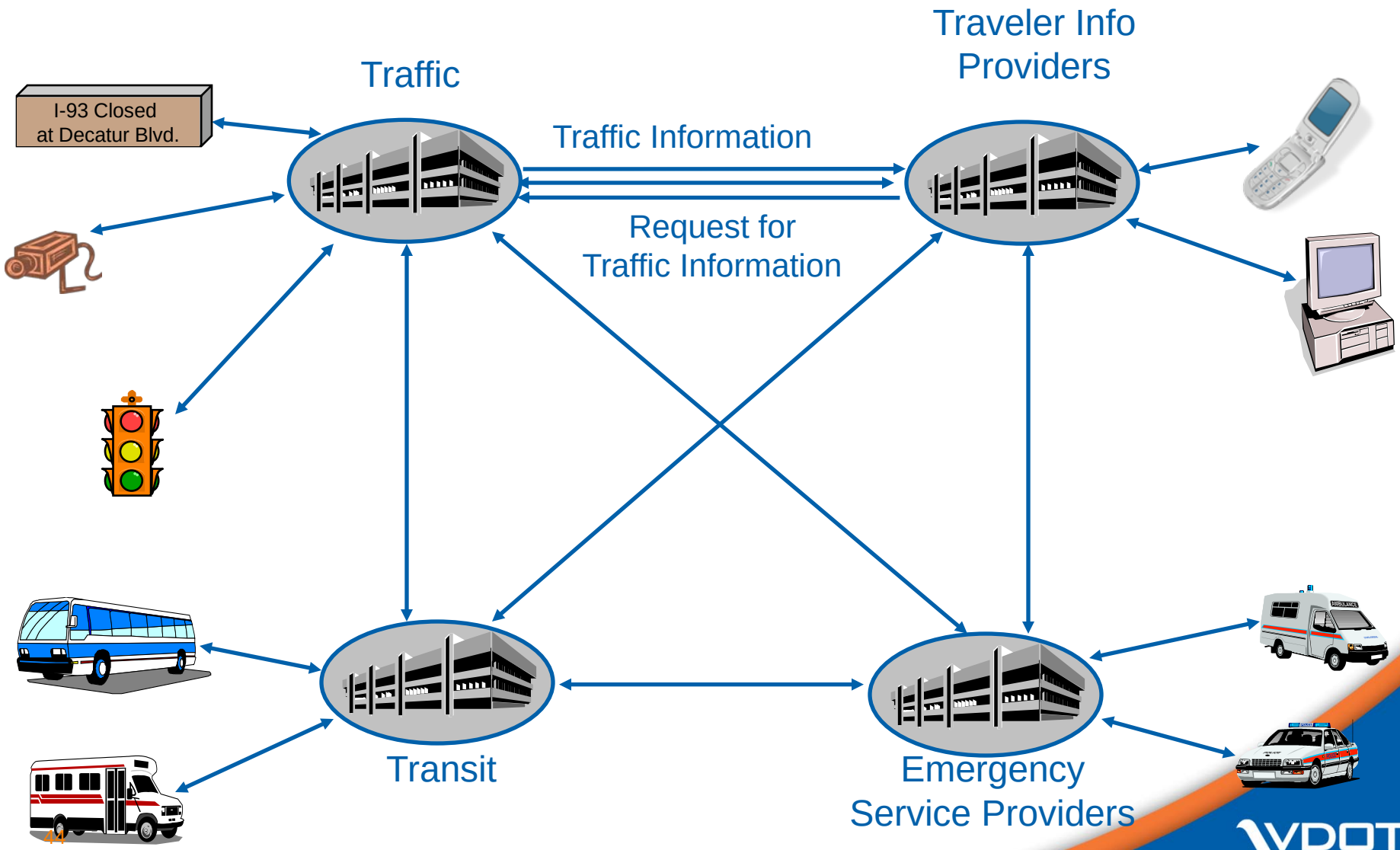
Identifies:

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





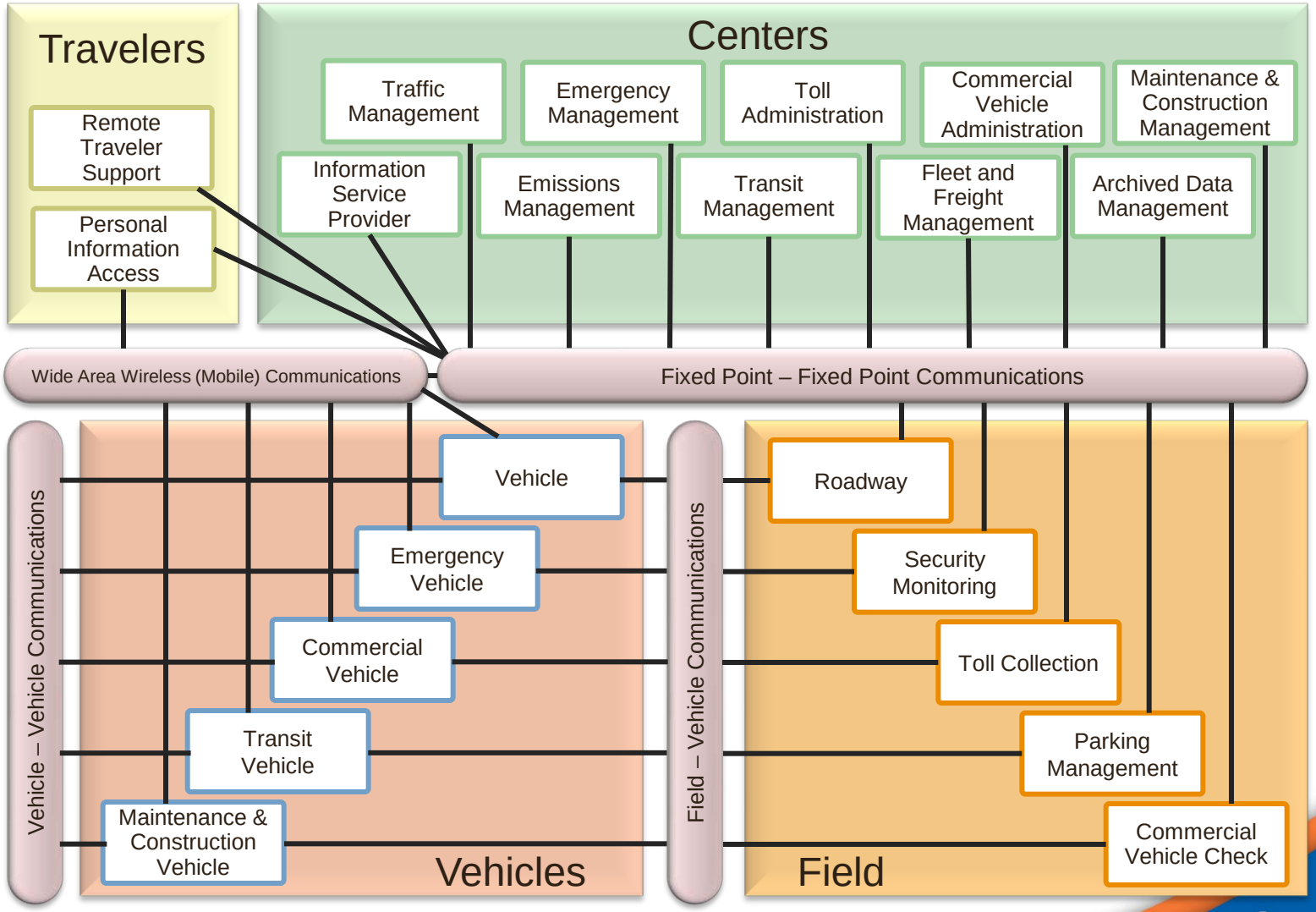
ITS Architectures Provide a Framework for Integration



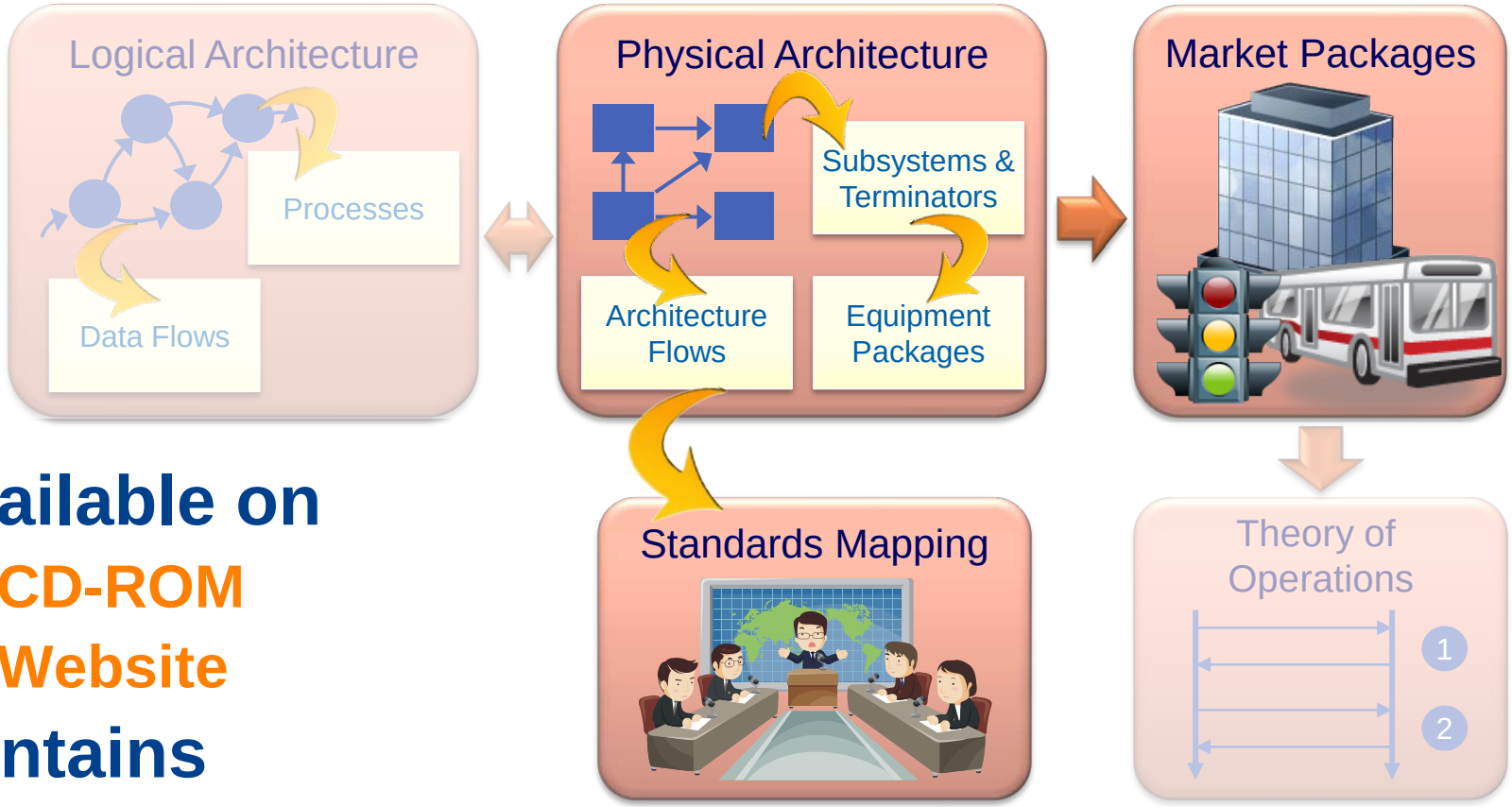
An ITS Architecture Produces Real Benefits

- 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



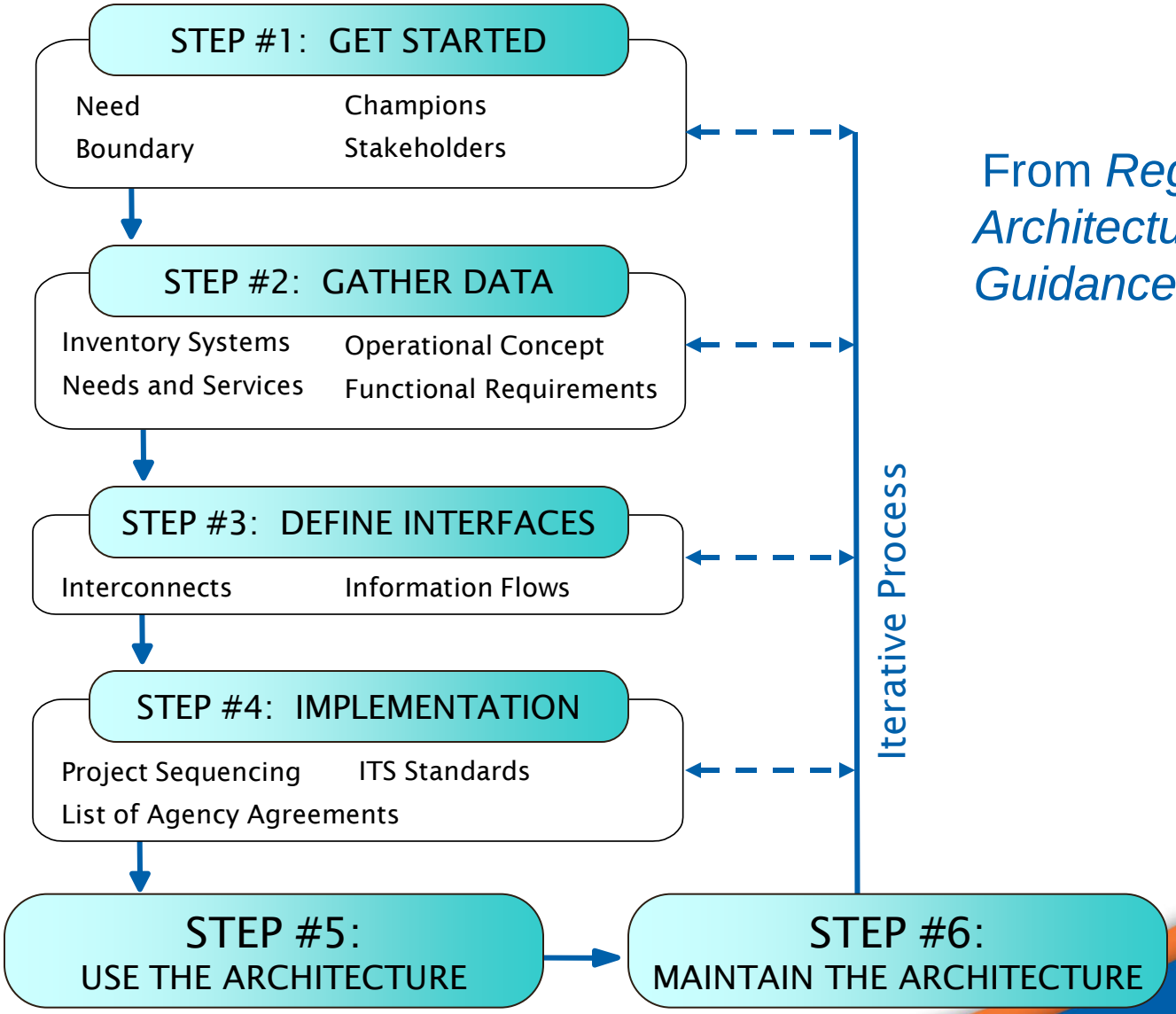
Available on

- CD-ROM
- Website

Contains

- Hypertext
- PDF documents
- Databases

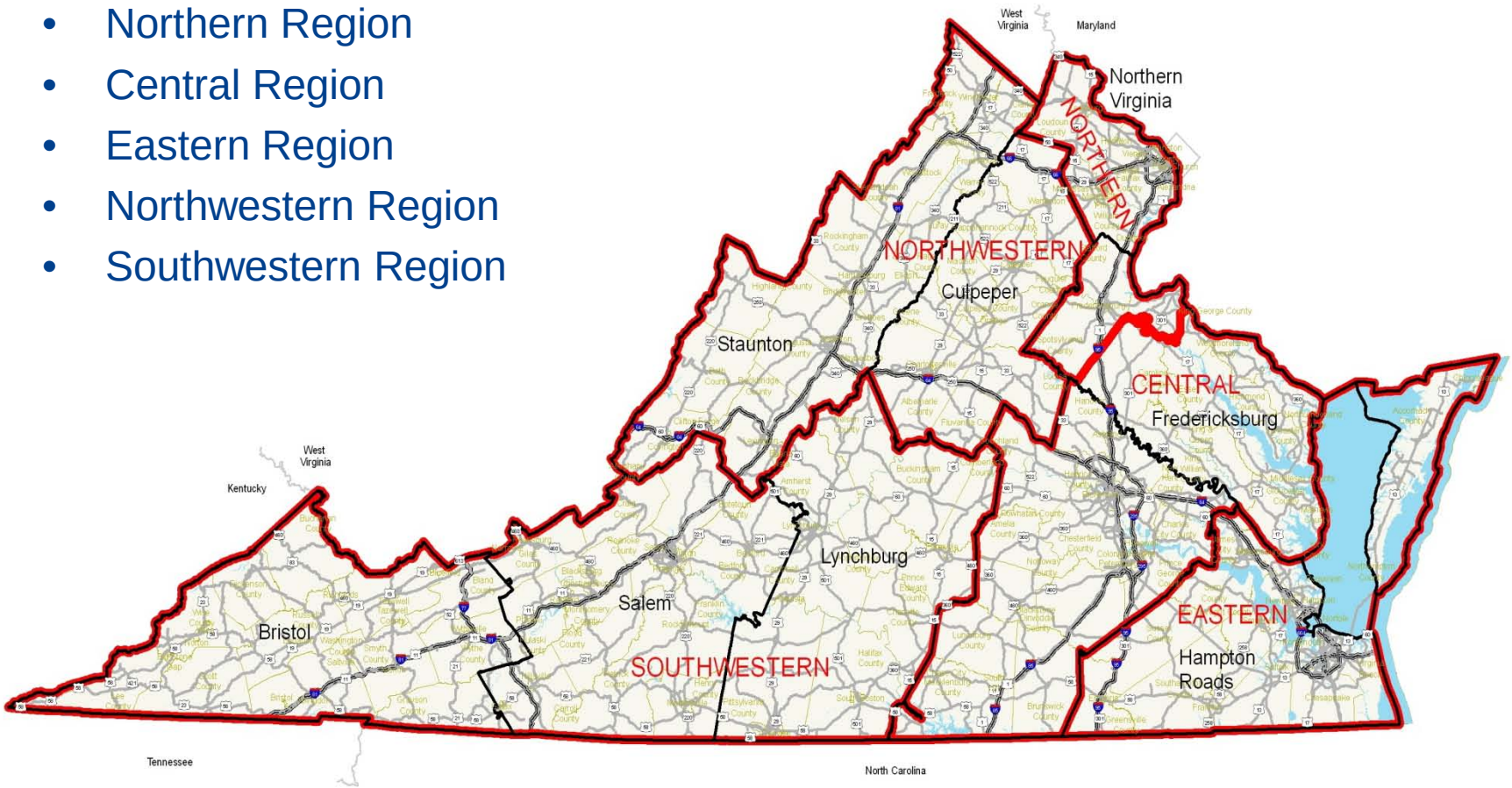
Regional ITS Architecture Development Process



From *Regional ITS Architecture Guidance Document*

VA ITS Architectures

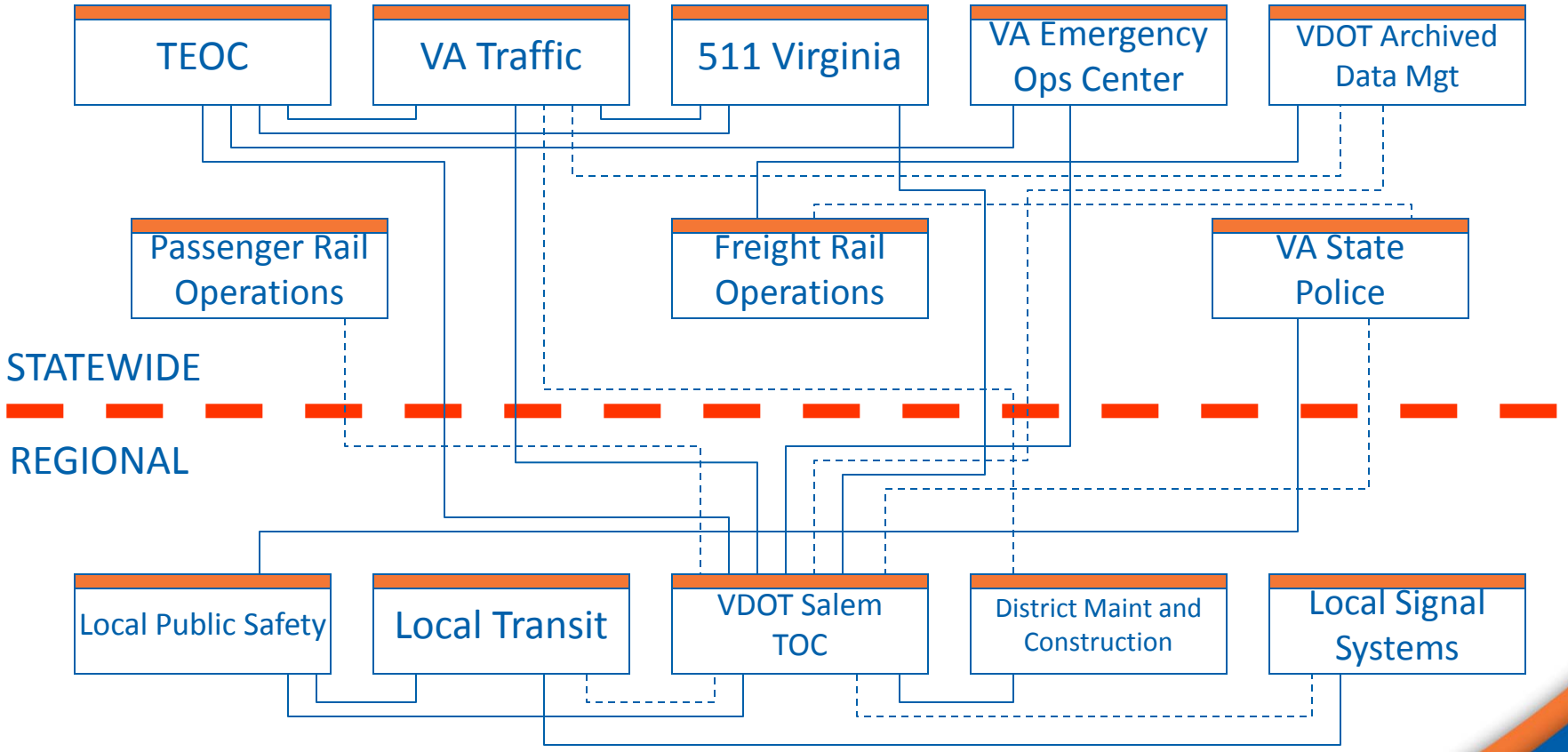
- Statewide
- Northern Region
- Central Region
- Eastern Region
- Northwestern Region
- Southwestern Region



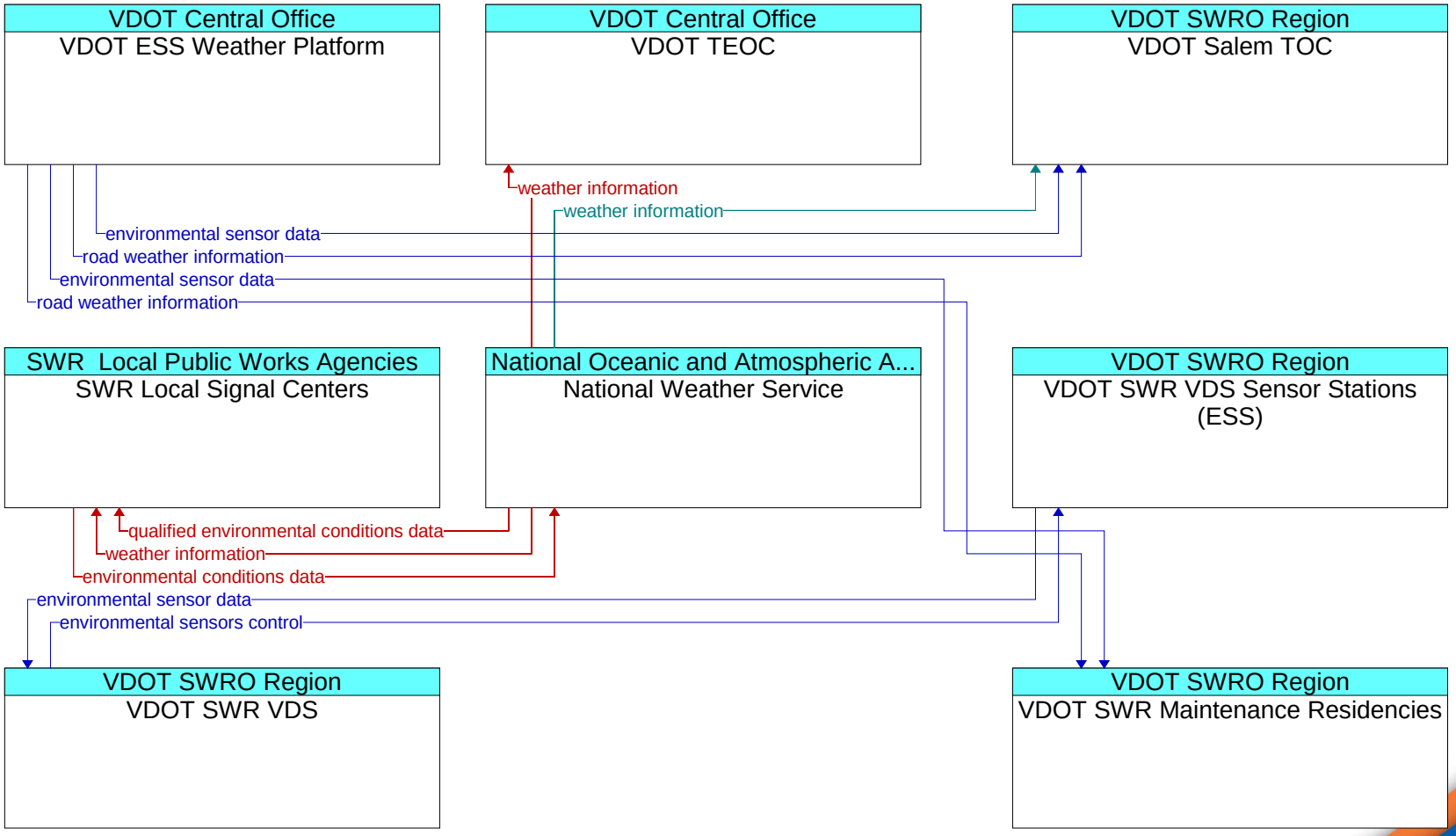
Statewide vs Regional Scope

- **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

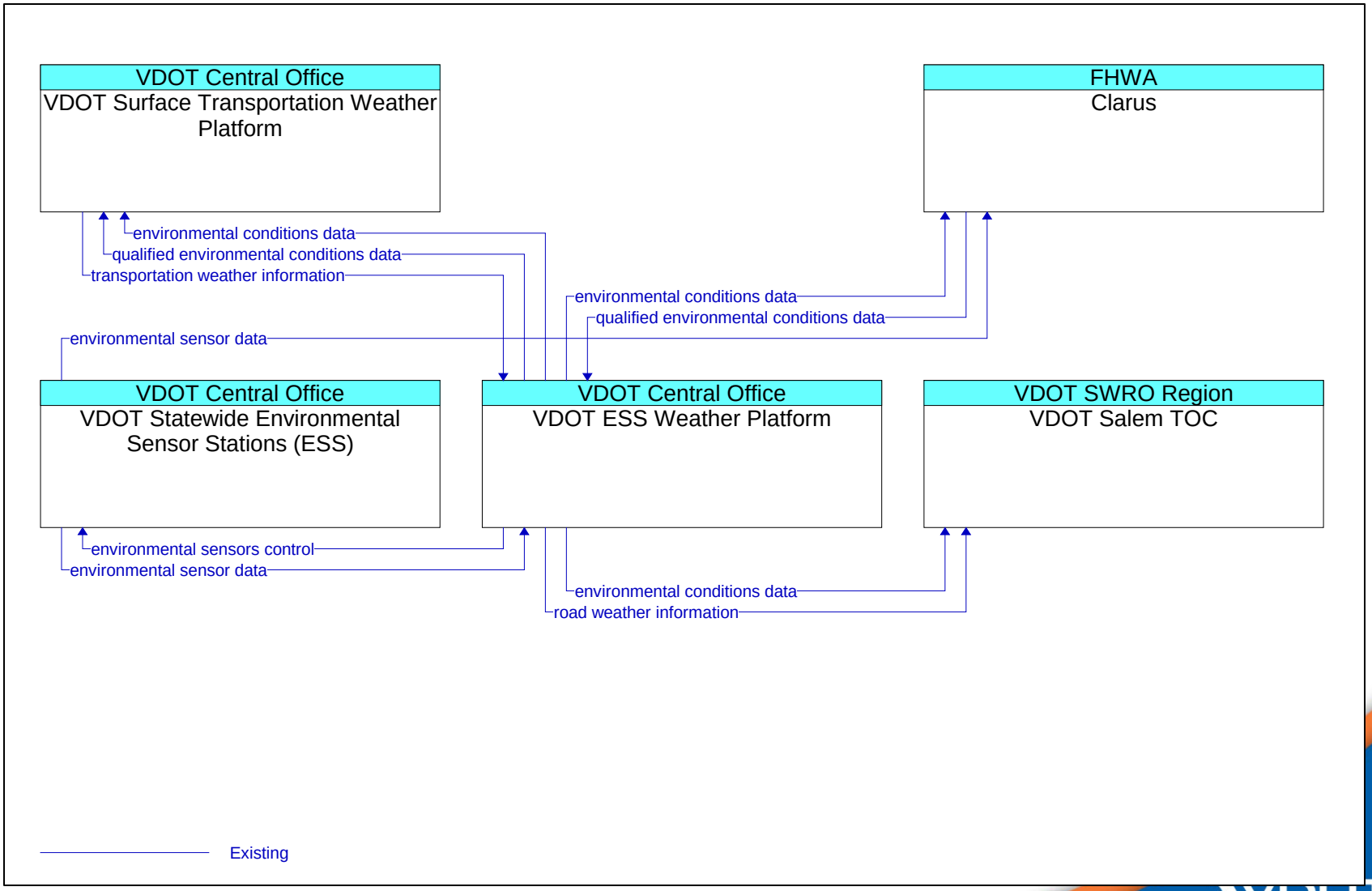
Statewide vs. Regional Example



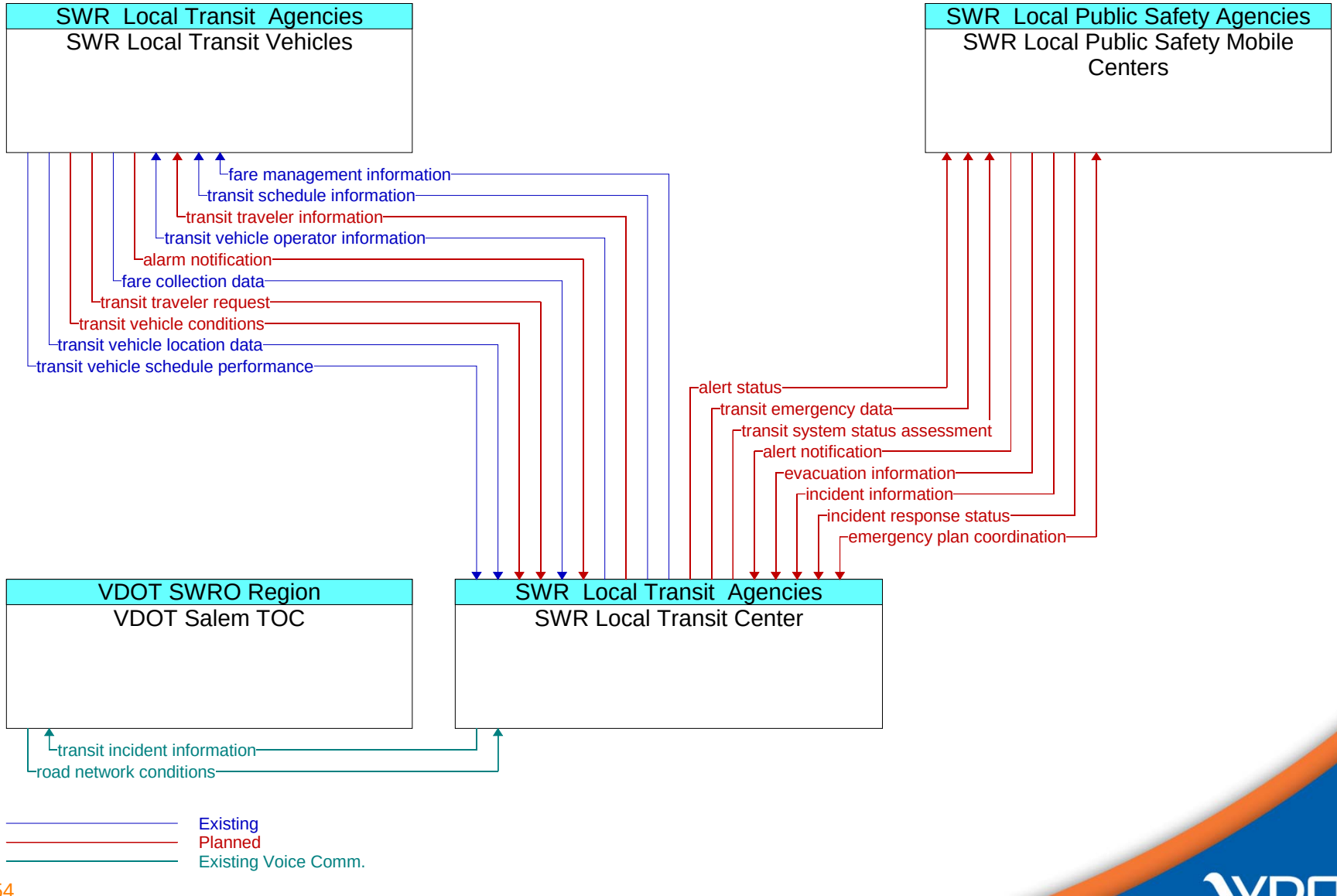
Southwest Weather-Related ITS



Weather (Statewide)



Southwest Transit-Related ITS



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

Participant Notes

Participant Notes

Participant Notes

TRANSPORTATION/ITS NEEDS BREAKOUT GROUPS RECAP

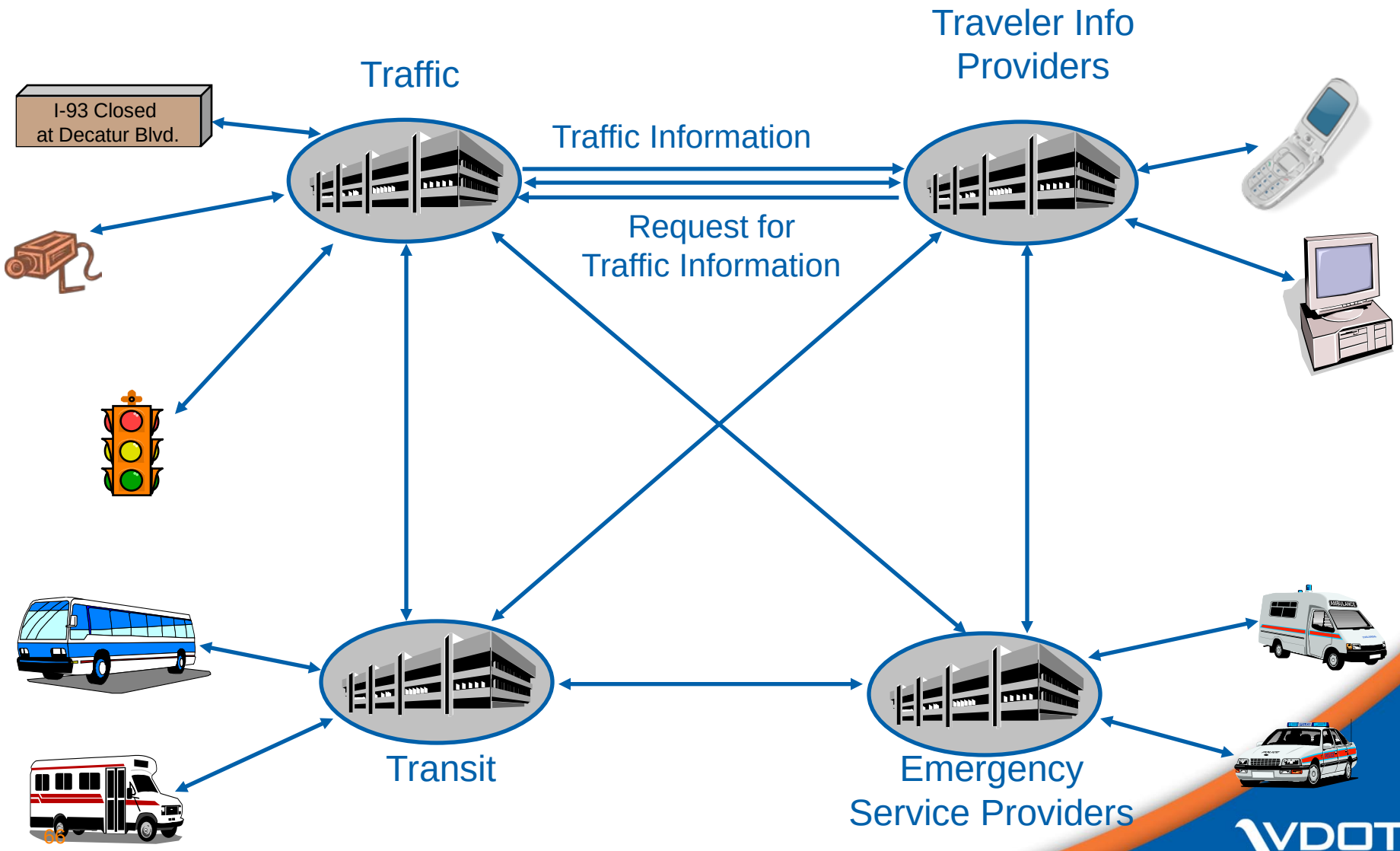
Breakout Group – Reports
What did we learn?

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

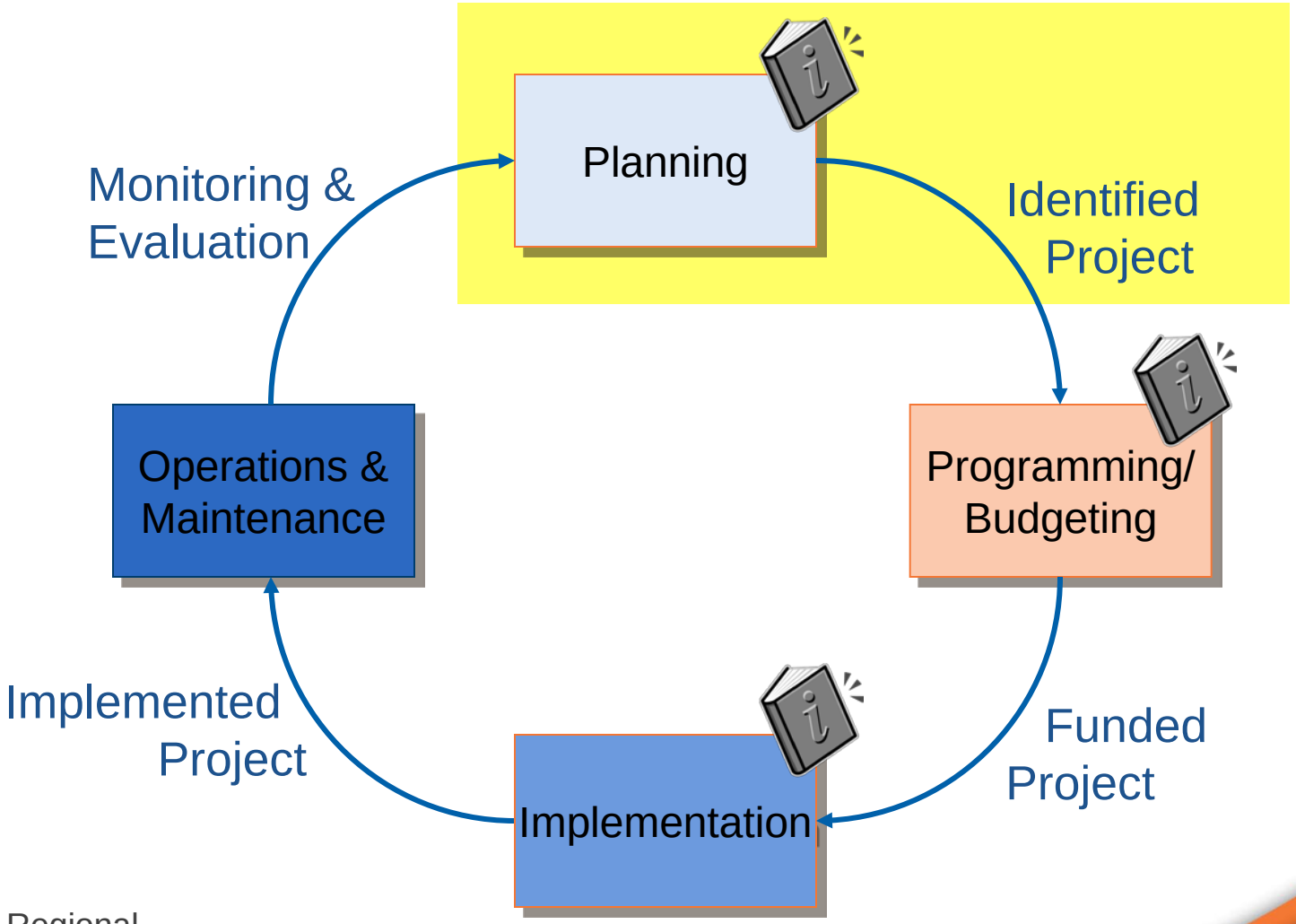
ITS Architecture

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



= Regional Architecture Use

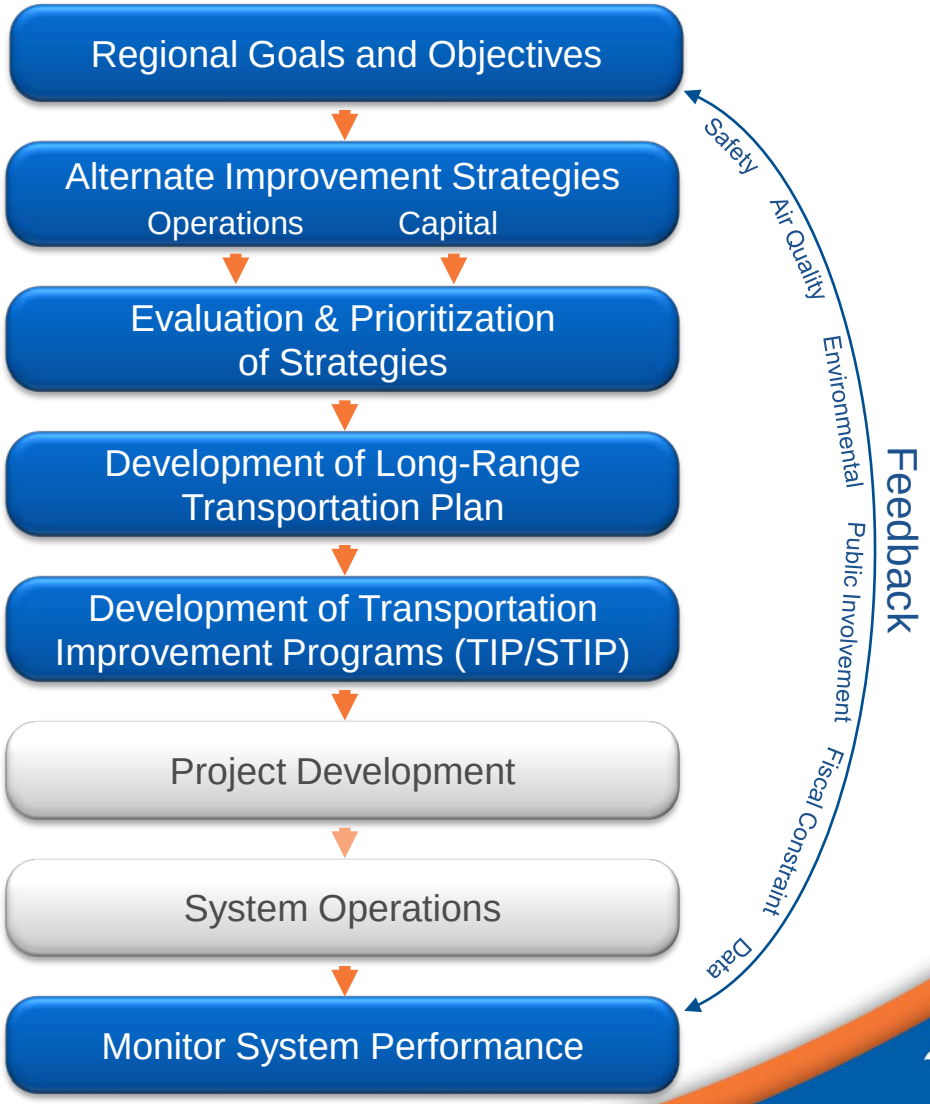
Reasons for Architecture Use in Transportation Planning

- Architecture represents a consensus vision of Operations and Planning stakeholders for deployment of ITS systems
- Addresses both short range projects and long range strategies

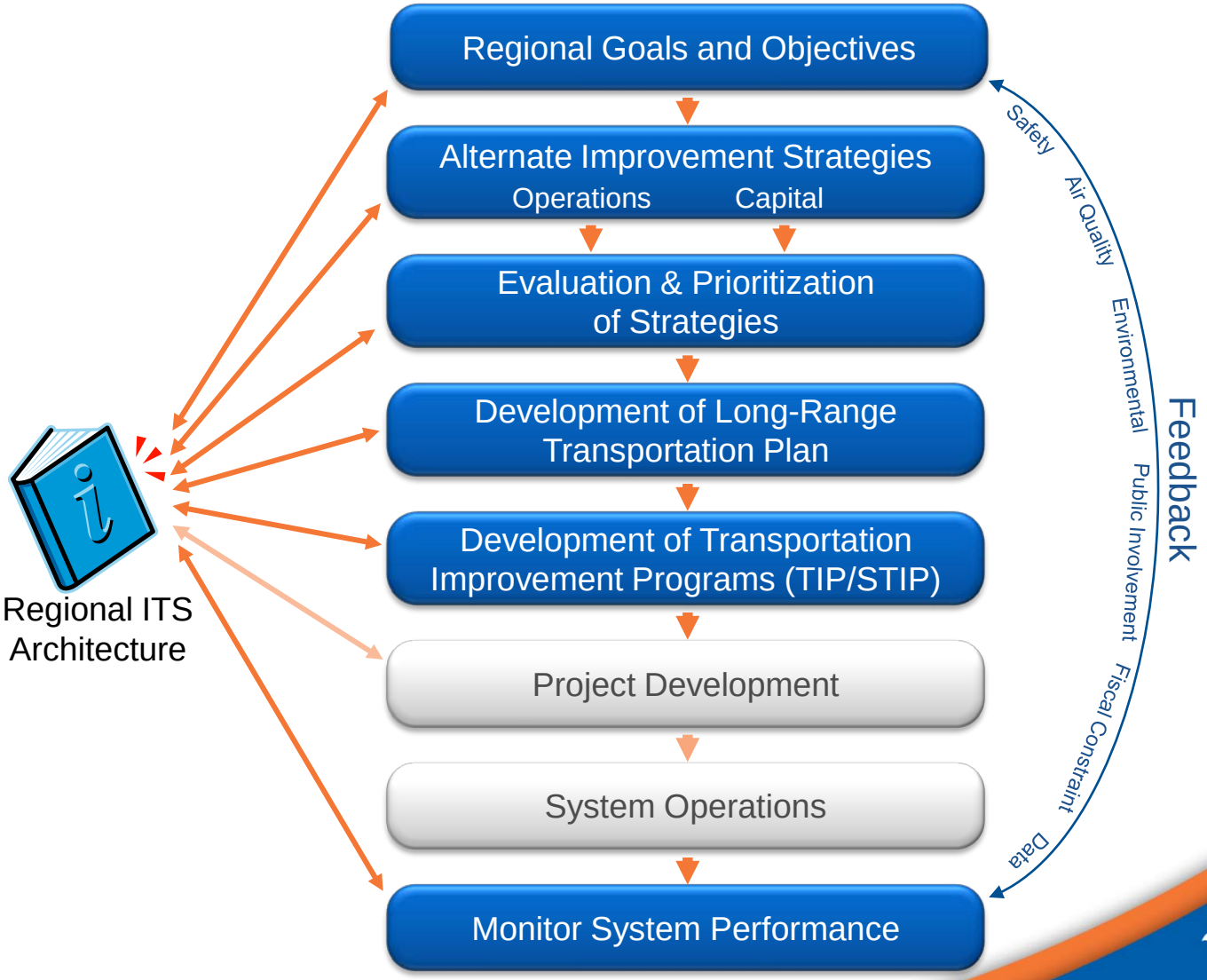
Transportation Planning Process

GOALS

PROJECTS



Regional Architecture and Transportation Planning



Strategy Evaluation and Prioritization

Potential Strategies

Evaluation and prioritization

- Regional Goals and Objectives
- Alternate Improvement Strategies
  - Operations
  - Capital
- Evaluation & Prioritization of Strategies

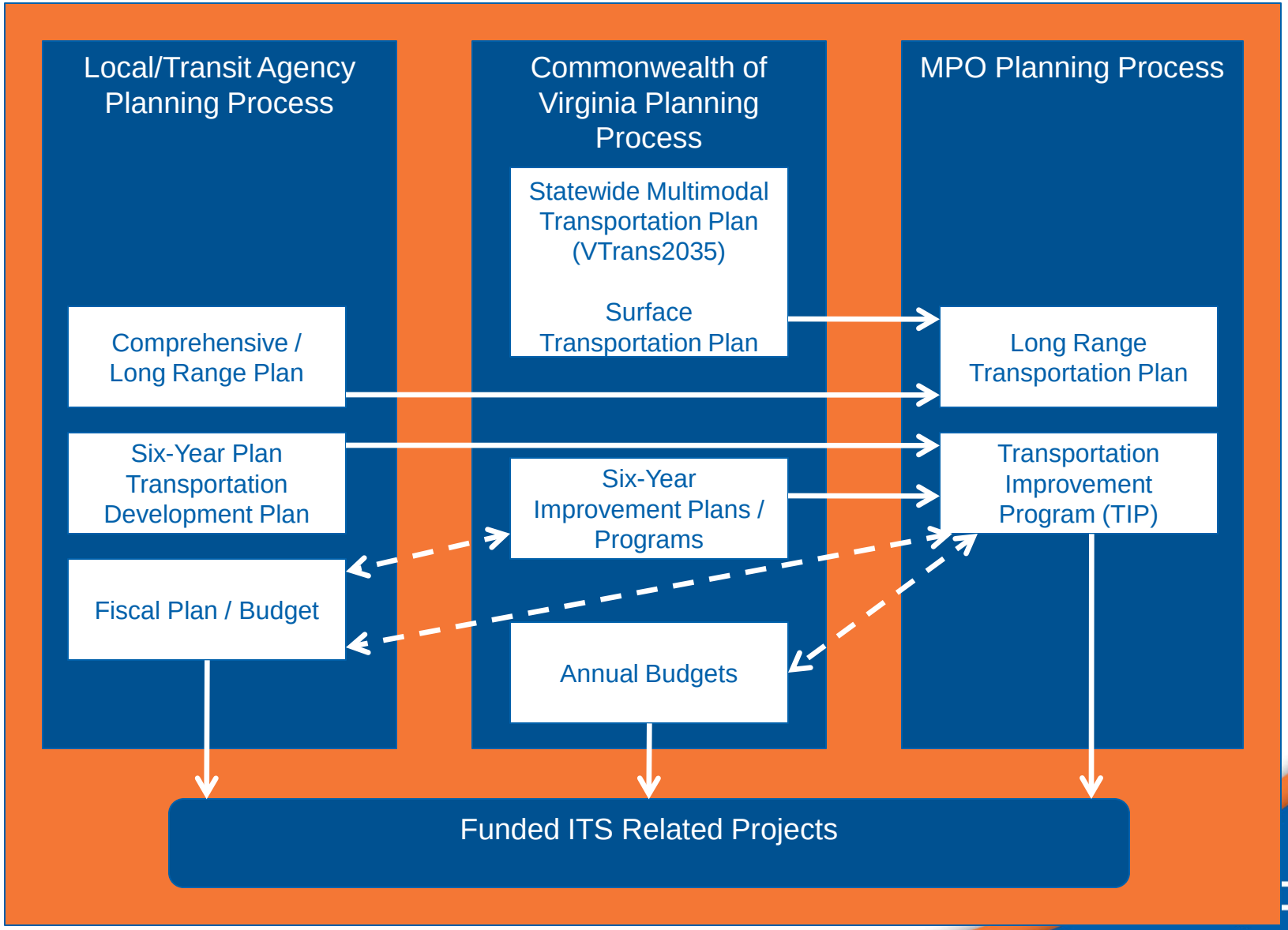
Selected Strategies

Included in

Long Range Plan

Evaluation and prioritization of strategies are key planning activities

Using the Virginia Eastern 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

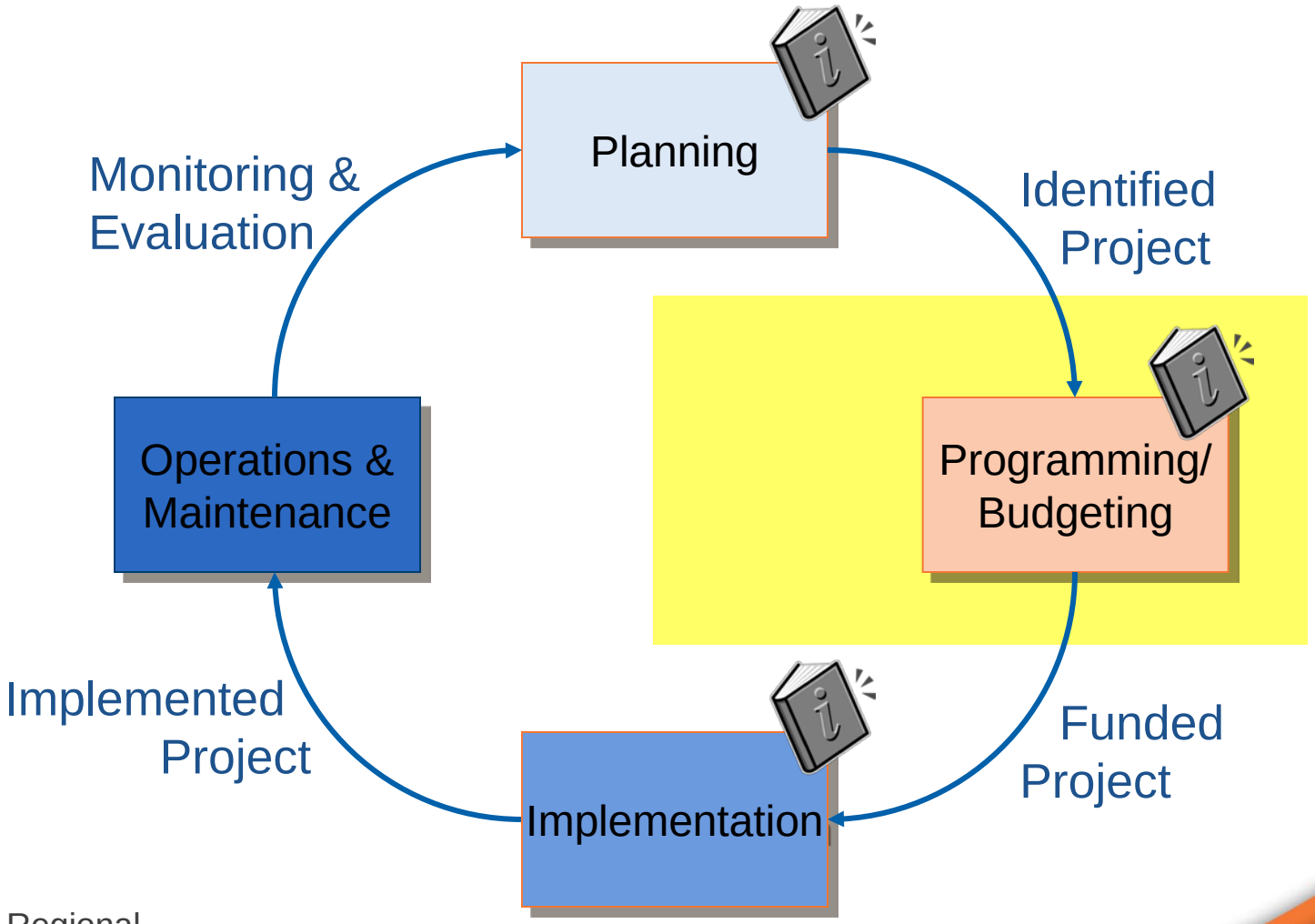
Monitor for architecture implementation in planning – VDOT and DRPT

- 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

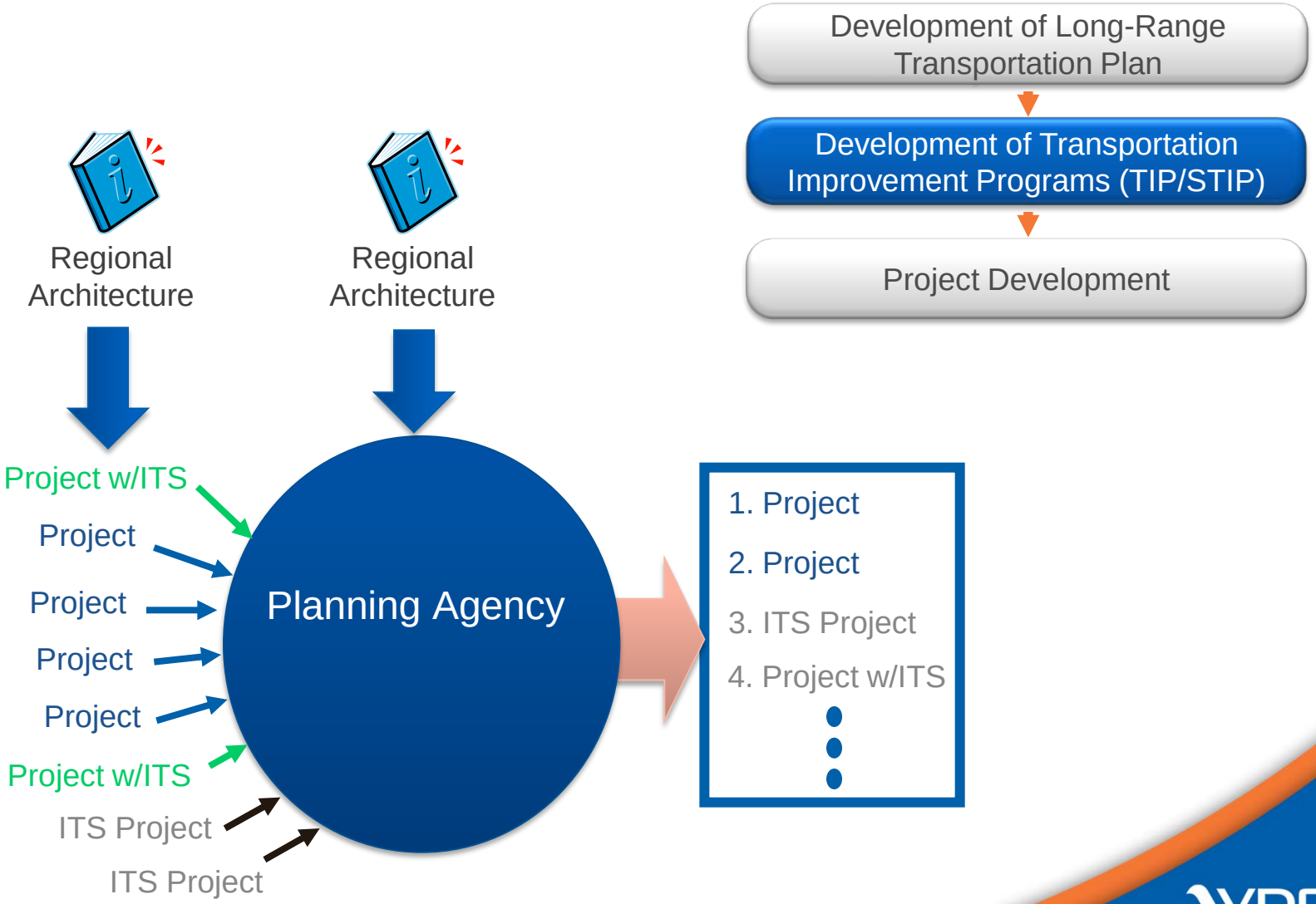
- Evaluate planning processes for inclusion of architecture
- Coordinate with VDOT

Architecture Use in Project Life Cycle



= Regional Architecture Use

Architecture Use in Programming/Budgeting

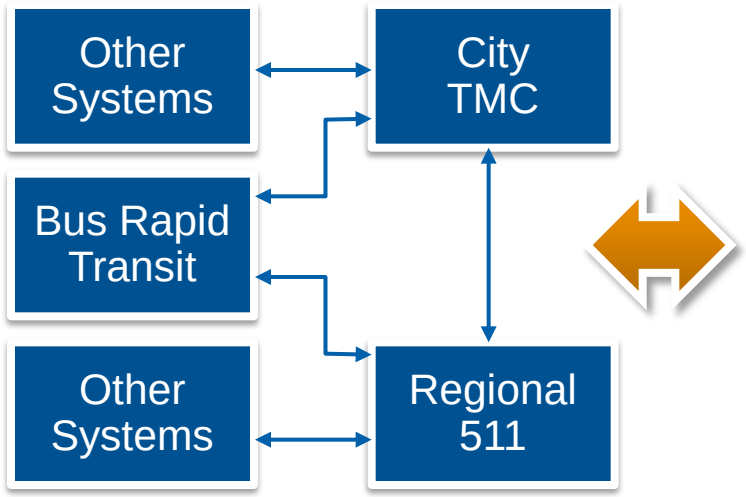


Benefits of Architecture Use in Programming/Budgeting

- 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

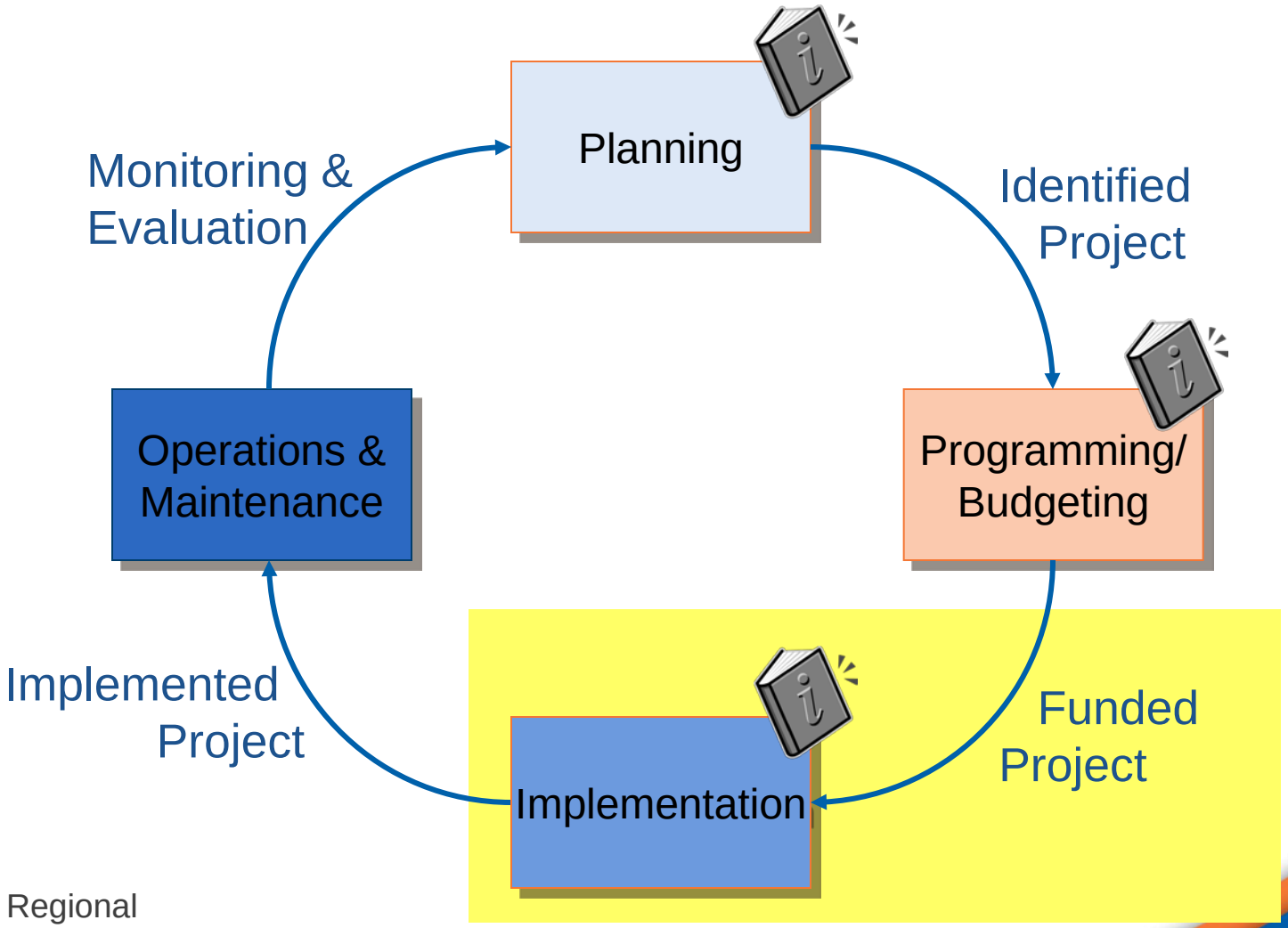
Regional Architecture



Transportation Improvement Program

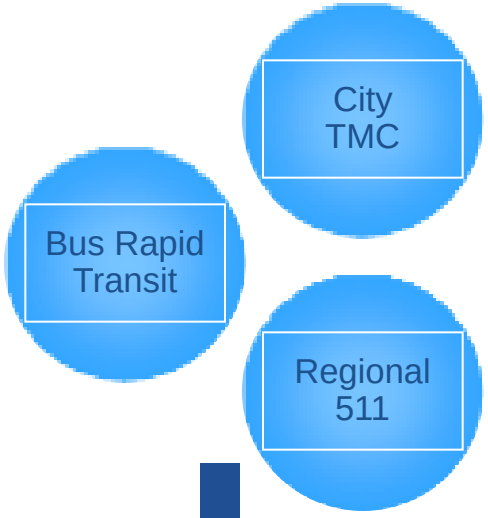
Agency	Number	Project	Funding
City	C11-321	City TMC	$400K
CTrans	T12-023	Bus Rapid Transit Ph1	$1.4M
DOT	D11-843	Regional 511 Ph2	$600K

Architecture Use in Project Life Cycle



= Regional Architecture Use

Reasons for Architecture Use in Project Implementation

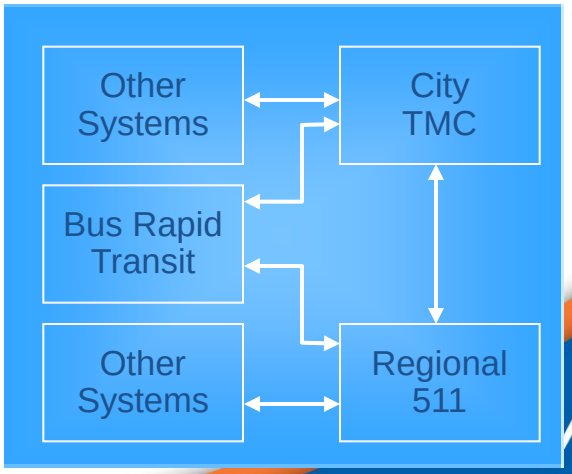


Blueprint

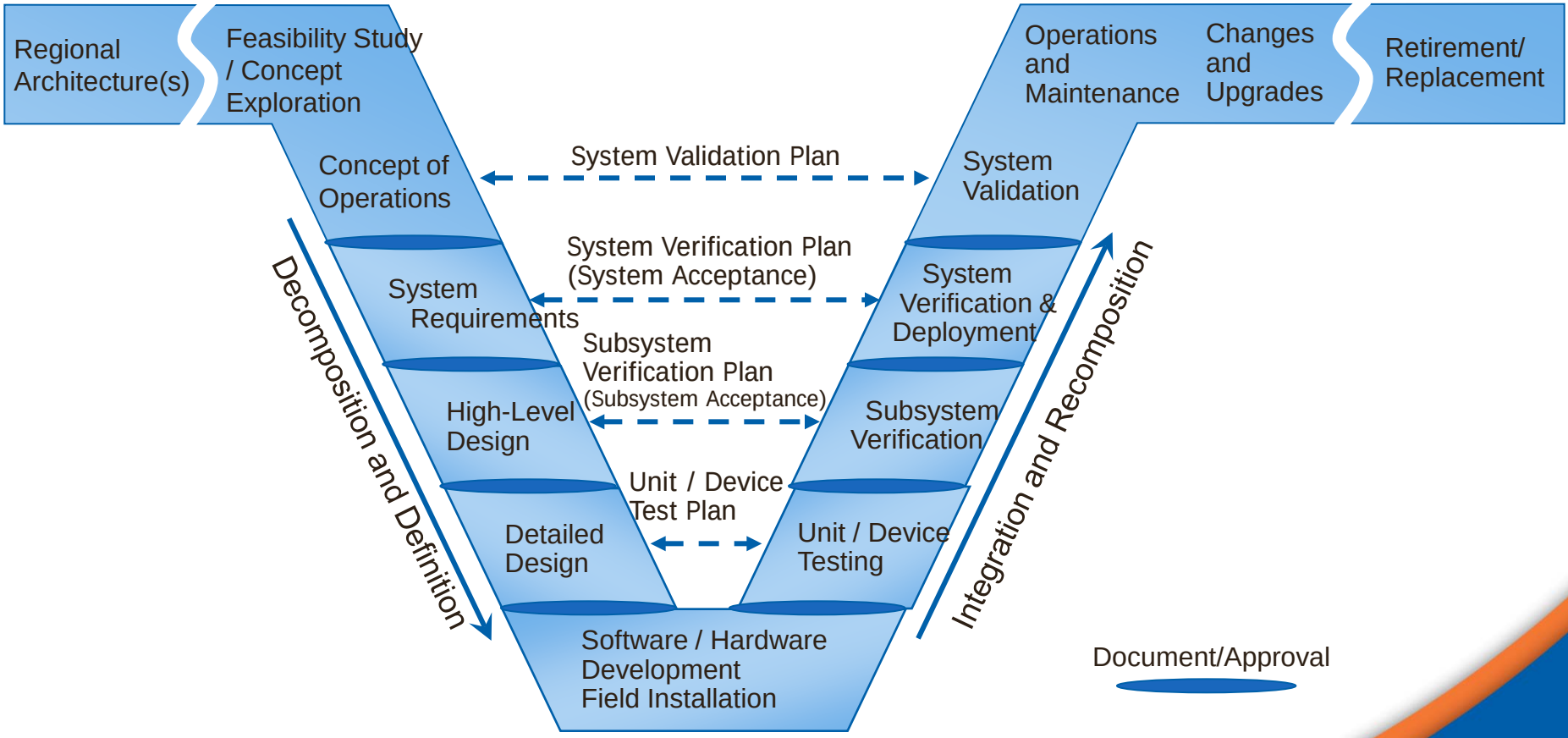
Integration Opportunities

Efficiency

Rule/Policy

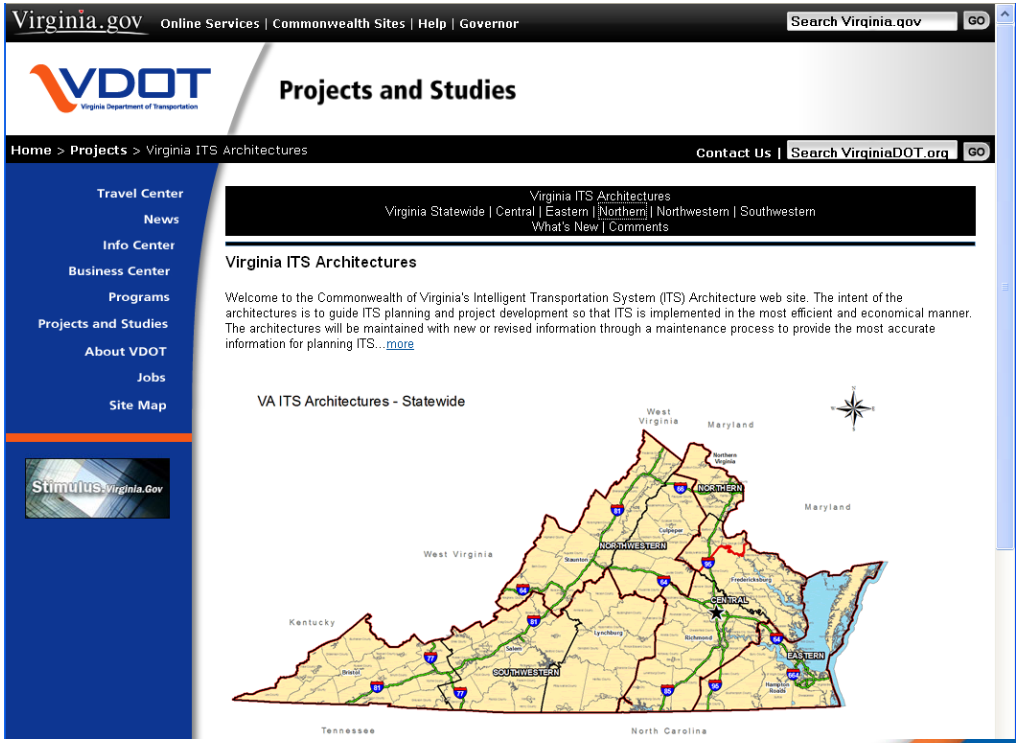


Systems Engineering Process



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**



http://local.iteris.com/virginiaitsarchitecture/

VDOT Southwest Region I-77 Project

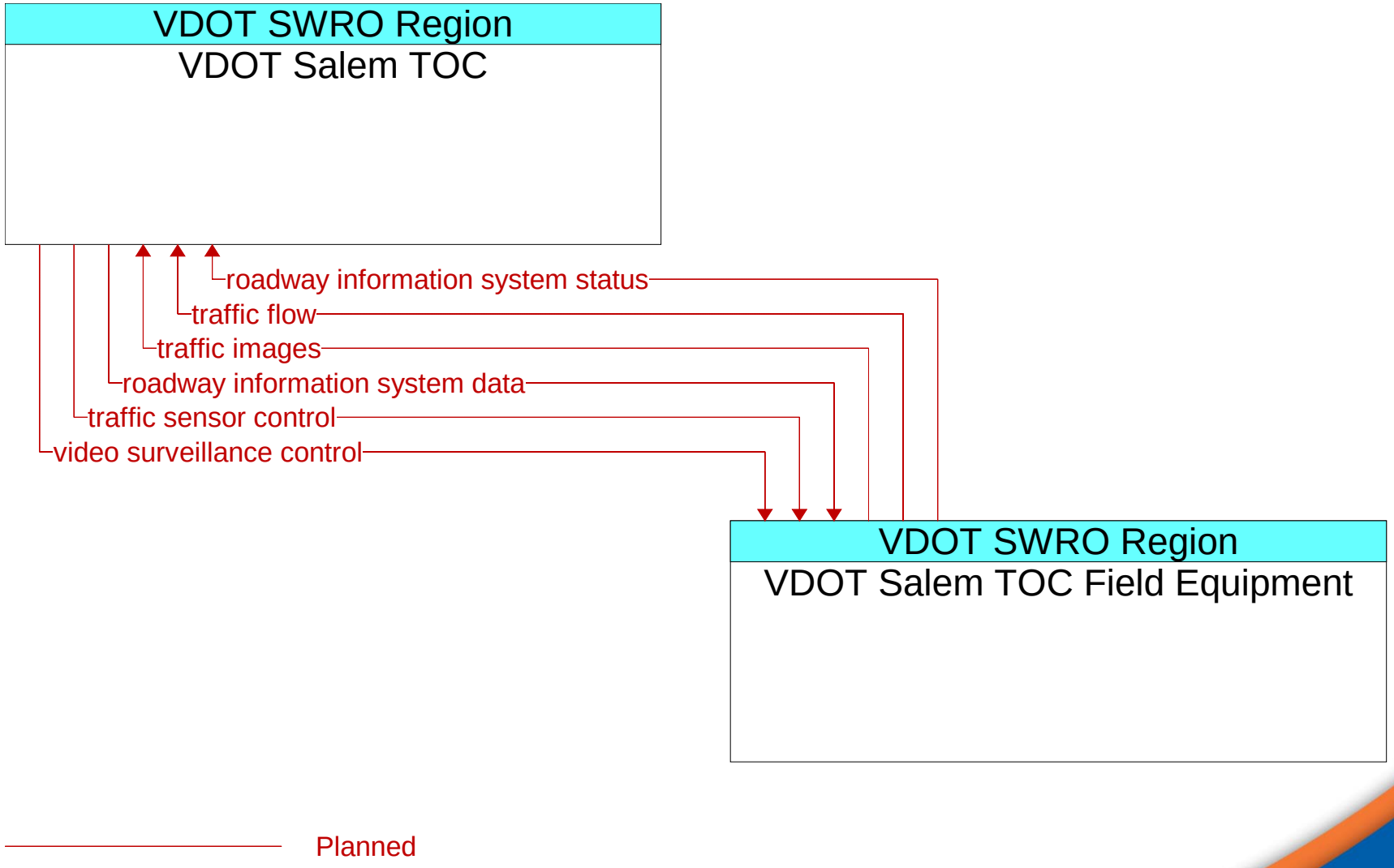
Addresses Emergency and Traffic Management needs on I-77 between MM 41 and MM 67.5

3 CMS

7 CCTV with integrated VDS

6 VDS

VDOT I-77 MM41-67.5 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

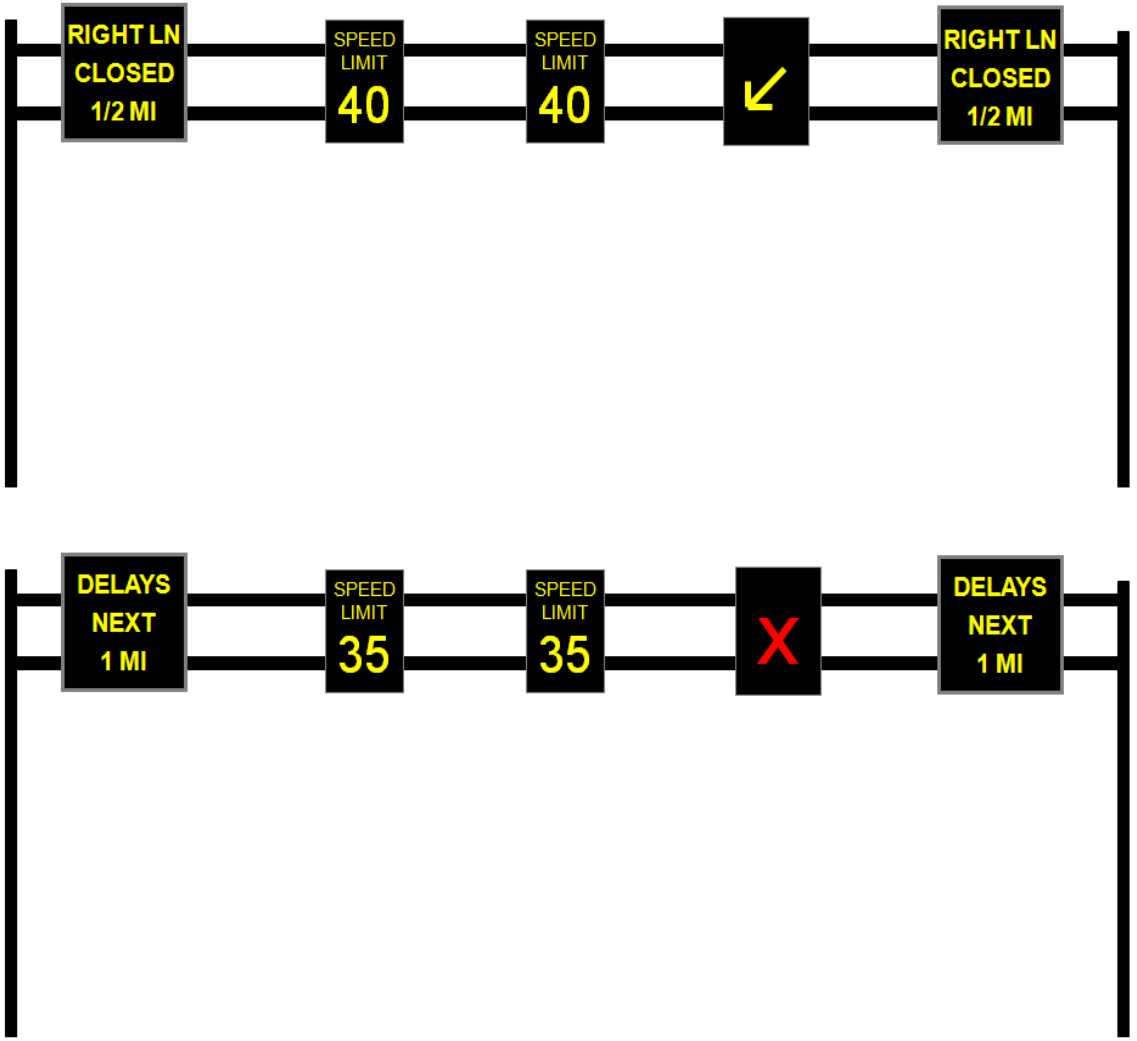
10 Overhead Lane Management Systems (OLMS)

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

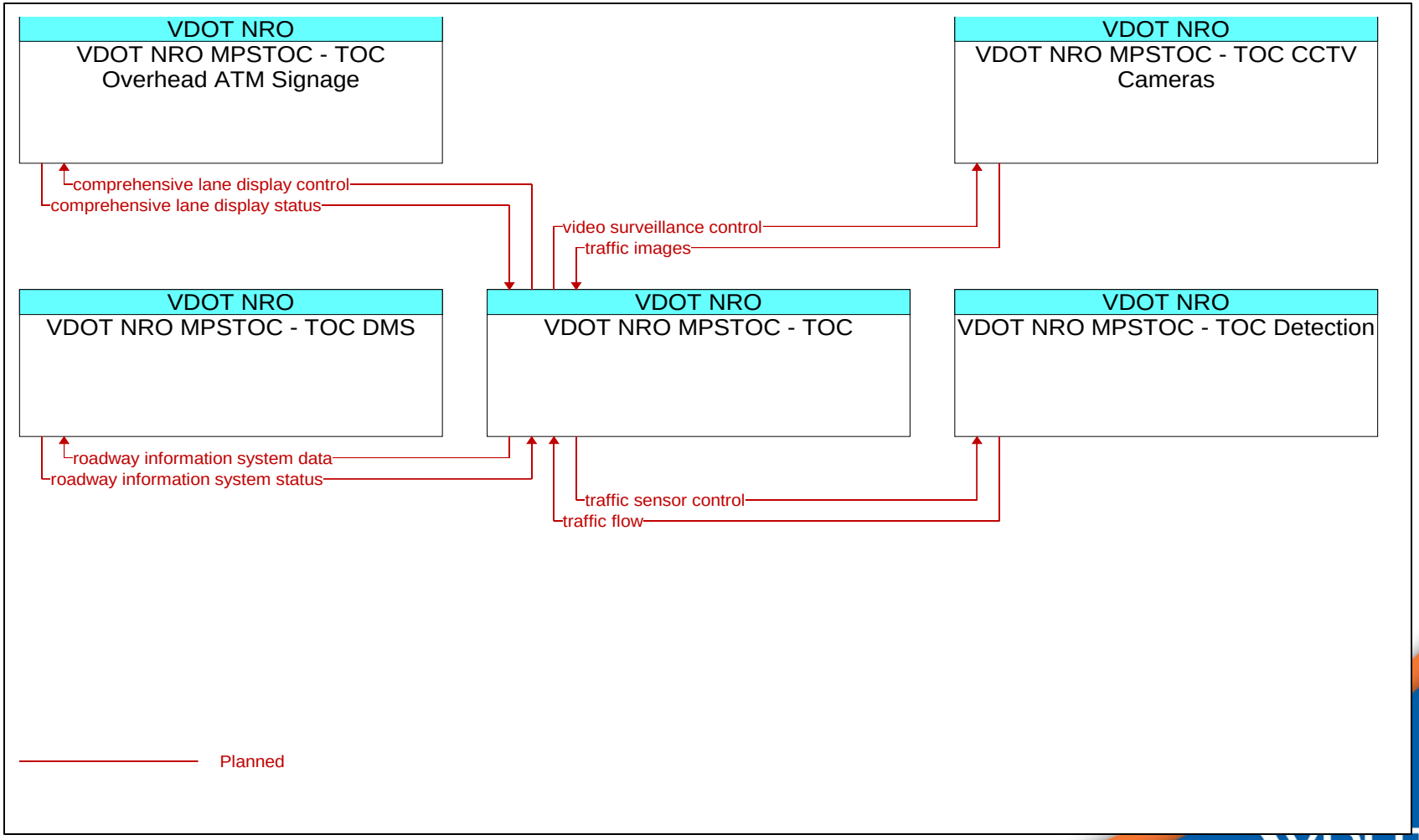
4 CCTV (Closed Circuit Television)

2 DMS (Dynamic Message Signs)

Typical OLMS Display



Project ITS architecture

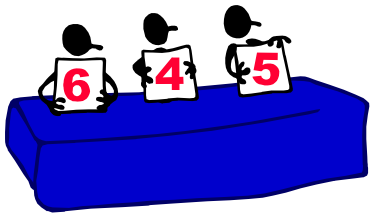


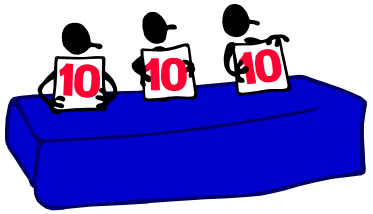
IDENTIFY GAPS AND SUGGESTED ARCHITECTURE CHANGES

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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