VDOT's Data Innovations:
Meeting MAP-21 Requirements and Beyond

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Topics

- **VDOT Context**

- **Current/Recent Initiatives**

  - **Review of All VDOT Systems**

  - **Traffic and Safety Assets Data Mart**

  - **Mobile Asset Data Collection**

  - **Traveler's Information Portal**

  - **TOC Outsourcing**

- **MAP-21 Readiness**

- **Priority Future Initiative**

  - **Asset Management System**

Virginia Road System

72K Total Centerline Road Miles

57K VDOT-maintained Centerline Miles

Interstate
Primary
Secondary
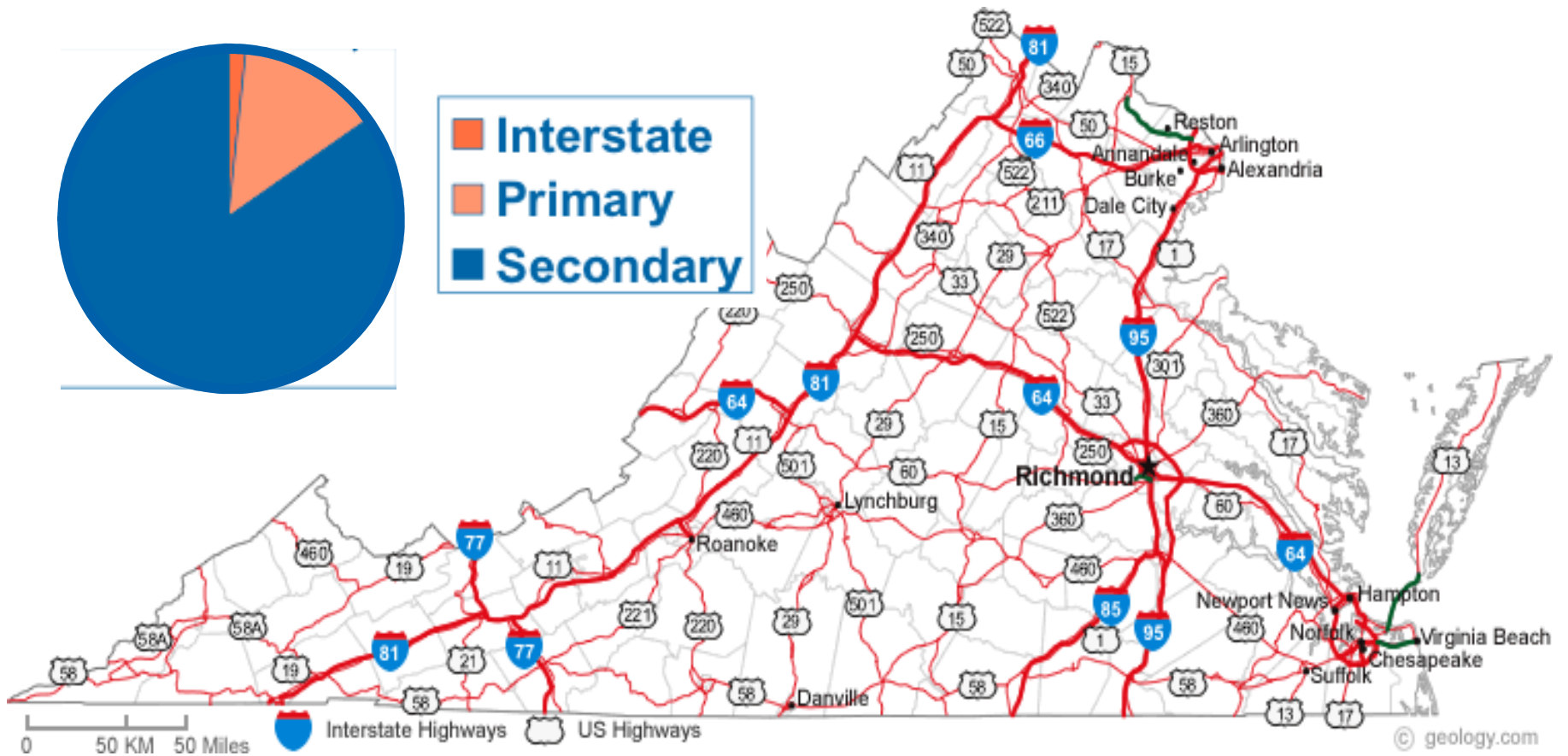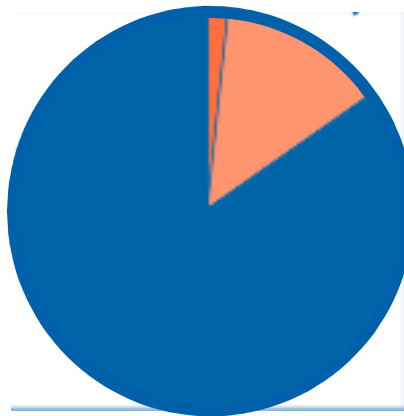
VDOT At a Glance

- Maintain 3rd largest road network in U.S – 57,800 Centerline Miles

- **126,530**   **Lane Miles Interstate, Primary, Secondary & Frontage**

- **19,390**   **Bridges & Large Culverts**

- **7**   **Tunnels (4 water, 2 mountain , 1 urban)**

- **7**   **Ferry Boats**

- **17**   **Movable Bridges**

- **5**   **Traffic Operations Centers**

- **43**   **Safety Rest Areas**

- **654,549**   **Ground-Mounted Signs**

- **10,533**   **Overhead Signs**

- **66,689**   **Miles of Pavement Markings**

- **6,532**   **Miles of Guardrail**

- **3,244**   **Signalized Intersections & Flashers**

- **1,317**   **ITS – 641 CCTV, 496 DMS, 79 PDMS, 81 RWIS, 20 HAR**

Maintenance Investment

The focus of physical condition of assets
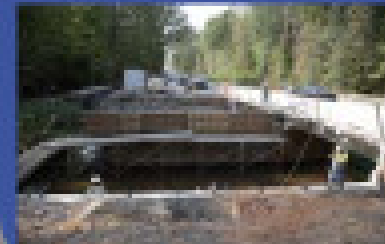
Interstate, Primary, Secondary Roads

Paving

Striping

Replace

Upgrade

5

Maintenance Investment
The focus of physical condition of assets

Interstate, Primary, Secondary Roads
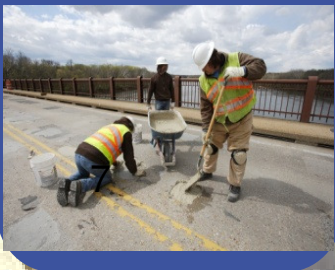
Paving

Striping

Replace

Upgrade

6
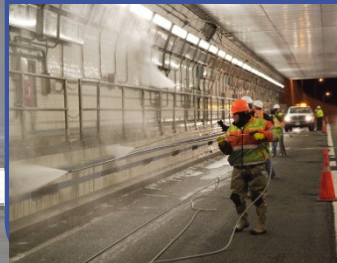
Maintenance Services
The focus of ordinary/routine maintenance of assets

Interstate, Primary, Secondary Roads

Patching

Washing

Pruning

Flushing

Mowing

FY 2013 & 2014 Needs Base Budget

VDOT

Investment: $1,980 Million

Services: $1,800 Million

Investment pie chart:
- Road Surface $967.20
- Bridges, $324.10
- Tunnels $56.20
- Traffic & Safety $561.70
- Emergency & Incident Magmt. $73.10

Services pie chart:
- Emergency & Incident Mgmt. $437.40
- Facility & Other $416.00
- Roadway $390.70
- Roadside $356.40
- Traffic & Safety, $212.90
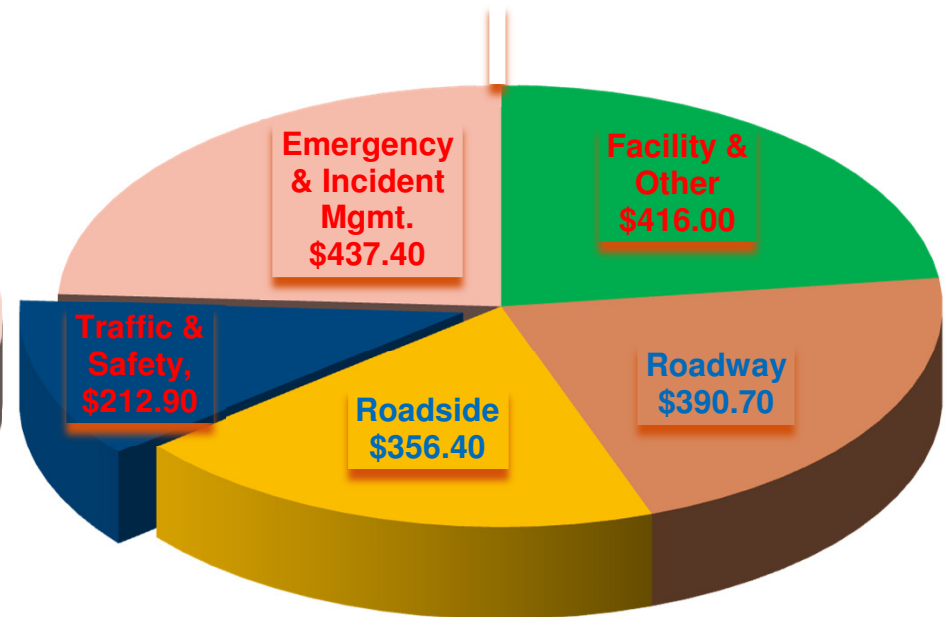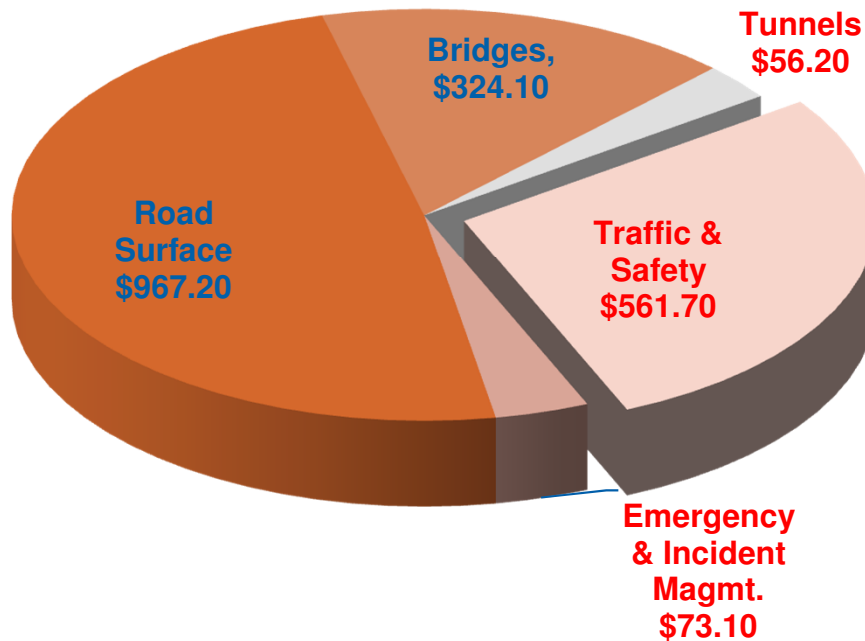
Total Traffic & Operations Needs: $1,757 Million   VS.

Total Maintenance Program Needs: $ 3,800 Million

Focus on Traffic and Operations

- **Manage non-recurring congestion**

- **Deploy next generation technology and communications network**

- **Deliver safety programs**

- **Emergency response and event planning**

- **Incident management systems**

- **Integrated corridor management**

- **Road weather information**

- **Traveler's information**

- **Etc.**

VDOT Dashboard
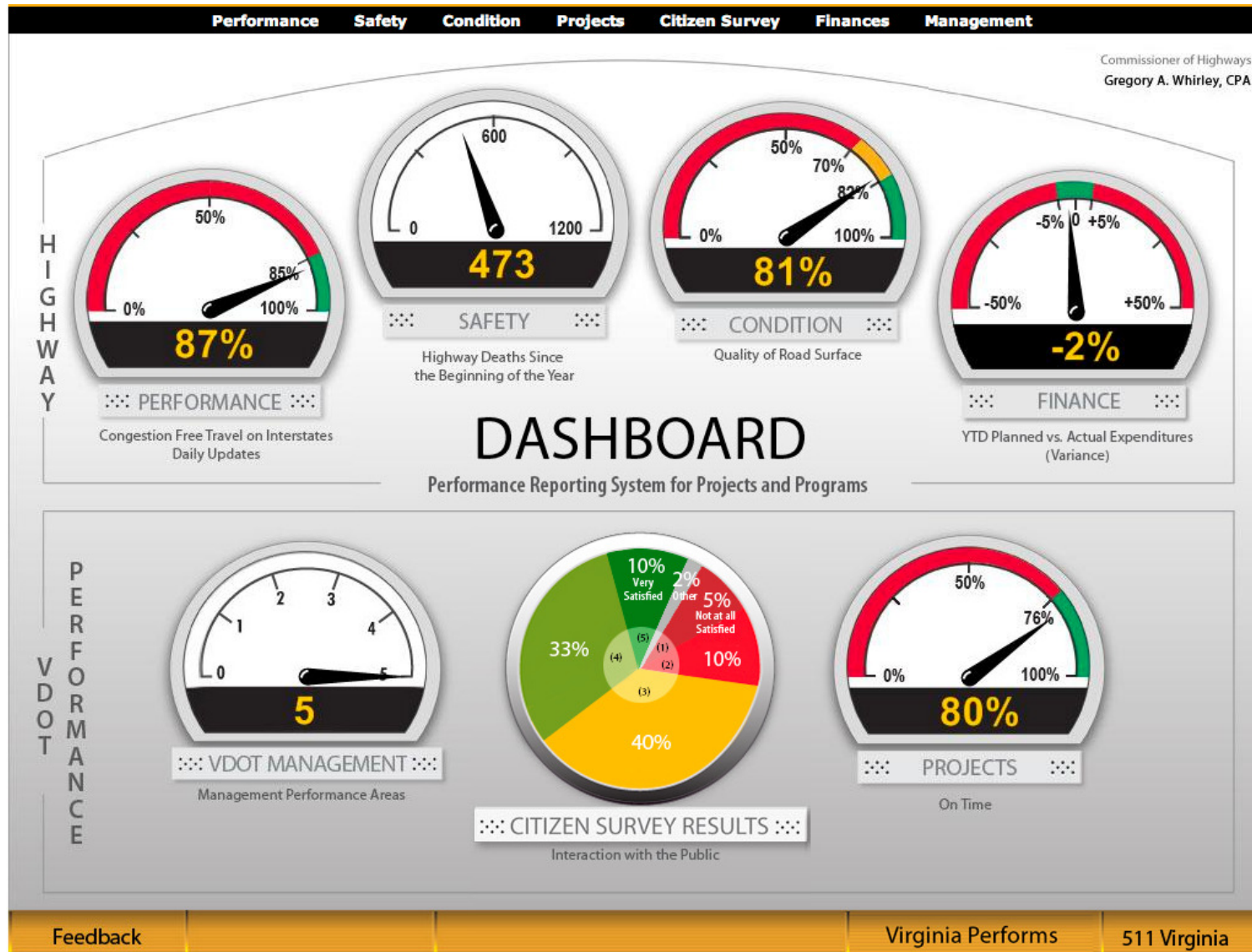
Current/Recent Initiatives

Assessment of All VDOT IT Systems

The Need:

Lack of common understanding about what IT applications exist, how they are being used to meet business needs, and their benefit to VDOT
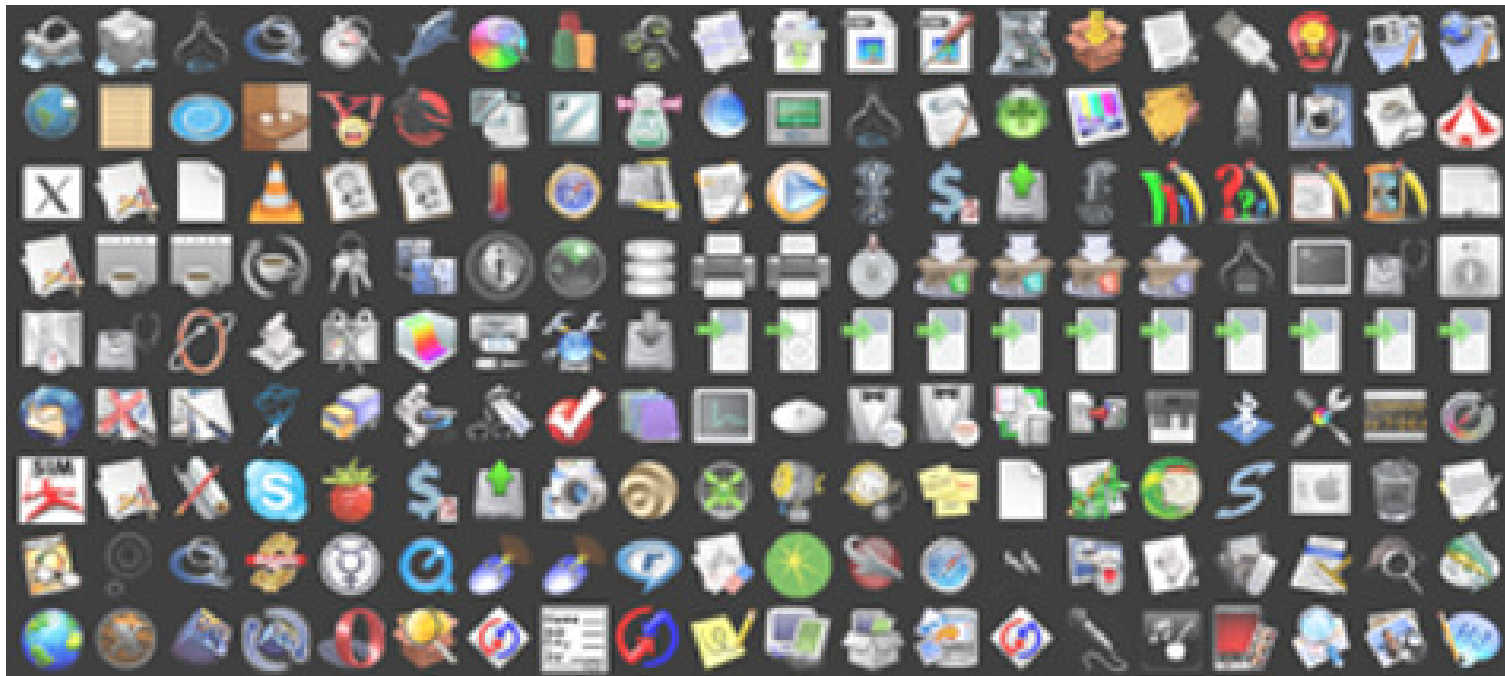
Assessment Purpose

- **Document current VDOT IT applications, use, and needs - using a standard methodology.**

- **Identify opportunities for improving how VDOT IT applications can support business needs – short term and long-term.**

- **Identify opportunities for greater efficiencies for how IT applications can support VDOT business activities.**

- **Identify common functions that could be consolidated to serve multiple application needs.**

Methodology

- **Step 4: Create data flow diagrams for each application.**
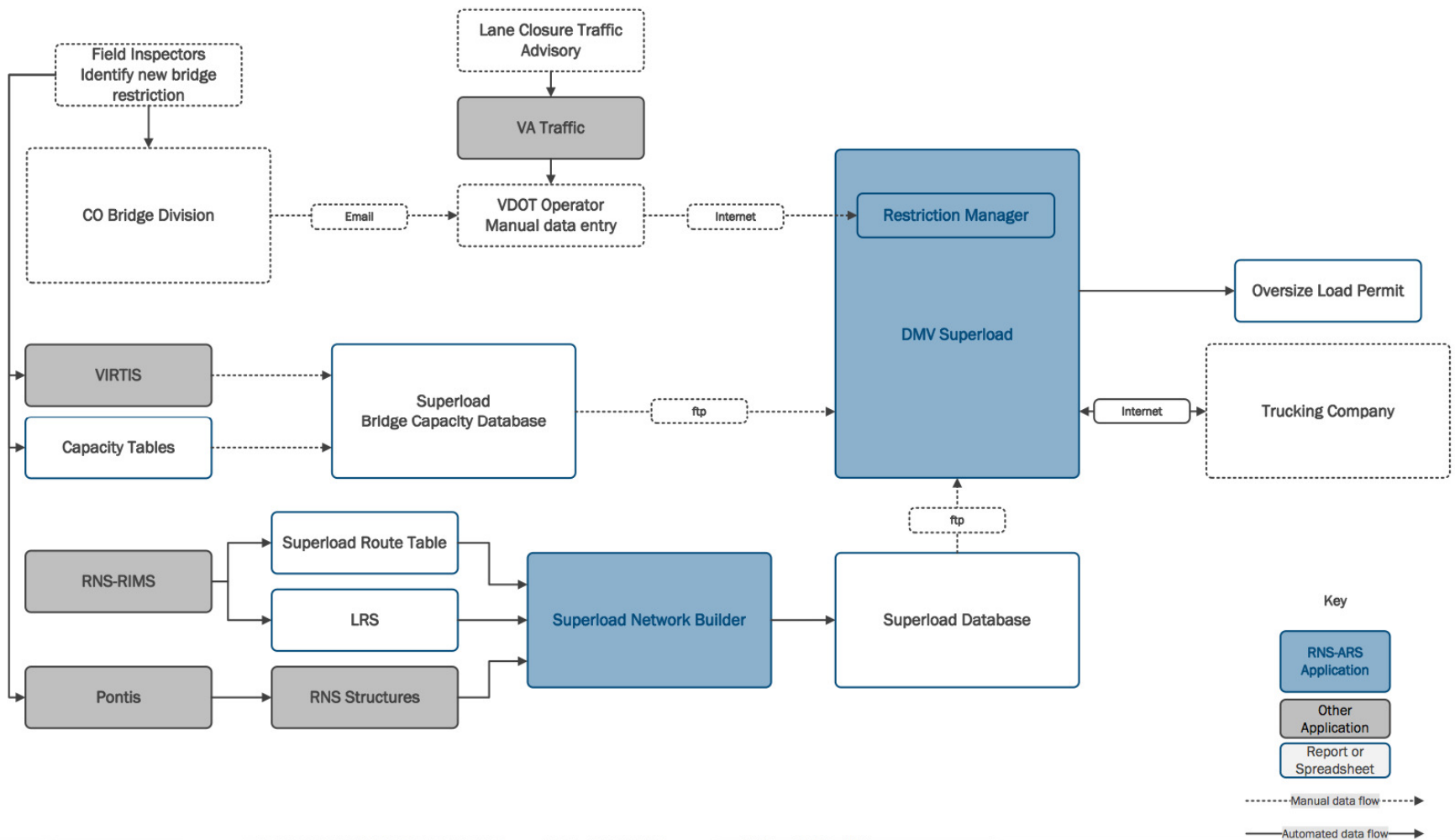
Making the Data and Decision Link – Traffic and ITS Assets

- Create a central data repository containing existing ITS and Traffic asset information to meet priority reporting needs

- Provide immediate value with existing data

- Create model that can be extended over time as more data become available

- Ensure flexibility to accommodate changes in source data systems (e.g. TMC transition, new AMS/MMS, etc.)

Communities of Interest

- **Approach to assembling staff from different units within VDOT to collaborate on development of recommendations and guidelines about data needs:**

  - **Brings staff together from across the Department**

  - **Encourages a practical focus: what data are really needed to support decision-making?**

  - **Provides a collaborative, bottom-up approach**

- **Concept was recommended through the 2008 Data Business Plan**

COI Identified Info Needs

IDENTIFICATION OF NEEDS AND SOLUTIONS

1. M&R Policies and Practices

2. Standards and Specifications

3. Upgrade & Replacement Needs

BUDGETING

4. Developing 6 Year Budgets

5. Allocating available resources

WORK SCHEDULING AND MANAGEMENT

6. Determining what work to outsource

7. Scheduling specific work activities

8. Actions to Improve Material and Equipment Performance

9. Asset Upgrades/ Enhancements Associated with Projects

REAL-TIME SYSTEM MANAGEMENT

10. Real time response to service requests

MONITORING AND PERFORMANCE REPORTING

11. Setting Performance Measures and Targets

Concept Diagram

Transactional Systems	Central Repository (ODS)	Data Mart
ATMS Micromain AMMS (ERO) IMMS (NRO) Spreadsheets/Access DB Roadware data...	Standardized inventory database	Data structured to support reporting

Statement of Decisions & Info Needs

- **IDENTIFICATION OF NEEDS AND SOLUTIONS**

    – Decision #1: What should VDOT's long term strategy be for investments in ITS Assets?

    – Decision #2: What are our anticipated maintenance and replacement needs for ITS assets over the next three biennia?

    – Decision #3: What technology standards and specifications should be established for new ITS projects?

    – Decision #4: What preventive maintenance and replacement policies should be implemented?

- **Budgeting**

    – Decision #5: How should (limited) resources be allocated across ITS investment areas? /How should Candidate ITS investments be prioritized/What specific ITS-related projects should be included in VDOT's Six Year Program

- **WORK SCHEDULING AND MANAGEMENT**

    – Decision #6: What aspects of ITS Asset deployment, operation and maintenance should be contracted out?

    – Decision #7: What steps should be taken to improve equipment performance?

    – Decision #8: What should the statewide benchmark be for equipment availability?

- **REAL-TIME SYSTEM MANAGEMENT**

    – Decision #9: What actions are required to efficiently maintain and operate ITS devices and the associated communications network?

    – Decision #10: What devices are in immediate need of repair?

- **MONITORING AND REPORTING PERFORMANCE**

    – Decision #11: What should be allocated to VDOT's Operations Program?

VDOT

Example Detail

Decision #7: What steps should be taken to improve equipment performance?

Made By	CO and Regions
Timeframe	Assess on a quarterly basis
Information Needs	• *Are there patterns of equipment performance based on equipment type, make/model, location or other characteristics?* • *Is any vendor's equipment posing continual maintenance and performance shortfalls?* • *Which pieces of equipment are currently under warranty?* • What funds are available to address equipment performance?
Data Sources	• Regional ITS asset inventories • Statewide ITS asset geodatabase • Manufacturer's equipment manuals • IEEE, FHWA, Other State DOT's ITS Programs • Regional Operations Maintenance Management ITS Fiscal Budget • On-site Asset Maintenance Log Books • ITS on-hand spare parts inventory
Current Capabilities	• Limited ability to summarize pertinent characteristics of existing inventory
Recommended Improvement Actions	• Improve existing ITS asset data baseline • Establish business solutions and procedures for regular updating of ITS inventory data • Develop standards for asset service lives

Initiatives: Data Mart

- **Objective:**
  - Groundwork for Statewide Traffic and ITS Asset Inventory

- **Focused on 4 Priority Assets:**
  - Signs, Signals, Guardrail and Changeable Message Signs (CMS)

- **Expected Outcome:**
  - Document existing asset inventory and inventory update process
  - Establish needs and meta data for statewide inventory
  - Concept of Operations for a system to produce statewide inventory
 - Development of prototype system

Initiatives: Data Mart – cont'd

- **Benefits:**
  - **Consistency**
    - Meta data for Traffic and ITS Asset Information
    - Documented systems of record for asset inventory
  - **Reduced Work Loads**
    - Automate combination of inventory from disparate data sources
  - **Improved Decision Making**
    - Compare information across District/Regional boundaries
    - Support Needs Based Budgeting
    - Facilitate combination of TE Asset Information with other systems/data
      - * Dashboard, PMS and BMS, Mapping Tools, etc.
    - Provide reporting tools
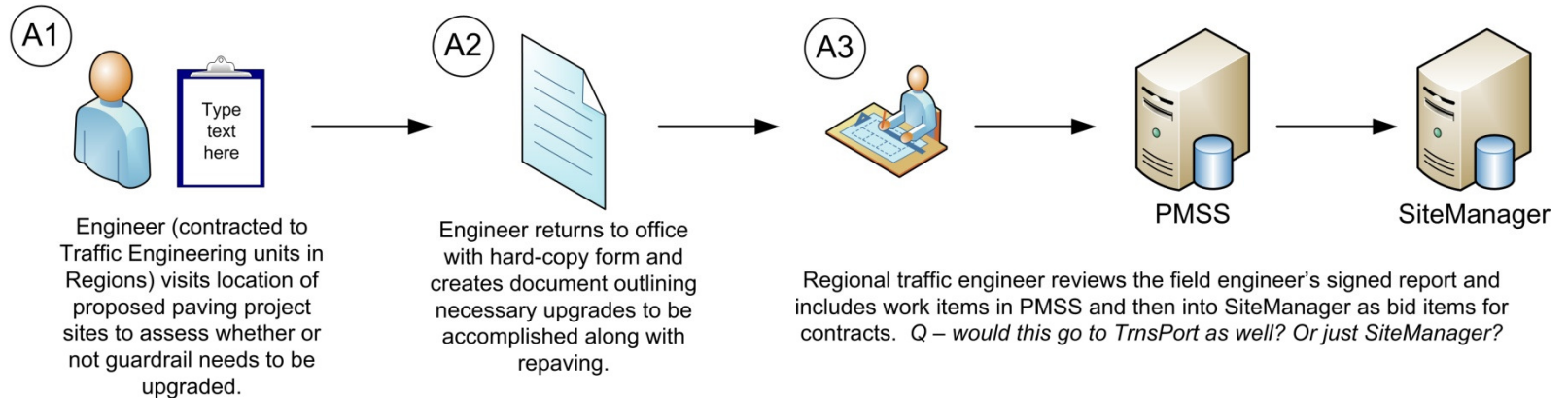
Initiatives: Guardrail Mobile App

- **Objective**
  - Design a mobile application to support guardrail inspection and onsite decision making

- **Expected Outcome**
  - Document Regional guardrail inspection processes
  - Establish a consistent, streamlined statewide inspection process
  - Prototype application could be used for other assets

- **Expected Benefits**
  - Consistent condition assessment and documentation
  - Automatic collection of GPS and integration with other data
  - Reduced effort for District/Regional/Consultant forces
  - Improved guardrail inventory and decision making process

Guardrail Data
Collection using Mobile Devices
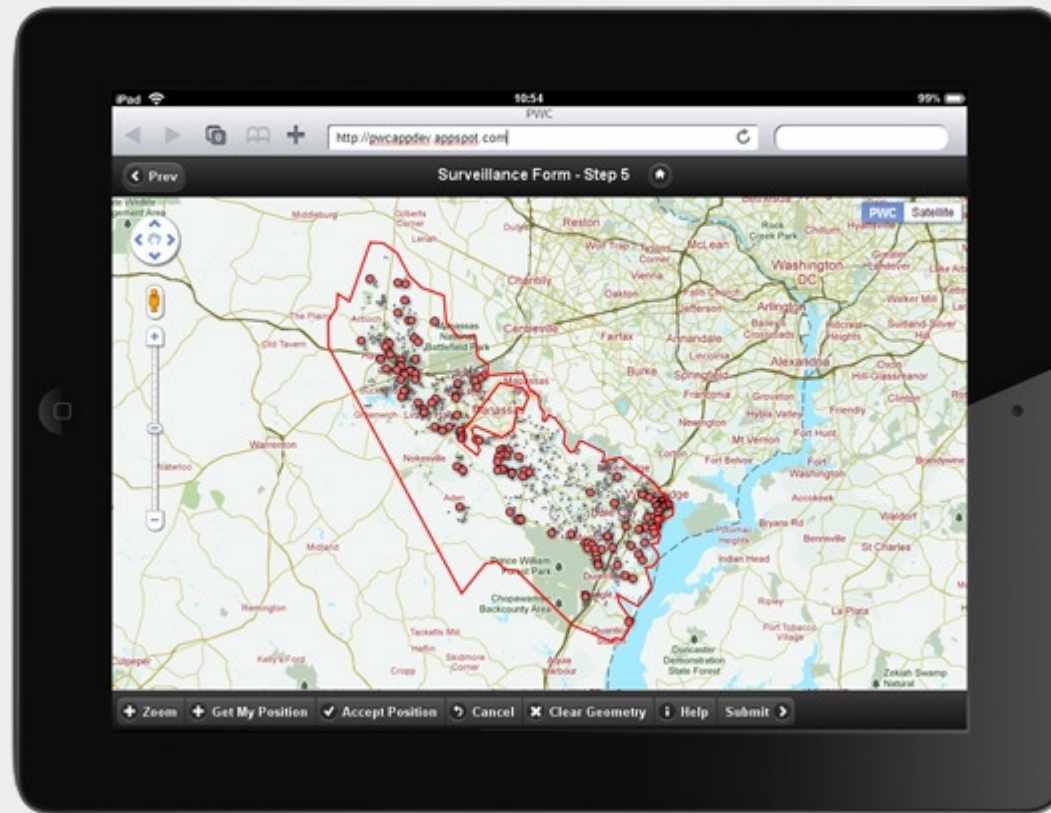
1.Existing Inventory from Roadware is synched to device
2. Data entry will be synched to the database in the cloud whenever internet is accessible
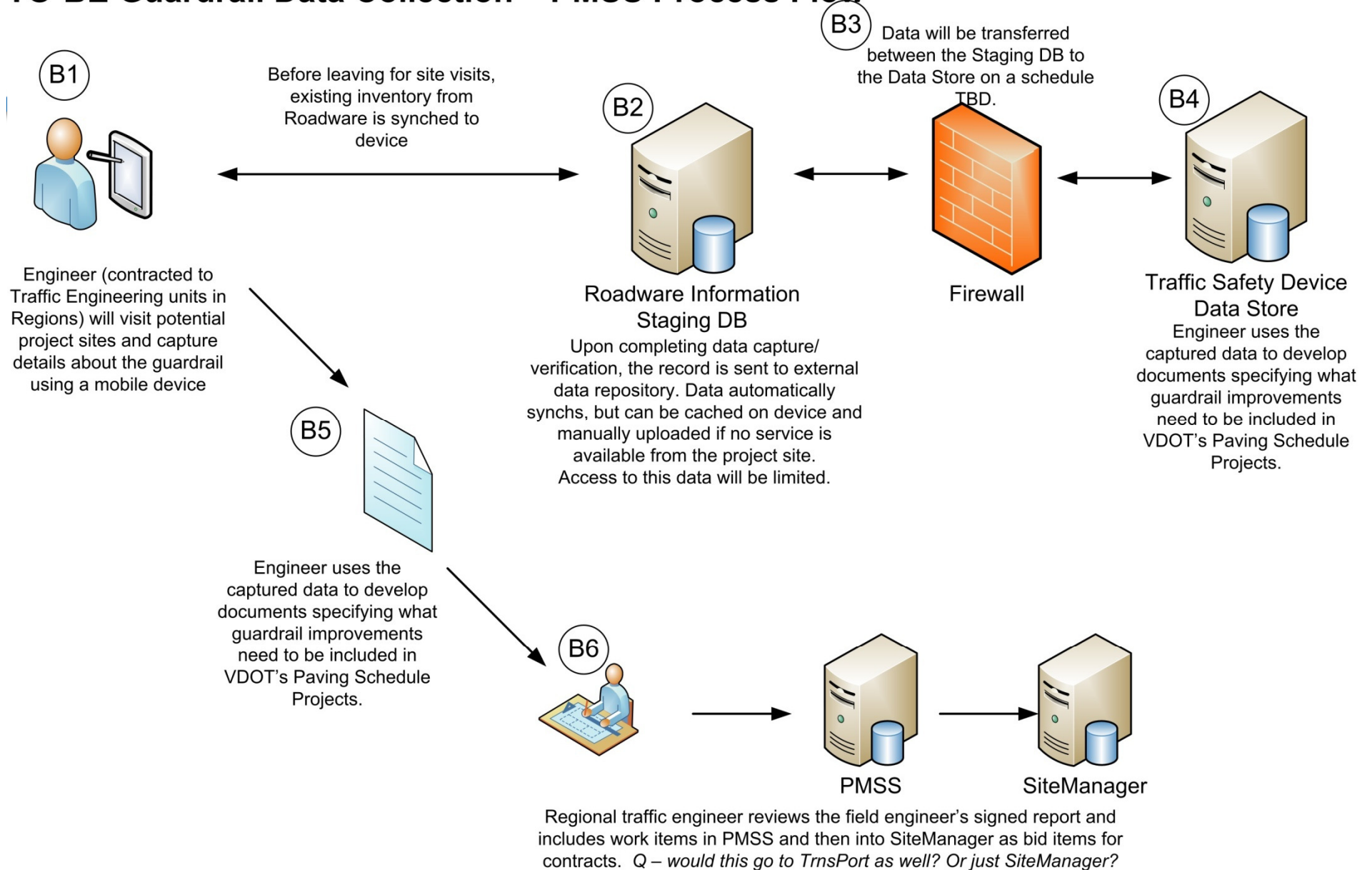
AS-IS Guardrail Data Collection – PMSS Process Flow

VDOT

A1 — Engineer (contracted to Traffic Engineering units in Regions) visits location of proposed paving project sites to assess whether or not guardrail needs to be upgraded.

Type text here

A2 — Engineer returns to office with hard-copy form and creates document outlining necessary upgrades to be accomplished along with repaving.

A3 — Regional traffic engineer reviews the field engineer's signed report and includes work items in PMSS and then into SiteManager as bid items for contracts. *Q – would this go to TrnsPort as well? Or just SiteManager?*

PMSS   **SiteManager**

Issues to be addressed

- Engineers have the option to collect data using a Trimble unit, excel spreadsheet (using laptop in vehicle) or using a hard-copy form. All contractors are using the hard-copy form. The electronic options are cumbersome and not user friendly.

- The electronic versions require a lot of manual data entry.

- Engineers are doing double data entry, making it prone to errors when they return to the office. This also requires more time in the office and less in the field.

- Engineers are developing documents with different formats. So a Regional Traffic Engineer will receive a differently formatted document from each engineer.

- *Question – are the engineers entering data from the field-worksheet into an excel spreadsheet and then to the document? Or do they enter the data directly to the document?*

- Note: our initative will not alter the flow of documents to the RTE for coordination in PMSS and SiteManager. Any process we add must continue supporting this project development flow.

- None of the data captured by the field is captured in a database for further analysis. Users generate a document and that's the end of the data's lifecycle.

- We collect a great deal of guardrail data via the Roadware contract, but it does not include critical details about some physical attributes – or condition of the assets.

- *The immediate focus of our pilot will be on the collection of data for the project development process, but it should be designed to support a more proactive process for inventorying data pertaining to guardrails and other assets.*

TO-BE Guardrail Data Collection – PMSS Process Flow

B3 Data will be transferred between the Staging DB to the Data Store on a schedule TBD.

B1

Before leaving for site visits, existing inventory from Roadware is synched to device

B2

B4

Engineer (contracted to Traffic Engineering units in Regions) will visit potential project sites and capture details about the guardrail using a mobile device

Roadware Information Staging DB
Upon completing data capture/ verification, the record is sent to external data repository. Data automatically synchs, but can be cached on device and manually uploaded if no service is available from the project site. Access to this data will be limited.

Firewall

Traffic Safety Device Data Store
Engineer uses the captured data to develop documents specifying what guardrail improvements need to be included in VDOT's Paving Schedule Projects.

B5

Engineer uses the captured data to develop documents specifying what guardrail improvements need to be included in VDOT's Paving Schedule Projects.

B6

PMSS

SiteManager

Regional traffic engineer reviews the field engineer's signed report and includes work items in PMSS and then into SiteManager as bid items for contracts. *Q – would this go to TrnsPort as well? Or just SiteManager?*

Vision: Tablet Field Data Entry

Traveler's Information Portal

Initiatives: TOC Outsourcing

- **Objectives:**
    - Centralize management & operation of 5 TOC centers
    - Provide interoperability of 5 TOC centers

- **Focused on Key Service Areas**
    - Safety Service Patrol
    - TOC Operations
    - ATMS Platform
    - ITS Devices Maintenance
    - Integration of Freeway & Arterial Operations
    - System Performance Monitoring & Reporting

MAP-21 Readiness

New Data Requirements Under Map 21

- **State is required to develop a risk-based asset management plan for (NHS) to improve or preserve the condition of the assets and the performance of the system.**

- **Pavements & Bridges required,**

- **All infrastructure assets within the highway right-of-way encouraged**
  - **(pavement markings, culverts, guardrail, signs, traffic signals, lighting, ITS infrastructure, rest areas, etc)**

Current Status in Asset Management

- PAVEMENT MANAGEMENT SYSTEM (Agile)

- BRIDGE MANAGEMENT SYSTEM (Pontis)

- No asset management system for traffic assets (signals, signs, guardrails etc)

  - o Do have a snapshot of traffic asset inventory through Roadware effort (not accurate and up to date)

  - o District/Regions maintain their own asset inventory of varying formats and data quality

Traffic & Operations Data Challenge

- No real time, updated statewide traffic asset inventory
- Heavily rely on districts/regions to report on asset numbers/changes
- Lack of asset condition tracking
- Lack of tools to capture new asset acceptance
- Difficult to implement performance management
- Difficulty in developing needs based budgeting
- No Traffic Asset Management System

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Traffic Assets & Performance Measures

Traffic Asset Data and Risk Assessment Critical to Support Key Decisions in Other MAP-21 PM areas:

- **Congestion Reduction**
  - **Information sharing availability between disparate stakeholders to incorporate resource sharing**
  - **%-age of Traffic Signals Retimed in Accordance within Agency Requirements or Best Practices**
  - **Integrating Freeway & Arterial Operations**

- **Safety**
  - **Incident Clearance**
  - **Time Since Retiming (including timing of safety related yellow & red change intervals)**
  - **MUTCD Retroreflectivity Requirements**

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Traffic Assets & Performance Measures

Traffic Asset Data and Risk Assessment Critical to Support Key Decisions in Other MAP-21 PM areas:

- **Reduce Project Delivery Delays**
  - **Assess and improve existing processes & procedures**
  - **Improve access to asset data to make informed decisions on how to utilize existing assets**
  - **Find improvements in project development & construction processes (specifications, standards, preapproved items) to eliminate obstacles and redundancies**

How can we meet the MAP 21 Requirements

- Document Business Processes and data needs

- Improve Asset Data Collection Process

- Promote the implementation of Traffic Asset Management System

- Organizational & Cultural Adjustments

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MAP-21 Readiness

- **VDOT is in good shape to meet national performance measures requirement of MAP-21 (2014-2016 timeframe) for pavement and bridges**

- **VDOT is ready to move towards greater performance management with next stage of measurement**

- **Work is already in process for Safety and Asset Plans in anticipation of MAP-21 rules**

Future Need/Initiative

New Asset Management System

District Administrators Council Recommendations

- **Reduce Administrative Burden.**

- **Simple to Use.**

- **Enhance Decision-Making.**

- **Mobile Field Use**

- **Systematic Reporting.**

- **Efficient and Effective.**

- **Support VDOT's AM Goals.**
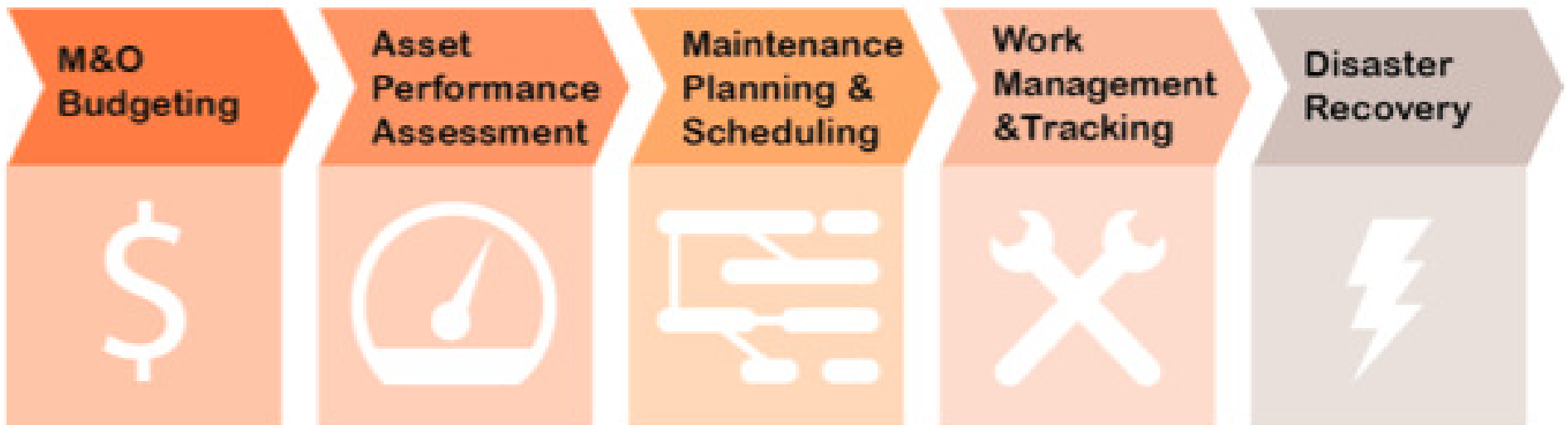
Risk-Based Asset Management Plan

- **Know the asset inventory & condition**

- **Know the asset's expected lifecycle to allow enterprise Needs Based Budgeting**

- **Monitor emerging technologies to make sound decisions as part of systematic upgrades & strategic improvements**

- **Ensure asset inventory data supports critical business decisions to support data investment**

Risk-Based Asset Management Plan

- Document and examine existing processes & procedures, making improvements as necessary

- Pursue creation/modification of metadata into existing processes & procedures-mitigate creation of "new steps" into existing workloads

- Ensure common availability of consistent asset data sets

- Stakeholder recognition and understanding of risks at their assigned level (enterprise, program, project, etc.) and mitigation strategies

Needed Components

- Statewide Asset Management System (AMS) is needed to support improved efficiency and effectiveness of core business processes related to the management of VDOT's infrastructure assets.

- The core business processes that support the management of VDOT's assets are:

M&O Budgeting	Asset Performance Assessment	Maintenance Planning & Scheduling	Work Management &Tracking	Disaster Recovery

Maintenance and Operations Budgeting

DESCRIPTION

- **What should be budgeted for each asset class? (identification and prioritization of M&O needs per Code of Virginia § 33.1-13.03)**

ANTICIPATED BENEFITS

- **Eliminate duplicative inventory record keeping systems across central office and field units (spreadsheets, databases, maps, etc.)**

- **Reduce effort for field staff to provide annual needs assessment data**

- **Improve needs assessment accuracy and credibility**

Asset Performance Assessment

DESCRIPTION

- **What is the condition of our assets relative to targets (for federal MAP-21 requirements, and Code of Virginia § 33.1-13.03)**

- **Are we in compliance with federal mandates for traffic assets (MUTCD sign retro- reflectivity, NCHRP350/MASH guardrail standards)?**

ANTICIPATED BENEFITS

- **Ensure VDOT compliance with federal mandates**

Preventive Maintenance Planning & Scheduling

DESCRIPTION

- What preventive maintenance work should be done to maximize asset life and avoid service disruptions?

- How can this work be accomplished in the most efficient manner?

ANTICIPATED BENEFITS

- Support proactive identification of maintenance issues that may impact safety or traffic flow.

- Achieve greater efficiency in deployment of field staff and equipment by reducing amount of unplanned work.

- Extend asset life

Work Management & Tracking

DESCRIPTION

- What resources are needed to address a reported maintenance issue?

- What are we spending on different activities and how can we improve efficiencies?

ANTICIPATED BENEFITS

- Enable collection of better information for field office managers that helps them optimize efficiencies without requiring duplicative data entry or additional field staff time

Work Management & Tracking

ANTICIPATED BENEFITS (continued)

- **Improve efficiency and response time by ensuring staff have correct equipment and materials to respond to maintenance issues**

- **Reduce travel time by enabling staff to better diagnose problems in the office**

- **Provide maintenance managers with better understanding of how staff and equipment are being used to assist in budgeting and planning**

Disaster Recovery

DESCRIPTION

- What resources are required to restore the roadway to its pre-disaster condition?

- How do we plan to be able to respond to unforeseen disasters?

ANTICIPATED BENEFITS

- Improved preparedness for disasters

- Ensure full reimbursement for damages

Next Steps

- **Obtain Executive Buy-In**

- **Obtain Field Buy-In and Culture Change**

- **Leverage Existing IT Platforms/Systems**
    - ❖ **Capitalize on Pavement Management System**
    - ❖ **Capitalize on TOC Maintenance Management System**

Please Wake Up … Van is finally done with her presentation … Matt has been dying to use his hook!