

International Symposium of the 32nd Japan Road Conference

Management of Pavement Assets in Virginia

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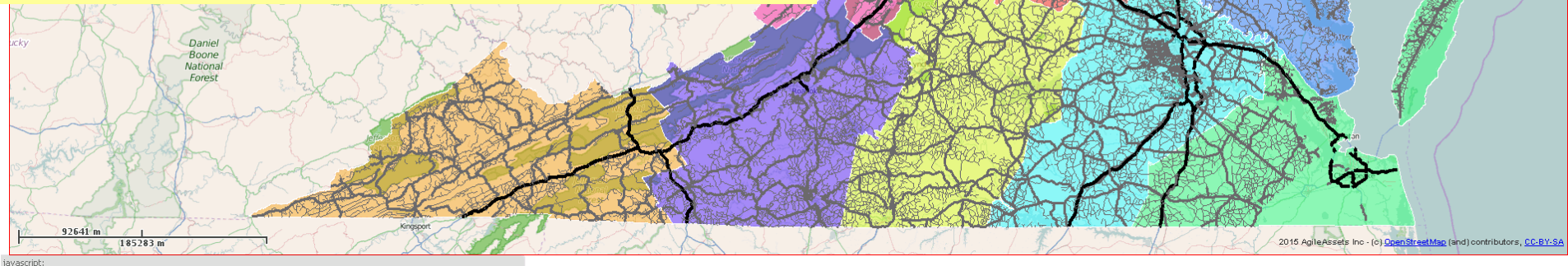
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 - Network-level optimization
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1. VDOT's Needs-Based Budgeting Process

- ✓ VDOT maintains and operates over 128,000 lane miles of pavements
 - Interstate : ~5,500 lane-miles
 - Primary: ~22,000 lane-miles
 - Secondary: ~100,000 lane-miles
- ✓ 3rd largest network of state maintained highways in the US



Annual Pavement Needs Methodology

- ✓ VDOT pavement management business processes use established asset management principles and policies
 - Annual condition assessment
 - 100% interstate & primary pavements + 20% secondary
 - Set performance targets and goals
 - Optimization of available funds using pavement management software
 - Performance monitoring and reporting

VDOT Needs

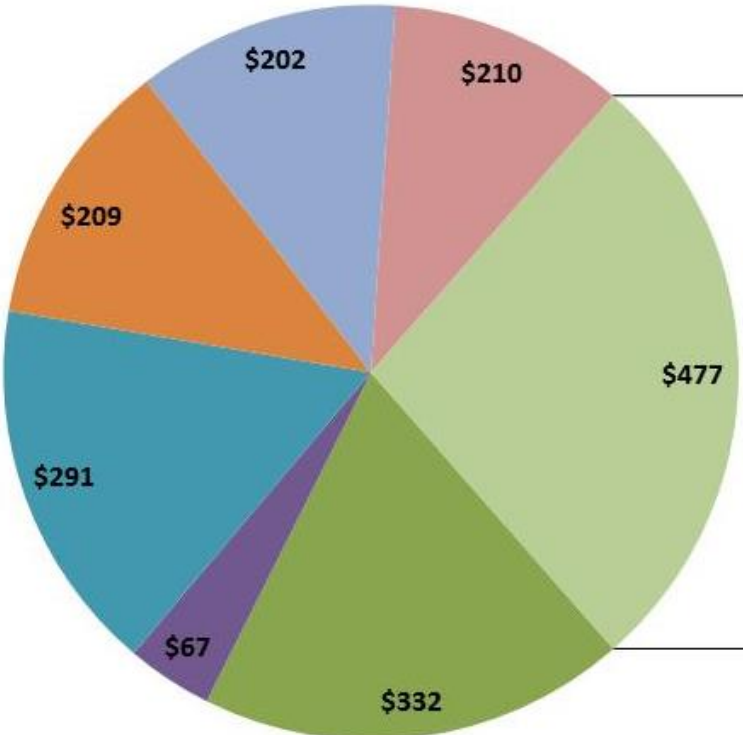
- ✓ **Performance targets for pavements and bridges:**
 - **Pavement Performance**
 - Interstate – 82%
 - Primary – 82%
 - Secondary – 65%
 - Bridge Performance
 - All Systems - 92%
- ✓ Calculate funding needs to meet performance measures/targets for a sustained program
- ✓ VDOT must also perform services such as
 - Snow Removal and Emergency Operations
 - Routine Maintenance
 - Incident Response
 - Drainage
 - Traffic Operations Center – 24 hour service
 - Mowing

VDOT Needs and Budget

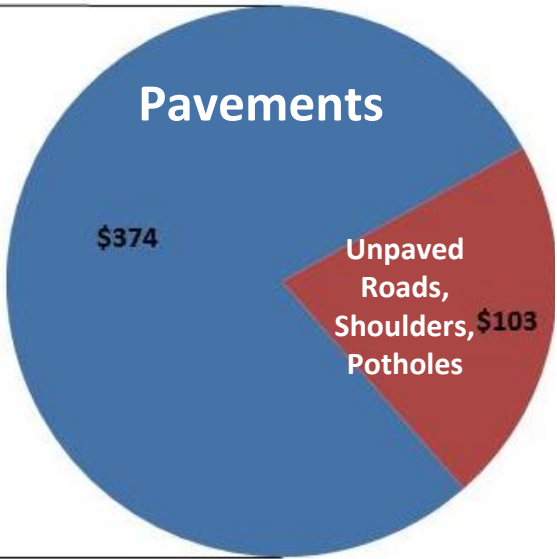
- ✓ FY 2016 VDOT Annual Needs and Preliminary Proposed Allocations For Existing Infrastructure (\$ Millions)

Description	Annual VDOT Needs	Preliminary Proposed M&O Allocations	Preliminary Proposed Construction Allocations*	Total Preliminary Proposed Funding	Difference between Needs and Allocations
Roads	876	398	78	476	(400)
Bridges	832	187	145	332	(500)
Other Services and Repairs	1,380	973	7	979	(401)
Total	\$3,088	\$1,558	\$229	\$1,788	(\$1,301)

VDOT Anticipated FY 2016 Funding Distribution (\$ Millions)



Roads



Pavements

- Pavements
- Unpaved Roads, Shoulders, Potholes
- Bridges
- Tunnels
- Emergency and Incident Management
- Traffic
- Roadside
- Facility and Other

2. Pavement Management Data Collection

- ✓ Automated data collection contracted out
- ✓ Yearly data collection scope (VDOT Maintained):
 - 100% of interstate pavements
 - 100% of primary pavements
 - Approx. 20% of secondary pavements
- ✓ Primary Extensions (maintained by towns and localities) since 2014
- ✓ All NHS routes (required for Federal Reporting)
- ✓ **High focus on quality data – Independent verifications**

Data Collection Vehicle

Photolog

- Single view
- Panoramic view
- 1300 x 1030 pixel
- 1920 x 1080 (HDTV)
- Direct-to-digital
- Custom angles

Geometry & Spatial

- Inertial measurement unit
- HPMS curve type
- Long. Grade
- Cross slope
- Centerline mapping
- Spatial referencing for GIS integration

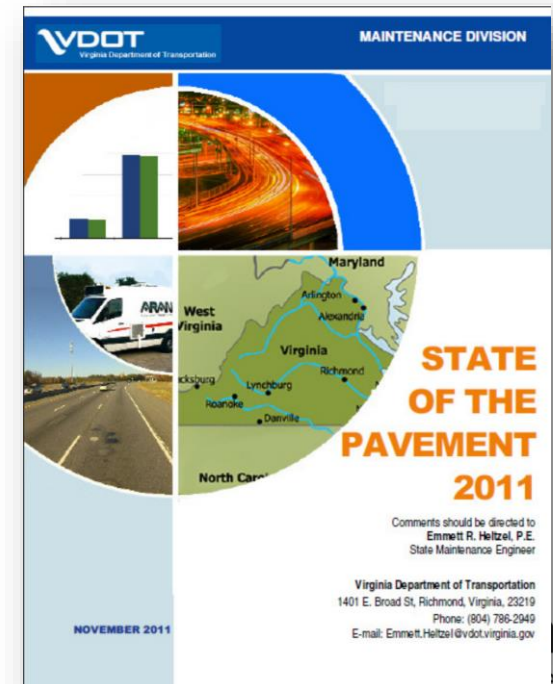


Pavement

- Image recognition software
- Strobe-lit pavement video
- Roughness
- Texture
- Rutting
- Surface Distress
- Ground Penetrating Radar

Assets

- Inventory from imagery
- Location determined
- Offset measured
- Height and width measured
- Sign code recorded
- Condition assessment



Ongoing Enhancements

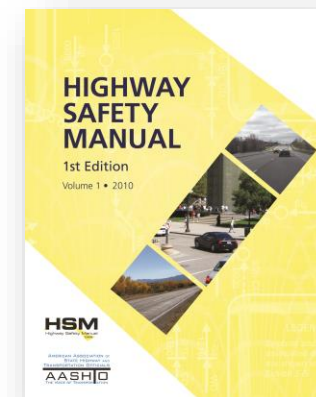
Traffic Speed Deflectometer (TSD)

- ✓ Continuous deflections for the Interstate and primary roads
- ✓ Enhanced project selection decision tree



Continuous Friction Measurement Equipment

- ✓ FHWA Pavement Friction Management Support Program
- ✓ $SPF_i = e^{\beta_0 + \sum_j (\beta_j X_{ij}) + \epsilon}$
- ✓ Empirical Bayes Estimation
- ✓ B/C Estimations



3. Pavement Investment Decision Process

Central office

- ✓ Network level decision making
- ✓ **Network optimization**
- ✓ Allocates funding
- ✓ Sets paving targets
- ✓ Condition data collection
- ✓ LRS management

Maintenance Districts

- ✓ Project level decision making
- ✓ **Project selection**
- ✓ Rehabilitation design
- ✓ Recording pavement work
- ✓ Homogeneous sectioning
- ✓ Develop paving schedules – work program
- ✓ Construction management

Pavement Condition Assessment

Pavement Condition
Category based on CCI

Based on International
Roughness Index (IRI)

→ Excellent (≥ 90)

→ Good (Between 70 and 89)

→ Fair (Between 60 and 69)

→ Poor (Between 50 and 59)

→ Very Poor (≤ 49)

→ Excellent (< 60)

→ Good (Between 60 and 99)

→ Fair (Between 100 and 139)

→ Poor (Between 140 and 199)

→ Very Poor (≤ 200)

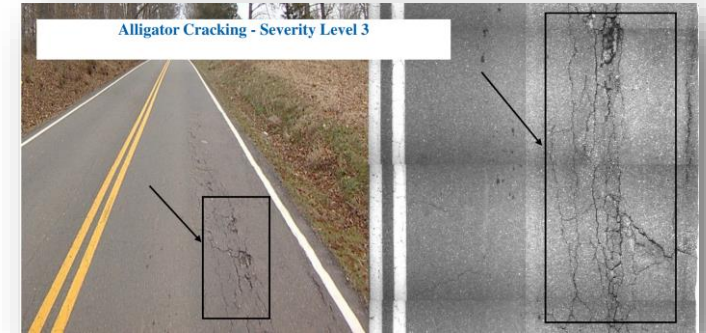
✓ 'Poor' and 'Very Poor' pavements are termed as 'Deficient'

Sufficient

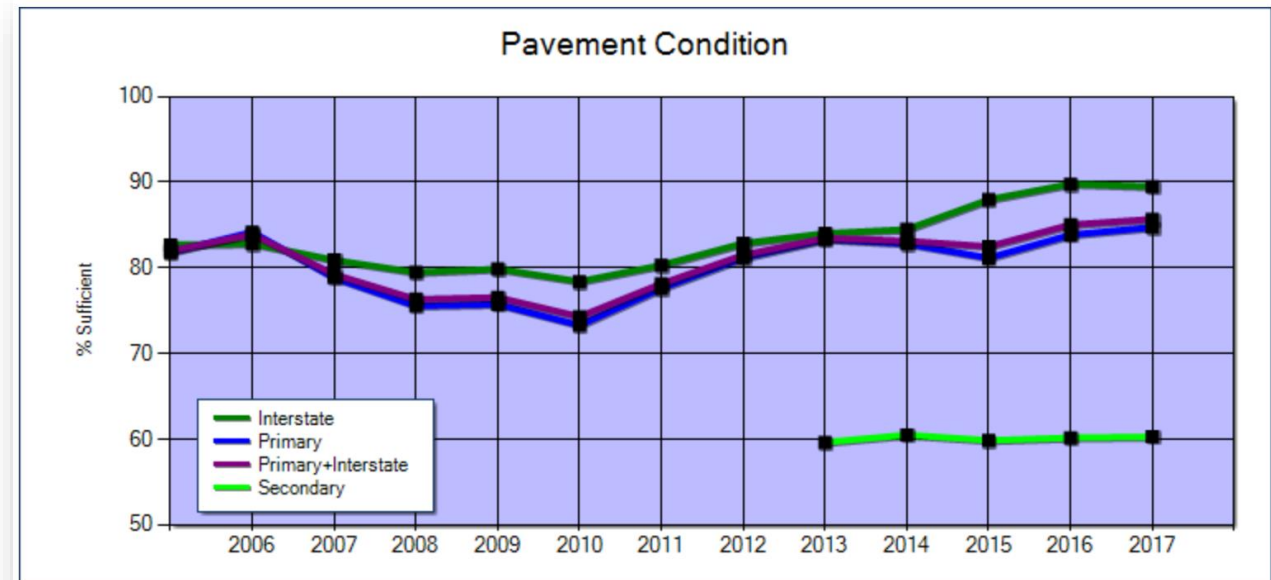
Pavement Performance Targets

✓ Pavement Performance Targets:

- Interstate: at least 82% sufficient
- Primary: at least 82% sufficient
- Secondary: at least 65% sufficient



- ✓ VDOT currently meets performance targets on the interstate and primary systems but not on the secondary system



Repair Categories

Preventive Maintenance (PM)

- Minor Patching ≤ 2 " Depth
 - $< 5\%$ pavement area
- Surface Treatment
- Thin Overlays up to 1"

Restorative Maintenance (RM)

- Heavy Patching ≤ 9 " Depth
 - $< 20\%$ of pavement area
- FDP and up to 4" Overlay
- Milling and up to 4" Overlay

Corrective Maintenance (CM)

- Moderate Patching ≤ 6 " Depth
 - $< 10\%$ of pavement area
- PDP and thin (≤ 2 ") Overlay
- ≤ 2 " Milling and ≤ 2 " Overlay

Reconstruction (RC)

- Mill, Break and Seat and Thick Overlay
- Reconstruction
- **FDR**

Unconstrained Needs Analysis

- ✓ Decision matrix rules for triggering treatments
- ✓ Provides section-by-section treatment and cost regardless of available funds
- ✓ Assists districts in making project level selections
- ✓ Factors include:
 - Distresses Collected (Pavement Condition)
 - Pavement Age, Pavement Structure, Traffic Levels

Optimization Analysis

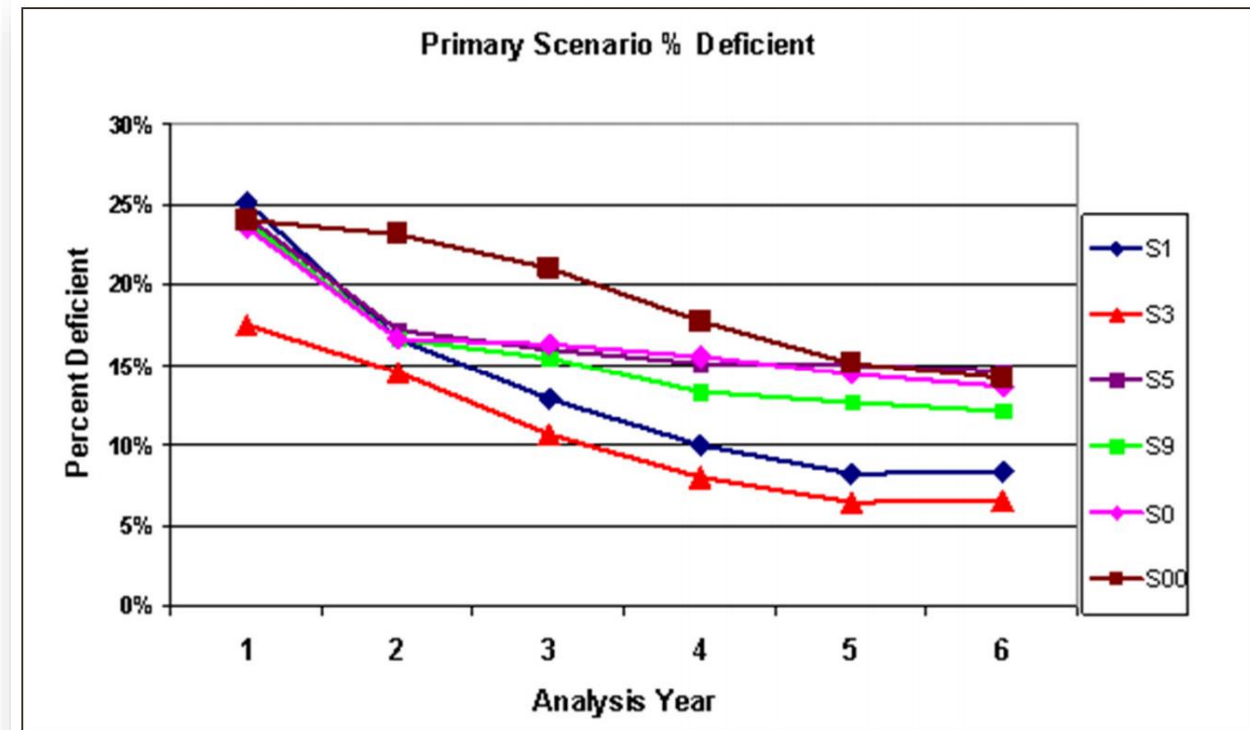
✓ Network Level Scenarios (Multi-Constraint)

- Maximize benefit objective
- Budgetary & condition (CCI) constraints
- Multi year,
- Multi objective

✓ District Specific

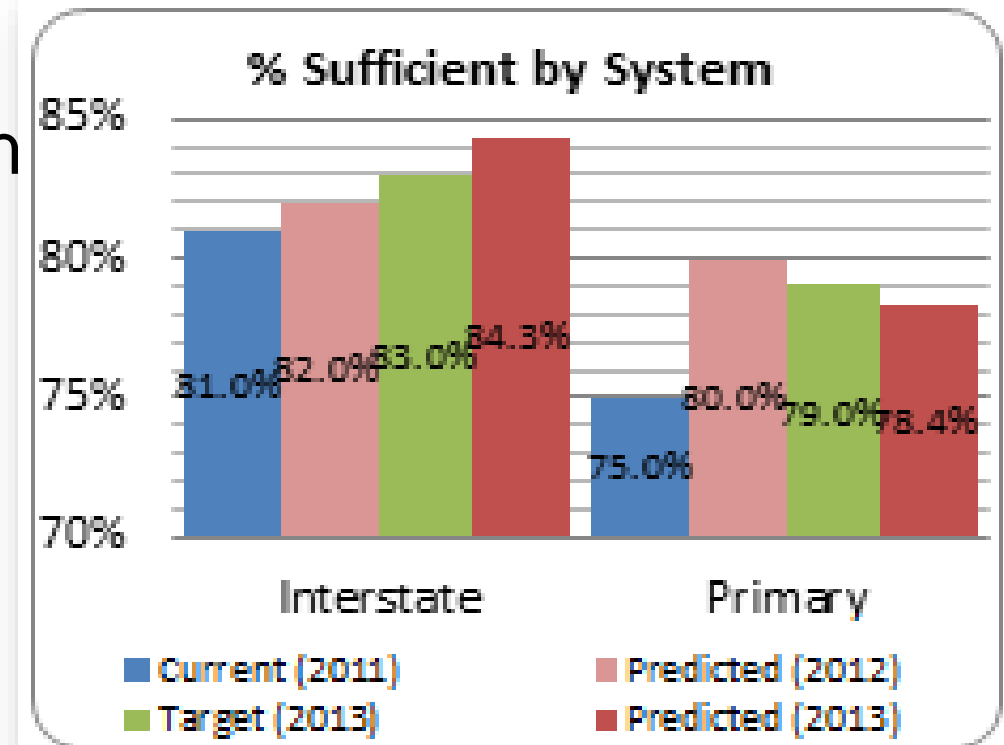
✓ Route Classification Specific

(Interstate, Primary, Secondary)

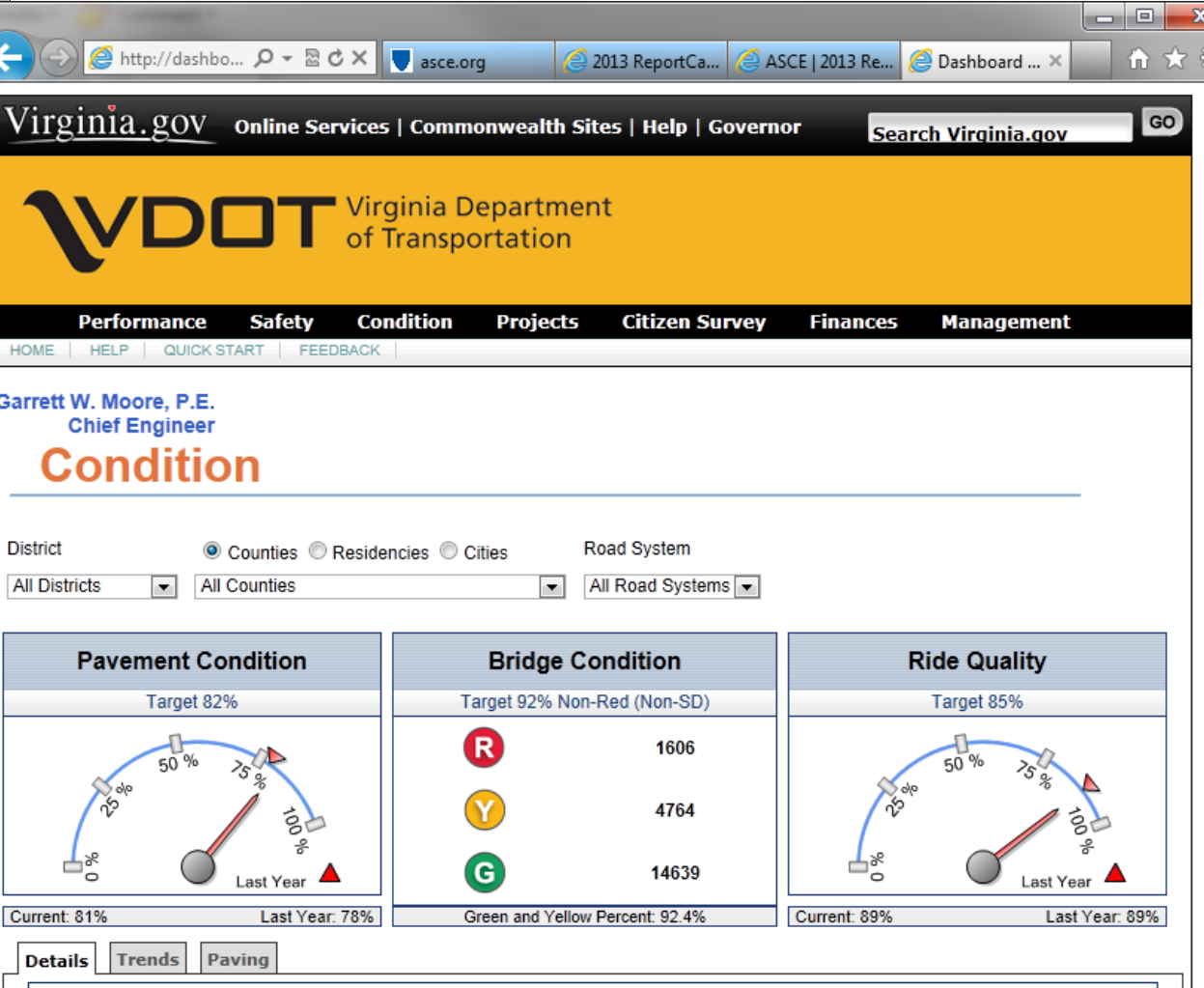
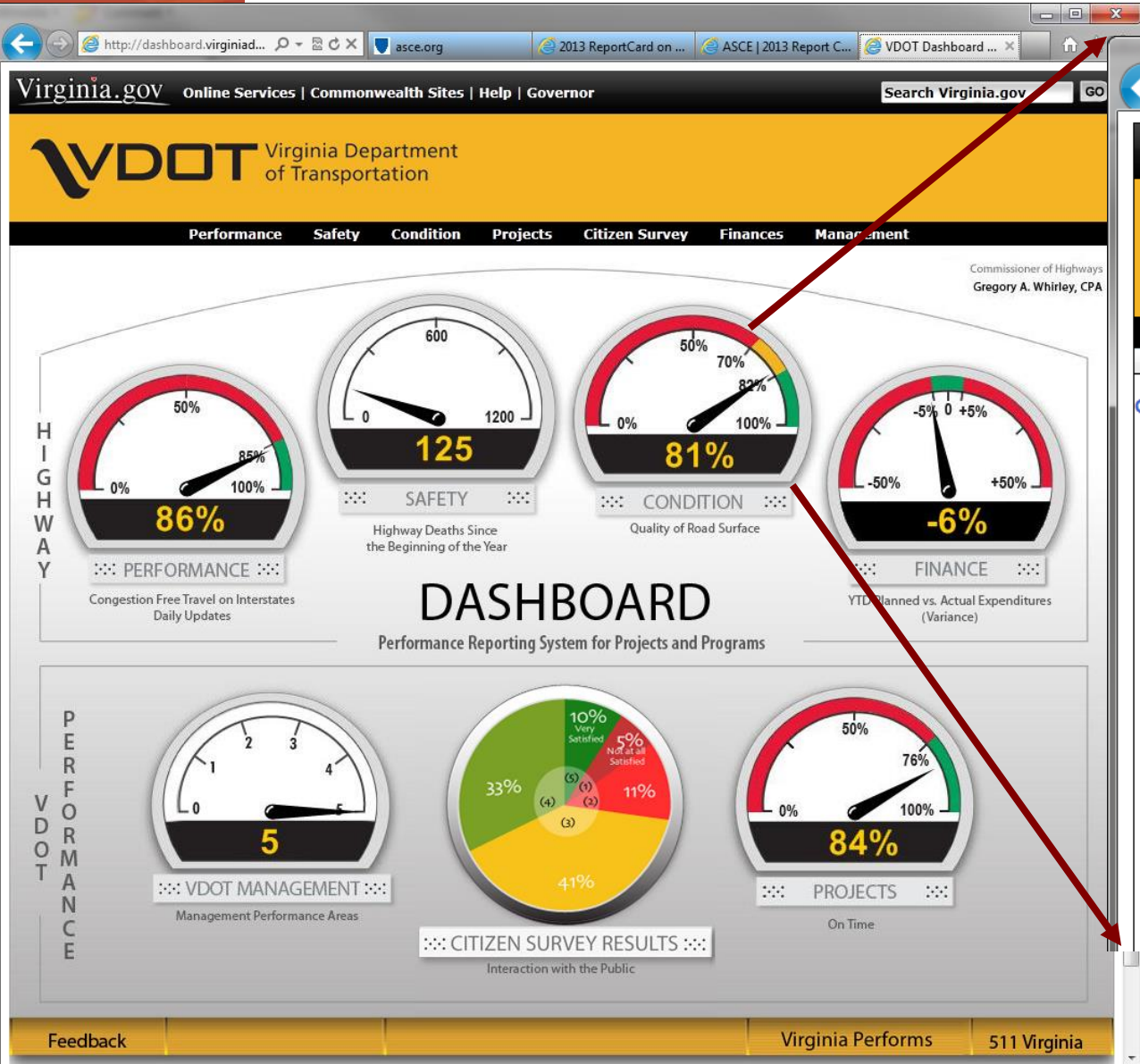


Project Selection

- ✓ Decentralized to the district level
- ✓ District pavement manager work with residency engineers to select specific sections and interventions
 - Often differ from network-level recommendation
- ✓ Must meet “optimized” performance targets



4. Performance Measures

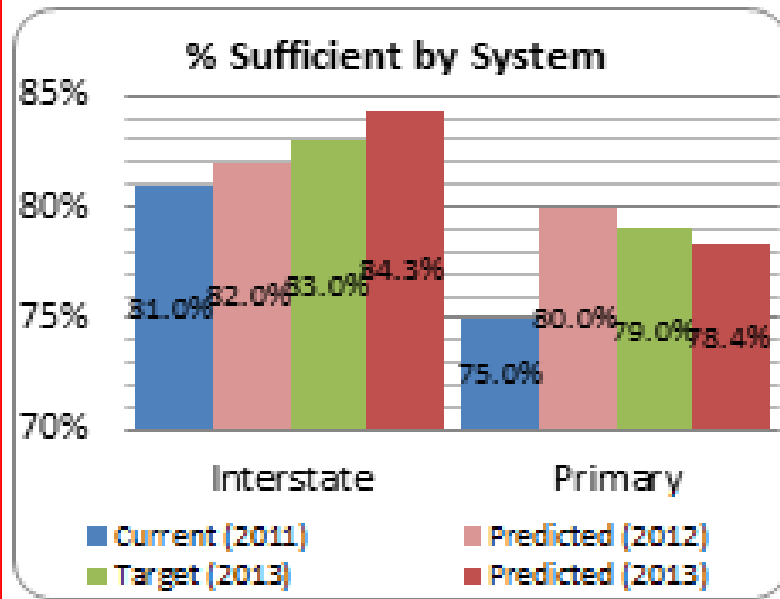


<http://dashboard.virginiadot.org/Pages/Maintenance/Bridge.aspx>

District Level Performance Reporting Process

- ✓ Based on Optimization, set Baseline Targets
 - % Sufficient
 - Repair Category Lane Miles
- ✓ Compare Planned Projects vs. Actual Targets
 - Optimization Results vs. District Planned Projects
 - Unconstrained Results vs District Planned Projects
- ✓ Report differences in results
- ✓ Provide Districts with opportunities for course correction
- ✓ Finalize Project Lists and Performance Reports

Sample Report



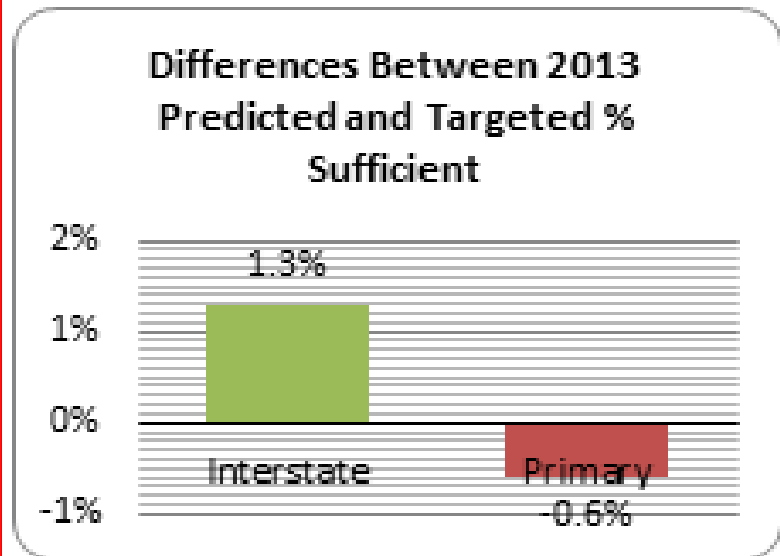
Hampton Roads Condition Summary

Interstate System

Current (2011) % Sufficient:	81.0%
Predicted (2012) % Sufficient:	82.0%
Targeted (2013) % Sufficient:	83.0%
Predicted (2013) % Sufficient:	84.3%

Primary System

Current (2011) % Sufficient:	75.0%
Predicted (2012) % Sufficient:	80.0%
Targeted (2013) % Sufficient:	79.0%
Predicted (2013) % Sufficient:	78.4%



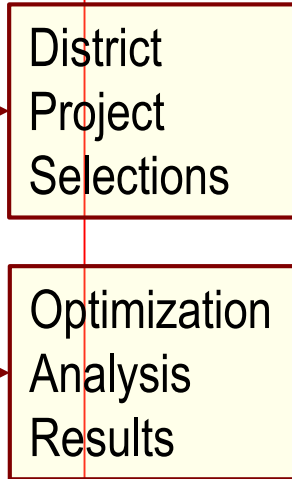
Hampton Roads Predicted vs. Targeted % Sufficient in 2013

Interstate System

2013 Predicted % Sufficient:	84.3%
2013 Targeted % Sufficient:	83.0%
Difference:	+1.3%

Primary System

2013 Predicted % Sufficient:	78.4%
2013 Targeted % Sufficient:	79.0%
Difference:	-0.6%



5. Concluding Remarks

- ✓ Adopted Asset Management practices in the 1990's
- ✓ Clearly defined **performance targets**
- ✓ Clearly defined business processes (for decision support)
- ✓ **High quality data**
 - Pavements → bridges → other assets
- ✓ Two stage decision making process (supported by state of the art software)
 - **Network optimization** (central) → **Project selection** (decentralized)
- ✓ Emphasis on **communication** of performance targets and measures to “all” stakeholders

Credits

Virginia DOT

- ✓ **Garrett Moore, Chief Engineer**
- ✓ Tanveer Chowdhury
- ✓ Raja Shekharan
- ✓ Matthew Ayotte
- ✓ Akyiaa Morrison
- ✓ Brian Diefenderfer

- ✓ Aaron D. Gerber, Kercher Engineering
- ✓ Eric Perrone, AgileAssets
- ✓ Samer Katicha, VTTI
- ✓ Edgar de Leon, VTTI

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