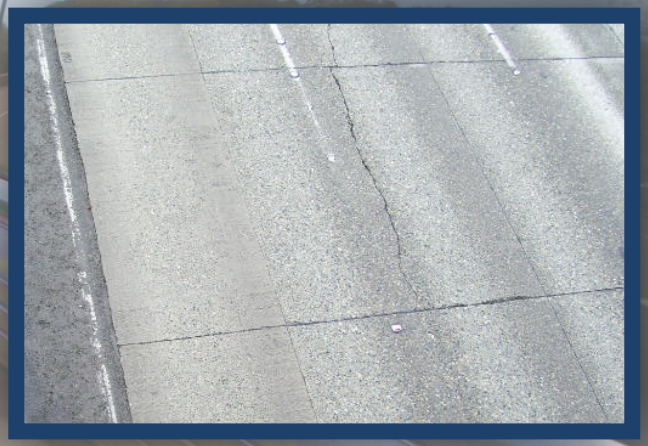
Pavement Performance Measurement in Hampton Roads



the heartbeat of HAMPTON ROADS TPO
TRANSPORTATION PLANNING ORGANIZATION

JULY 2014

T14-07

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Pavement Performance Measurement in Hampton Roads

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TRANSPORTATION PLANNING ORGANIZATION

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T14-07

Report Documentation

TITLE

Pavement Performance Measurement in Hampton Roads

AUTHOR

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ABSTRACT

In this document, HRTPO staff presents, analyzes, and summarizes publically-available pavement data for Hampton Roads in order to determine the condition and smoothness of the region's pavements.

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REPORT DATE

July 2014

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ACKNOWLEDGMENTS

This document was prepared by the Hampton Roads Transportation Planning Organization (HRTPO) in cooperation with the US Department of Transportation (USDOT), Federal Highway Administration (FTA), Virginia Department of Transportation (VDOT), and Virginia Department of Rail and Public Transportation (DRPT). The contents of this report reflect the views of the HRTPO. The HRTPO staff is responsible for the facts and accuracy of the date presented herein. The contents do not necessarily reflect the official views or policies of the FHWA, FTA, VDOT, or DRPT. This report does not constitute a standard, specification, or regulation. FHWA, FTA, VDOT, or DRPT acceptance of this report as evidence of fulfillment of the objectives of this program does not constitute endorsement/approval of the need for any recommended improvements, nor does it constitute approval of their location and design or a commitment to fund any such improvements. Additional project level environmental impact assessments and/or studies of alternatives may be necessary.

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Introduction

The purpose of this report is to measure the performance of pavements in Hampton Roads. In addition to the value of knowing whether efforts to maintain pavements are being effective, recent events have made this report particularly timely. First, after the October 2008 financial crisis, the federal government allocated more money to the states for highway construction. In an attempt to quickly spend that money, many states reportedly applied the money to re-paving projects (as opposed to new highway construction which takes longer due to preliminary engineering). Secondly, during 2011 the number of lane closures per week in Hampton Roads increased greatly. Thirdly, on July 6, 2012, President Obama signed the federal transportation authorization bill MAP-21 which focuses on performance management. Finally, in 2013 "after intense public outcry from local residents, state lawmakers, and city leaders over the horrible potholes",[1] the administrator of VDOT's Hampton Roads District resigned.

[1] http://wtkr.com/2013/02/14/vdot-district-administrator-dennis-heuer-resigns/

Pavement Performance Measurement

This examination of pavement performance is comprised of:

A. Maintenance Funding
B. Lane Closures, and
C. Pavement Data

A. Maintenance Funding

This examination of maintenance funding is divided into two sections:

1. Virginia
2. Hampton Roads District

Note that pavement maintenance represents only a portion of maintenance and operations funding.

1. Virginia (Maintenance Funding)

This examination of maintenance funding in Virginia includes:

a. Allocations
b. Spending

Allocations are planned funding, and spending is actual funding.

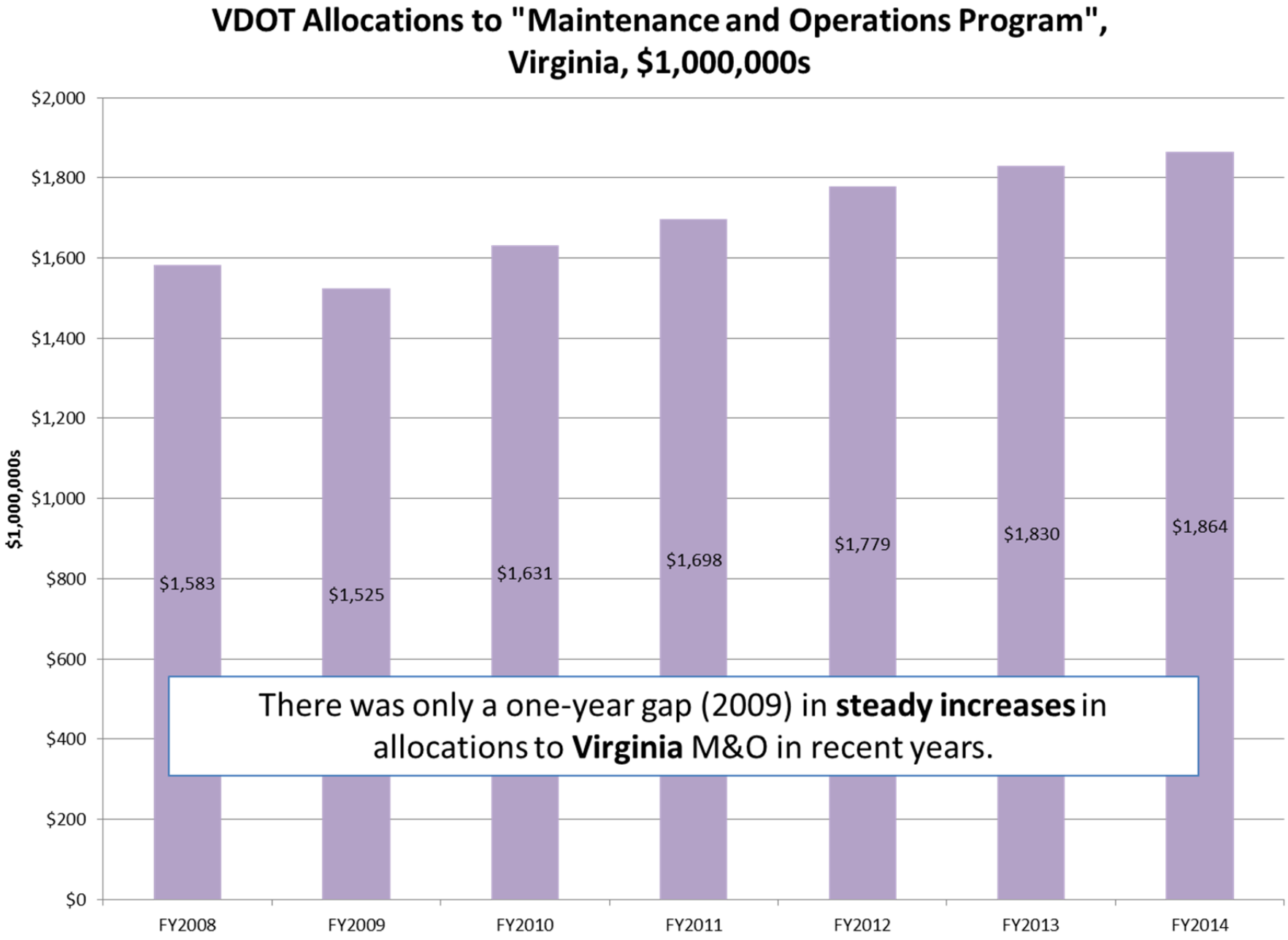
a. Allocations (Virginia Maintenance Funding)

The source of these allocations to maintenance and operations in Virginia is VDOT's Six-Year Improvement Program (SYIP) documents.

Table 1 **VDOT and Cities**

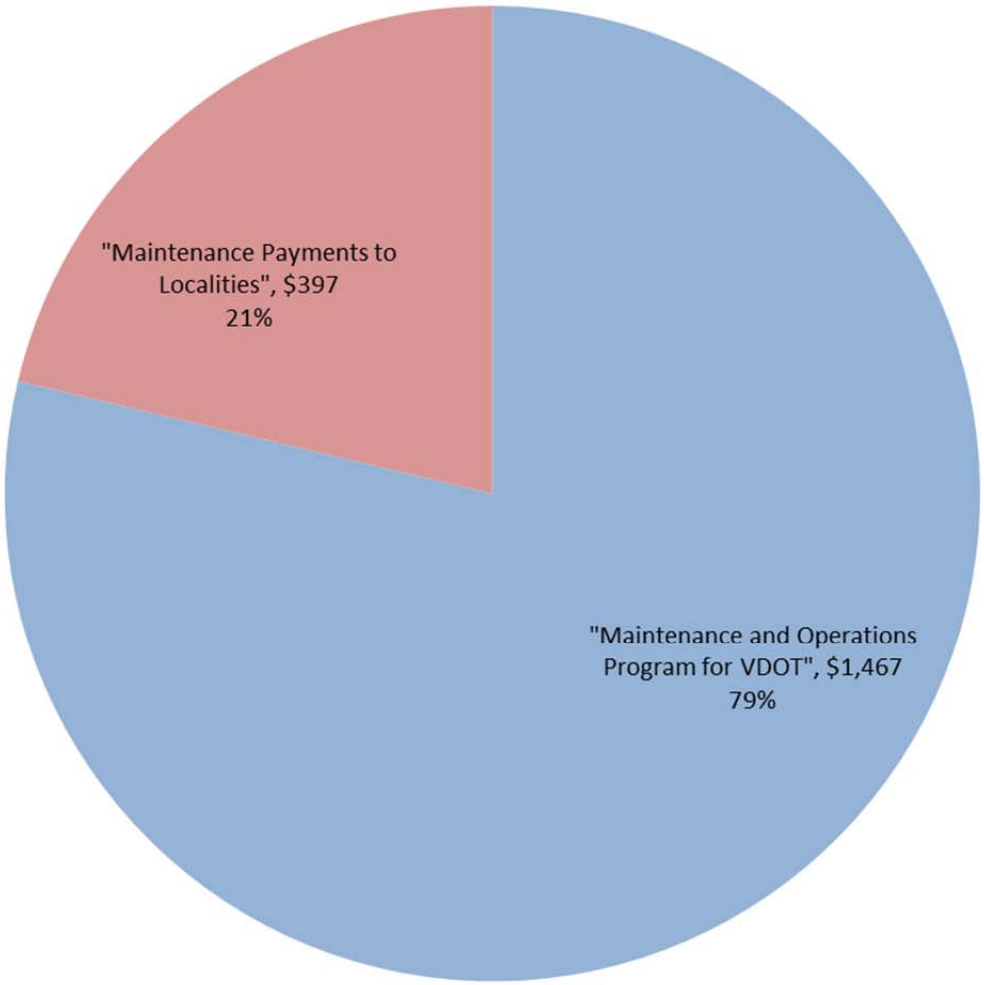
- Basically, VDOT **directly** maintains:
  - Interstates (in both cities and counties)
  - Primaries and Secondaries in counties
  - Hereinafter: "**VDOT-Maintained Roadways**"
- And VDOT **indirectly** maintains:
  - Non-interstates in the cities (via **transfer payments**)
  - Hereinafter: "**City-Maintained Roadways**"

Source: HRTPO; Pavement Performance Measurement.pptx

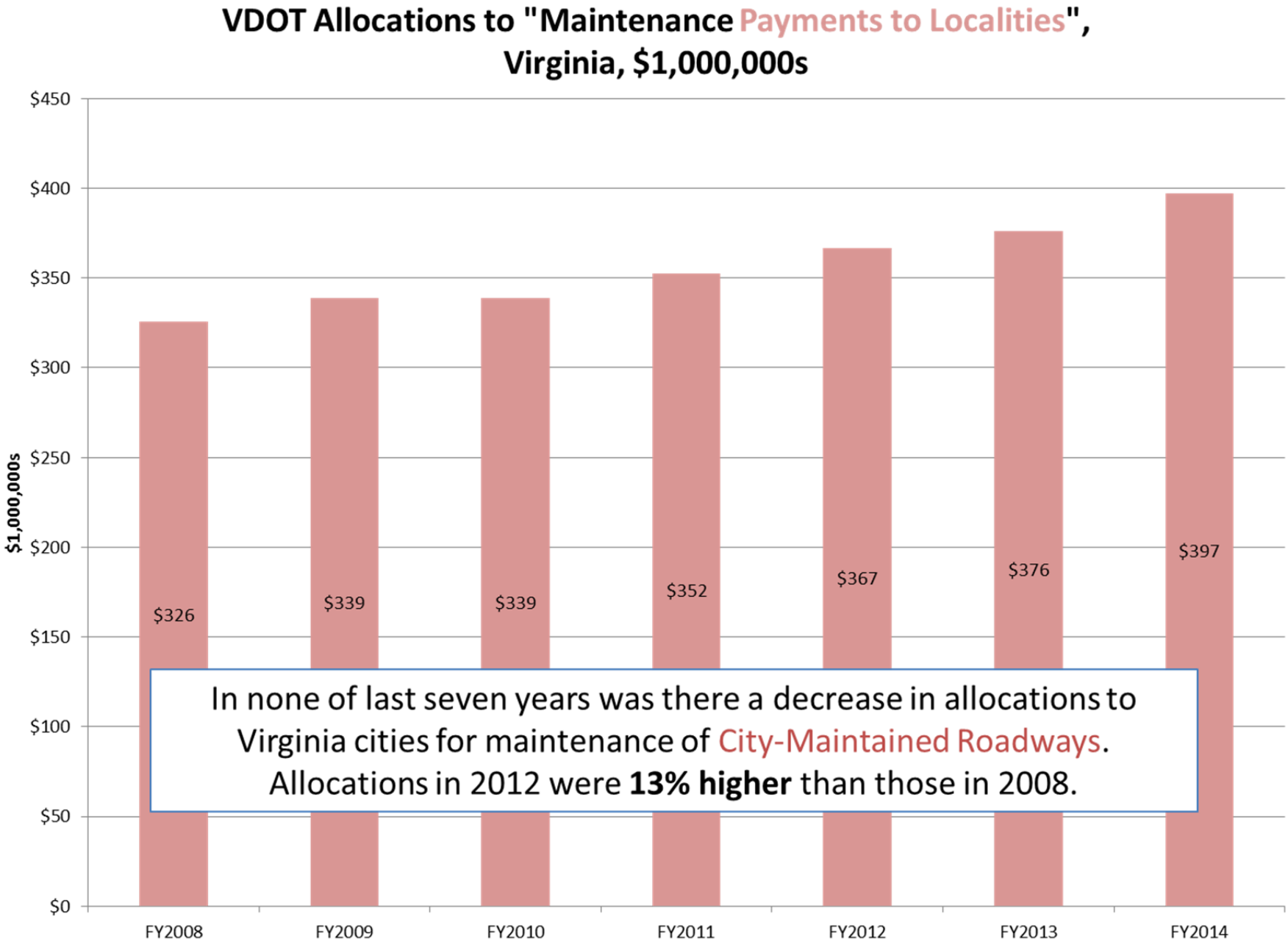


Source: HRTPO analysis of VDOT data; Pavement Performance Measurement.pptx

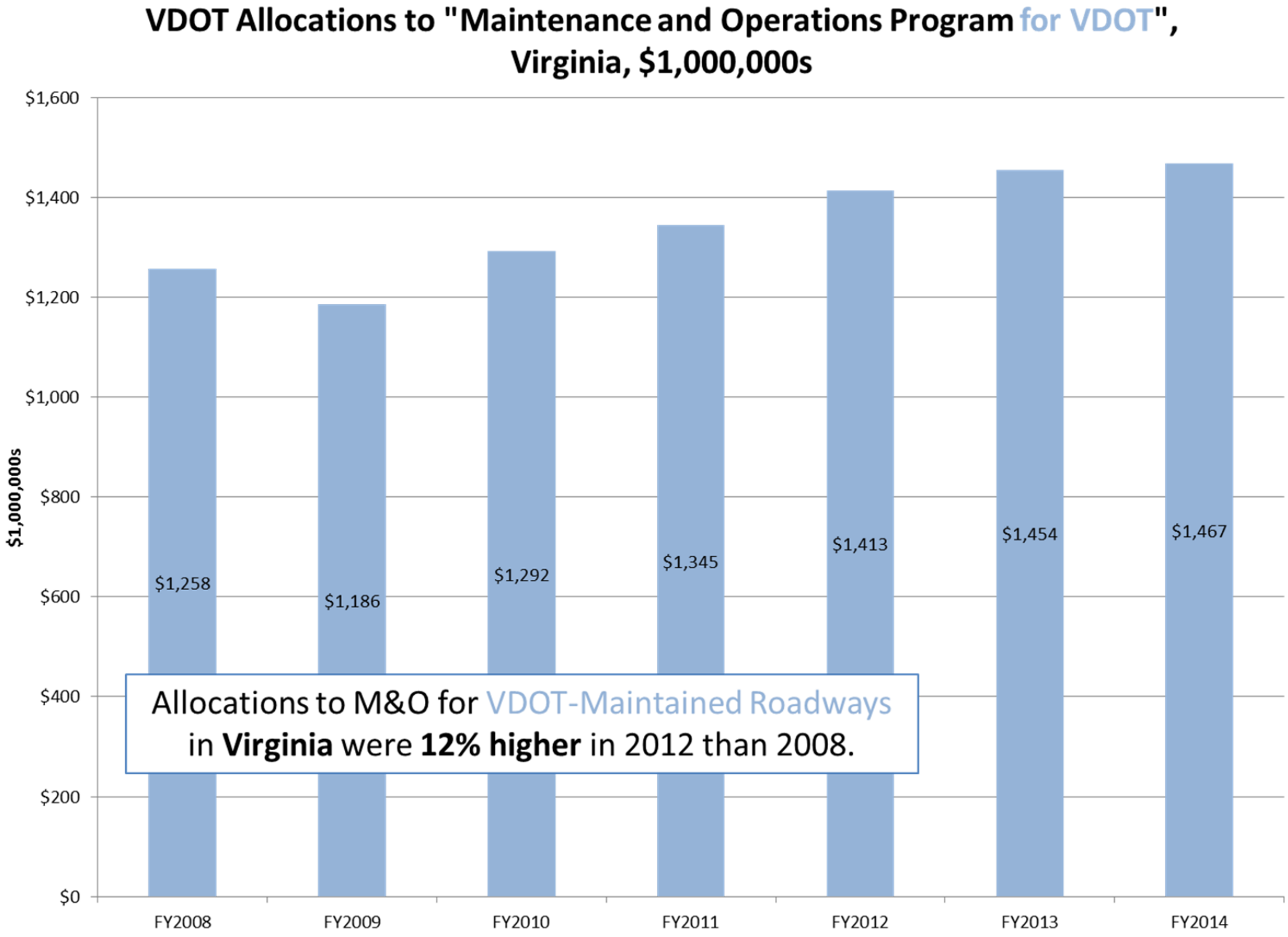
VDOT Allocations to "Maintenance and Operations Program", Virginia, FY14, $1,000,000s



Source: HRTPO analysis of VDOT data; SYIP Maintenance reports- summary.xlsx



Source: HRTPO analysis of VDOT data; Pavement Performance Measurement.pptx

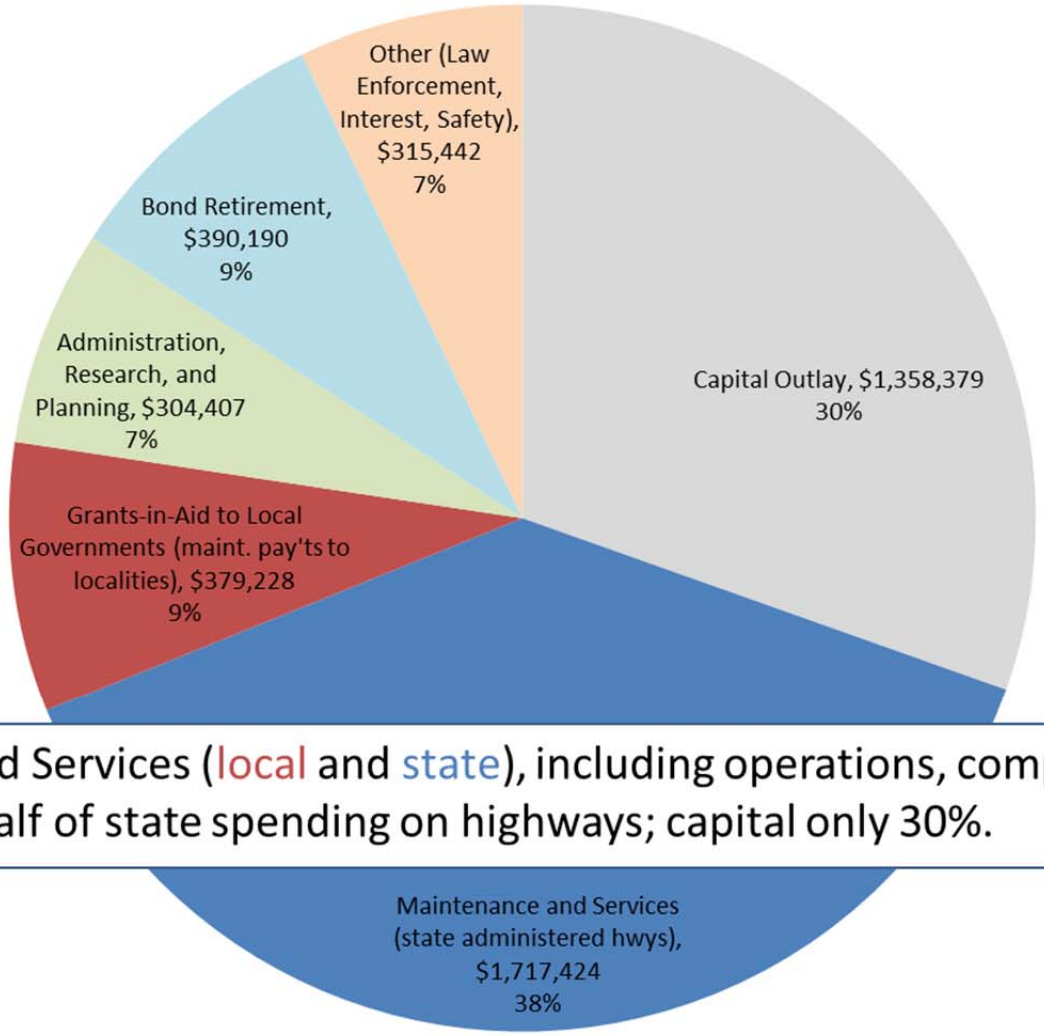


Source: HRTPO analysis of VDOT data; Pavement Performance Measurement.pptx

b. **Spending** (Virginia Maintenance Funding)

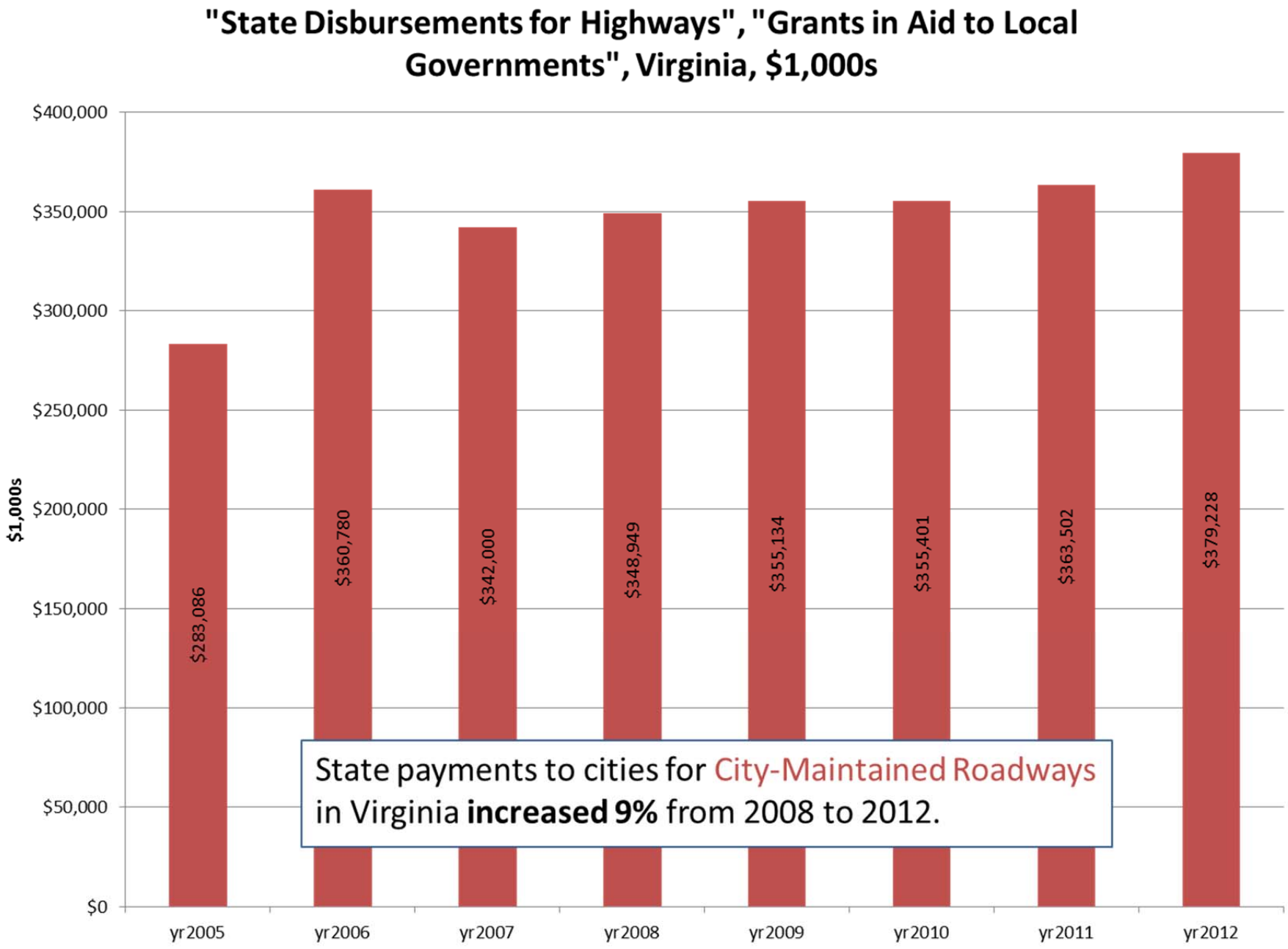
The source of spending numbers for maintenance and operations in Virginia on the following pages is FHWA's *Highway Statistics* annual reports.

"State Disbursements for Highways", Virginia, 2012, $1,000s

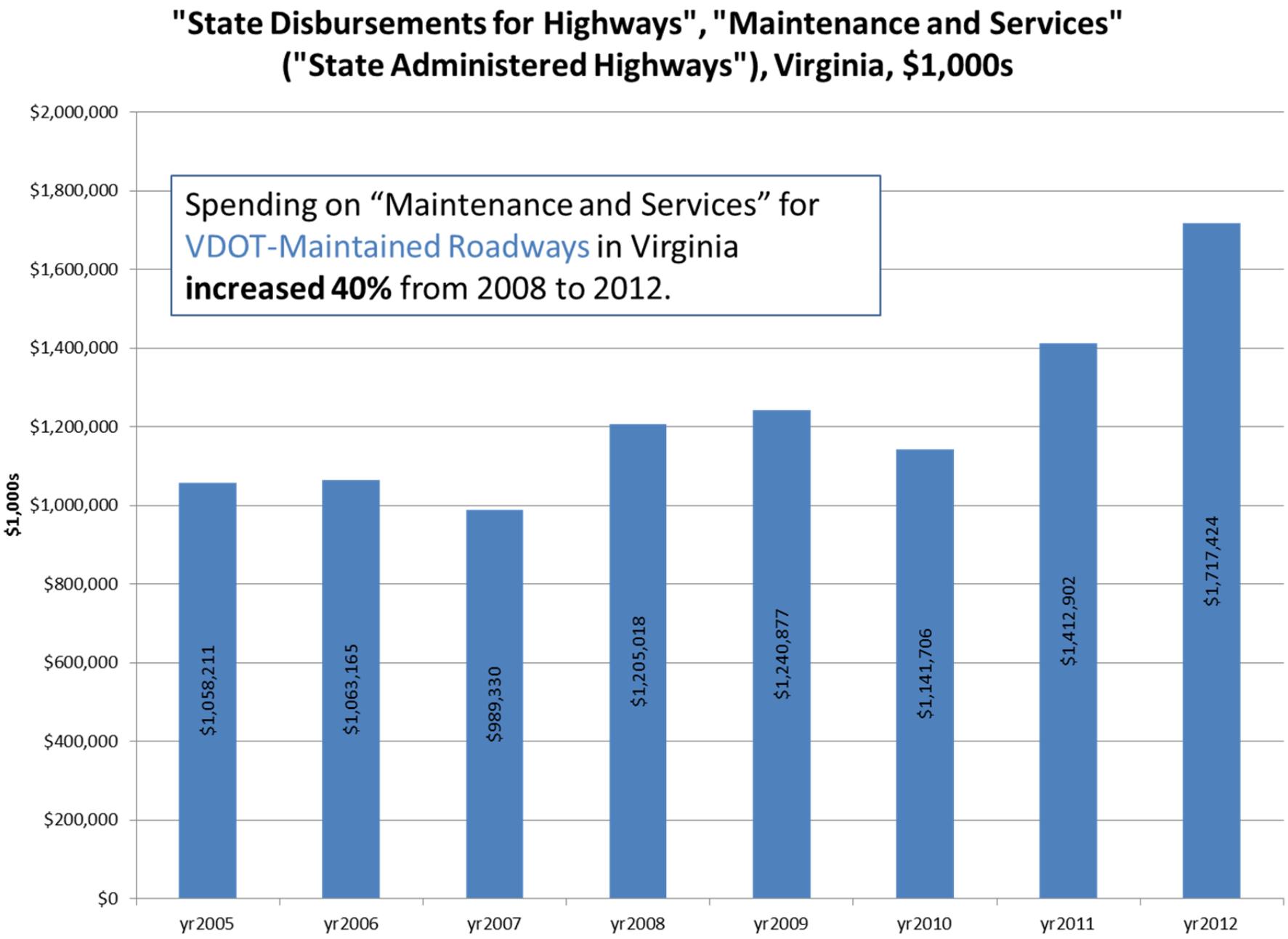


Maintenance and Services (local and state), including operations, comprises approximately half of state spending on highways; capital only 30%.

Source: HRTPO analysis of FHWA data; Pavement Performance Measurement.pptx



Source: HRTPO analysis of FHWA data; Pavement Performance Measurement.pptx



Source: HRTPO analysis of FHWA data; Pavement Performance Measurement.pptx

2. Hampton Roads District (Maint. Funding)

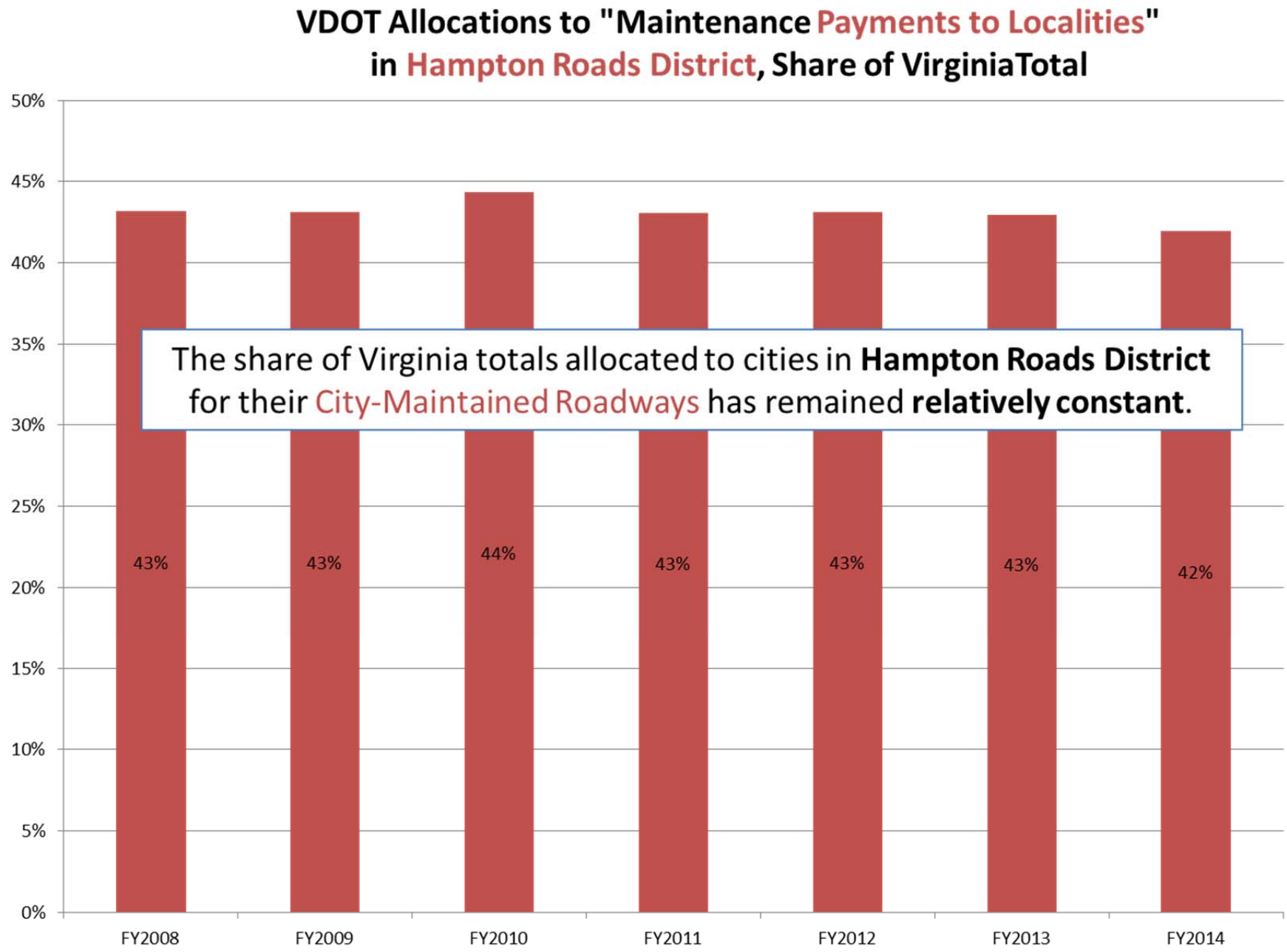
This examination of maintenance and operations funding covers VDOT's Hampton Roads District:

Figure 1 HR District

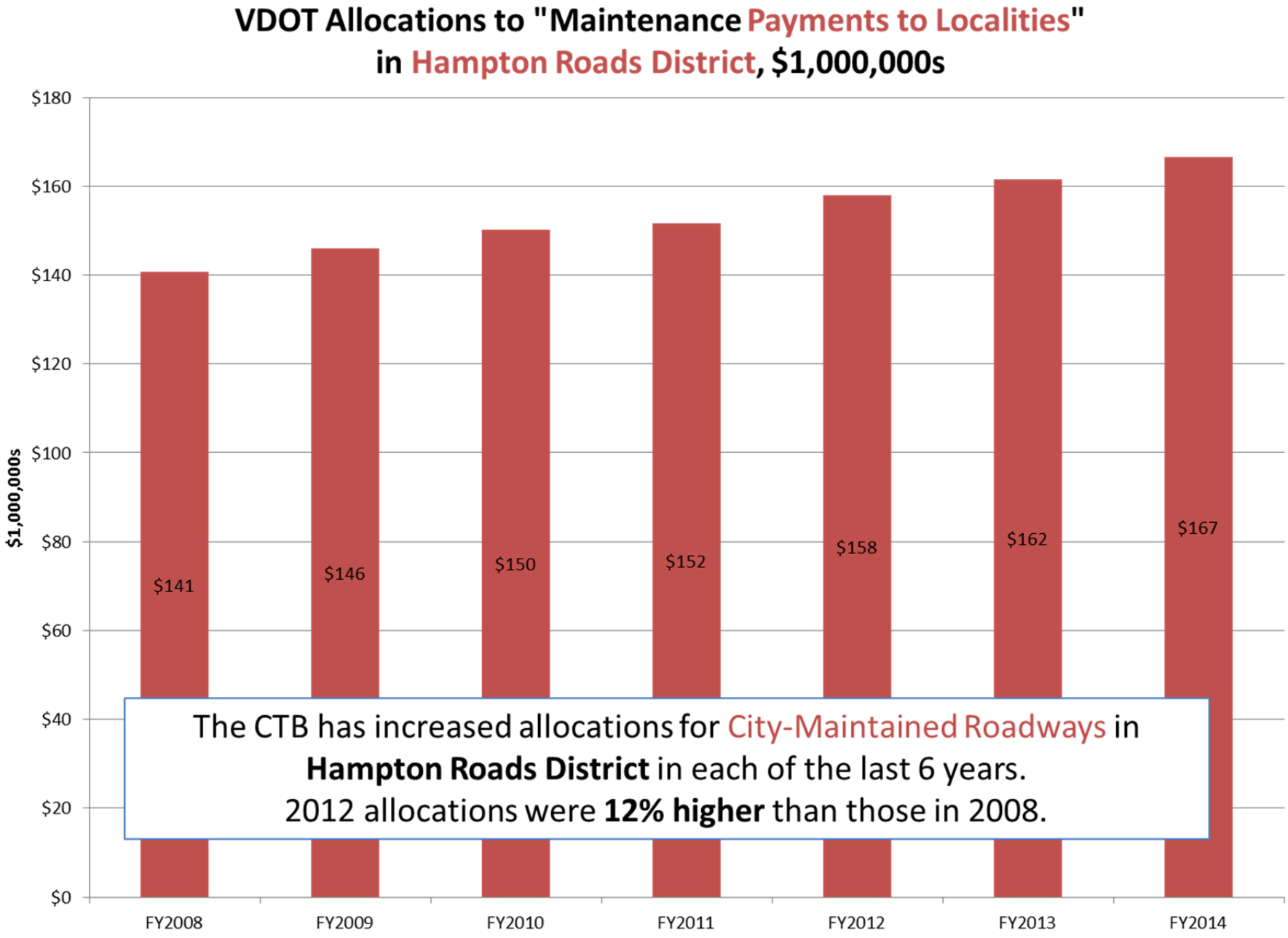
Source: VDOT; Hampton Roads District map.jpg

As mentioned previously, VDOT directly maintains "VDOT-Maintained Roadways" (Interstates throughout Hampton Roads and non-interstates in the counties of Hampton Roads), and passes money to cities which maintain "City-Maintained Roadways" (non-interstates in cities). The 11 cities in the Hampton Roads District are the nine cities served by HRTPO (Williamsburg, Poquoson, Newport News, Hampton, Norfolk, Virginia Beach, Portsmouth, Chesapeake, and Suffolk), plus Franklin and Emporia.

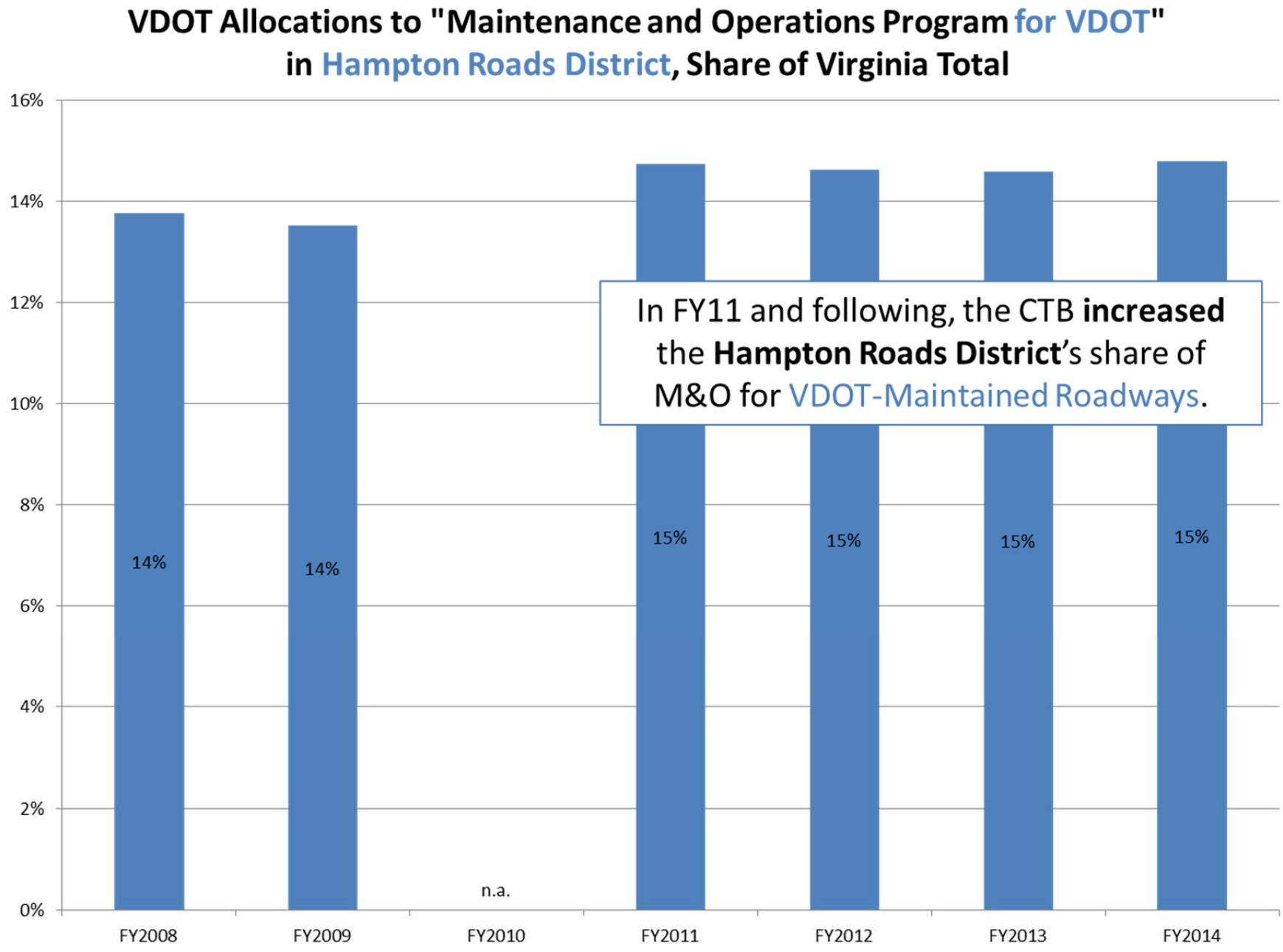
The source of allocations on following pages is the "Maintenance & Operations" reports in the VDOT SYIPs.



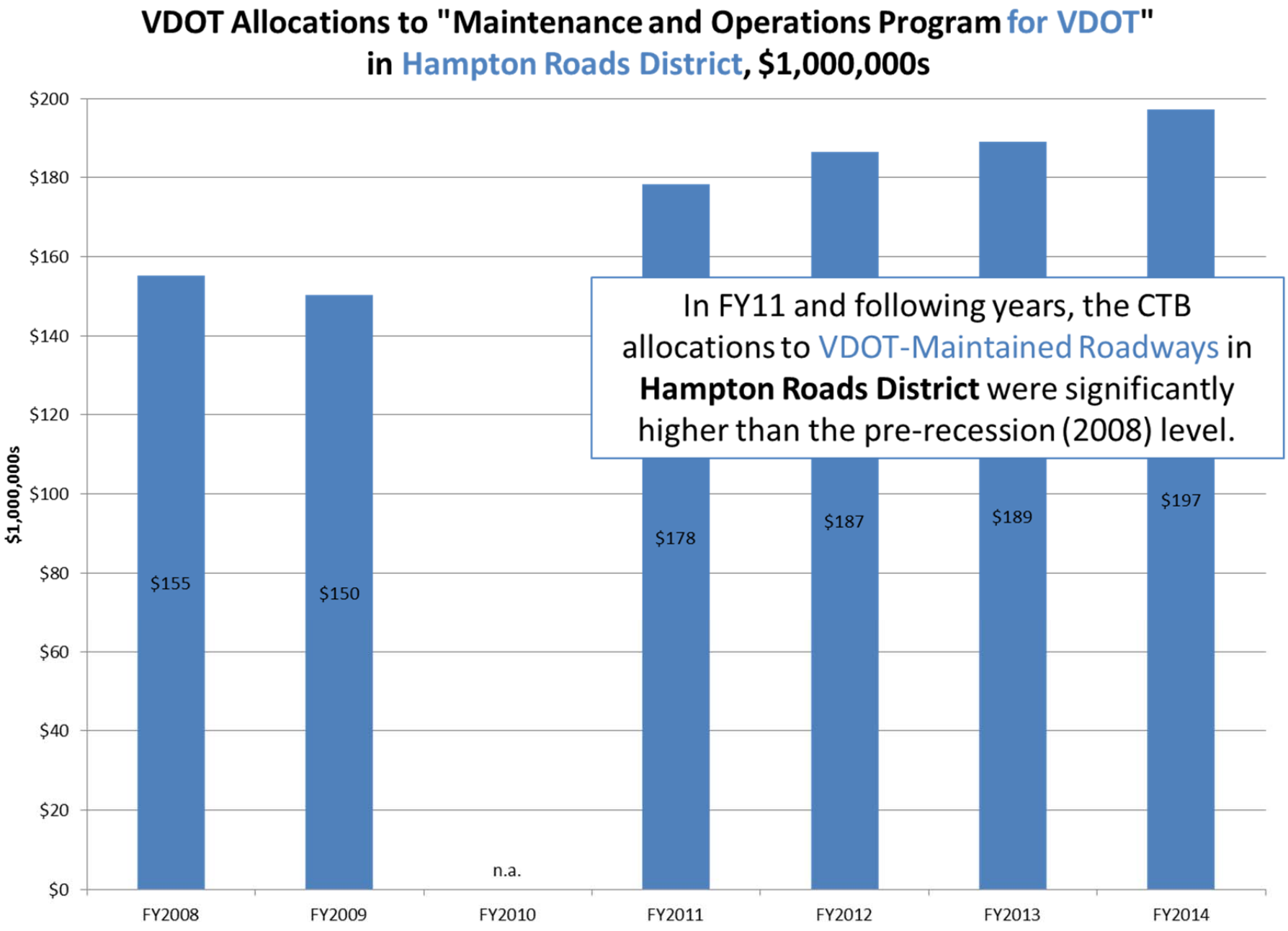
Source: HRTPO analysis of VDOT data; Pavement Performance Measurement.pptx



Source: HRTPO analysis of VDOT data; Pavement Performance Measurement.pptx



Source: HRTPO analysis of VDOT data; Pavement Performance Measurement.pptx



Source: HRTPO analysis of VDOT data; Pavement Performance Measurement.pptx

The above findings for maintenance/operations/services are summarized below.

Table 2 **Maintenance Funding Summary**

- Virginia
  - City-Maintained Roadways
    - 2012 *allocations* were **13% higher** than those in 2008.
    - 2012 *spending* was **9% higher** than that of 2008.
  - VDOT-Maintained Roadways
    - 2012 *allocations* were **12% higher** than those in 2008.
    - 2012 *spending* was **40% higher** than that of 2008.
- Hampton Roads District
  - City-Maintained Roadways
    - 2012 allocations were **12% higher** than those in 2008.
  - VDOT-Maintained Roadways
    - 2012 allocations were **21% higher** than those in 2008.

Source: HRTPO analysis of VDOT data; Pavement Performance Measurement.pptx

B. Lane Closures

VDOT's Annual Reports for the Hampton Roads Transportation Operations Center (HRTOC) is the source of the lane closure data in this section.

Note that re-paving is not the only reason for lane closures. Other reasons include replacing guardrails, trimming trees, and replacing pavement markings.

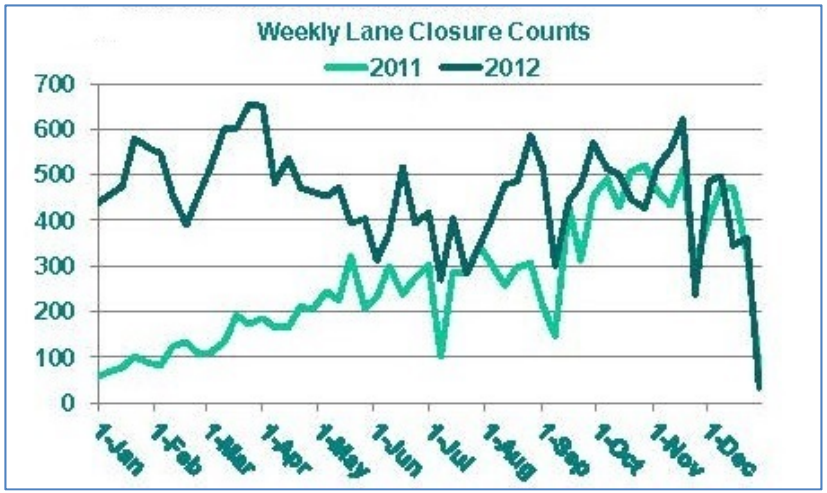
As shown in Figure 2, lane closures increased 5-fold during 2011 to approximately 500 per week.

Figure 2 **2011 Lane Closures in Hampton Roads**

Source: VDOT; lane closures.jpg

As shown in Figure 3, lane closures remained at approximately 500 per week.

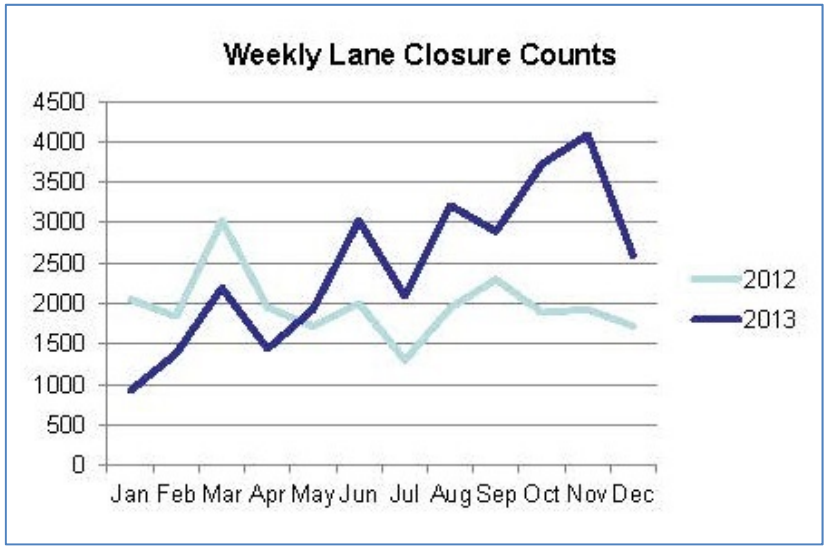
Figure 3 **2012 Lane Closures in Hampton Roads**



Source: VDOT; lane closures.jpg

As shown in Figure 4, lane closures reached 1,000 per week near the end of 2013 (4,000 per month).

Figure 4 **2013 Lane Closures in Hampton Roads**



Source: VDOT; lane closures.jpg

In summary, lane closures increased 10-fold from 100 per week in January 2011 to 1,000 per week in November 2013.

C. Pavement Data

As shown in Table 3, VDOT measures pavement performance with two indices, CCI and IRI:

Table 3 **Pavement Performance Indices**

- Cracking of pavements is measured using **Critical Condition Index (CCI)**.
  - Software interprets video images.
  - VDOT considers CCI ≥ 60 as sufficient.
  - VDOT target- interstate and primary CCI: 82% sufficiency
  - This measure is called **"Pavement Condition"** below.
- Roughness of all pavements is measured using **International Roughness Index (IRI)**.
  - Physical measurement w/ units of slope (in/mi).
  - VDOT considers IRI < 140 as sufficient for Interstates and Primaries; IRI < 220 as sufficient for Secondaries
  - VDOT target- interstate and primary IRI: 85% sufficiency
  - This measure is called **"Ride Quality"** below.

Source: HRTPO analysis of VDOT data; Pavement Performance Measurement.pptx

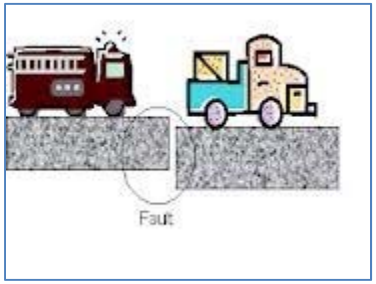
CCI measures cracking in pavements, as shown in Figure 5:

Figure 5 **Cracking**

Source: VDOT; alligator- VDOT- 2006 SOP.jpg

IRI measures roughness, e.g. due to the difference in height of concrete slabs, as shown in Figure 6:

Figure 6 **Roughness**



Source: FHWA; pavement fault- FHWA - half.jpeg

Pavement data is presented in this section for the following two categories:

1. Interstates, by State
2. VDOT-Maintained Roadways

1. Interstates, by State

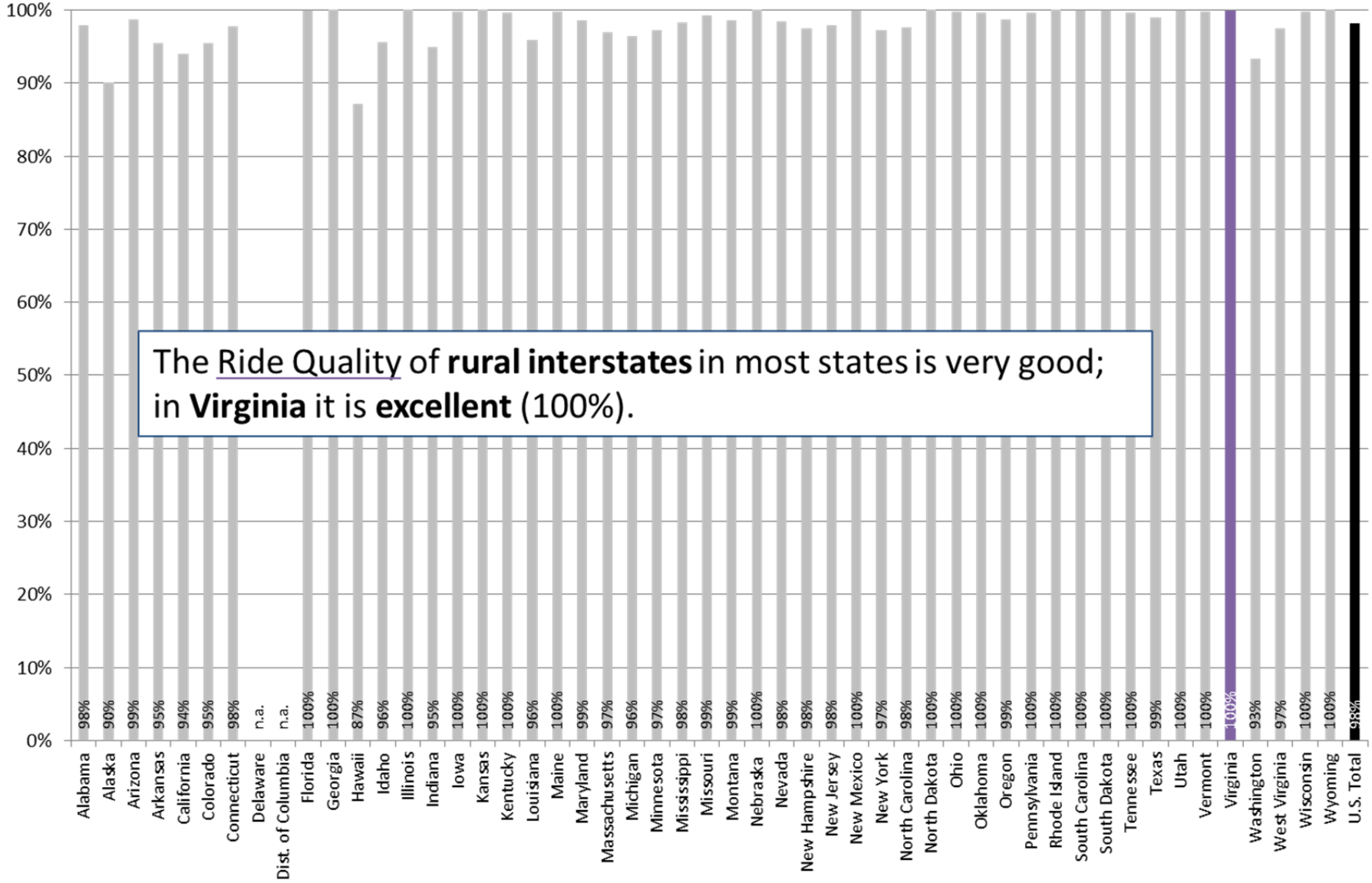
The source of pavement performance data for this sub-section is FHWA's annual "Highway Statistics" reports.

The data included herein is:

- Ride Quality only
  - This FHWA report does not provide Pavement Condition data by state.

- Interstate only
  - This HRTPO report does not summarize the FHWA Ride Quality data of lower road classes.
  - Whereas VDOT considers IRI < 140 in/mi. as sufficient for Interstates, FHWA considers IRI <= 170 in/mi. as acceptable for Interstates.

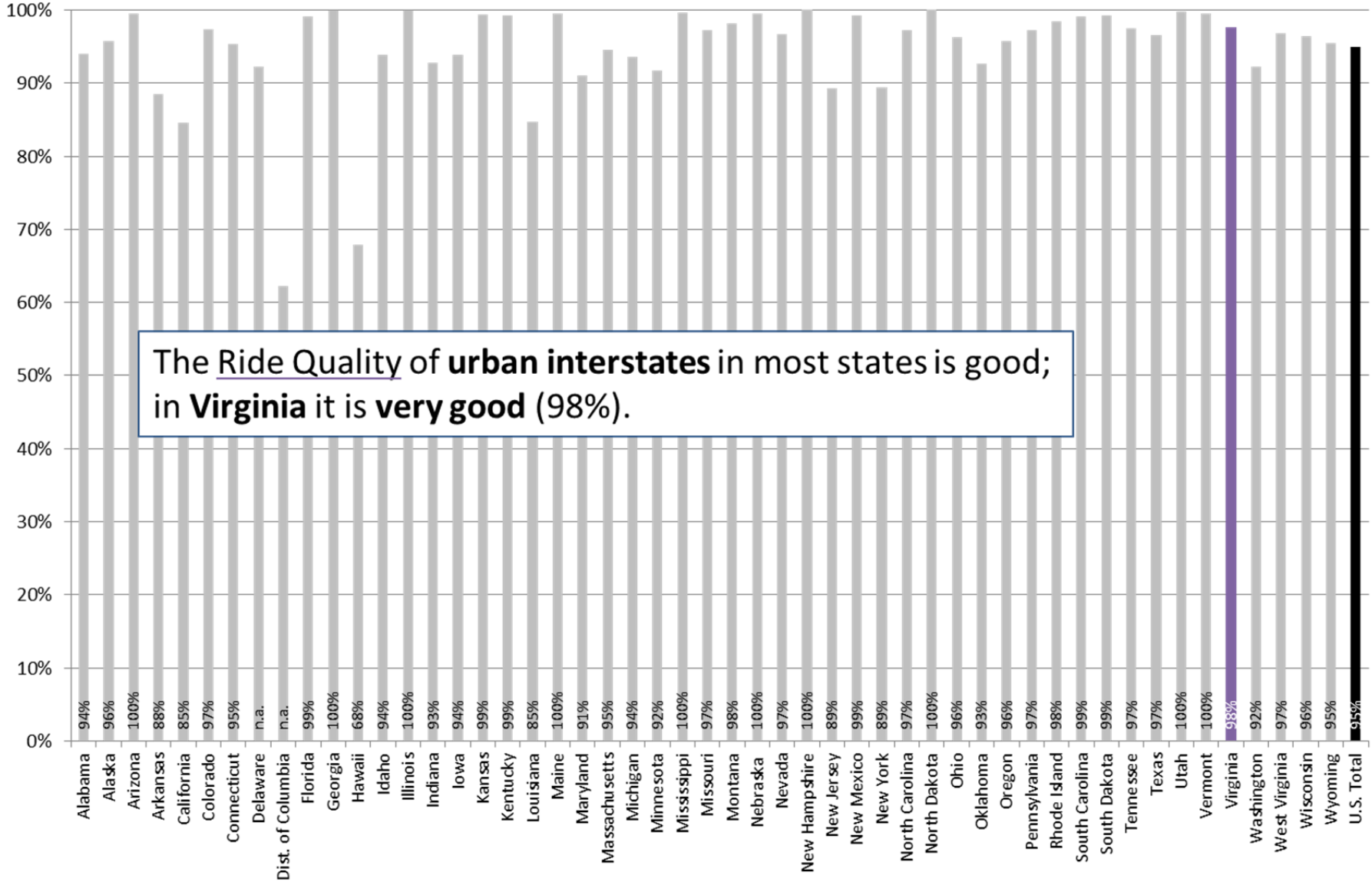
Ride Quality, Rural Interstates, Acceptable Lane-Miles (IRI <= 170 in/mi), 2012



The Ride Quality of **rural interstates** in most states is very good; in **Virginia** it is **excellent** (100%).

Source: HRTPO analysis of FHWA data; Pavement Performance Measurement.pptx

Ride Quality, Urban Interstates, Acceptable Lane-Miles (IRI <= 170 in/mi), 2012



Source: HRTPO analysis of FHWA data; Pavement Performance Measurement.pptx

2. VDOT-Maintained Roadways

For this sub-section, VDOT's "State of the Pavement" annual reports is the source of:

- Pavement data (shown in charts prepared by HRTPO)
- Maps

VDOT gathers pavement data for 100% of its Interstates and Primaries annually, and gathers sample data for 20% of its Secondaries annually.

The data included herein is:

a. Pavement Condition
   - i.e. cracking

b. Ride Quality
   - i.e. roughness

a. Pavement Condition (VDOT-Maintained Roadways)

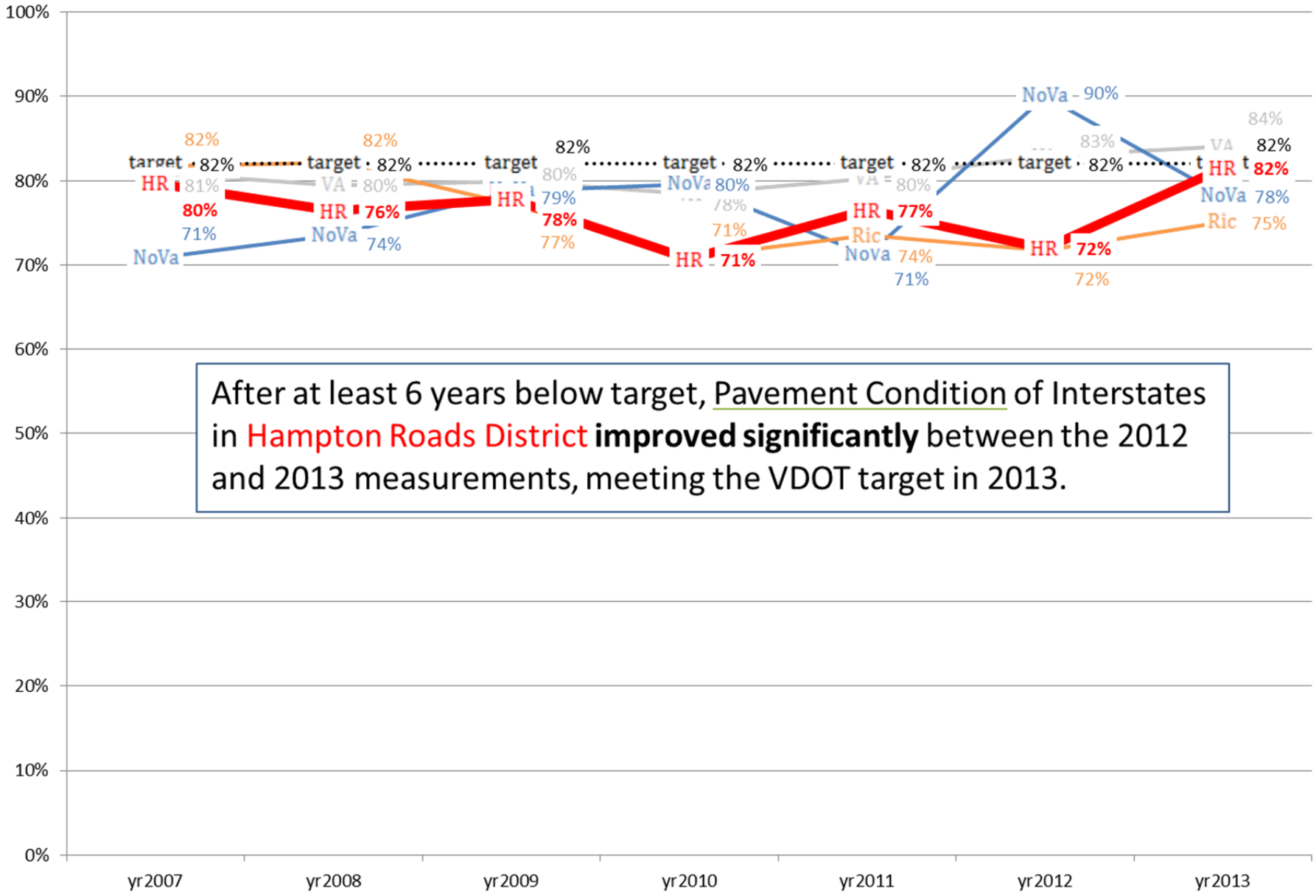
Pavement Condition (cracking) is examined by road type for VDOT-Maintained Roadways on the following pages:

- Interstate
- Primary
- Secondary

<u>Interstates</u>

Pavement Condition of Interstates—by District—is shown on following page:

Pavement Condition, Interstates, lane-miles w/ CCI fair or better



Source: HRTPO analysis of VDOT data; Pavement Performance Measurement.pptx

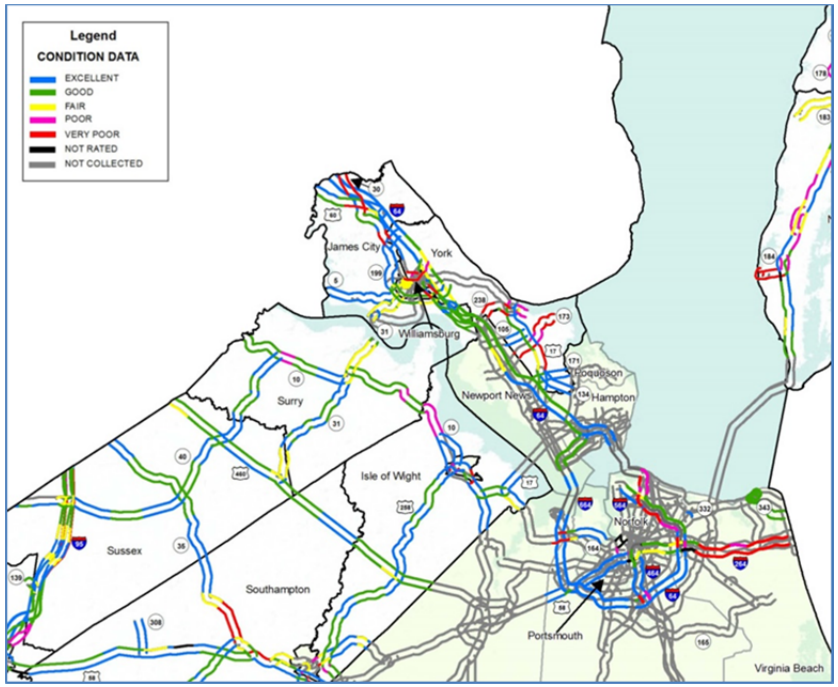
As shown on the figures on this page, poor pavement conditions improved on the following Interstates:

- I-664 in Newport News
- I-664 in Chesapeake
- I-264 in Norfolk
- I-95 in Sussex

Figure 7 **2012 Pavement Condition- Interstates**

Source: VDOT;HR interstates.jpg

Figure 8 **2013 Pavement Condition- Interstates**

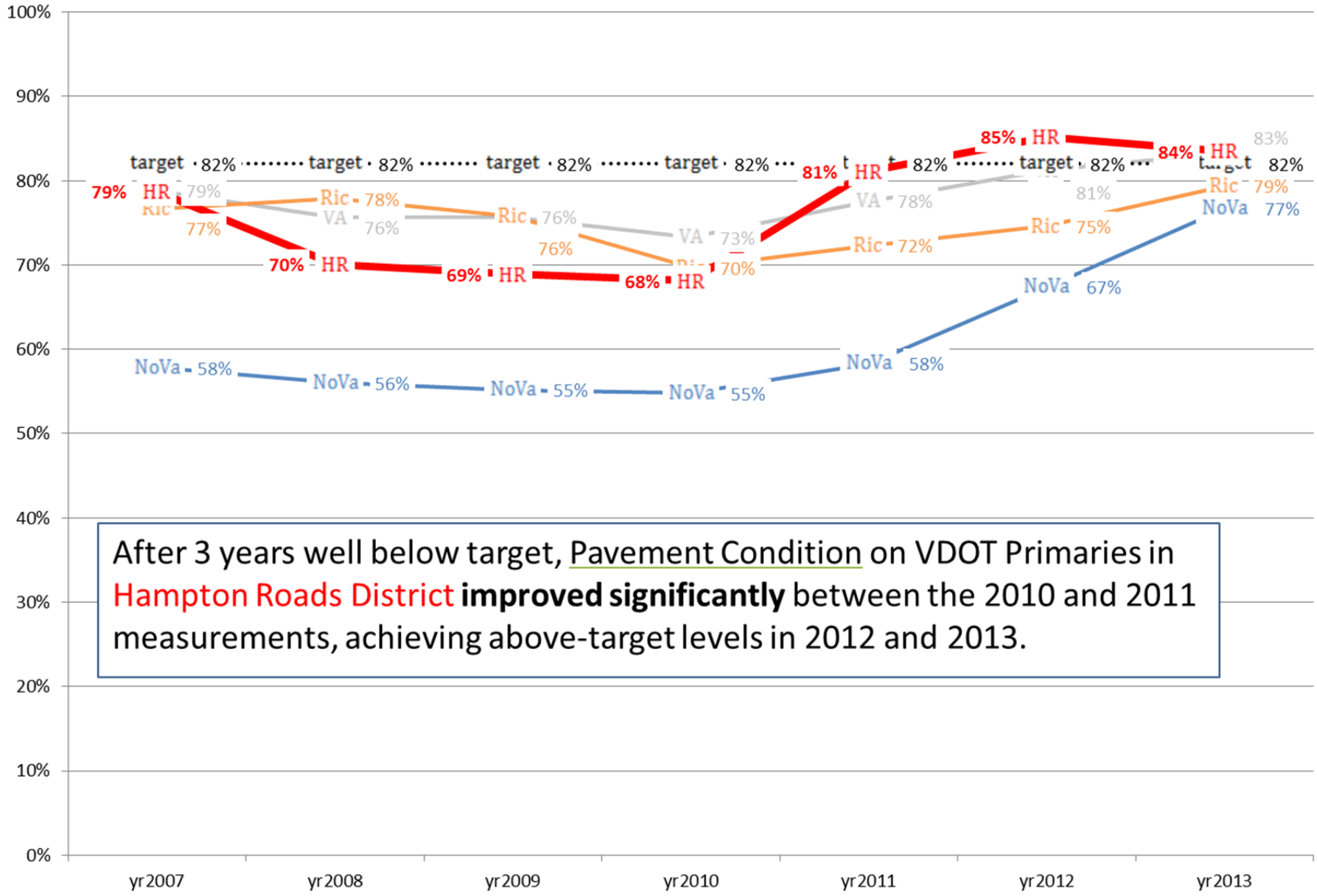


Source: VDOT; HR interstates.jpg

Primaries

Pavement Condition of Primaries is shown on following page:

Pavement Condition, VDOT Primaries, lane-miles w/ CCI fair or better



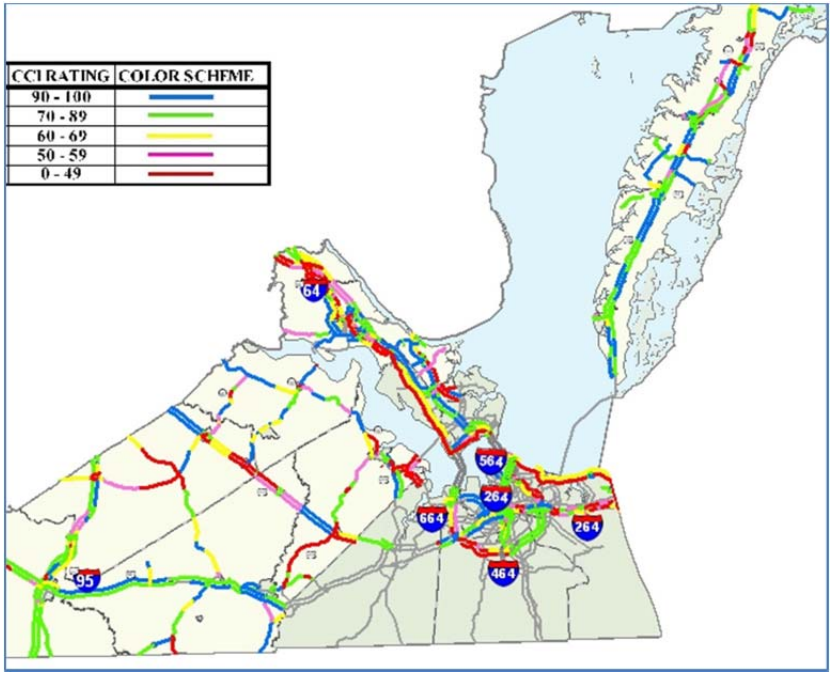
After 3 years well below target, Pavement Condition on VDOT Primaries in Hampton Roads District **improved significantly** between the 2010 and 2011 measurements, achieving above-target levels in 2012 and 2013.

Source: HRTPO analysis of VDOT data; Pavement Performance Measurement.pptx

As shown on the figures on this page, poor pavement conditions improved on the following Primaries:

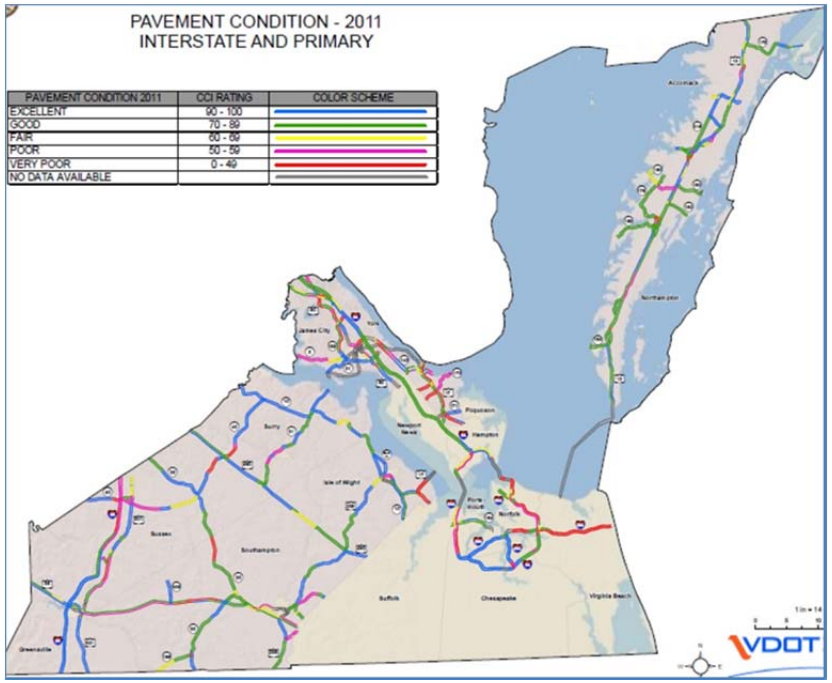
- US 460
- VA 40 and VA 35 in Sussex

Figure 9 2010 Pavement Condition- Primaries



Source: VDOT; HR primaries.jpg

Figure 10 2011 Pavement Condition- Primaries

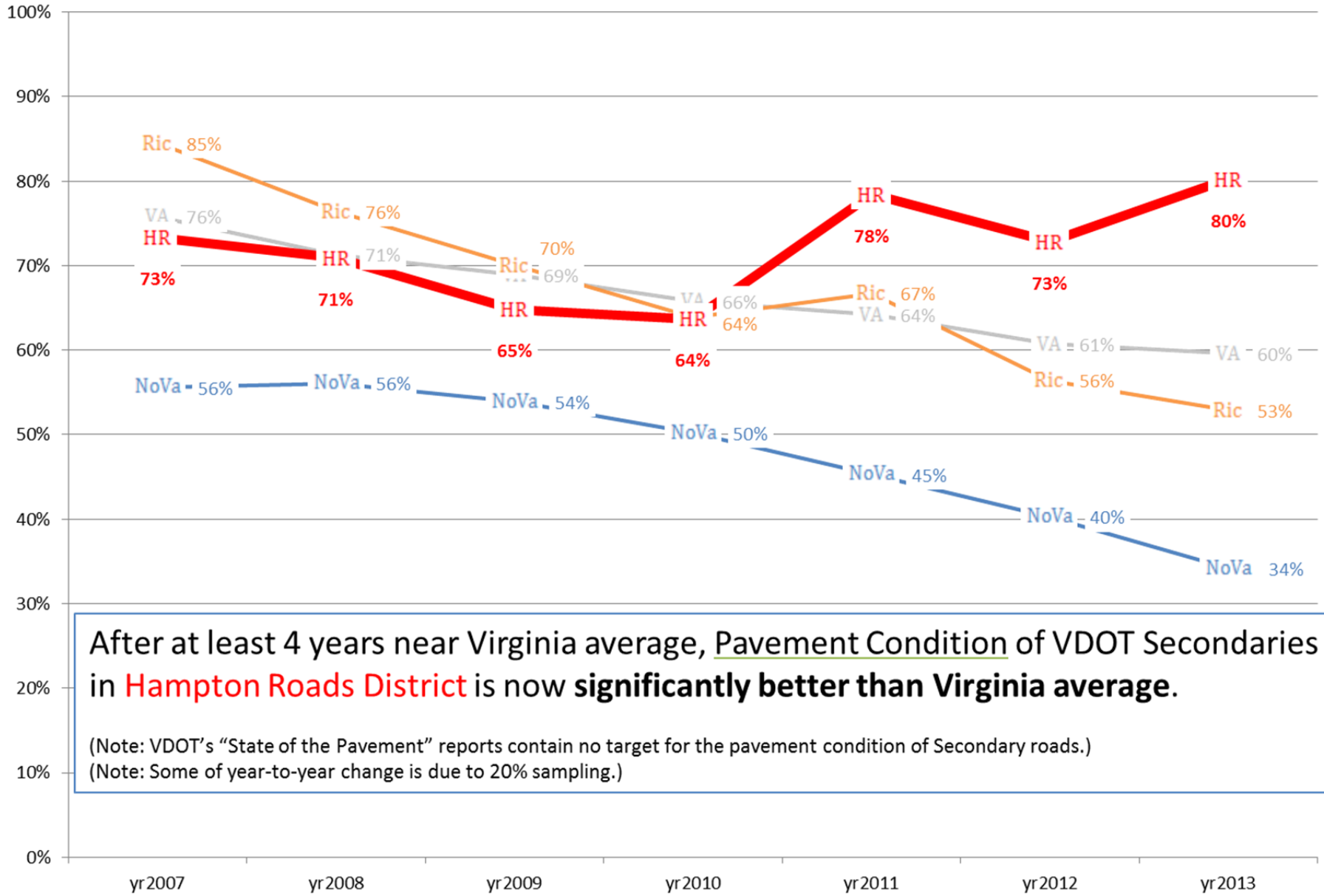


Source: VDOT; HR primaries.jpg

Secondaries

Pavement Condition of Secondaries is shown on following page:

Pavement Condition, VDOT Secondaries, lane-miles w/ CCI fair or better



After at least 4 years near Virginia average, Pavement Condition of VDOT Secondaries in Hampton Roads District is now **significantly better than Virginia average**.

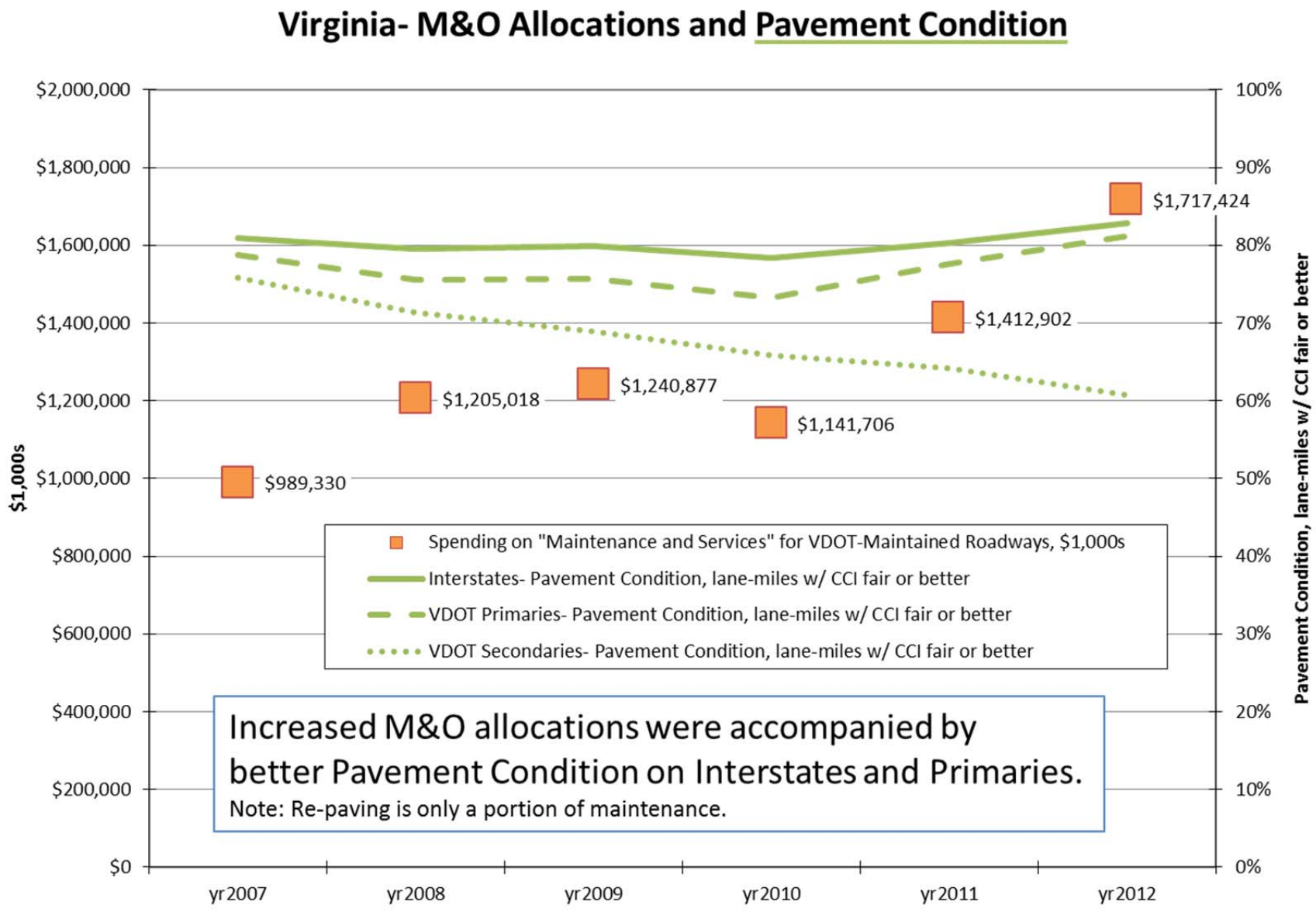
(Note: VDOT's "State of the Pavement" reports contain no target for the pavement condition of Secondary roads.)
(Note: Some of year-to-year change is due to 20% sampling.)

Source: HRTPO analysis of VDOT data; Pavement Performance Measurement.pptx

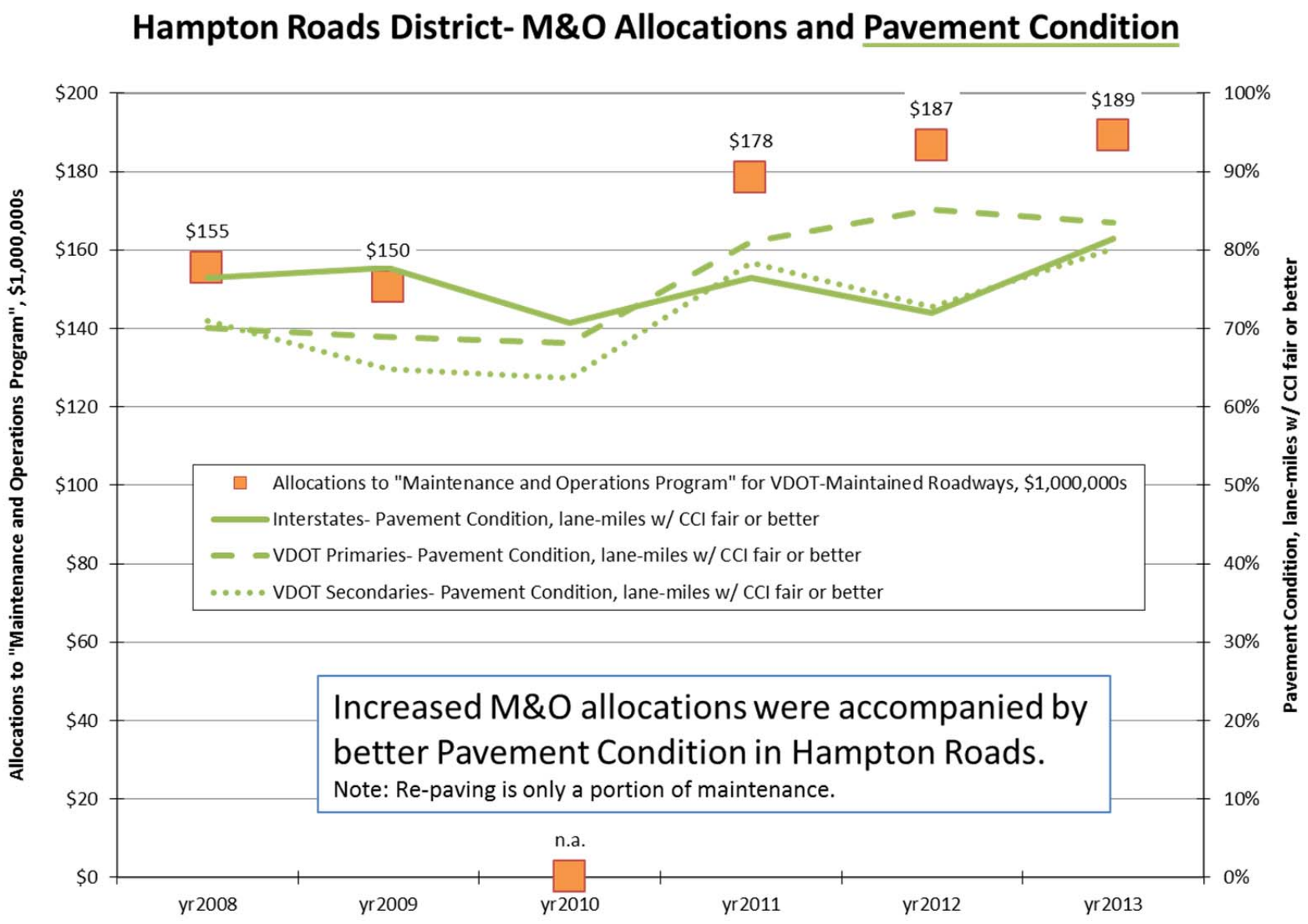
Comparing M&O Allocations to Pavement Condition

Maintenance & Operations (M&O) allocations are compared to Pavement Condition on the following pages, by location:

- Virginia
- Hampton Roads District



Source: HRTPO analysis of VDOT data; Pavement Performance Measurement.pptx



Source: HRTPO analysis of VDOT data; Pavement Performance Measurement.pptx

Summary (Pavement Condition of VDOT-Maintained Roads)

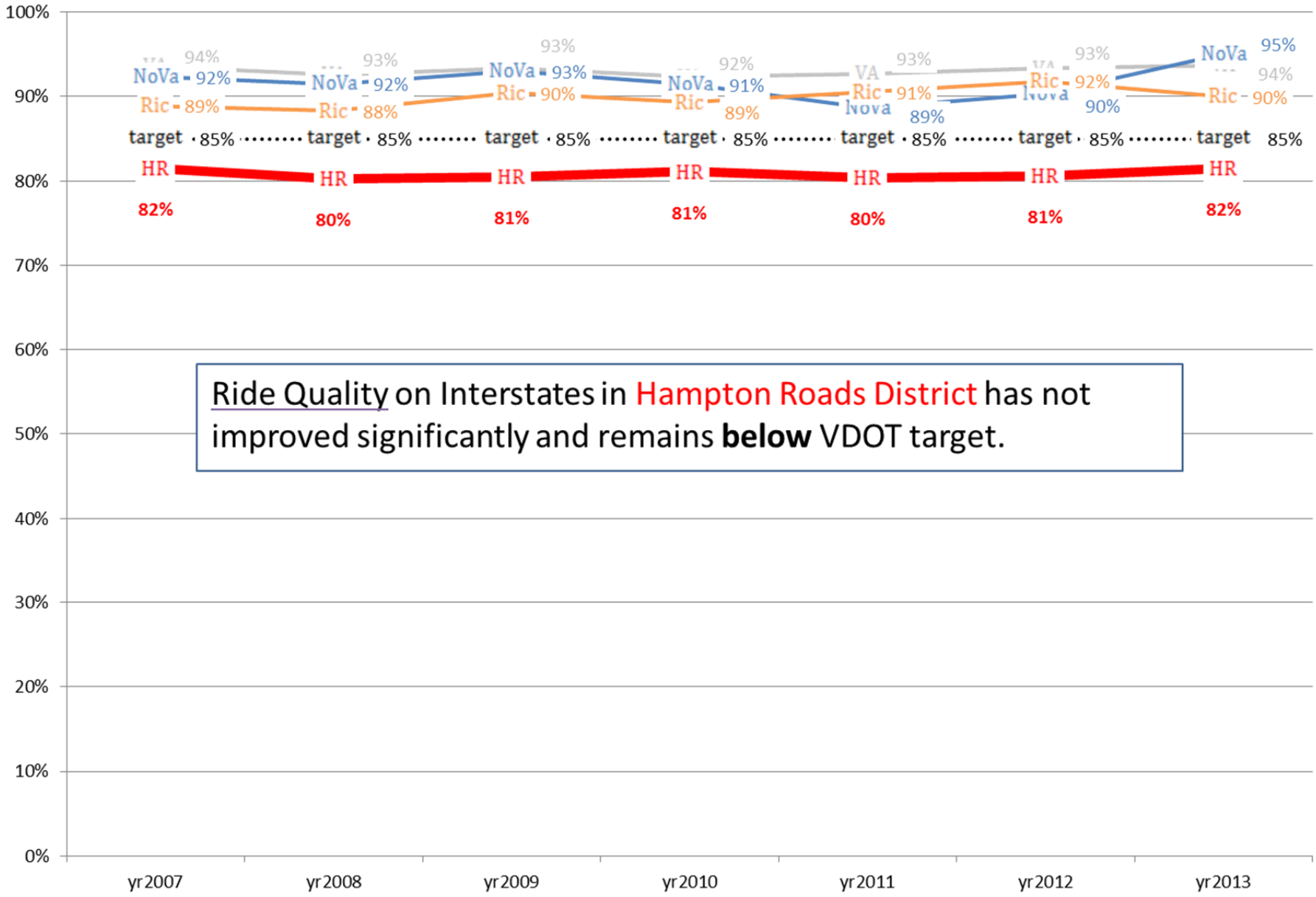
The higher allocations to VDOT M&O for Hampton Roads District starting in FY11 were accompanied by significantly better Pavement Condition in FY11, FY12, and FY13.

b. Ride Quality (VDOT-Maintained Roadways)

Ride Quality (roughness) is examined by road type for VDOT-Maintained Roadways on the following pages:

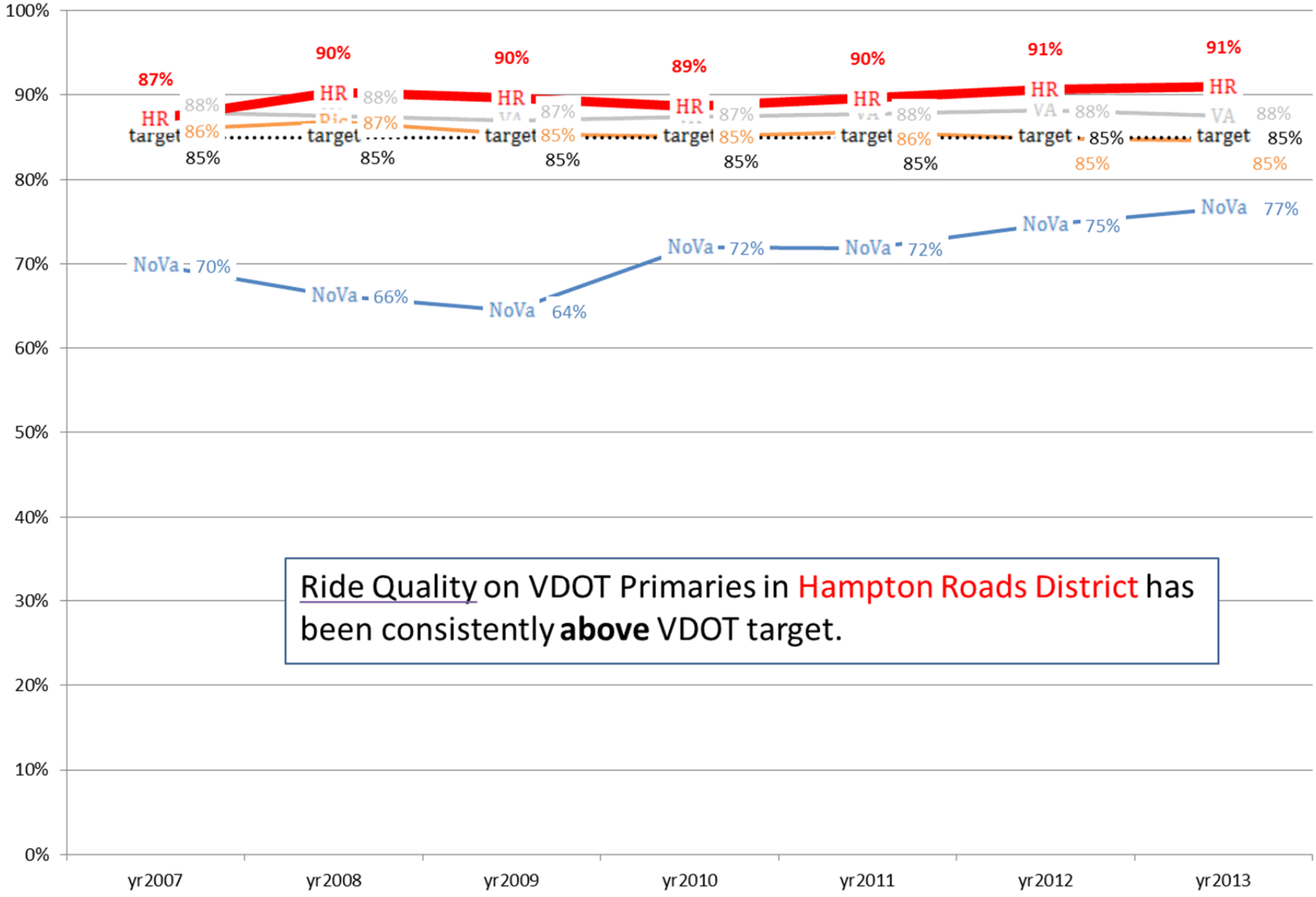
- Interstate
- Primary
- Secondary

Ride Quality, Interstates, lane-miles w/ IRI fair or better



Source: HRTPO analysis of VDOT data; Pavement Performance Measurement.pptx

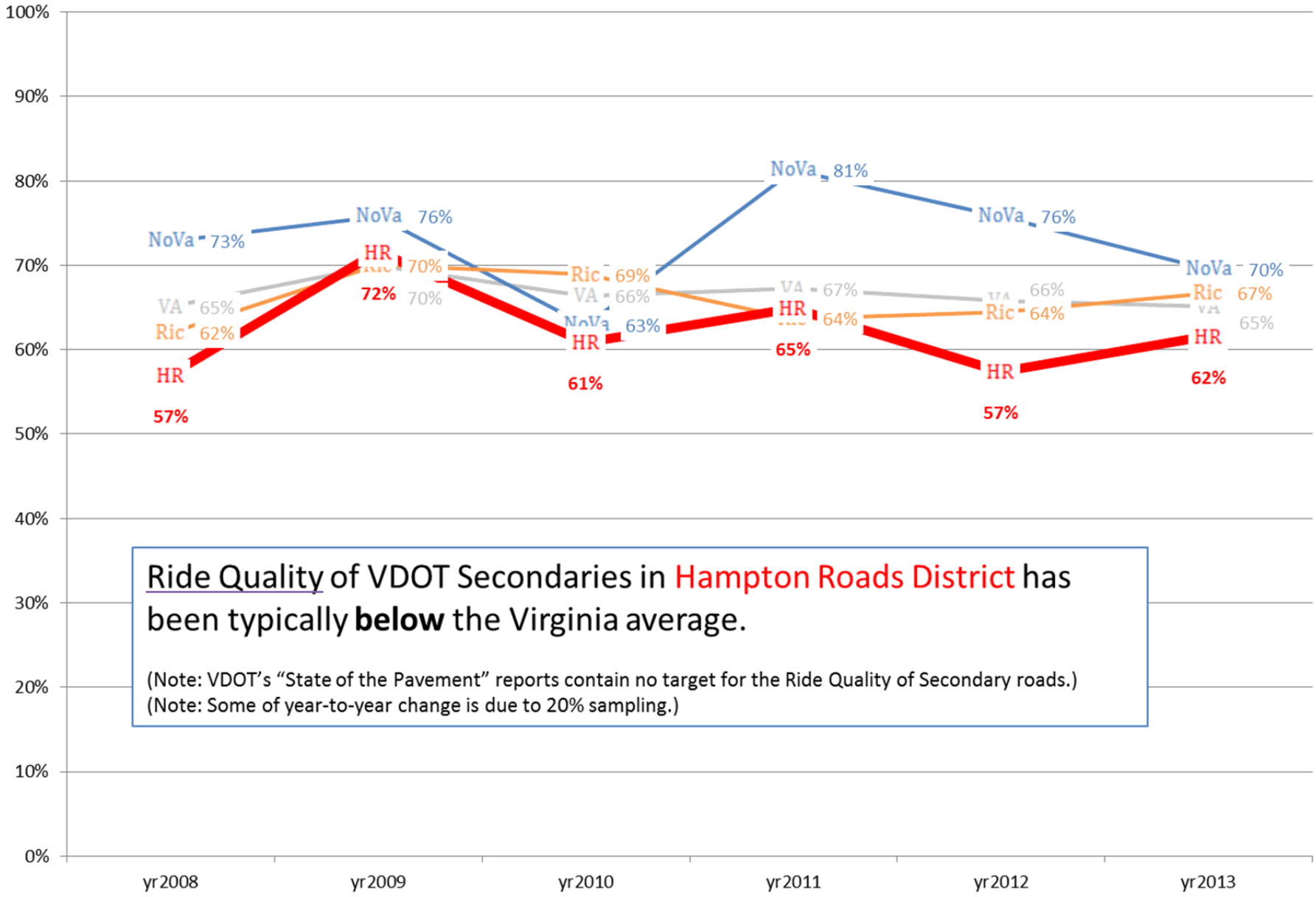
Ride Quality, VDOT Primaries, lane-miles w/ IRI fair or better



Ride Quality on VDOT Primaries in Hampton Roads District has been consistently **above** VDOT target.

Source: HRTPO analysis of VDOT data; Pavement Performance Measurement.pptx

Ride Quality, VDOT Secondaries, lane-miles w/ IRI fair or better



Ride Quality of VDOT Secondaries in Hampton Roads District has been typically **below** the Virginia average.

(Note: VDOT's "State of the Pavement" reports contain no target for the Ride Quality of Secondary roads.)
(Note: Some of year-to-year change is due to 20% sampling.)

Source: HRTPO analysis of VDOT data; Pavement Performance Measurement.pptx

Summary (Ride Quality of VDOT-Maintained Roads)

The Ride Quality of VDOT-Maintained Roadways in Hampton Roads District varies by road type:

- Interstate: below target
- Primaries: above target
- Secondaries: below average

Ride Quality in Hampton Roads District has been very steady over time. It has neither worsened nor improved, even after the higher allocations to VDOT M&O for Hampton Roads District starting in FY11.

Conclusion

Although Ride Quality has stayed the same, the higher allocations to VDOT M&O for Hampton Roads District starting in FY11 were accompanied by significantly better Pavement Condition for VDOT-Maintained Roadways in FY11, FY12, and FY13.

Appendix

Pavement Condition vs. Ride Quality

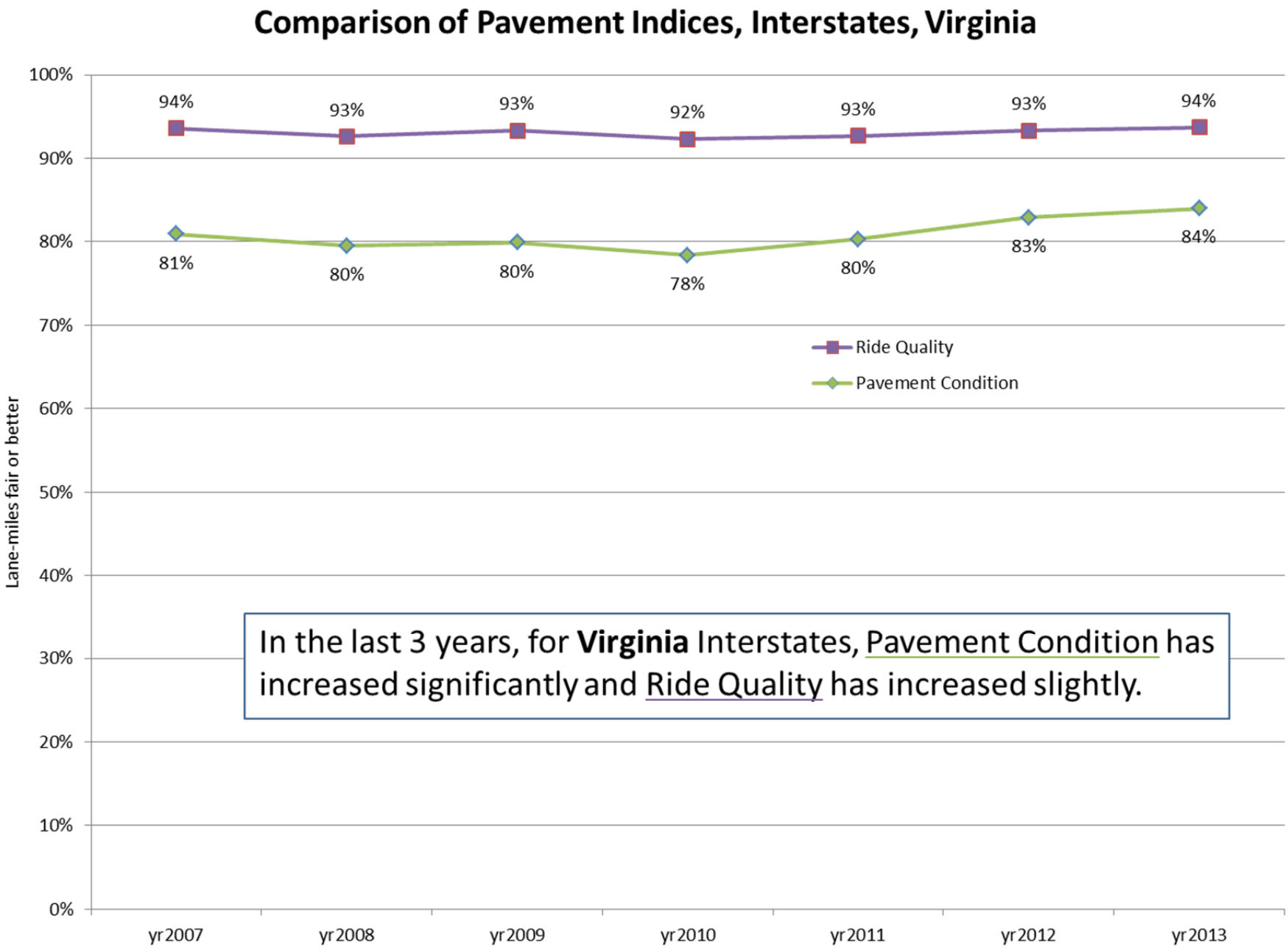
In the appendix, the two pavement measures used in this report—Pavement Condition and Ride Quality—are compared to each other for VDOT-Maintained Roadways in:

A. Virginia
B. Hampton Roads District

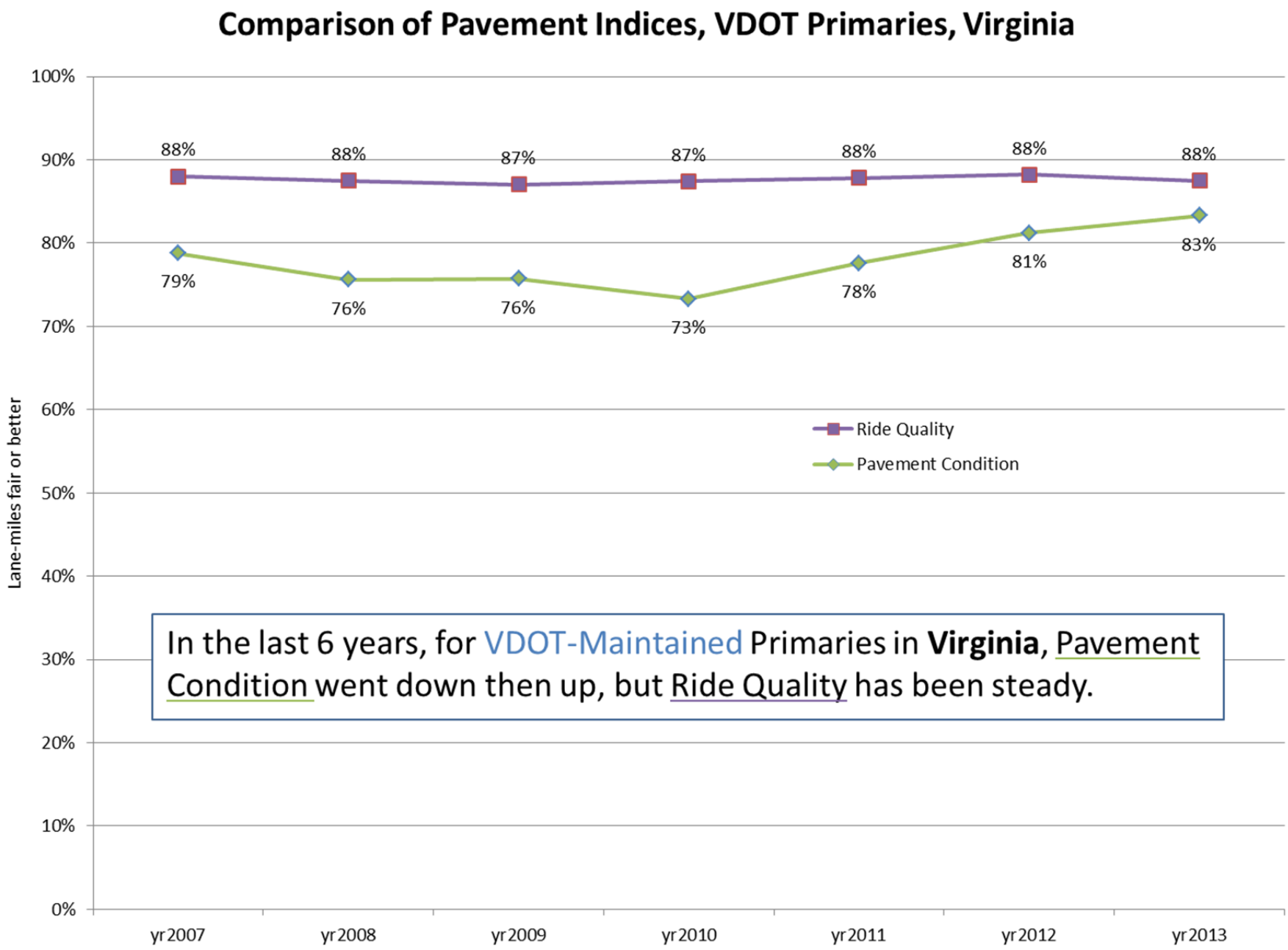
The source of data for this comparison is VDOT's annual "State of the Pavement" reports.

A. Virginia

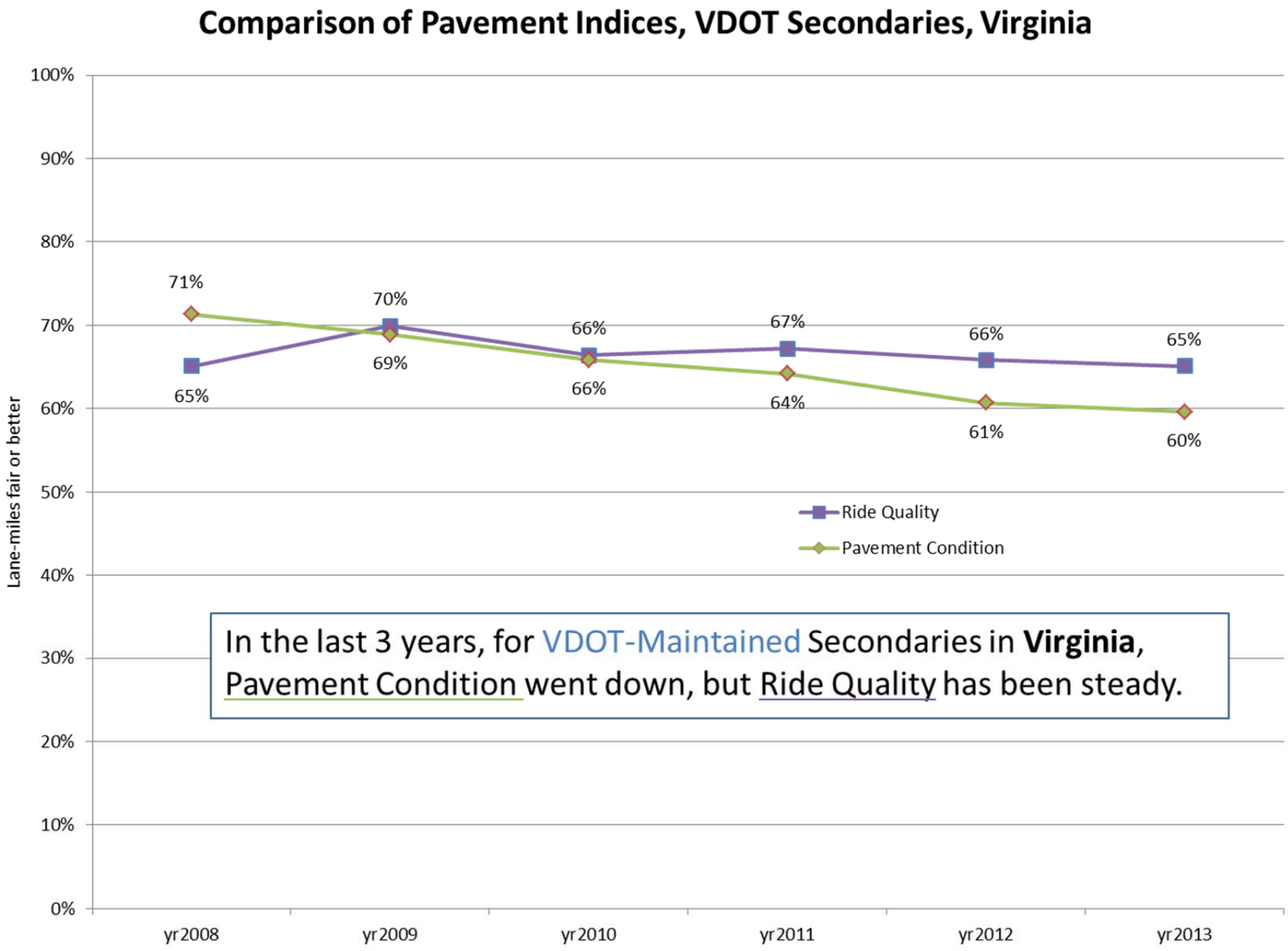
The comparison of the two pavement measures using Virginia roadways is presented on the following pages.



Source: HRTPO Analysis of VDOT data; Pavement Performance Measurement.pptx



Source: HRTPO Analysis of VDOT data; Pavement Performance Measurement.pptx



Source: HRTPO Analysis of VDOT data; Pavement Performance Measurement.pptx

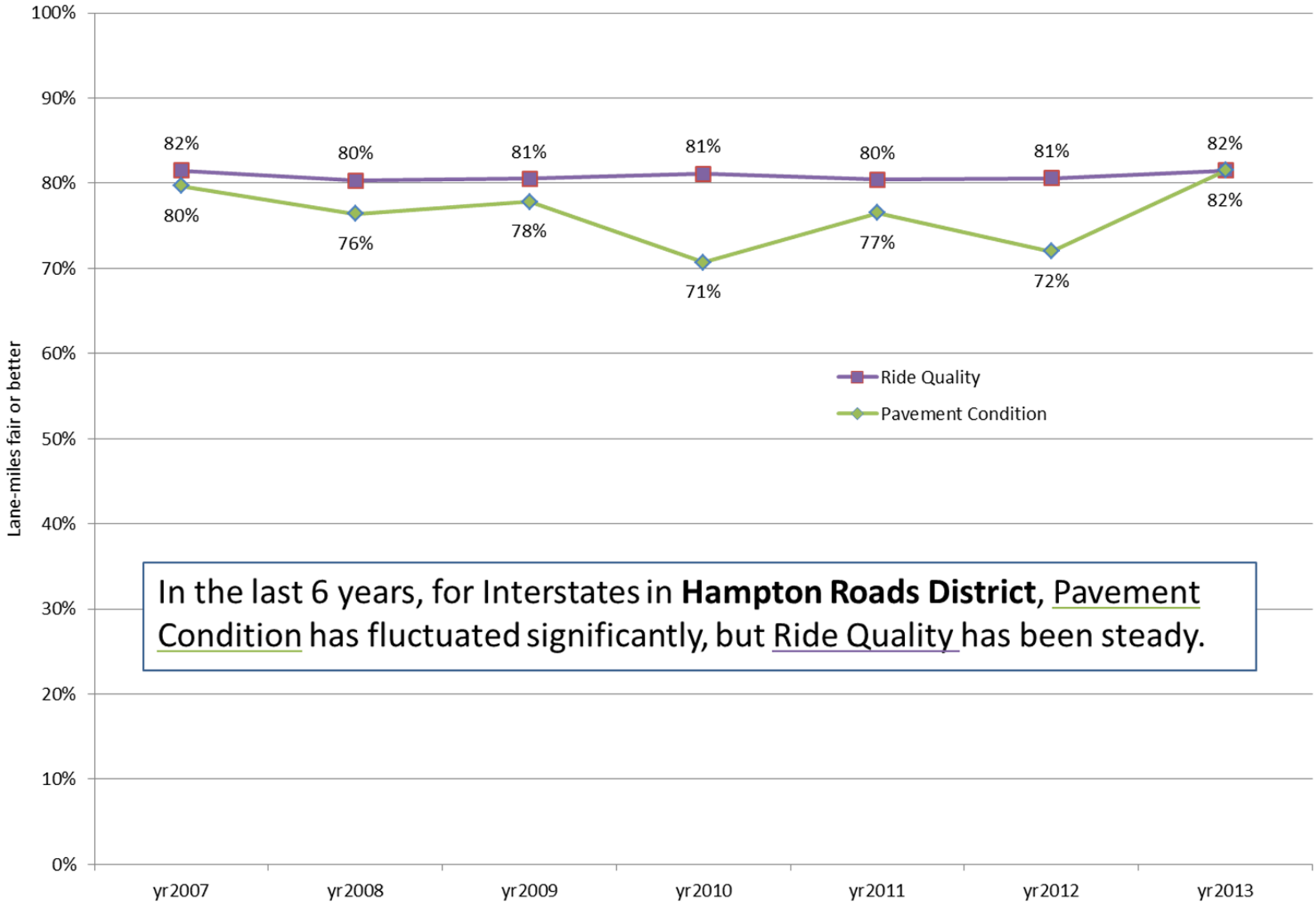
Summary (Virginia)

Whereas Pavement Condition of VDOT-Maintained Roadways in Virginia varied over time—Interstates and Primaries improving, and Secondaries deteriorating—Ride Quality for all roadway types remained steady.

B. Hampton Roads District

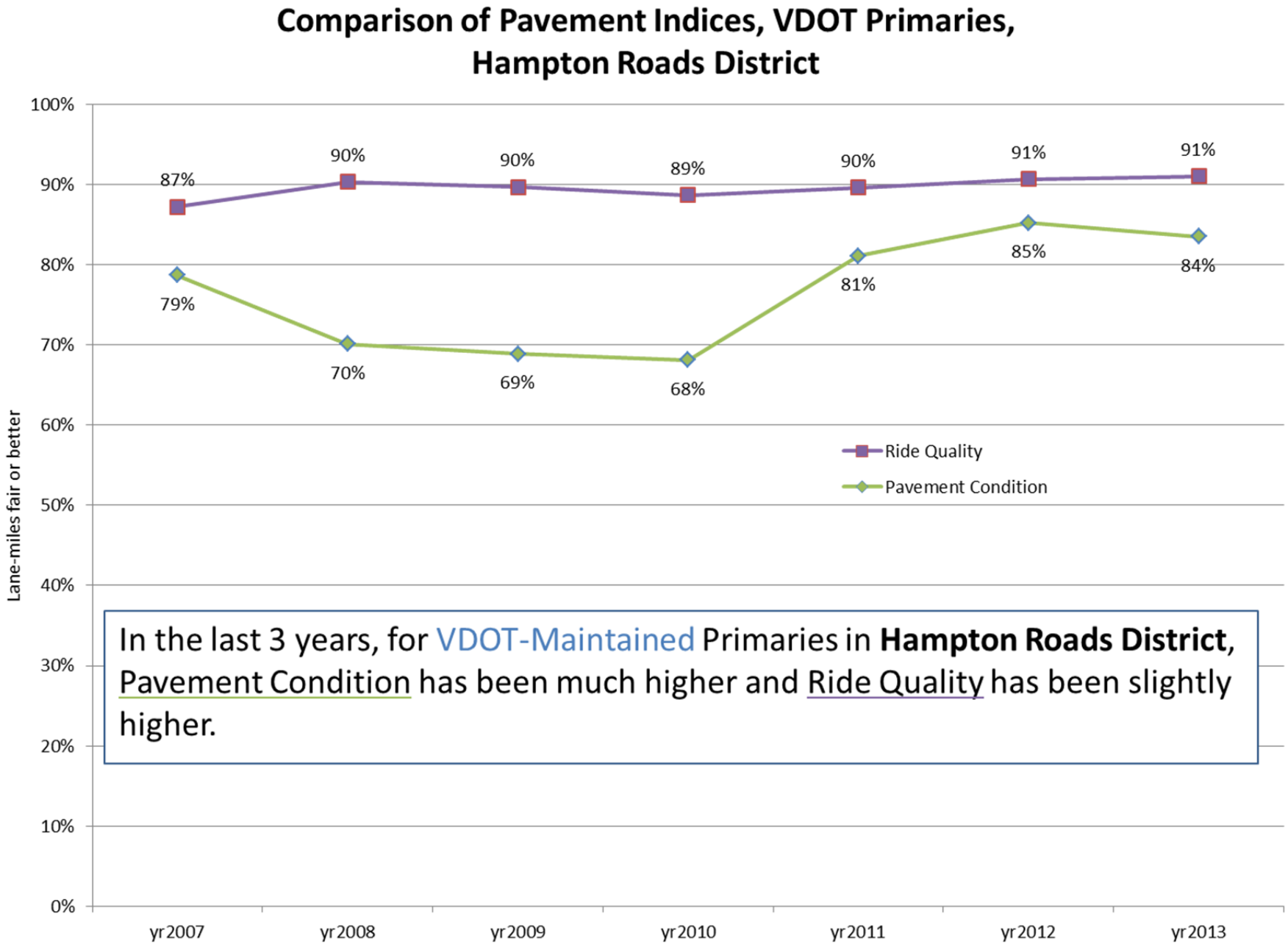
The comparison of the two pavement measures using the roadways of Hampton Roads District is presented on the following pages.

Comparison of Pavement Indices, Interstates, Hampton Roads District



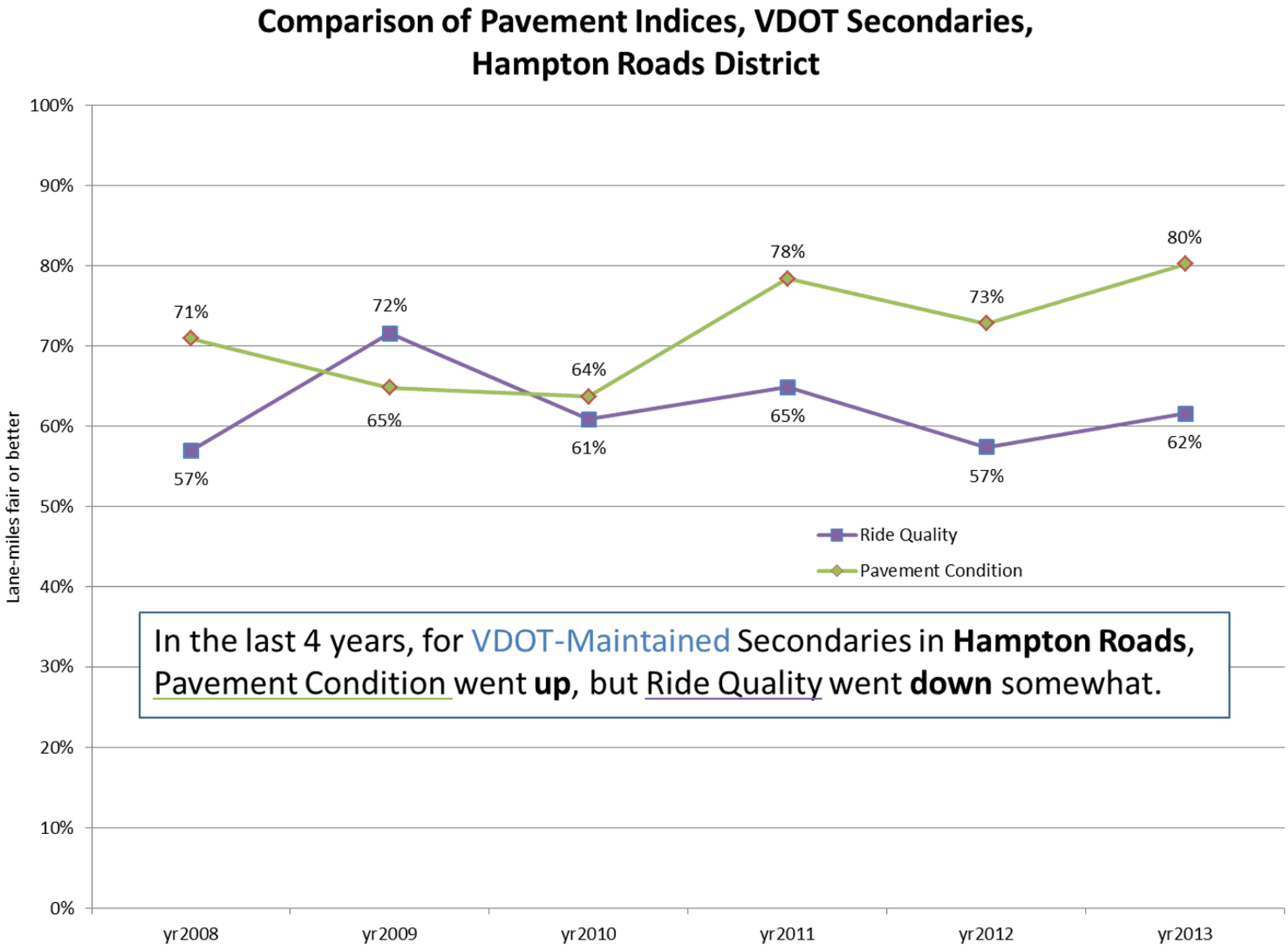
In the last 6 years, for Interstates in **Hampton Roads District**, Pavement Condition has fluctuated significantly, but Ride Quality has been steady.

Source: HRTPO Analysis of VDOT data; Pavement Performance Measurement.pptx



In the last 3 years, for VDOT-Maintained Primaries in **Hampton Roads District**, Pavement Condition has been much higher and Ride Quality has been slightly higher.

Source: HRTPO Analysis of VDOT data; Pavement Performance Measurement.pptx



Source: HRTPO Analysis of VDOT data; Pavement Performance Measurement.pptx

Summary (Hampton Roads District)

Whereas Pavement Condition of VDOT-Maintained Roadways in Hampton Roads District varied over time—Interstates deteriorating then improving, and Primaries and Secondaries improving significantly—Ride Quality for all roadway types remained steady, as in the case of Virginia roadways above.

Overall Summary (Comparison of Two Pavement Measures)

Considering the above sections of the appendix—Virginia and Hampton Roads District—Pavement Condition has generally improved, but Ride Quality has been steady.