Pavement Performance Measurement in Hampton Roads
HAMPTON ROADS TRANSPORTATION PLANNING ORGANIZATION
Camelia Ravanbakht
Interim Executive Director

VOTING MEMBERS:

CHESAPEAKE
Alan P. Krasnoff

JAMES CITY COUNTY
Mary K. Jones

PORTSMOUTH
Kenneth I. Wright

GLOUCESTER COUNTY
John C. Meyer, Jr.

NEWPORT NEWS
McKinley Price

SUFFOLK
Linda T. Johnson

HAMPTON
George Wallace

NORFOLK
Paul D. Fraim

VIRGINIA BEACH
William D. Sessoms, Jr.

ISLE OF WIGHT COUNTY
Delores Dee-Dee Darden

POQUOSON
W. Eugene Hunt, Jr.

WILLIAMSBURG
Clyde Haulman

YORK COUNTY
Thomas G. Shepperd, Jr.

MEMBERS OF THE VIRGINIA SENATE
The Honorable Thomas K. Norment, Jr.
The Honorable Frank W. Wagner

MEMBERS OF THE VIRGINIA HOUSE OF DELEGATES
The Honorable Christopher P. Stolle
The Honorable David Yancey

TRANSPORTATION DISTRICT COMMISSION OF HAMPTON ROADS
William E. Harrell, President/Chief Executive Officer

WILLIAMSBURG AREA TRANSIT AUTHORITY
Kevan Danker, Executive Director

VIRGINIA DEPARTMENT OF TRANSPORTATION
James Utterback, Hampton Roads District Administrator

VIRGINIA DEPARTMENT OF RAIL AND PUBLIC TRANSPORTATION
Jennifer Mitchell, Director

VIRGINIA PORT AUTHORITY
John Reinhart, CEO/Executive Director
HAMPTON ROADS TRANSPORTATION PLANNING ORGANIZATION

NON-VOTING MEMBERS:

CHESAPEAKE
James E. Baker

ISLE OF WIGHT COUNTY
Anne Seward

NORFOLK
Marcus Jones

SUFFOLK
Selena Cuffee-Glenn

WILLIAMSBURG
Jackson C. Tuttle

GLOUCESTER COUNTY
Brenda G. Garton

JAMES CITY COUNTY
Doug Powell

POQUOSON
J. Randall Wheeler

VIRGINIA BEACH
James K. Spore

YORK COUNTY
James O. McReynolds

HAMPTON
Mary Bunting

NEWPORT NEWS
James M. Bourey

PORTSMOUTH
John Rowe

FEDERAL HIGHWAY ADMINISTRATION
Irene Rico, Division Administrator, Virginia Division

FEDERAL AVIATION ADMINISTRATION
Jeffrey W. Breeden, Airport Planner, Washington Airports Office District

PENINSULA AIRPORT COMMISSION
Ken Spirito, Executive Director

CITIZEN TRANSPORTATION ADVISORY COMMITTEE
Shepelle Watkins-White, Chair

MILITARY LIAISONS
Robert Clark, Captain, U.S. Navy
Vacant, U.S. Coast Guard
John J. Allen, Jr., Colonel, Langley
William S. Galbraith, Colonel, Langley

INVITED PARTICIPANT
John Malbon, Commonwealth Transportation Board

FEDERAL TRANSIT ADMINISTRATION
Brigid Hynes-Cherin, Acting Regional Administrator, Region 3

VIRGINIA DEPARTMENT OF AVIATION
Randall P. Burdette, Director

NORFOLK AIRPORT AUTHORITY
Wayne E. Shank, Executive Director

FREIGHT TRANSPORTATION ADVISORY COMMITTEE
Arthur Moye, Jr., Co-Chair (Nonvoting Board Member)
Delegate Christopher P. Stolle, Co-Chair (Voting Board Member)

HRTPO PROJECT STAFF
Robert B. Case, P.E., Ph.D. Principal Transportation Engineer
Keith Nichols, P.E. Senior Transportation Engineer
Kathlene Grauberger Senior Administrative Assistant
Michael Long General Services Manager
Christopher Vaigneur Assistant General Services Manager
Pavement Performance Measurement in Hampton Roads

JULY 2014
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.
<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>1</td>
</tr>
<tr>
<td>Pavement Performance Measurement</td>
<td>2</td>
</tr>
<tr>
<td>Maintenance Funding</td>
<td>3</td>
</tr>
<tr>
<td>Lane Closures</td>
<td>20</td>
</tr>
<tr>
<td>Pavement Data</td>
<td>22</td>
</tr>
<tr>
<td>Interstates, by State</td>
<td>23</td>
</tr>
<tr>
<td>VDOT-Maintained Roadways</td>
<td>26</td>
</tr>
<tr>
<td>Conclusion</td>
<td>41</td>
</tr>
<tr>
<td>Appendix: Pavement Condition vs. Ride Quality</td>
<td>42</td>
</tr>
</tbody>
</table>
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 repaving 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>
<thead>
<tr>
<th>Table 1</th>
<th>VDOT and Cities</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Basically, VDOT <strong>directly</strong> maintains:</td>
<td></td>
</tr>
<tr>
<td>- Interstates (in both cities and counties)</td>
<td></td>
</tr>
<tr>
<td>- Primaries and Secondaries in counties</td>
<td></td>
</tr>
<tr>
<td>- Hereinafter: “<strong>VDOT-Maintained Roadways</strong>”</td>
<td></td>
</tr>
</tbody>
</table>

| - And VDOT **indirectly** maintains: |
|   - Non-interstates in the cities (via **transfer payments**) |
|   - Hereinafter: “**City-Maintained Roadways**” |

Source: HRTPO; Pavement Performance Measurement.pptx
VDOT Allocations to "Maintenance and Operations Program", Virginia, $1,000,000s

There was only a one-year gap (2009) in **steady increases** in allocations to **Virginia** M&O in recent years.

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
In none of last seven years was there a decrease in allocations to Virginia cities for maintenance of City-Maintained Roadways. Allocations in 2012 were 13% higher than those in 2008.
Allocations to M&O for VDOT-Maintained Roadways in Virginia were 12% higher in 2012 than 2008.

Source: HRPTO 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
"State Disbursements for Highways", "Grants in Aid to Local Governments", Virginia, $1,000s

State payments to cities for City-Maintained Roadways in Virginia increased 9% from 2008 to 2012.

Source: HRTPO analysis of FHWA data; Pavement Performance Measurement.pptx
"State Disbursements for Highways", "Maintenance and Services" ("State Administered Highways"), Virginia, $1,000s

Spending on “Maintenance and Services” for VDOT-Maintained Roadways in Virginia increased 40% from 2008 to 2012.

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:

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.
The share of Virginia totals allocated to cities in Hampton Roads District for their City-Maintained Roadways has remained relatively constant.

Source: HRTPO analysis of VDOT data; Pavement Performance Measurement.pptx
VDOT Allocations to "Maintenance Payments to Localities" in Hampton Roads District, $1,000,000s

The CTB has increased allocations for City-Maintained Roadways in Hampton Roads District in each of the last 6 years. 2012 allocations were 12% higher than those in 2008.

Source: HRTPO analysis of VDOT data; Pavement Performance Measurement.pptx
VDOT Allocations to "Maintenance and Operations Program for VDOT" in Hampton Roads District, Share of Virginia Total

In FY11 and following, the CTB increased the Hampton Roads District’s share of M&O for VDOT-Maintained Roadways.

Source: HRTPD analysis of VDOT data; Pavement Performance Measurement.pptx
In FY11 and following years, the CTB allocations to VDOT-Maintained Roadways in Hampton Roads District were significantly higher than the pre-recession (2008) level.

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

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

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.
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
The Ride Quality of urban interstates in most states is good; in Virginia it is very good (98%).

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

**Interstates**

Pavement Condition of Interstates—by District—is shown on following page:
After at least 6 years below target, Pavement Condition of Interstates in Hampton Roads District improved significantly between the 2012 and 2013 measurements, meeting the VDOT target in 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 Interstates:

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

Figure 7  2012 Pavement Condition- Interstates

Figure 8  2013 Pavement Condition- Interstates

Pavement Condition of Primaries is shown on following page:
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*

**Figure 10**  
*2011 Pavement Condition- Primaries*

**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
Increased M&O allocations were accompanied by better Pavement Condition on Interstates and Primaries.

Note: Re-paving is only a portion of maintenance.

Source: HRTPO analysis of VDOT data; Pavement Performance Measurement.pptx
Increased M&O allocations were accompanied by better Pavement Condition in Hampton Roads.
Note: Re-paving is only a portion of maintenance.
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 on Interstates in Hampton Roads District has not improved significantly and remains below VDOT target.

Source: HRTPO analysis of VDOT data; Pavement Performance Measurement.pptx
Ride Quality on VDOT Primaries in Hampton Roads District has been consistently above VDOT target.
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.
In the last 3 years, for Virginia Interstates, Pavement Condition has increased significantly and Ride Quality has increased slightly.

Source: HRTPO Analysis of VDOT data; Pavement Performance Measurement.pptx
In the last 6 years, for VDOT-Maintained Primaries in Virginia, Pavement Condition went down then up, but Ride Quality has been steady.

Source: HRTPO Analysis of VDOT data; Pavement Performance Measurement.pptx
Comparison of Pavement Indices, VDOT Secondaries, Virginia

In the last 3 years, for VDOT-Maintained Secondaries in Virginia, Pavement Condition went down, but Ride Quality has been steady.

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.
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
Comparison of Pavement Indices, VDOT Primaries, Hampton Roads District

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
In the last 4 years, for VDOT-Maintained Secondaries in Hampton Roads, Pavement Condition went up, but Ride Quality went down somewhat.

Source: HRTPA 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.