MIDTOWN TUNNEL CLOSURE
TRAFFIC AND TRANSIT
ANALYSIS

HAMPTON ROADS
PLANNING DISTRICT COMMISSION
JUNE 2004
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This report was included in the Work Program for Fiscal Year 2003-2004, which was approved by the Commission and the Metropolitan Planning Organization at their meetings of March 19, 2003.

PREPARED BY

HAMPTON ROADS PLANNING DISTRICT COMMISSION
JUNE 2004
# REPORT DOCUMENTATION

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<td>June 2004</td>
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## ABSTRACT

During the week of September 14, 2003, Hurricane Isabel approached the East Coast of the United States, eventually passing through Hampton Roads on Thursday, September 18, 2003. Among the damage that Isabel left behind was a flooded Midtown Tunnel. The tunnel would remain closed for almost four weeks, re-opening on October 15, 2003. This study is an analysis of traffic volumes and transit ridership during the tunnel closure. It provides information on the role that the Midtown Tunnel has in the region’s transportation system.

## ACKNOWLEDGEMENTS

This report was prepared in cooperation with the U.S. Department of Transportation, the Federal Highway Administration, the Virginia Department of Transportation, and the cities of Hampton Roads. The contents of this report reflect the views of the staff of the Hampton Roads MPO. The MPO staff is responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the Hampton Roads Planning District Commission or cooperating bodies. The report does not constitute a standard, specification or regulation. FHWA or VDOT acceptance of this report as evidence of fulfillment of the objectives of this planning study 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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THE EVENTS OF HURRICANE ISABEL

The week of September 14, 2003 will long be remembered by the residents of Hampton Roads. It was during this week that the path of Hurricane Isabel was carefully followed as it closed in on the East Coast of the United States. On Thursday of that week (September 18, 2003), Isabel made landfall in the Outer Banks of North Carolina, passed through Hampton Roads, and continued on through Virginia.

FIGURE 1. Path of Hurricane Isabel

Isabel.hurricane.track.jpg

FIGURE 2. Events Timeline

Sunday, September 14, 2003: Hurricane Isabel approaching east coast of the United States.

Monday, September 15, 2003: Isabel begins turning towards Mid-Atlantic states.

Thursday, September 18, 2003: Isabel makes landfall in the Outer Banks of North Carolina, and continues on a northwest path through Hampton Roads. Midtown Tunnel floods and is closed. Tolls on Jordan Bridge are removed ($0.75 for a two-axle vehicle).

Wednesday, October 15, 2003: Midtown Tunnel re-opens at approximately 3:00 p.m.

Friday, October 17, 2003: Tolls resumed on Jordan Bridge at approximately 5:30 a.m.

Isabel left significant damage in its wake. This included countless downed trees, wind damage, erosion, and significant flooding in some areas. Flooding was a particular problem for the Midtown Tunnel. A stuck plate kept the tunnel’s flood-gate
open. The tunnel filled with 44 million gallons of water and remained closed for nearly four weeks\textsuperscript{1}.

**FIGURE 3. A Flooded Midtown Tunnel**

![Tunnel flood image]

**BACKGROUND ON THE MIDTOWN TUNNEL**

The Midtown Tunnel is a significant regional gateway, providing one of the primary access points to and from Norfolk and Portsmouth across the Elizabeth River. Norfolk is home to a thriving downtown area and the world’s largest Navy base. Norfolk had 15% of the region’s population and 24% of the region’s employment in 2000, while Portsmouth accounted for 7% of the 2000 population and 6% of the region’s employment. In addition to serving commuters and shoppers, approximately 4.2% of its daily traffic volume is truck traffic\textsuperscript{2}. Appendices B and C have regional and Midtown Tunnel location maps for those not familiar with the facility.

**ANALYSIS OF HIGHWAY TRAFFIC VOLUMES**

One of the usual tools for analyzing the impact of a transportation facility is the region’s travel demand forecasting model. This study is unique in that an extensive set of actual traffic counts were used instead of estimates from the model. The extended closing of the Midtown Tunnel provided this rare opportunity. However, in the interest of seeing how well the regional travel demand forecasting model performs, a brief comparison of the model versus the actual counts is included in Appendix D.

\textsuperscript{1} “September-October 2003 Bulletin”, Virginia Department of Transportation.

Inventory of Traffic Counts

Daily traffic counts were gathered for the study period of 8/4/2003 through 11/30/2003. This is seventeen weeks (Monday through Sunday), or 119 days of data. The Study Period was divided into six parts:

1. **Summer**: 8/4/2003 through 9/1/2003
2. **Pre-Isabel**: 9/2/2003 through 9/14/2003
3. **Isabel**: 9/15/2003 through 9/21/2003
4. **Midtown Closed**: 9/22/2003 through 10/15/2003
5. **Post-Reopening A**: 10/16/2003 through 11/2/2003

The “Midtown Closed” period was defined to start on 9/22/03 to coincide with the first workday following Hurricane Isabel. The tunnel actually closed on Thursday, 9/18/03, the day Isabel passed through the region.

Forty count locations were obtained from the Virginia Department of Transportation’s (VDOT) monthly tunnel reports, VDOT continuous count stations, and from the City of Chesapeake. All available continuous counts were considered for this study. The number of counts for each of the forty count locations ranged from 119 (100% coverage) to 101 (85% coverage), with the average being 115 (97% coverage). See Table 1 for the inventory of counts used.

The counts used were located throughout the region, with nine localities represented. The distance of the counts from the Midtown Tunnel ranged from 2 miles to 41 miles, with the average being 14 miles. See Maps 1 and 2 for maps of count locations.

Data was also desired for the High-rise Bridge (I-64 from I-464 to G. Washington Hwy. in Chesapeake), and Campostella Bridge. However, there was not a counter at these locations during the study period. The High-rise Bridge in particular was likely impacted by the Midtown Tunnel closure. A permanent counter has since been installed for the High-rise Bridge. Traffic counts for additional interstate locations were also available via the VDOT Smart Travel Lab. A cursory review of these counts revealed that the quality of the counts was too inconsistent for including in an analysis of a 119-day period.
**TABLE 1. Inventory of Traffic Count Locations**

<table>
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<th>COUNT SOURCE</th>
<th>ID1</th>
<th>ID2</th>
<th>LOCALITY</th>
<th>ROUTE</th>
<th>ROAD</th>
<th>FROM</th>
<th>TO</th>
<th>NUMBER OF COUNTS</th>
<th>%</th>
<th>DIST.</th>
<th>LOS</th>
<th>LANES</th>
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<td>119</td>
<td>100%</td>
<td>0.0</td>
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<td>DT</td>
<td></td>
<td>Norfolk / Port</td>
<td>264</td>
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<td>Norfolk</td>
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<td>119</td>
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<td>2.0</td>
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<td>JB</td>
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<td>337</td>
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<td>150123</td>
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<td>13 / 460</td>
<td>Military Hwy (Gilmerton Bridge)</td>
<td>Canal Dr</td>
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<td>100%</td>
<td>5.8</td>
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<td>225</td>
<td>Independence Blvd</td>
<td>Va. Beach Blvd</td>
<td>Pembroke Blvd</td>
<td>119</td>
<td>100%</td>
<td>9.8</td>
<td>E</td>
<td>6</td>
</tr>
<tr>
<td>VDOT Continuous Count</td>
<td>150103</td>
<td></td>
<td>Va. Beach</td>
<td>58</td>
<td>Laskin Rd</td>
<td>Va. Beach Blvd</td>
<td>First Colonial Rd</td>
<td>119</td>
<td>100%</td>
<td>15.8</td>
<td>D</td>
<td>4</td>
</tr>
<tr>
<td>VDOT Continuous Count</td>
<td>677732</td>
<td></td>
<td>Va. Beach</td>
<td>13</td>
<td>Northampton Blvd</td>
<td>Diamond Springs Rd</td>
<td>Independence Blvd</td>
<td>113</td>
<td>95%</td>
<td>8.8</td>
<td>C</td>
<td>6</td>
</tr>
<tr>
<td>VDOT Continuous Count</td>
<td>150105</td>
<td></td>
<td>Va. Beach</td>
<td>615</td>
<td>Oceana Blvd</td>
<td>Credle Rd</td>
<td>First Colonial Rd</td>
<td>119</td>
<td>100%</td>
<td>17.4</td>
<td>B</td>
<td>4</td>
</tr>
<tr>
<td>VDOT Continuous Count</td>
<td>150104</td>
<td></td>
<td>Va. Beach</td>
<td>60</td>
<td>Shore Dr</td>
<td>Northampton Blvd</td>
<td>Bay Lake Rd</td>
<td>111</td>
<td>93%</td>
<td>11.0</td>
<td>F</td>
<td>4</td>
</tr>
<tr>
<td>VDOT Continuous Count</td>
<td>50045</td>
<td></td>
<td>York</td>
<td>173</td>
<td>Denbigh Blvd</td>
<td>Newport News LC</td>
<td>Rte 17</td>
<td>119</td>
<td>100%</td>
<td>23.3</td>
<td>na</td>
<td>2</td>
</tr>
<tr>
<td>VDOT Continuous Count</td>
<td>50193</td>
<td></td>
<td>York</td>
<td>17</td>
<td>GW Memorial Hwy</td>
<td>Hampton Hwy</td>
<td>Dare Rd</td>
<td>110</td>
<td>92%</td>
<td>20.2</td>
<td>F</td>
<td>4</td>
</tr>
<tr>
<td>VDOT Continuous Count</td>
<td>150003</td>
<td></td>
<td>York</td>
<td>641</td>
<td>Penniman Rd</td>
<td>Rte 199</td>
<td>Colonial Pkwy</td>
<td>115</td>
<td>97%</td>
<td>33.1</td>
<td>C</td>
<td>2</td>
</tr>
</tbody>
</table>

"Number of Counts" refers to the number of daily counts available during the study period of 8/4/03 through 11/30/03 (119 days).
119 counts equals 100%.
"Dist." is the euclidean distance in miles from the Midtown Tunnel.
"LOS" is the lower of the AM or PM LOS based on typical weekday counts from 1997 to 2000; it is from "Congestion Management System for Hampton Roads, Virginia 2001 - Technical Appendix", HRPDC, June 2001.
Gilmerton Bridge LOS was updated to reflect more recent traffic counts.
"na" - not available.

**AVG:** 115 97% 13.4
MAP 1. Traffic Count Locations, Regional
MAP 2. Traffic Count Locations, South Hampton Roads
Analysis of Traffic Counts

The primary purpose of this study is to determine the impact that closing the Midtown Tunnel had on the transportation system of Hampton Roads. Traffic patterns vary greatly for weekdays versus weekends, and so they will be analyzed separately. Detailed profiles for each of the count locations can be found in Appendix A.

One caveat to be considered is that the Jordan Bridge was not collecting its usual $0.75 toll (for two-axle vehicles) during the closure of the Midtown Tunnel. The removal of this disincentive would certainly have an impact on the use of the Jordan Bridge. However, the data required to determine the magnitude of the toll’s impact is not available.

Weekdays

Table 2 and Map 3 illustrate the change in average weekday traffic volume during the closure of the Midtown Tunnel. The road segments with the largest increase in average weekday traffic were the other Elizabeth River crossings (the Jordan Bridge without a toll, Downtown Tunnel and Gilmerton Bridge). Some less-expected locations with increases were I-564 (alternate route to the Navy base), Battlefield Blvd. north of I-64, Mercury Blvd., and the HRBT. The largest declines in weekday traffic were I-664, Western Freeway, Hampton Blvd., and Military Highway at Bower’s Hill. Some of these locations (e.g. Oceana Blvd.) may have had changes in traffic volumes that were not the direct result of the Midtown Tunnel closure. Other factors (possibly military-related activities in the case of Oceana Blvd. for example) may have played a role in traffic growth or decline.

When the increases and decreases in traffic are logically connected, we can determine those corridors that are the most sensitive to changes at the Midtown Tunnel:

- **Other Elizabeth River crossings** (Jordan Bridge, Downtown Tunnel, Gilmerton Bridge)
- **Hampton Roads crossings** (HRBT, MMBT)
- **extensions of Midtown Tunnel** (Hampton Blvd., Western Fwy.)
- **I-564**
- **Other local roads**
TABLE 2. Traffic Volumes for Typical Weekday vs. Midtown Tunnel Closed Weekday

<table>
<thead>
<tr>
<th>ID</th>
<th>LOCALITY</th>
<th>ROAD</th>
<th>FROM</th>
<th>TO</th>
<th>TYPICAL WEEKDAY VOLUME</th>
<th>M' TOWN CLOSED WEEKDAY VOLUME</th>
<th>CHANGE VOLUME</th>
<th>% CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MT Norf / Ports</td>
<td>Midtown Tunnel</td>
<td>Norfolk</td>
<td>Portsmouth</td>
<td>37,631</td>
<td>0</td>
<td>-37,631</td>
<td>-100.0%</td>
<td></td>
</tr>
<tr>
<td>JB Norf / Ports</td>
<td>Jordan Bridge</td>
<td>Chesapeake</td>
<td>Portsmouth</td>
<td>6,718</td>
<td>20,252</td>
<td>13,535</td>
<td>201.5%</td>
<td></td>
</tr>
<tr>
<td>DT Norf / Ports</td>
<td>Downtown Tunnel</td>
<td>Norfolk</td>
<td>Portsmouth</td>
<td>103,859</td>
<td>108,629</td>
<td>4,771</td>
<td>4.6%</td>
<td></td>
</tr>
<tr>
<td>150123 Ches</td>
<td>Gilmerton Bridge</td>
<td>Canal Dr</td>
<td>Bainbridge Blvd</td>
<td>36,548</td>
<td>41,200</td>
<td>4,652</td>
<td>12.7%</td>
<td></td>
</tr>
<tr>
<td>150121 Chesapeake</td>
<td>Battlefield Blvd</td>
<td>I-64</td>
<td>Military Hwy</td>
<td>42,987</td>
<td>46,591</td>
<td>3,604</td>
<td>8.4%</td>
<td></td>
</tr>
<tr>
<td>150118 Hampton</td>
<td>Mercury Blvd</td>
<td>Chestnut Ave</td>
<td>Big Bethel Rd</td>
<td>49,307</td>
<td>52,765</td>
<td>3,459</td>
<td>7.0%</td>
<td></td>
</tr>
</tbody>
</table>

Typical Weekday is average of T, W, TH from 9/2/03 - 9/14/03 and 11/3/03 - 11/26/03, not including Veteran's Day. Midtown Closed Weekday is average of T, W, TH from 9/22/03 - 10/14/03.

Source of counts: VDOT and City of Chesapeake.
MAP 3. Change in Weekday Traffic Volumes With Midtown Tunnel Closed

Change in Average Weekday Traffic

- Star: Midtown Tunnel
- Red: Increase greater than 1,000
- Black: + / - 1,000
- Green: Decrease greater than 1,000

Dot size indicates magnitude of change.
Saturdays

The changes in traffic patterns are more difficult to determine for weekend versus weekday traffic. This is due to the greater variety and sensitivity of activities that people get involved with during their weekends, as opposed to weekday activities being largely repetitive and predictable. For example, the weather could have an impact on discretionary shopping or outdoor activities during a weekend. Also, many special events are held during weekends. Because of the complexities of weekend traffic, few conclusions are made, with the remaining data being informational.

Map 4 and Table 3 illustrate the change in average Saturday traffic volumes during the closure of the Midtown Tunnel. Many of the changes in traffic patterns are similar to those seen for the weekday traffic. There is increased traffic along the Elizabeth River routes of the Downtown Tunnel, Jordan Bridge, and Gilmerton Bridge. There are also increases in traffic on the HRBT and I-564. Likewise, there were decreases at the MMMBT, Western Fwy., and Hampton Blvd. There were also many other roads (e.g., Northampton Blvd., Dominion Blvd., several roads on the Peninsula) with increases in volume. They may or may not have been impacted by the Midtown Tunnel closing. For example, those living on the Peninsula may have chosen to not travel to South Hampton Roads on weekends while the Midtown Tunnel was closed, instead staying closer to home, with the result being an increase in volume on the Peninsula roads. This explanation is speculative, however.

Elizabeth River and Peninsula-South Hampton Roads Crossings

It appears that the total volume of traffic using the Elizabeth River crossings declined during the Midtown Tunnel closure. See Table 4. Two important continuous traffic count locations were unavailable, however – the I-64 High-Rise Bridge and the Campostella Bridge. This prevents making a definitive calculation of all Elizabeth River Crossings. These two missing facilities would have to have increased in traffic volume by almost 15,000 vehicles per day to help make up for the loss of traffic at the Midtown Tunnel. The Jordan Bridge (without a toll) was the most desirable alternate to the Midtown Tunnel during the week while the Downtown Tunnel was the most desirable alternate on the weekend.

The volume of traffic crossing from the Peninsula to South Hampton Roads was not impacted as greatly by the Midtown Tunnel closure as the Elizabeth River crossings. The most noticeable impact was a shift of users from the MMMBT to the HRBT. During the week, the net effect was almost negligible, with a change of only a little over 400 in total Hampton Roads crossings. On Saturdays, there was an average increase of about 3,000 in total Hampton Roads crossings, possibly due to truck and personal trips involved with continued clean-up following Isabel.
### TABLE 4. Elizabeth River and Peninsula-South Hampton Roads Crossings

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>MT</td>
<td>Midtown Tunnel</td>
<td>Norfolk</td>
<td>Portsmouth</td>
<td>-37,631</td>
<td>100%</td>
<td>-22,158</td>
<td>100%</td>
</tr>
<tr>
<td>JB</td>
<td>Jordan Bridge</td>
<td>Chesapeake</td>
<td>Portsmouth</td>
<td>+13,535</td>
<td>36%</td>
<td>+6,546</td>
<td>30%</td>
</tr>
<tr>
<td>DT</td>
<td>Downtown Tunnel</td>
<td>Norfolk</td>
<td>Portsmouth</td>
<td>+4,771</td>
<td>13%</td>
<td>+10,491</td>
<td>47%</td>
</tr>
<tr>
<td>150123</td>
<td>Gilmerton Bridge</td>
<td>Canal Dr.</td>
<td>Bainbridge Bvd.</td>
<td>+4,652</td>
<td>12%</td>
<td>+1,462</td>
<td>7%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SUBTOTAL</td>
<td>-14,673</td>
<td>61%</td>
<td>-3,659</td>
</tr>
<tr>
<td>I-64</td>
<td>High-rise bridge</td>
<td>I-464</td>
<td>G.W. Hwy.</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td></td>
<td>Campostella bridge</td>
<td>I-264</td>
<td>Wilson Rd.</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
</tbody>
</table>

### Change is avg. volume with Midtown Tunnel closed minus avg. volume with M.T. open.

n.a. = not available
MAP 4. Change in Saturday Traffic Volumes With Midtown Tunnel Closed
### TABLE 3. Traffic Volumes for Typical Saturday vs. Midtown Tunnel Closed Saturday

<table>
<thead>
<tr>
<th>ID</th>
<th>Locality</th>
<th>Road</th>
<th>From</th>
<th>To</th>
<th>Typical Saturday Volume</th>
<th>Midtown Closed Saturday Volume</th>
<th>Change Volume</th>
<th>Change %</th>
</tr>
</thead>
<tbody>
<tr>
<td>MT</td>
<td>Norfolk / Ports</td>
<td>Midtown Tunnel</td>
<td>Norfolk</td>
<td>Portsmouth</td>
<td>22,158</td>
<td>0</td>
<td>-22,158</td>
<td>-100%</td>
</tr>
<tr>
<td>DT</td>
<td>Norfolk / Ports</td>
<td>Downtown Tunnel</td>
<td>Norfolk</td>
<td>Portsmouth</td>
<td>89,529</td>
<td>100,021</td>
<td>10,491</td>
<td>11.7%</td>
</tr>
<tr>
<td>J6 / J9</td>
<td>Chesapeake / Ports</td>
<td>Jordan Bridge</td>
<td>Chesapeake</td>
<td>Portsmouth</td>
<td>3,309</td>
<td>9,855</td>
<td>6,546</td>
<td>197.8%</td>
</tr>
<tr>
<td>50163 / 150051 NN</td>
<td>I-64</td>
<td>Oyster Point Rd.</td>
<td>J. Clyde Morris Blvd.</td>
<td>118,684</td>
<td>123,645</td>
<td>4,960</td>
<td>4.2%</td>
<td></td>
</tr>
<tr>
<td>150108</td>
<td>Newport News</td>
<td>Jefferson Ave</td>
<td>Denbigh Blvd</td>
<td>Richneck Rd</td>
<td>34,031</td>
<td>37,743</td>
<td>3,712</td>
<td>10.9%</td>
</tr>
<tr>
<td>HRBT</td>
<td>Hampton / Norfolk</td>
<td>I-64 (HRBT)</td>
<td>Hampton</td>
<td>Norfolk</td>
<td>86,491</td>
<td>89,095</td>
<td>2,604</td>
<td>3.0%</td>
</tr>
<tr>
<td>150010 / 150079 Portsmouth</td>
<td>I-264</td>
<td>Victory Blvd.</td>
<td>Portsmouth Blvd.</td>
<td>53,824</td>
<td>56,233</td>
<td>2,409</td>
<td>4.5%</td>
<td></td>
</tr>
<tr>
<td>677732</td>
<td>Va. Beach</td>
<td>Independence Blvd</td>
<td>Va. Beach Blvd</td>
<td>Pembroke Blvd</td>
<td>48,065</td>
<td>50,441</td>
<td>2,376</td>
<td>4.9%</td>
</tr>
<tr>
<td>677768</td>
<td>Va. Beach</td>
<td>Northampton Blvd</td>
<td>Diamond Springs Rd</td>
<td>35,537</td>
<td>37,817</td>
<td>2,280</td>
<td>6.4%</td>
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</tr>
<tr>
<td>150114</td>
<td>Norfolk</td>
<td>Tidewater Dr</td>
<td>Norview Ave</td>
<td>Cromwell Dr</td>
<td>33,484</td>
<td>35,707</td>
<td>2,222</td>
<td>6.6%</td>
</tr>
<tr>
<td>150101</td>
<td>Newport News</td>
<td>Jefferson Ave</td>
<td>Main St</td>
<td>Harpersville Rd</td>
<td>44,265</td>
<td>46,433</td>
<td>2,168</td>
<td>4.9%</td>
</tr>
<tr>
<td>150092</td>
<td>Hampton</td>
<td>HRCP</td>
<td>I-64</td>
<td>Magruder Blvd</td>
<td>41,975</td>
<td>43,910</td>
<td>1,935</td>
<td>4.6%</td>
</tr>
<tr>
<td>150107</td>
<td>Newport News</td>
<td>Ft Eustis Blvd</td>
<td>Jefferson Ave</td>
<td>NCL, Newport News</td>
<td>13,154</td>
<td>15,049</td>
<td>1,894</td>
<td>14.4%</td>
</tr>
<tr>
<td>150998</td>
<td>Chesapeake</td>
<td>Bridge Rd</td>
<td>Churchland Blvd</td>
<td>ECL, Suffolk</td>
<td>21,738</td>
<td>23,605</td>
<td>1,867</td>
<td>8.6%</td>
</tr>
<tr>
<td>150095</td>
<td>Chesapeake</td>
<td>Military Hwy</td>
<td>ECL, Suffolk</td>
<td>I-664</td>
<td>61,254</td>
<td>63,116</td>
<td>1,862</td>
<td>3.0%</td>
</tr>
<tr>
<td>150091</td>
<td>Hampton</td>
<td>Armstead Ave</td>
<td>Tidemill Ln</td>
<td>Hampton Roads Center Pkwy</td>
<td>28,446</td>
<td>30,276</td>
<td>1,830</td>
<td>6.4%</td>
</tr>
<tr>
<td>150100</td>
<td>Isle of Wight Co</td>
<td>James River Bridge</td>
<td>na</td>
<td>na</td>
<td>25,780</td>
<td>27,584</td>
<td>1,814</td>
<td>7.0%</td>
</tr>
<tr>
<td>50163</td>
<td>York</td>
<td>GW Mem Hwy</td>
<td>Hampton Hwy</td>
<td>Dare Rd.</td>
<td>50,389</td>
<td>52,120</td>
<td>1,731</td>
<td>3.4%</td>
</tr>
<tr>
<td>150123</td>
<td>Chesapeake</td>
<td>Gilmoreton Bridge</td>
<td>Canal Dr</td>
<td>Bainbridge Blvd</td>
<td>27,195</td>
<td>28,657</td>
<td>1,462</td>
<td>5.4%</td>
</tr>
<tr>
<td>150118</td>
<td>Hampton</td>
<td>Mercury Blvd</td>
<td>Chestnut Ave</td>
<td>Big Bethel Rd</td>
<td>53,230</td>
<td>54,632</td>
<td>1,402</td>
<td>2.6%</td>
</tr>
<tr>
<td>150106</td>
<td>Chesapeake</td>
<td>Dominion Blvd</td>
<td>Cedar Rd</td>
<td>Bainbridge Blvd</td>
<td>25,852</td>
<td>26,938</td>
<td>1,086</td>
<td>4.2%</td>
</tr>
<tr>
<td>150036 / 150037 Norfolk</td>
<td>I-564</td>
<td>Int'l Terminal Blvd</td>
<td>Admiral Taussig Blvd</td>
<td>25,693</td>
<td>26,714</td>
<td>1,021</td>
<td>4.0%</td>
<td></td>
</tr>
<tr>
<td>150120</td>
<td>Norfolk</td>
<td>Int'l Terminal Blvd</td>
<td>Hampton Blvd</td>
<td>Ruthven Rd</td>
<td>21,804</td>
<td>22,789</td>
<td>985</td>
<td>4.5%</td>
</tr>
<tr>
<td>150104</td>
<td>Va. Beach</td>
<td>Shore Dr</td>
<td>Northampton Blvd</td>
<td>Bay Lake Rd</td>
<td>36,812</td>
<td>37,765</td>
<td>953</td>
<td>2.6%</td>
</tr>
<tr>
<td>50078</td>
<td>South Hampton</td>
<td>Rte 58</td>
<td>Bus 58, e. of Courtland</td>
<td>18,268</td>
<td>19,207</td>
<td>939</td>
<td>5.1%</td>
<td></td>
</tr>
<tr>
<td>150110</td>
<td>Norfolk</td>
<td>Princess Anne Rd</td>
<td>Ballentine Blvd</td>
<td>Azalea Garden Rd</td>
<td>19,396</td>
<td>20,322</td>
<td>926</td>
<td>5.1%</td>
</tr>
<tr>
<td>50300</td>
<td>Suffolk</td>
<td>Main St</td>
<td>Nansemond River bridge</td>
<td>27,049</td>
<td>27,987</td>
<td>938</td>
<td>3.4%</td>
<td></td>
</tr>
<tr>
<td>150121 Chesapeake</td>
<td>Battlefield Blvd</td>
<td>I-64</td>
<td>Military Hwy</td>
<td>37,388</td>
<td>38,140</td>
<td>752</td>
<td>2.0%</td>
<td></td>
</tr>
<tr>
<td>150326</td>
<td>Southampton</td>
<td>Rte 58 Bus</td>
<td>Rte 58</td>
<td>w. corp. limit Franklin</td>
<td>2,321</td>
<td>2,835</td>
<td>514</td>
<td>22.1%</td>
</tr>
<tr>
<td>150093</td>
<td>York</td>
<td>Penniman Rd</td>
<td>Rte 199</td>
<td>Colonial Pkwy</td>
<td>3,139</td>
<td>3,368</td>
<td>229</td>
<td>7.3%</td>
</tr>
<tr>
<td>1500127 / 150022 Suffolk</td>
<td>I-664</td>
<td>College Dr</td>
<td>Western Fwy</td>
<td>43,034</td>
<td>43,242</td>
<td>208</td>
<td>0.5%</td>
<td></td>
</tr>
<tr>
<td>50405</td>
<td>York</td>
<td>Denbigh Blvd</td>
<td>Newport News CL</td>
<td>Rte 17</td>
<td>15,699</td>
<td>15,759</td>
<td>60</td>
<td>0.4%</td>
</tr>
<tr>
<td>150096</td>
<td>Chesapeake</td>
<td>Rte 17</td>
<td>N. Carolina state line</td>
<td>10,554</td>
<td>10,526</td>
<td>-28</td>
<td>-0.3%</td>
<td></td>
</tr>
<tr>
<td>150110</td>
<td>Chesapeake</td>
<td>Battlefield Blvd</td>
<td>N. Carolina state line</td>
<td>24,404</td>
<td>24,296</td>
<td>-108</td>
<td>0.4%</td>
<td></td>
</tr>
<tr>
<td>150094</td>
<td>Suffolk</td>
<td>Rte 13</td>
<td>N. Carolina state line</td>
<td>6,274</td>
<td>6,128</td>
<td>-146</td>
<td>-2.3%</td>
<td></td>
</tr>
<tr>
<td>150105</td>
<td>Va. Beach</td>
<td>Oceana Blvd</td>
<td>Credle Rd</td>
<td>First Colonial Rd</td>
<td>27,342</td>
<td>27,158</td>
<td>-184</td>
<td>-0.7%</td>
</tr>
<tr>
<td>150103</td>
<td>Va. Beach</td>
<td>Laskin Rd</td>
<td>Va. Beach Blvd</td>
<td>First Colonial Rd</td>
<td>30,845</td>
<td>30,605</td>
<td>-240</td>
<td>-0.8%</td>
</tr>
<tr>
<td>MMBT</td>
<td>Suffolk</td>
<td>I-664 (MMMBT)</td>
<td>Suffolk</td>
<td>Newport News</td>
<td>45,261</td>
<td>43,872</td>
<td>-1,389</td>
<td>-3.1%</td>
</tr>
<tr>
<td>150119</td>
<td>Norfolk</td>
<td>Hampton Blvd</td>
<td>Lafayette River bridge</td>
<td>28,984</td>
<td>27,466</td>
<td>-1,519</td>
<td>-5.2%</td>
<td></td>
</tr>
<tr>
<td>150109</td>
<td>Portsmouth</td>
<td>Western Fwy</td>
<td>Cedar Ln</td>
<td>West Norfolk Rd</td>
<td>19,542</td>
<td>15,098</td>
<td>-4,444</td>
<td>-22.7%</td>
</tr>
</tbody>
</table>

Typical Saturday is average from 9/2/03 - 9/14/03 and 11/3/03 - 11/26/03.
Midtown Closed Saturday is average from 9/22/03 - 10/14/03, not including Columbus Day weekend.

Source of counts: VDOT and City of Chesapeake.
Response to the Midtown Tunnel Re-opening

The Midtown Tunnel had a noticeable increase in traffic volume immediately following its re-opening (time period Post-Reopening A – 10/16/2003 to 11/2/2003). See Figure 4. Additional profiles for all other facilities are in Appendix A.

The Midtown Tunnel weekday volumes were up about 9,000 vehicles per day during this time period versus “typical” volumes (weekdays: 46,322 vs. 37,631; Saturdays: 31,713 vs. 22,158). The possible reasons for this marked rise during this time period are varied. It could have been simply a reaction to the tunnel finally re-opening, where the media coverage of the re-opening drew new users to the facility for a short time. It could also have been due to increased demand for supplies related to Hurricane Isabel recovery and re-stocking of other goods. Truck trips across the Midtown Tunnel and to the port terminals along Hampton Blvd. would be affected by this demand, although the Hampton Blvd. and Western Fwy. did not rise as much as the Midtown Tunnel volumes.
FIGURE 4. Midtown Tunnel Traffic Volume Profile
Daily Traffic Volume: 8/4/03 to 11/30/03

Source of data: VDOT monthly tunnel reports.
TRANSIT ANALYSIS

Hampton Roads Transit (HRT) provided daily ridership data for the Elizabeth River Ferry and monthly ridership for the entire system. Year 2002 system ridership is included as a reference, to better understand what ridership in September and October 2003 might have looked like if Isabel hadn’t occurred. See Figures 5 and 6 and Table 5. The Elizabeth River Ferry did show a change in ridership during the closing of the Midtown Tunnel. Weekdays increased by an average of over 300 riders and Saturdays increased by over 1,000 riders. There was also a drop in systemwide ridership due to Isabel in September 2003 followed by a recovery in ridership level in October.

<table>
<thead>
<tr>
<th>TIME PERIOD</th>
<th>WEEKDAY</th>
<th>SATURDAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical</td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td></td>
<td>474</td>
<td>1,040</td>
</tr>
<tr>
<td>Midtown Tunnel Closed</td>
<td>833</td>
<td>1,376</td>
</tr>
<tr>
<td>CHANGE</td>
<td>359</td>
<td>336</td>
</tr>
</tbody>
</table>

Weekday is T/W/TH.
Typical is based on ridership for 9/2/03-9/14/03 and 11/3/03-11/26/03, not including 11/11 and 11/22/03.

RELIABILITY OF ALTERNATE CHOICES

The alternate routes chosen by commuters during the closing of the Midtown Tunnel each have their own difficulties with accommodating the additional traffic. Table 6 is a summary of the primary alternate routes studied and their existing and future status.

<table>
<thead>
<tr>
<th>Road</th>
<th>Lanes</th>
<th>Current LOS</th>
<th>Typical Weekday Volume</th>
<th>Current Status</th>
<th>2026 Plan Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midtown Tunnel</td>
<td>2 E</td>
<td>38,000</td>
<td>Long queues at am and pm peaks</td>
<td>No project in Plan.</td>
<td></td>
</tr>
<tr>
<td>Downtown Tunnel</td>
<td>4 F</td>
<td>104,000</td>
<td>Long queues at am and pm peaks</td>
<td>No project in Plan.</td>
<td></td>
</tr>
<tr>
<td>Jordan Bridge</td>
<td>2 C</td>
<td>7,000</td>
<td>Toll. Weight restriction of 3 tons.</td>
<td>No project in Plan.</td>
<td></td>
</tr>
<tr>
<td>Gilmerton Bridge</td>
<td>4 E</td>
<td>37,000</td>
<td>Primary alternate to High-rise Bridge</td>
<td>Bridge replacement project. No additional capacity.</td>
<td></td>
</tr>
<tr>
<td>High-rise Bridge</td>
<td>4 F</td>
<td>88,000</td>
<td>Long queues several days of the week</td>
<td>No project in Plan.</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>16</td>
<td>274,000</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

“LOS” is the lower of the AM or PM LOS based upon typical weekday counts from 1997 to 2000; it is from the “Congestion Management System for Hampton Roads, Virginia 2001 – Technical Appendix”, HRPDC, June 2001. Gilmerton Bridge and High-rise Bridge counts and LOS were updated to reflect recent traffic counts.

When considering the current congestion and desirability of each of the alternate routes to the Midtown Tunnel to get across the Elizabeth River, we can see that the reliability of these routes is already delicate. A breakdown of any one of these individual routes for any time period will have an impact on the other routes. The current Regional Transportation Plan includes no capacity improvements for this whole corridor.
FIGURE 5. Elizabeth River Ferry
Daily Ridership: 8/4/03 to 11/30/03

Source of data: Hampton Roads Transit.
FIGURE 6. Hampton Roads Transit Systemwide Monthly Ridership

COSTS OF HURRICANE ISABEL

The costs associated with Hurricane Isabel’s impact are steep. Table 7 includes cost estimates from a few sectors of the economy. The cost estimates continue to change but do provide an idea of the magnitude of expenses involved with a hurricane.

TABLE 7. Costs Associated With Hurricane Isabel

<table>
<thead>
<tr>
<th>SECTOR</th>
<th>GEOGRAPHY</th>
<th>COST ESTIMATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 VDOT</td>
<td>Virginia</td>
<td>$100 million</td>
</tr>
<tr>
<td>2 Insurance</td>
<td>Virginia</td>
<td>$500 million</td>
</tr>
<tr>
<td></td>
<td>All areas</td>
<td>Over $2 billion</td>
</tr>
<tr>
<td>3 Red Cross</td>
<td>All areas</td>
<td>$14 million to $17 million</td>
</tr>
<tr>
<td>4 Military base repairs</td>
<td>All areas</td>
<td>Over $442 million</td>
</tr>
<tr>
<td>5 Taxable sales</td>
<td>Hampton Roads</td>
<td>$422 million increase</td>
</tr>
<tr>
<td>6 All sectors</td>
<td>Hampton Roads</td>
<td>$1.6 billion</td>
</tr>
</tbody>
</table>

Source:
1 - Virginia Department of Transportation
3 - American Red Cross
4 - Peter Hardin, Richmond Times-Dispatch
5 - Old Dominion University College of Business and Public Administration
6 - Christopher Schnaars, Daily Press.
CONCLUSIONS AND RECOMMENDATIONS

Hurricane Isabel had a tremendous impact on every community in its path, with the Outer Banks and Hampton Roads being among the hardest hit. One of the most significant events for Hampton Roads was the flooding and subsequent closure of the Midtown Tunnel for nearly four weeks. This is a critical highway in the region, serving an average of over 37,000 vehicles each weekday. An analysis of the transportation system during the closing of the Tunnel reveals useful information about the Midtown Tunnel and the region’s transportation system:

- The most desirable alternate routes to the Midtown Tunnel were the Elizabeth River crossings (Jordan Bridge, Downtown Tunnel, and Gilmerton Bridge; data was not available for the High-rise Bridge). The most desirable alternate route for weekday travel was the Jordan Bridge (without a toll). The Downtown Tunnel was the most desirable alternate on Saturdays. Other important alternates were the Hampton Roads Bridge Tunnel, I-564, and the Elizabeth River Ferry.

- The 2026 Regional Transportation Plan includes no capacity improvements to the Elizabeth River Crossings.

- A newly re-opened highway may attract a significant number of new users for a period of time.

- Improved data resources are needed for monitoring use of the region’s traffic and transit systems, for both typical days and as unique events occur (e.g., natural disasters, accidents, completion of new road projects, etc.). This will greatly assist with timely operational analyses.

- The VDOT Smart Traffic Center and the local media are in the position of dispensing “real time” information on traffic conditions and alternate routes during natural disasters and other extraordinary events. Improvement of an action plan to provide this array of information to the public in a useful and timely manner is needed.
Appendix A. Traffic Volume Profiles
WESTERN FREEWAY from Cedar Ln. to West Norfolk Rd.
Daily Traffic Volume: 8/4/03 to 11/30/03

Source of data: VDOT, count ID 150109.
DOWNTOWN TUNNEL (I-264)
Daily Traffic Volume: 8/4/03 to 11/30/03

Source of data: VDOT monthly tunnel reports.
MILITARY HIGHWAY from Canal Dr. to Bainbridge Blvd.
Daily Traffic Volume: 8/4/03 to 11/30/03

DAILY VOLUME

- Summer
- Pre-Isabel
- Isabel week
- Midtown closed
- Midtown re-opened (A)
- Midtown re-opened (B)

Source of data: VDOT, count ID 150123.
Daily Traffic Volume: 8/4/03 to 11/30/03

Source of data: VDOT monthly tunnel reports.
RTE 58 from Bus. 58 e. of Cortland to Bus. 58 w. of Franklin

Daily Traffic Volume: 8/4/03 to 11/30/03

Source of data: VDOT, count ID 50078.
I-64 from Oyster Point Rd. to J. Clyde Morris Blvd.

Daily Traffic Volume: 8/4/03 to 11/30/03

Source of data: VDOT, count ID 50163 and 150051.

Isabel tunnel vols-9.xls  chart I-64
I-264 from Victory Blvd. to Portsmouth Blvd.  
Daily Traffic Volume: 8/4/03 to 11/30/03

Source of data: VDOT, count ID 150010 and 150079.
I-664 from College Dr. to Western Fwy.
Daily Traffic Volume: 8/4/03 to 11/30/03

Source of data: VDOT, count ID 150012 and 150022.
I-564 from International Terminal Blvd. to Hampton Blvd.
Daily Traffic Volume: 8/4/03 to 11/30/03

Source of data: VDOT, count ID 150036 and 150037.
DOMINION BLVD. from Bainbridge Blvd. to Cedar Rd.
Daily Traffic Volume: 8/4/03 to 11/30/03

Source of data: VDOT, count ID 150106.
NORTHAMPTON BLVD. from Diamond Springs Rd. to Independence Blvd.
Daily Traffic Volume: 8/4/03 to 11/30/03

Source of data: VDOT, count ID 677768.
MAIN STREET from Nansemond River bridge to Godwin Blvd.

Daily Traffic Volume: 8/4/03 to 11/30/03

Source of data: VDOT, county ID 50300.

Daily Traffic Volume: 8/4/03 to 11/30/03

- Summer
- Pre-Isabel
- Isabel Week
- Midtown Closed
- Midtown Re-opened (A)
- Midtown Re-opened (B)
BRIDGE ROAD from Churchland Blvd. to Suffolk corporate limits
Daily Traffic Volume: 8/4/03 to 11/30/03

Source of data: VDOT, count ID 150098.
BATTLEFIELD BOULEVARD from North Carolina state line to Ballahack Rd.

Daily Traffic Volume: 8/4/03 to 11/30/03

Source of data: VDOT, count ID 150111.
INTERNATIONAL BOULEVARD from Hampton Blvd. to Ruthven Rd.
Daily Traffic Volume: 8/4/03 to 11/30/03

Source of data: VDOT, count ID 150120.
LASKIN ROAD from Virginia Beach Blvd. to First Colonial Rd.
Daily Traffic Volume: 8/4/03 to 11/30/03

Source of data: VDOT, count ID 150103.
PRINCESS ANNE ROAD from Azalea Garden Rd. to Ballentine Blvd.

Daily Traffic Volume: 8/4/03 to 11/30/03

Source of data: VDOT, count ID 150110.
TIDEWATER DRIVE from Norview Ave. to Cromwell Dr.
Daily Traffic Volume: 8/4/03 to 11/30/03

Source of data: VDOT, count ID 150114.
HAMPTON BOULEVARD from Lafayette River bridge to Lexan Ave.

Daily Traffic Volume: 8/4/03 to 11/30/03

Source of data: VDOT, count ID 150119.
ROUTE 13 from North Carolina state line to Route 616
Daily Traffic Volume: 8/4/03 to 11/30/03

Source of data: VDOT, count ID 150094.
SHORE DRIVE from Northampton Blvd. to Bay Lake Rd.
Daily Traffic Volume: 8/4/03 to 11/30/03

Source of data: VDOT, count ID 150104.
INDEPENDENCE BLVD. from Pembroke Blvd. to Virginia Beach Blvd.

Daily Traffic Volume: 8/4/03 to 11/30/03

Source of data: VDOT, count ID 677732.
BUSINESS ROUTE 58 from Rte. 58 to w. corporate limits of Franklin
Daily Traffic Volume: 8/4/03 to 11/30/03

Source of data: VDOT, count ID 150326.

Daily Traffic Volume: 8/4/03 to 11/30/03

Isabel
summer
pre-Isabel
Isabel week
Midtown closed
Midtown re-opened (A)
Midtown re-opened (B)
ROUTE 17 from Hampton Hwy. to Dare Rd.
Daily Traffic Volume: 8/4/03 to 11/30/03

Source of data: VDOT, count ID 50193.
DENBIGH BOULEVARD from Newport News corporate limit to Route 17
Daily Traffic Volume: 8/4/03 to 11/30/03

Source of data: VDOT, count ID 50405.
ARMISTEAD AVENUE from Tidemill Ln. to Hampton Roads Center Pkwy.

Daily Traffic Volume: 8/4/03 to 11/30/03

Source of data: VDOT, count ID 150091.

DAILY VOLUME

summer  pre-Isabel  Isabel  week  Midtown closed  Midtown re-opened (A)  Midtown re-opened (B)

Source of data: VDOT, count ID 150091.
JEFFERSON AVENUE from Denbigh Blvd. to Richneck Rd.

Daily Traffic Volume: 8/4/03 to 11/30/03

Source of data: VDOT, count ID 150108.
FORT EUSTIS BOULEVARD from Jefferson Ave. to n. corporate limits of Newport News

Daily Traffic Volume: 8/4/03 to 11/30/03

Source of data: VDOT, count ID 150107.
MERCURY BOULEVARD from Chestnut Ave. to Big Bethel Rd.

Daily Traffic Volume: 8/4/03 to 11/30/03

Source of data: VDOT, count ID 150118.
JAMES RIVER BRIDGE
Daily Traffic Volume: 8/4/03 to 11/30/03

Source of data: VDOT, count ID 150100.
Appendix B. Map of Hampton Roads
MAP B1. Map of Hampton Roads
Appendix C. Aerial View of the Midtown Tunnel
FIGURE C1. Aerial View of the Midtown Tunnel

Aerial imagery © Commonwealth of Virginia

mtaerial4.wmf
Appendix D. Travel Demand Forecasting Model Analysis
The extensive data collected for the analysis of the Midtown Tunnel closure also provides a very rare opportunity to test the ability of the regional travel demand forecasting (TDF) model. The model is used for a variety of transportation planning activities, including analyzing the impact of highway improvements, examining traffic patterns in the region, and as a part of the air quality conformity process.

Highway alternatives tested with the TDF model are usually widenings of an existing road or the construction of a new highway. Use of the Midtown Tunnel closure data is a somewhat unconventional test because it is a check of how the model responds to the removal of an existing facility. However, this shouldn’t lower the expectations of how well the model performs.

**Table D1** compares the change in average weekday volume as estimated by the TDF model (with no Midtown Tunnel and no Jordan Bridge toll) versus the actual change in volume. The difference between the model volume change and the actual volume change ranged from +16,431 to –4,968. Over half of the segments had a difference of less than 1,000, and over 80% had a difference of 3,000 or less. See Figure D2. A scatter plot of model volumes versus actual volumes shows a good fit at a macro level both with the Midtown Tunnel open and after it is closed. See Figure D3.

The model had the most difficulty with allocating the change in traffic to the Elizabeth River crossings. The model overestimated the increase on the Downtown Tunnel and underestimated the increase on the Jordan Bridge and Gilmerton Bridge. It also underestimated the decrease in volume on I-664, Western Fwy., and Hampton Blvd.

correctly predicted an increase or decrease in volume, the model was correct 64% of the time (23 of 36 segments).

**FIGURE D1. Travel Demand Forecasting Network Near Midtown Tunnel**

![Sample Network Diagram](samplenet.emf)
TABLE D1. Travel Demand Forecasting Model Estimate of Midtown Tunnel Closure

<table>
<thead>
<tr>
<th>ID</th>
<th>LOCALITY</th>
<th>ROAD</th>
<th>FROM</th>
<th>TO</th>
<th>ACTUAL CHANGE VOLUME</th>
<th>MODEL CHANGE WITH MIDTOWN VOLUME</th>
<th>MODEL CHG FROM MIDTOWN M.T. CLOSED VOLUME</th>
<th>MODEL CHANGE % CHANGE</th>
<th>DIFF.</th>
<th>MODEL CHG vs ACTUAL CHG</th>
</tr>
</thead>
<tbody>
<tr>
<td>MT</td>
<td>Norf / Ports</td>
<td>Midtown Tunnel</td>
<td>Norfolk</td>
<td>Portsmouth</td>
<td>-37,631</td>
<td>40,024</td>
<td>0</td>
<td>-40,024</td>
<td>-100%</td>
<td>-2,393</td>
</tr>
<tr>
<td>DT</td>
<td>Norf / Ports</td>
<td>Downtown Tunnel</td>
<td>Norfolk</td>
<td>Portsmouth</td>
<td>4,777</td>
<td>99,066</td>
<td>120,268</td>
<td>21,202</td>
<td>21.4%</td>
<td>16,431</td>
</tr>
<tr>
<td>JB</td>
<td>Ches / Ports</td>
<td>Jordan Bridge</td>
<td>Chesapeake</td>
<td>Portsmouth</td>
<td>15,535</td>
<td>10,331</td>
<td>18,898</td>
<td>8,567</td>
<td>82.9%</td>
<td>-4,968</td>
</tr>
<tr>
<td>HRBT</td>
<td>Hamp / Norf</td>
<td>I-64 (HRBT)</td>
<td>Hampton</td>
<td>Norfolk</td>
<td>1,735</td>
<td>84,312</td>
<td>86,275</td>
<td>1,963</td>
<td>2.3%</td>
<td>230</td>
</tr>
<tr>
<td>150123</td>
<td>Ches</td>
<td>Gilmerton Bridge</td>
<td>Canal Dr</td>
<td>Bainbridge Blvd</td>
<td>4,602</td>
<td>23,506</td>
<td>24,602</td>
<td>1,096</td>
<td>4.7%</td>
<td>-3,556</td>
</tr>
<tr>
<td>150036 / 150037</td>
<td>Norfolk</td>
<td>I-564</td>
<td>Int'l Terminal Blv</td>
<td>Admiral Taussig Blvd</td>
<td>3,395</td>
<td>60,901</td>
<td>61,752</td>
<td>851</td>
<td>1.4%</td>
<td>-2,544</td>
</tr>
<tr>
<td>150100</td>
<td>Isle of Wight Co</td>
<td>James River Bridge</td>
<td>na</td>
<td>na</td>
<td>652</td>
<td>25,931</td>
<td>26,283</td>
<td>352</td>
<td>1.4%</td>
<td>-560</td>
</tr>
<tr>
<td>150105</td>
<td>Va. Beach</td>
<td>Oceana Blvd</td>
<td>Crede Rd</td>
<td>First Colonial Rd</td>
<td>1,275</td>
<td>25,070</td>
<td>25,324</td>
<td>254</td>
<td>1.0%</td>
<td>-1,022</td>
</tr>
<tr>
<td>150106</td>
<td>Chesapeake</td>
<td>Dominion Blvd</td>
<td>Cedar Rd</td>
<td>Bainbridge Blvd</td>
<td>-2,393</td>
<td>22,488</td>
<td>22,712</td>
<td>222</td>
<td>1.0%</td>
<td>516</td>
</tr>
<tr>
<td>150091</td>
<td>Hampton</td>
<td>Armistead Ave</td>
<td>Tidemill Rd</td>
<td>Hampton Roads Center Pkwy</td>
<td>-443</td>
<td>32,380</td>
<td>32,594</td>
<td>214</td>
<td>0.7%</td>
<td>-229</td>
</tr>
<tr>
<td>150095</td>
<td>Chesapeake</td>
<td>Military Hwy</td>
<td>ECL Suffolk</td>
<td>I-664</td>
<td>-1,045</td>
<td>75,446</td>
<td>75,571</td>
<td>125</td>
<td>0.2%</td>
<td>1,170</td>
</tr>
<tr>
<td>150092</td>
<td>Hampton</td>
<td>HRCP</td>
<td>I-64</td>
<td>Magnuder Blvd</td>
<td>-368</td>
<td>39,502</td>
<td>39,621</td>
<td>119</td>
<td>0.3%</td>
<td>-227</td>
</tr>
<tr>
<td>150118</td>
<td>Hampton</td>
<td>Mercury Blvd</td>
<td>Chestnut Ave</td>
<td>Big Bethel Rd</td>
<td>3,470</td>
<td>43,314</td>
<td>43,424</td>
<td>110</td>
<td>0.3%</td>
<td>-3,346</td>
</tr>
<tr>
<td>50193</td>
<td>York</td>
<td>GW Mem Hwy</td>
<td>Hampton Hwy</td>
<td>Dare Rd</td>
<td>141</td>
<td>44,423</td>
<td>44,488</td>
<td>65</td>
<td>0.1%</td>
<td>-76</td>
</tr>
<tr>
<td>150107</td>
<td>Newport News</td>
<td>Ft Eustis Blvd</td>
<td>Jefferson Ave</td>
<td>NCL Newport News</td>
<td>-237</td>
<td>16,978</td>
<td>17,015</td>
<td>37</td>
<td>0.2%</td>
<td>274</td>
</tr>
<tr>
<td>150093</td>
<td>York</td>
<td>Penniman Rd</td>
<td>Rte 199</td>
<td>Colonial Pkwy</td>
<td>-145</td>
<td>29,267</td>
<td>29,303</td>
<td>36</td>
<td>0.1%</td>
<td>-309</td>
</tr>
<tr>
<td>150108</td>
<td>Newport News</td>
<td>Jefferson Ave</td>
<td>Denbigh Blvd</td>
<td>Richneck Rd</td>
<td>-368</td>
<td>29,267</td>
<td>29,303</td>
<td>36</td>
<td>0.1%</td>
<td>-309</td>
</tr>
<tr>
<td>150103</td>
<td>Va. Beach</td>
<td>Laskin Rd</td>
<td>Va. Beach Blvd</td>
<td>First Colonial Rd</td>
<td>45</td>
<td>28,369</td>
<td>28,402</td>
<td>34</td>
<td>0.1%</td>
<td>-460</td>
</tr>
<tr>
<td>150104</td>
<td>Va. Beach</td>
<td>Shore Dr</td>
<td>Northampton Blvd</td>
<td>Bay Lake Rd</td>
<td>-4</td>
<td>41,556</td>
<td>41,589</td>
<td>33</td>
<td>0.1%</td>
<td>36</td>
</tr>
<tr>
<td>67732</td>
<td>Va. Beach</td>
<td>Independence Blvd</td>
<td>Va. Beach Blvd</td>
<td>Pembroke Blvd</td>
<td>778</td>
<td>43,466</td>
<td>43,486</td>
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FIGURE D2. Difference Between Model Volume Change and Actual Volume Change

FIGURE D3. Model Volume vs. Actual Volume

TYPICAL WEEKDAY: MIDTOWN TUNNEL CLOSED AND NO TOLL ON JORDAN BRIDGE

TYPICAL WEEKDAY: MIDTOWN TUNNEL OPEN AND TOLL ON JORDAN BRIDGE
Appendix E. VDOT Newsletter on Hurricane Isabel
Isabel blusters; VDOT not bullied

More than 1,000 roads were shut down by the hurricanes' onslaught. Within a week, most were clear of debris for motorists to travel again.

Hurricane Isabel blustered and flooded across Virginia Sept. 18, ripping roofs, knocking over silo-sized trees, turning off millions of lights, and shutting down 1,000 of Virginia's roads from Hampton Roads to the Shenandoah Valley to the Washington suburbs. Coming ashore as barely a "Category 2," the damage she caused put her, in many Virginians' minds, in the category of "catastrophic."

VDOT employees, on the ready as the storm made its destructive way into the state, were deployed everywhere, clearing roads and giving assistance to stranded motorists. Fallen trees, water, accidents, debris, washouts, and shattered telephone poles confronted hundreds of crews from the department. Electric power complicated the recovery — whether on or off — as the lack of power darkened 351 traffic signals in Fairfax.
County alone, and the presence of power in downed lines and trees inhibited VDOT’s workforce.

Then, a tornado crashed through Southside and Central Virginia Sept. 23, closing another 200 roads. But despite the tornado’s added insult, by Sept. 26 VDOT crews had reopened all but 72 roads closed by the storm and 32 roads hit by the tornado.

It wasn't without the work of almost 4,000 VDOTers, some of them performing near-Herculean efforts. While employees in the field struggled to make road repairs, VDOT office staffs strived to serve them, as well as the public. The Transportation Emergency Operations Center, to mention just one example, handled 35,136 calls from concerned citizens from Sept. 16-22.

Commissioner Philip Shucet commended every one of them: "No matter your job; no matter whether you're in the field or in the central office, all of you contributed in a positive way to our efforts over the past several days. From the people behind the desks to the people in the field with chain saws, it takes all of us to make this department work. And work it did."

Unfortunately, two VDOTers experienced serious injuries (see accompanying story).

Damages were not so light. The current estimate for all of VDOT's costs associated with Hurricane Isabel is $100 million, including damages to roads and other infrastructure.

**Heroic effort at Midtown Tunnel**

Stealing early into Hampton Roads with an advance thrust, Hurricane Isabel reached ruthlessly for the lives of VDOT employees trying to protect the Midtown Tunnel between Norfolk and Portsmouth. Risking their lives to put the tunnel's foot-thick...
floodgate in place before the hurricane hit, the tunnel team had to stop to rescue each other as the Elizabeth River poured in on them.

A steel plate, which had to be removed from the pavement before the floodgate could be locked, stayed stuck despite employees’ mighty efforts to pull it loose. David Kurtich, one of the first workers to arrive, removed four bolts that helped hold the plate down, but neither he nor others arriving could knock loose the temporary welds on the plate, which normally are broken with a small hammer. As they grappled with the plate, now under the rising water, the flood began to engulf them.

VDOTers began rushing to the scene as they heard of the struggle. Darrell Southerland drove a truck through three-feet of water from the Portsmouth side, and Facility Manager Bruce Wilkerson tried to do the same in his car, but was stalled by the rising flood. Robert Hewitt left his stalled pickup in the tunnel and scurried along a handrail on top of the catwalk to get to the Norfolk side with a big pry bar. Meanwhile, Robert Huffman drove a hefty tow truck from the Norfolk side to the tunnel entrance to haul the men out if necessary. After jumping out of the truck and trying to help with the plate, Huffman was swept into the tunnel. He was rescued only after a human chain of workers was formed to pull him back.

Finally, after Southerland phoned to say, "It's dangerous. We're losing it," facility manager Wilkerson told him to "Pull 'em." The men scrambled onto two trucks and drove out of the deepening storm surge.

After their defeat by the watery assault, tunnel employees were Opening in which the steal plate was locked at Midtown Tunnel

Citizens, leaders praise VDOT

"Please pass along to the entire 'storm team' my deepest appreciation and respect for the tremendous job that is being done. I have been proactively calling localities and asking their needs. The most frequent compliment I get is about VDOT's initiative and work ethic. Do not allow a few sporadic complaints, that will always find their way into the press, deter you from understanding of how grateful Virginians, and this Governor, are for your service."

- William H. Leighty, chief of staff, Office of the Governor.
downcast. Some called Wilkerson and offered to resign. Wilkerson said, "What for?" Responding to questions from the media, Commissioner Philip Shucet said, "There was no failure. There was no human error. Nature won."

Within the next week, the men's heroic stand had been praised not only by Commissioner Shucet, who called them gallant; but also by Gov. Mark Warner, who said the men had gone above and beyond the call of duty; and by President George Bush, who recognized them in a stop in Richmond for reports on storm recovery efforts.

The tunnel, which completely filled with 44 million gallons of water, has been pumped dry, and an assessment of damage from flooding to the tunnel systems is under way. Meanwhile, the tunnel team was planning temporary repairs that would allow motorists to use the Midtown tunnel during drive-time.

Two in Staunton seriously hurt

Two Staunton District employees, Garland F. Presgraves and Randal W. Vorous, felt the punch of a treacherous Hurricane Isabel as they worked to clear roads in Clarke County during the night of the storm.

As they intently cut up trees blocking Route 50, another tree, unseen by them, succumbed to the winds and fell with all its force on them. Vorous was able to crawl out from under the pressure of the fallen limbs, but he could not see Presgraves or get him to answer his call. After a desperate search of the flattened foliage, he found his workmate unconscious. After signaling for emergency help, Vorous sawed a path into where Presgraves lay. When emergency workers arrived, they were able to go right to Pregraves and lift him onto a stretcher.

Pesgraves was in serious condition at last report. Vorous had been treated and released from the hospital. They represent the commitment, in the face of danger, that VDOT

"You've got to hand it to VDOT. Battered by snow all winter, then taunted by rains and harangued by complaints of unmowed grass all summer, department workers have been out busting their humps 24-7."

- Chris Dovi, Street Beat columnist, Richmond-Times Dispatch

"Just wanted to say 'thanks' to all the hard-work during (the) hurricane. As a 911 officer, I know it was a busy time for us all. Thanks for the road work and more, Virginia DOT."

- Stuart, Hanover County

"I was super-pleased to see the work that was done during the storm to clear the roads of trees and put the lights back on in Pittsylvania County by 3 a.m. (Sept. 19).... Please pass on... praise...(to) those who brave the storm to keep us safe."

workers show every time a disaster touches the Commonwealth.
Appendix F. References

hurr-isabel-20030918-1715-g122kmvs.jpg (black and white cover photo) downloaded from www1.ncdc.noaa.gov/pub/data/images/hurr-isabel-20030918-1715-g122kmvs.jpg, downloaded 2/24/04

Isabel.hurricane.track.jpg downloaded from www2.ncsu.edu/eos/service/pams/meas/sco/research/nws/cases/20030918/isabel.hurricane.track.jpg on 2/24/04

Tunnelflood0920n.jpg downloaded from www.hamptonroads.com/images/temp/tunnelflood0920n.jpg on 4/14/04


