

Hampton Roads Regional Travel Time: Analysis

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ABSTRACT

This is an update to the regional travel time study for Hampton Roads and is the second travel time study in the region to use a Global Positioning System (GPS) for data collection and a Geographic Information System (GIS) for data analysis. The first comprehensive travel time study for the Southside was produced in 1983 and the first regional travel time study for the Peninsula was published in 1992. For this study, travel time data was collected on over 1,400 miles of roadway, including all of the thoroughfares contained in the Congestion Management Process for Hampton Roads.

The **Hampton Roads Regional Travel Time Trip Profile Summaries** contains the travel time summary profiles generated by the GPS/GIS system and is available in a hyperlinked format on CD or on the HRPDC website. The **Hampton Roads Regional Travel Time: Analysis** includes information on how the study was performed and analyses of the data collected for the study in the form of travel time contour maps and point-to-point travel time comparisons for selected activity centers.

ACKNOWLEDGMENTS

This report was prepared by the Hampton Roads Planning District Commission (HRPDC) in cooperation with the U.S. Department of Transportation (USDOT), the Federal Highway Administration (FHWA), and the Virginia Department of Transportation (VDOT). The contents of this report reflect the views of the staff of the Hampton Roads Area Metropolitan Planning Organization (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 FHWA, VDOT, or HRPDC. This 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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INTRODUCTION

Commuters often measure the length of their trips in terms of time rather than distance. Motorists pride themselves on knowing shortcuts and alternate routes, on avoiding accidents, incidents and delays, and on the resulting time saved for having such knowledge.

For more than 20 years the Hampton Roads Planning District Commission has worked to provide the region with complete, comprehensive travel time data and analysis through its **Regional Travel Time Study**.

Performed approximately every five years, the **Hampton Roads Regional Travel Time Study** provides a glimpse of the area's best and worst traffic conditions. This "snapshot" assists planners, engineers and developers in making decisions regarding business and home siting, as well as transportation improvements.

History

The study began on the Southside of Hampton Roads in 1983 and was joined by a Peninsula study, first published in 1992. The first complete regional study (southside and peninsula combined) was conducted in 1995.

The current study is compiled into two parts: The **Hampton Roads Regional Travel Time Trip Profile Summaries** and the **Hampton Roads Regional Travel Time: Analysis**. The **Trip Profile Summaries** portion of the study contains the travel time summary profiles generated by the GPS/GIS system and is available in a hyperlinked format on CD or on the HRPDC website. The **Hampton Roads Regional Travel**

Time: Analysis includes information on how the study was performed and analyses of the data collected for the study in the form of travel time contour maps and point-to-point travel time comparisons for selected activity centers. This portion of the study is also available on the HRPDC website or in hard copy.

Study Area

The Hampton Roads Metropolitan Planning Organization (MPO) study area is located in southeastern Virginia and covers more than 1,800 square miles. The area is divided into two sub-regions: the Peninsula and the Southside. The Peninsula is comprised of the cities of Hampton, Newport News, Poquoson, and Williamsburg, and the counties of James City, Gloucester and York. The Southside is comprised of the cities of Chesapeake, Norfolk, Portsmouth, Suffolk, Virginia Beach, and the county of Isle of Wight.



Regional Travel Time Study Area

For the purpose of this study, only roadways within the MPO study area were used.

Travel Time Network

The Travel Time road network consists of more than 1,400 miles of roadway in 13 jurisdictions. It is comprised primarily of the thoroughfare segments contained within the **Congestion Management Process (CMP)** network, formerly called the **Congestion Management System** network.

The total roadway mileage in the 2005 study is up 23%, nearly 320 miles, from the 2000 Travel Time Study. Most new roadway miles were added when all of Isle of Wight County became part of the MPO study area.

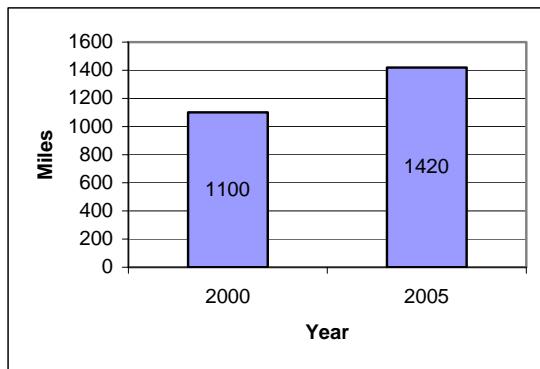


Figure 1-- Change in Travel Time Network Miles

For the 2005 Travel Time study the road network was divided into 339 run segments of varying lengths. One run was made in each direction during both the morning and afternoon peak hours. A list of travel time run segments used for this study may be found in **Appendix A.**

Methodology

Like the 2000 Regional Travel Time Study, the 2005 study used a global

positioning system (GPS) to collect data and a geographic information system (GIS) to process and analyze data.

Collection of data for the 2005 study took a full year to complete. Data collection began in January of 2005 and concluded in mid-December 2005. Data was collected during the week, with the exception of Monday mornings and Friday afternoons, to account for pre and post weekend traffic volumes that may be unusually heavy or light.

Using a GPS-equipped vehicle, data was collected by a driver attempting to be the “average” vehicle in the stream of traffic, while still obeying the posted speed limit. Upon completion of a day’s data collection, the GPS unit was downloaded into the GIS. From there the data was processed and analyzed using a customized ArcView 3.2 application.



GPS equipped vehicle with handheld data logger.

THE BIG PICTURE: WHAT THE DATA REVEALS

Regional Travel Time Contour Maps

By nature of design, travel time studies lend themselves to mapping. Mapping, especially contour mapping, is an effective way of conveying study results.

Prior to the use of GIS, creating travel time contours was a time consuming, laborious task involving manual calculations and hand drawn maps. The customized GIS application now used at the HRPDC has automated the process to a point in which a finished contour can be produced in about two hours. **Figures 2 to 4** illustrate the steps a GIS-produced contour undergoes to arrive at the final product.

To get the 'big picture' of this study, contour maps were created for 14 regional activity centers throughout Hampton Roads (**Figures 5 and 6**).

New to the list of activity centers is the town of Smithfield, in Isle of Wight County. Another new addition came when one existing activity center, Downtown Norfolk-Portsmouth, was divided into two separate and independent activity centers: Downtown Norfolk and Downtown Portsmouth. The division is designed to provide more even coverage across the study area.

To create a contour, a predetermined central point, or *centroid*, was selected for each of the 14 activity centers. Travel times were computed in all directions outbound from the centroid for a specific time interval. For this study contours were created in ten and twenty minute intervals using the afternoon peak hour data.

A list of the maps and their centroids may be found on [page 6](#).

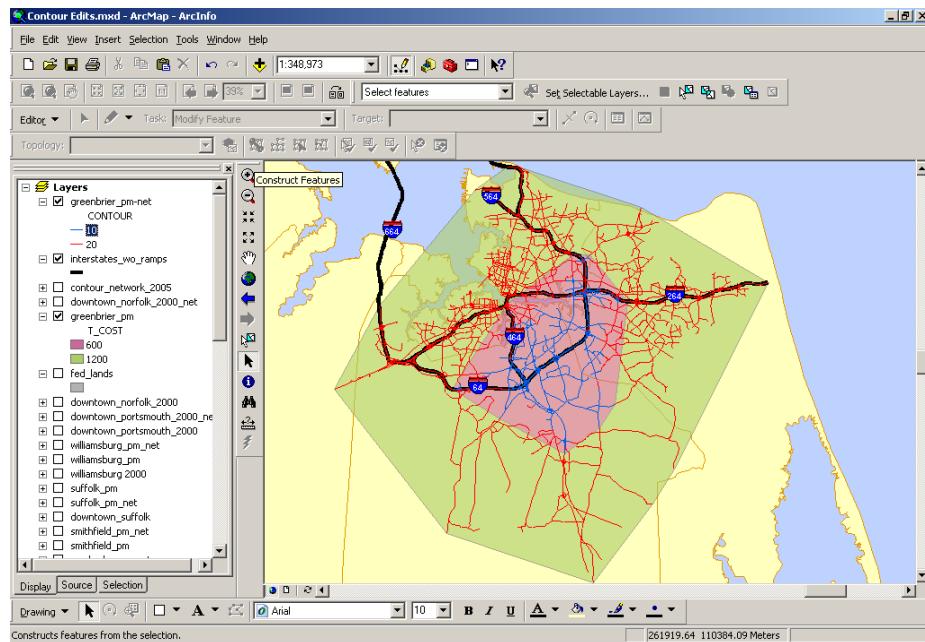


Figure 2. A 'Raw' Contour as Produced by the GIS. A 'raw' contour and its network as created by the customized ArcView 3.2 Travel Time application. The pink polygon and the blue portion of the network represent the 10-minute contour, while the green polygon and red portion of the network represent the 20-minute contour.

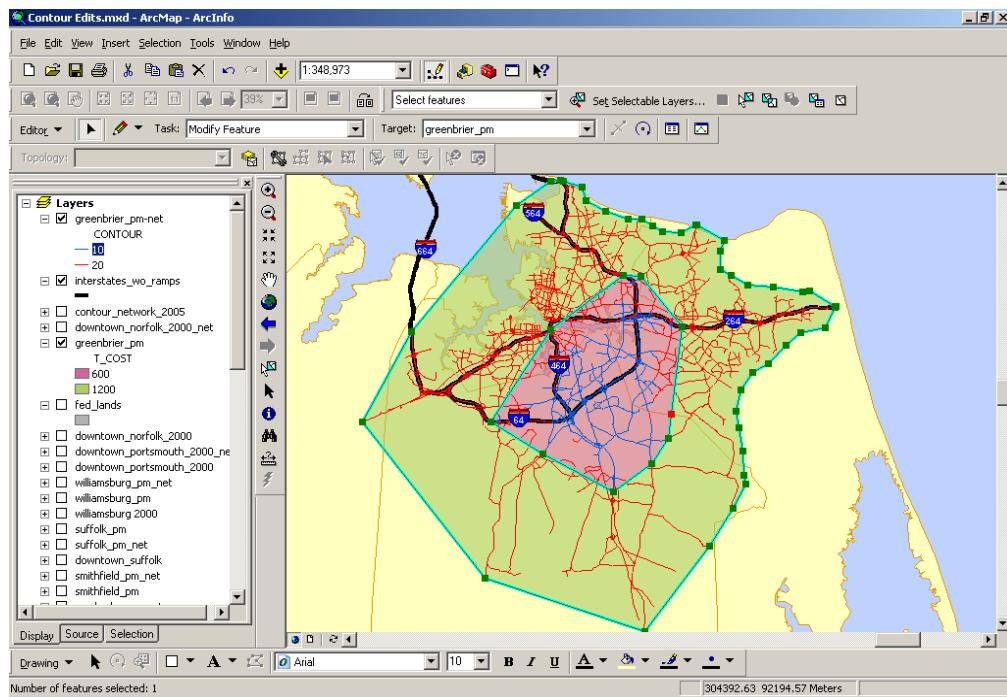


Figure 3. Editing a 'Raw' Contour. Beginning process of editing a raw contour. Vertices are added around the edges of both polygons and then dragged into place around the road network.

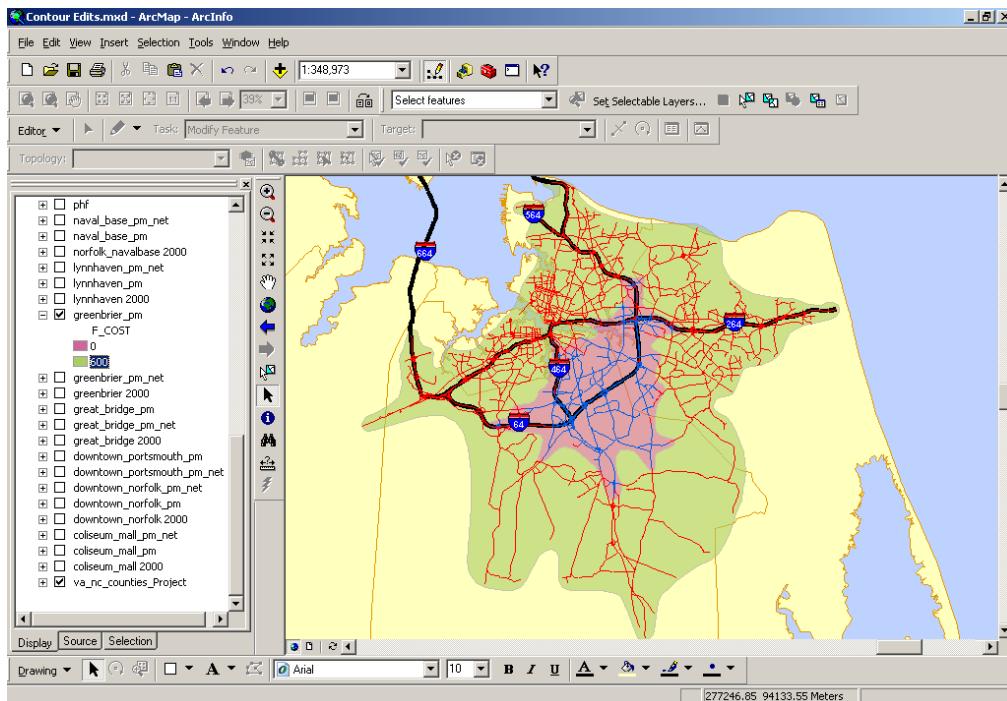


Figure 4. A Finished Contour. The finished 10 and 20-minute contours for the Greenbrier area.

Figure 5
Regional Activity Centers
Peninsula

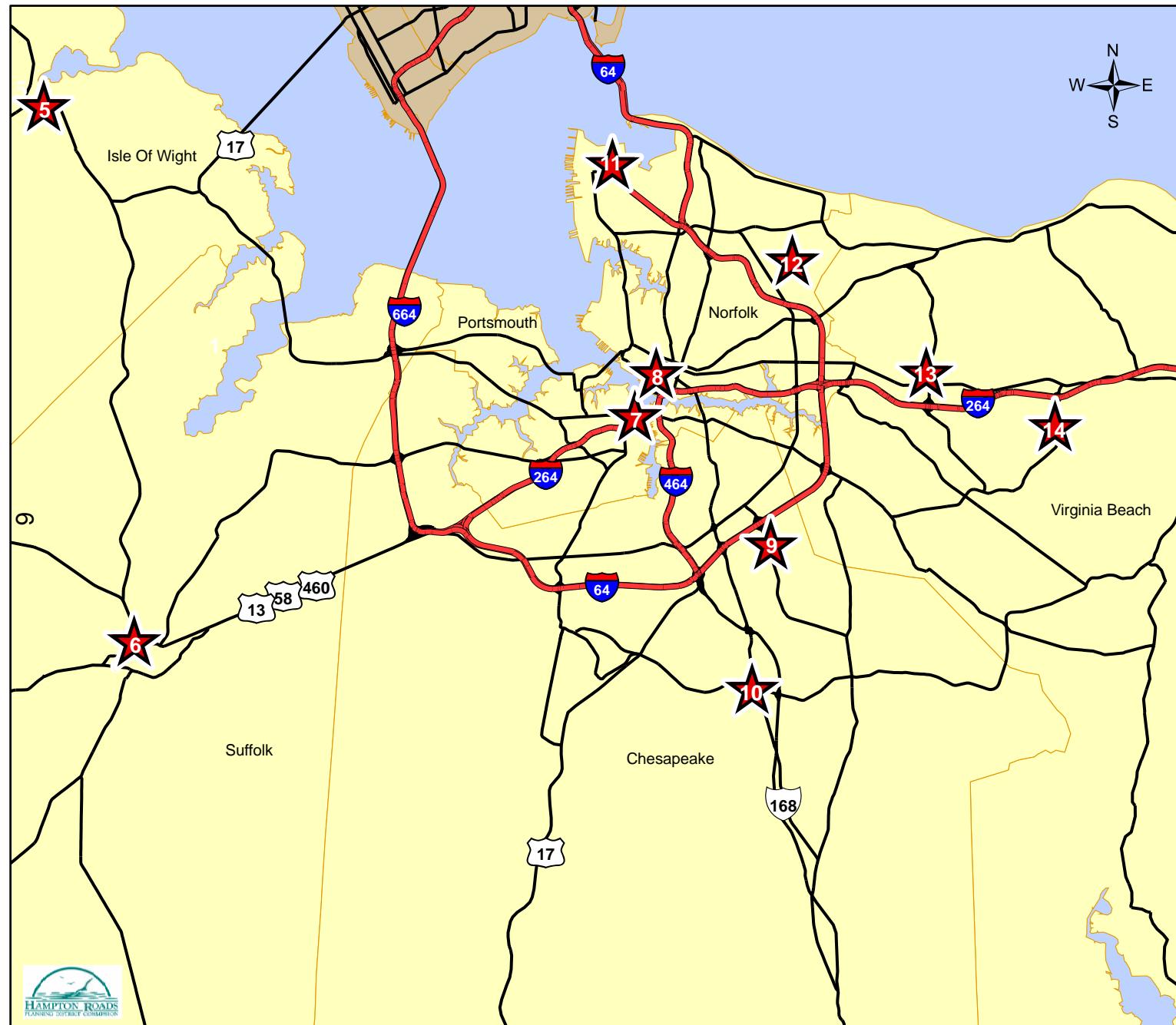
- 1 Colonial Williamsburg
Jamestown Rd & Richmond Rd
- 2 Newport News-Williamsburg
International Airport
Jefferson Ave & Bland Blvd
- 3 Coliseum Mall
Coliseum Dr & Mercury Blvd
- 4 Newport News City Hall
25th St & Washington Ave



0 1 2 4 6 8 Miles



Figure 6
Regional Activity Centers
Southside



0 1 2 4 6 8 Miles

LIST OF 10 AND 20-MINUTE OUTBOUND CONTOUR MAPS AND THEIR CENTROID LOCATIONS

Map 1 Colonial Williamsburg: Jamestown Rd and Richmond Rd

Map 2 Newport News-Williamsburg International Airport: Jefferson Ave and Bland Blvd

Map 3 Coliseum Mall: Coliseum Dr and Mercury Blvd

Map 4 Newport News City Hall: 25th St and Washington Ave

Map 5 Smithfield: Route 258/Main St and Church St S

Map 6 Downtown Suffolk: Main St and Constance Rd

Map 7 Downtown Portsmouth: County St and Crawford St

Map 8 Downtown Norfolk: Waterside Dr and Saint Pauls Blvd

Map 9 Greenbrier: Eden Way N and Greenbrier Pkwy

Map 10 Great Bridge: Mount Pleasant Rd and Battlefield Blvd

Map 11 Naval Base Norfolk: Interstate 564 and Admiral Taussig Blvd

Map 12 Norfolk International Airport: Norview Ave and Azalea Garden Rd

Map 13 Pembroke: Virginia Beach Blvd and Independence Blvd

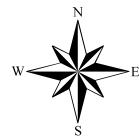
Map 14 Lynnhaven: Lynnhaven Pkwy and International Pkwy

Hampton Roads Regional Travel Time 2005: Map 1 Colonial Williamsburg

10 Minute

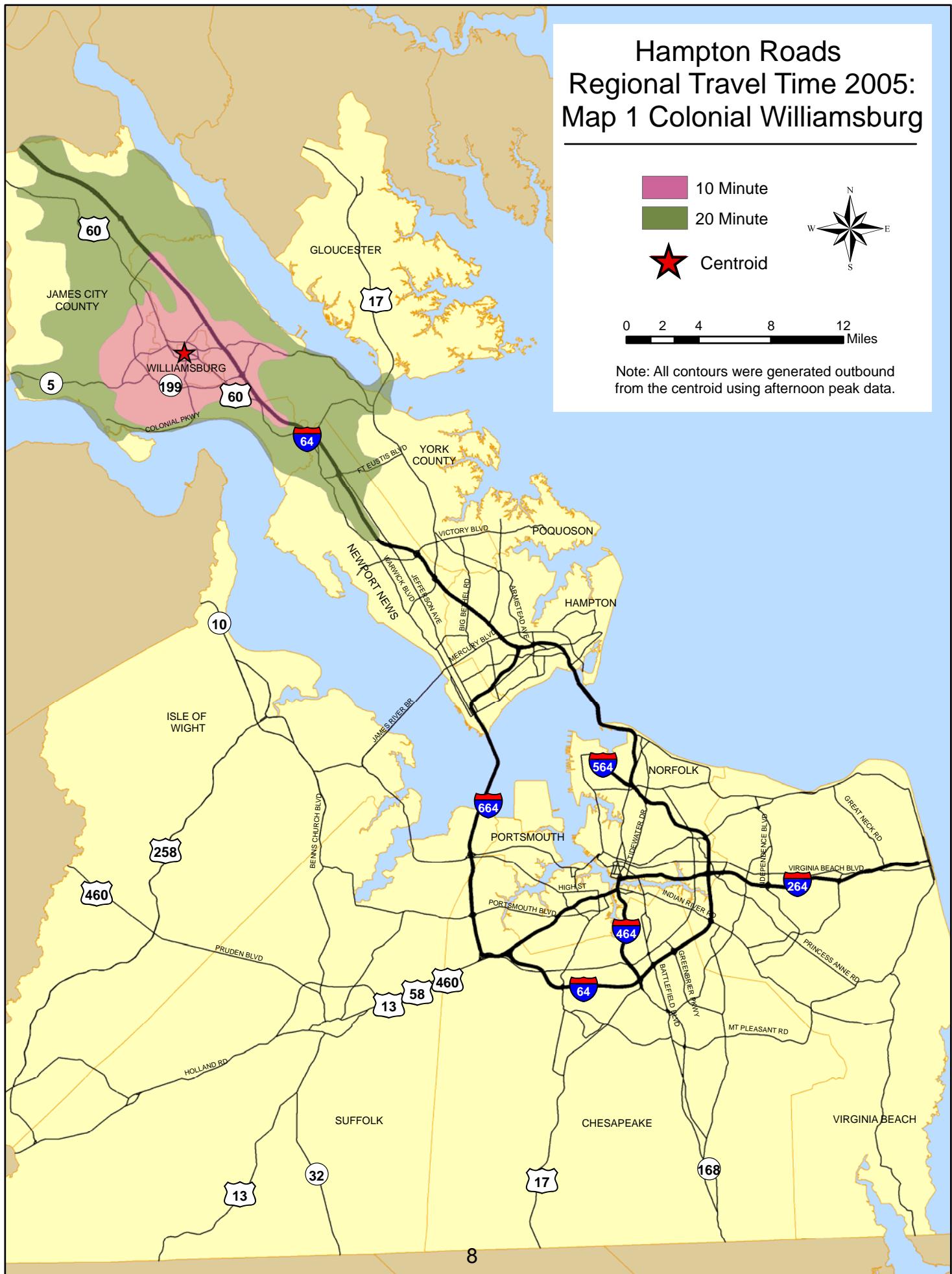
20 Minute

Centroid



0 2 4 8 12 Miles

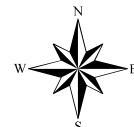
Note: All contours were generated outbound from the centroid using afternoon peak data.



Hampton Roads Regional Travel Time 2005: Map 2 Newport News- Williamsburg International Airport

10 Minute

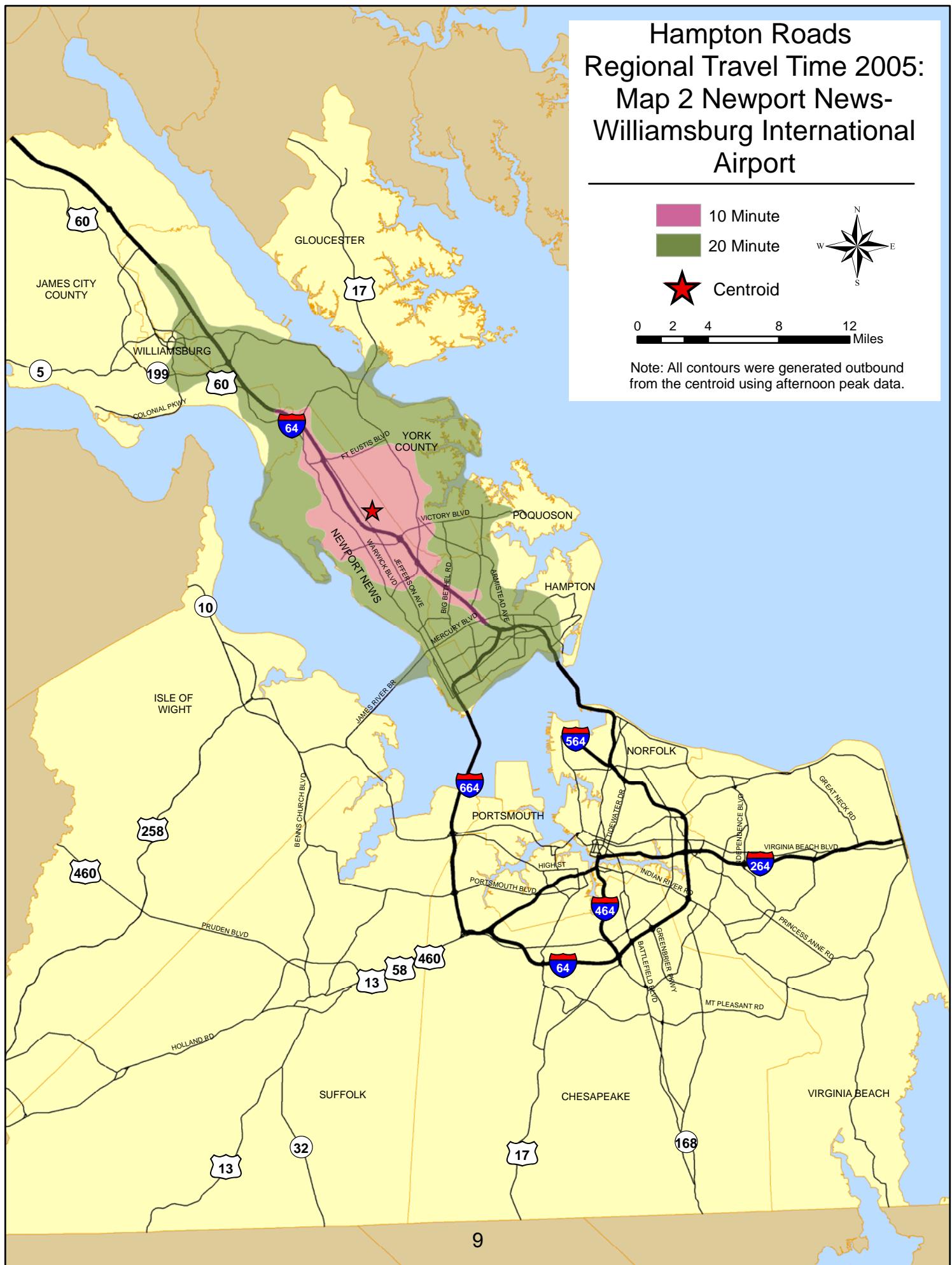
20 Minute



Centroid

0 2 4 8 12 Miles

Note: All contours were generated outbound from the centroid using afternoon peak data.

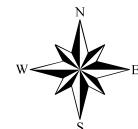


Hampton Roads Regional Travel Time 2005: Map 3 Coliseum Mall

10 Minute

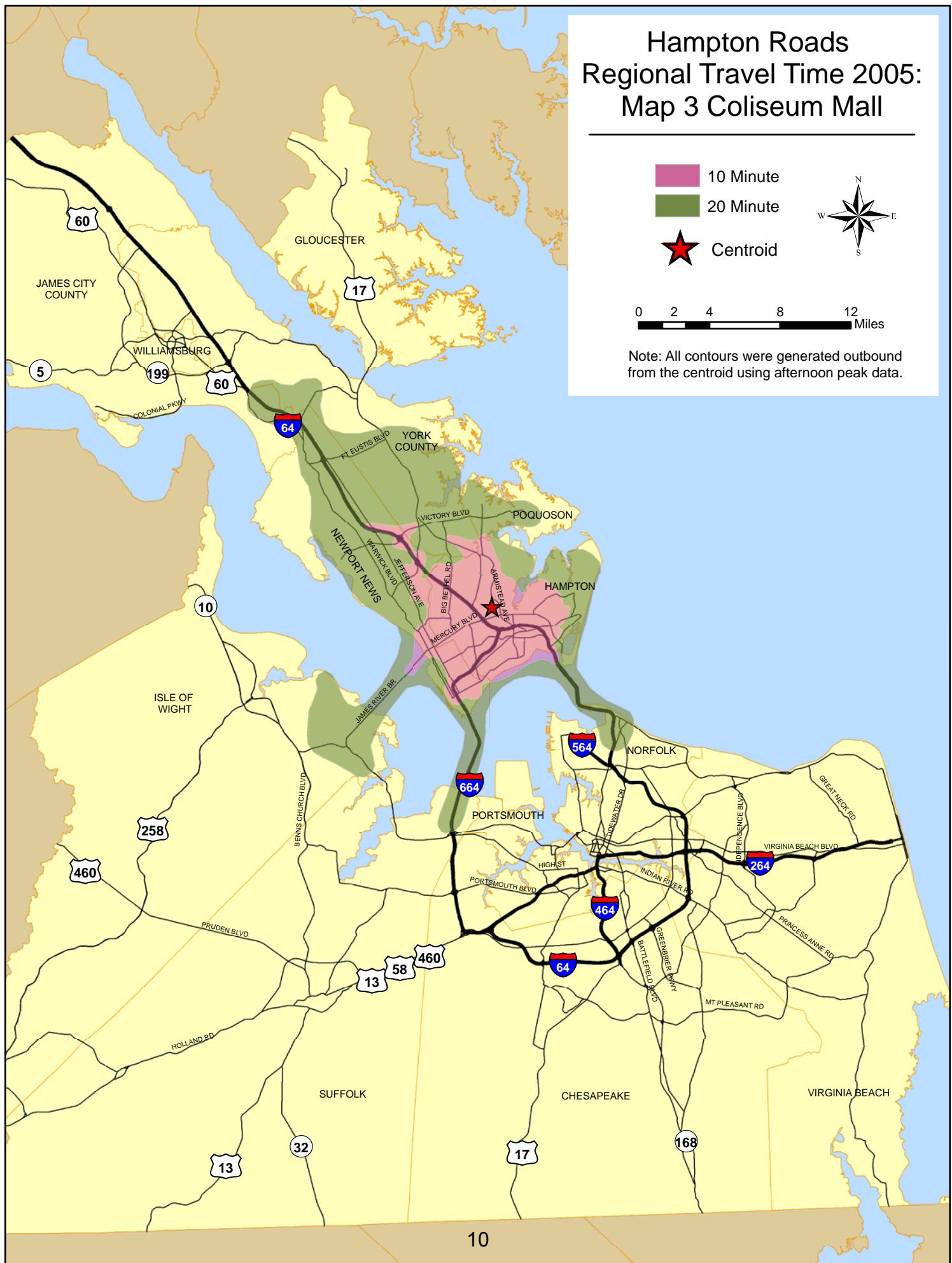
20 Minute

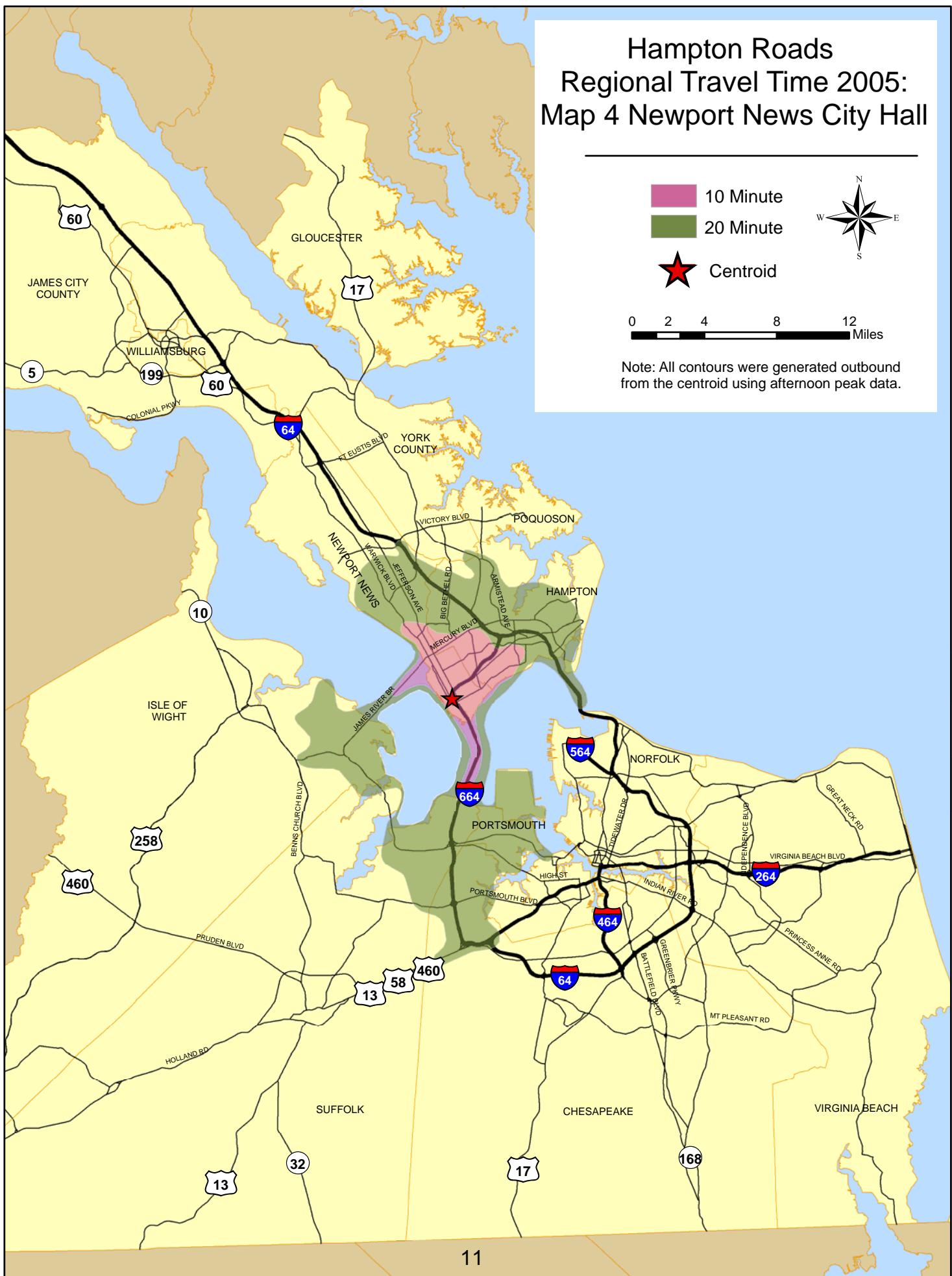
Centroid



0 2 4 8 12 Miles

Note: All contours were generated outbound from the centroid using afternoon peak data.



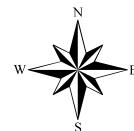


Hampton Roads Regional Travel Time 2005: Map 5 Smithfield

10 Minute

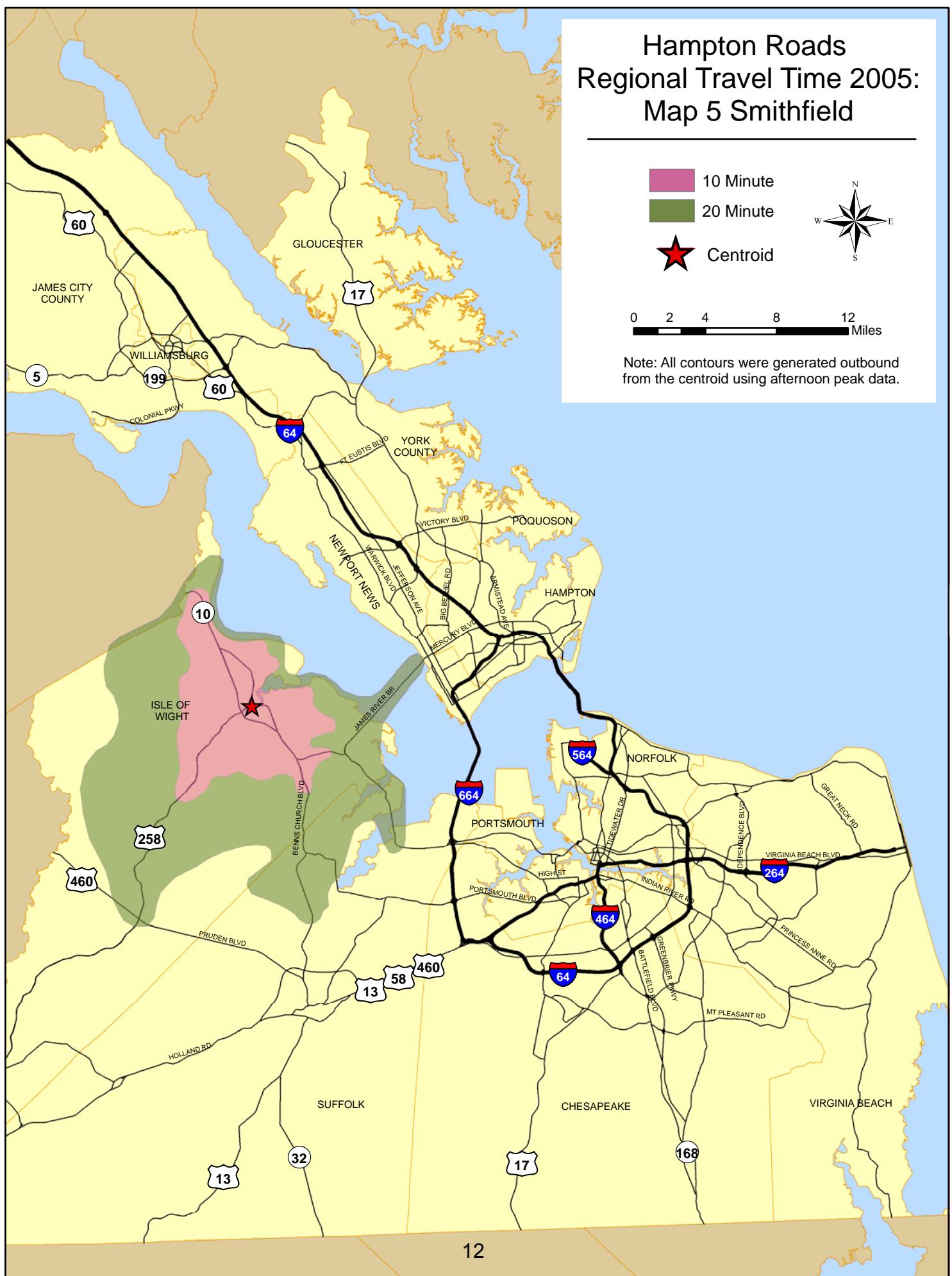
20 Minute

Centroid



0 2 4 8 12 Miles

Note: All contours were generated outbound from the centroid using afternoon peak data.



Hampton Roads Regional Travel Time 2005: Map 6 Downtown Suffolk

10 Minute

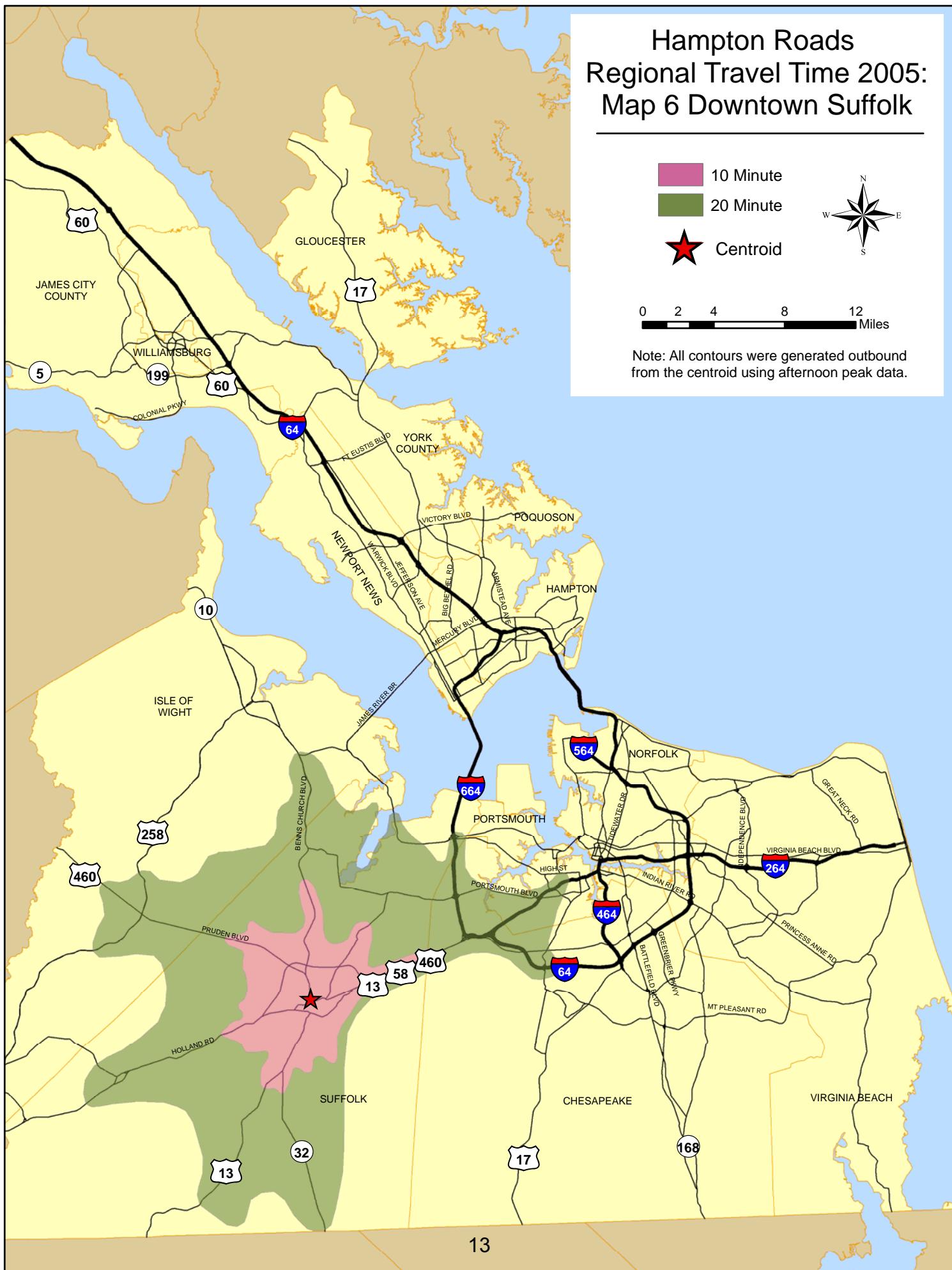
20 Minute

Centroid



0 2 4 8 12 Miles

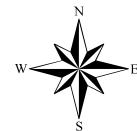
Note: All contours were generated outbound from the centroid using afternoon peak data.



Hampton Roads Regional Travel Time 2005: Map 7 Downtown Portsmouth

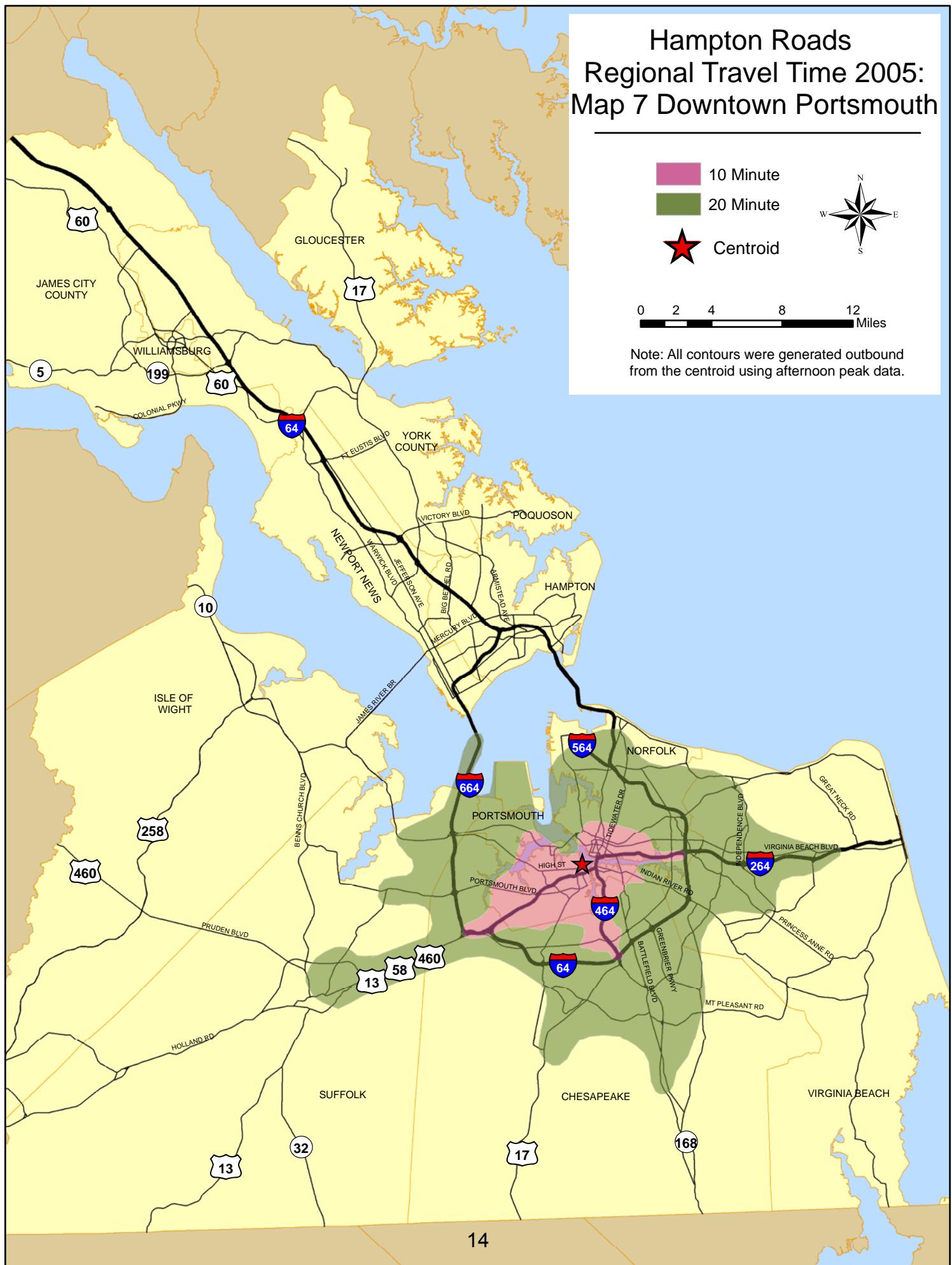
10 Minute
20 Minute

Centroid



0 2 4 8 12 Miles

Note: All contours were generated outbound from the centroid using afternoon peak data.



Hampton Roads Regional Travel Time 2005: Map 8 Downtown Norfolk

10 Minute

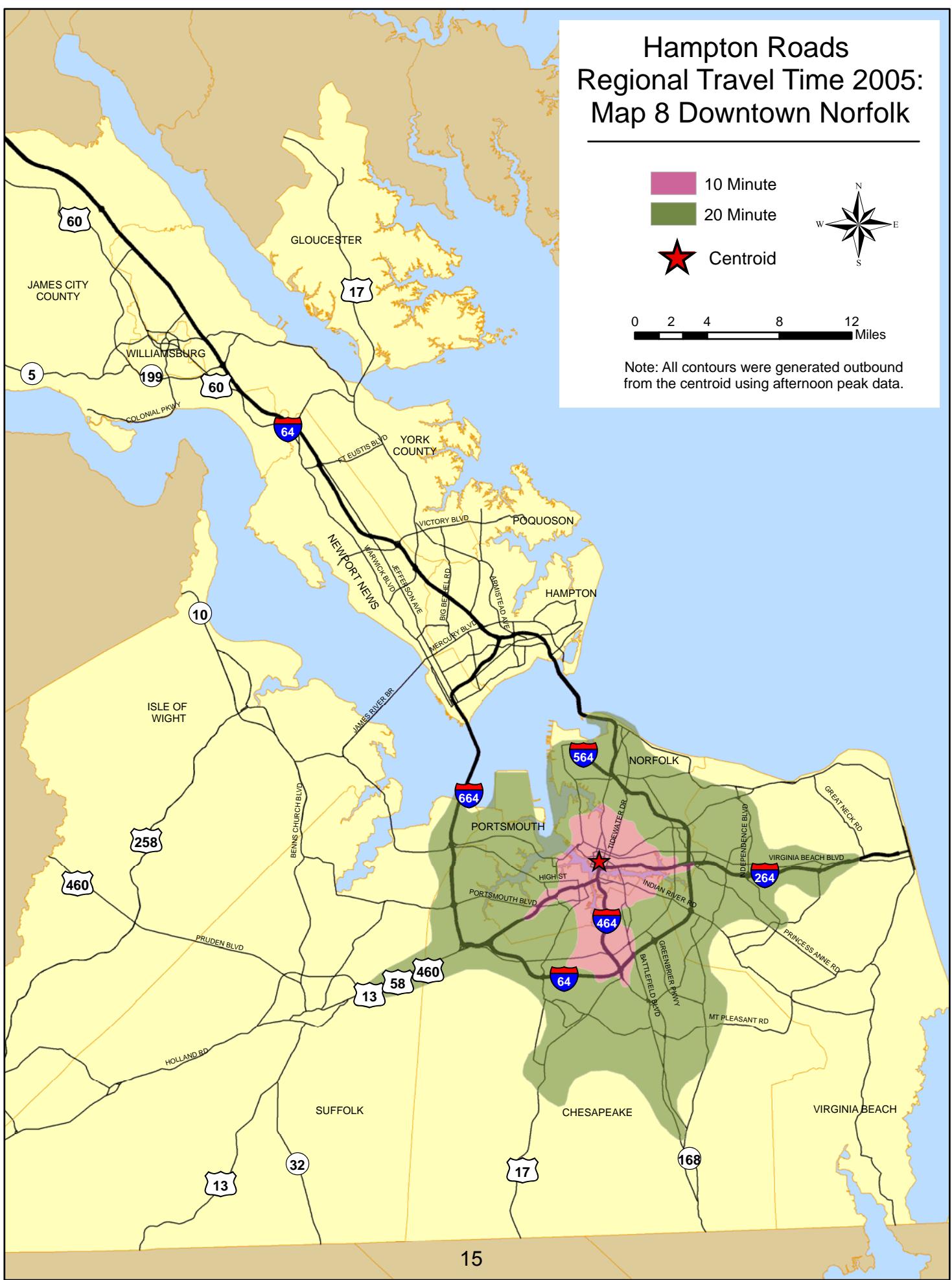
20 Minute

Centroid



0 2 4 8 12 Miles

Note: All contours were generated outbound from the centroid using afternoon peak data.



Hampton Roads Regional Travel Time 2005: Map 9 Greenbrier

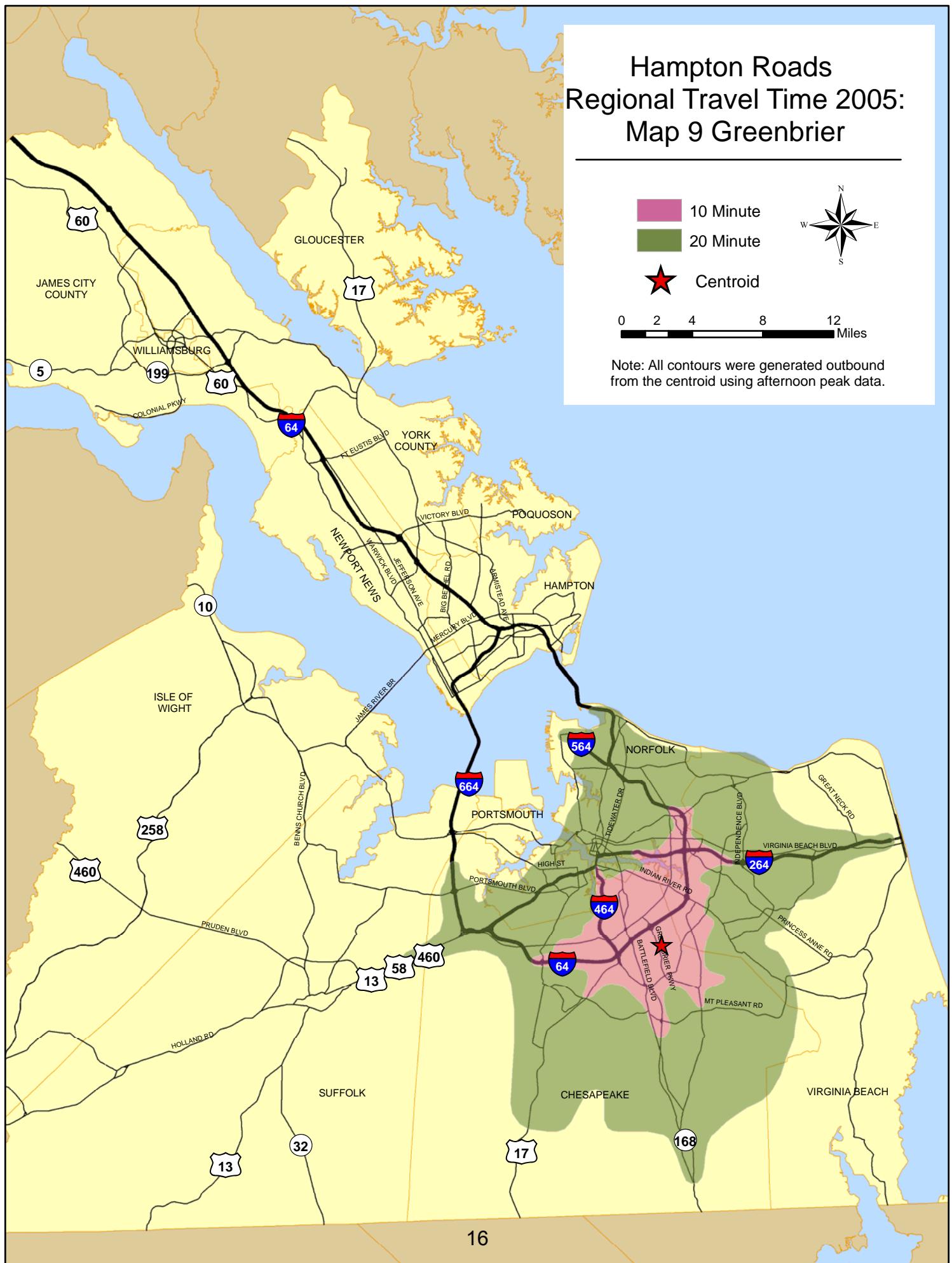
10 Minute
20 Minute

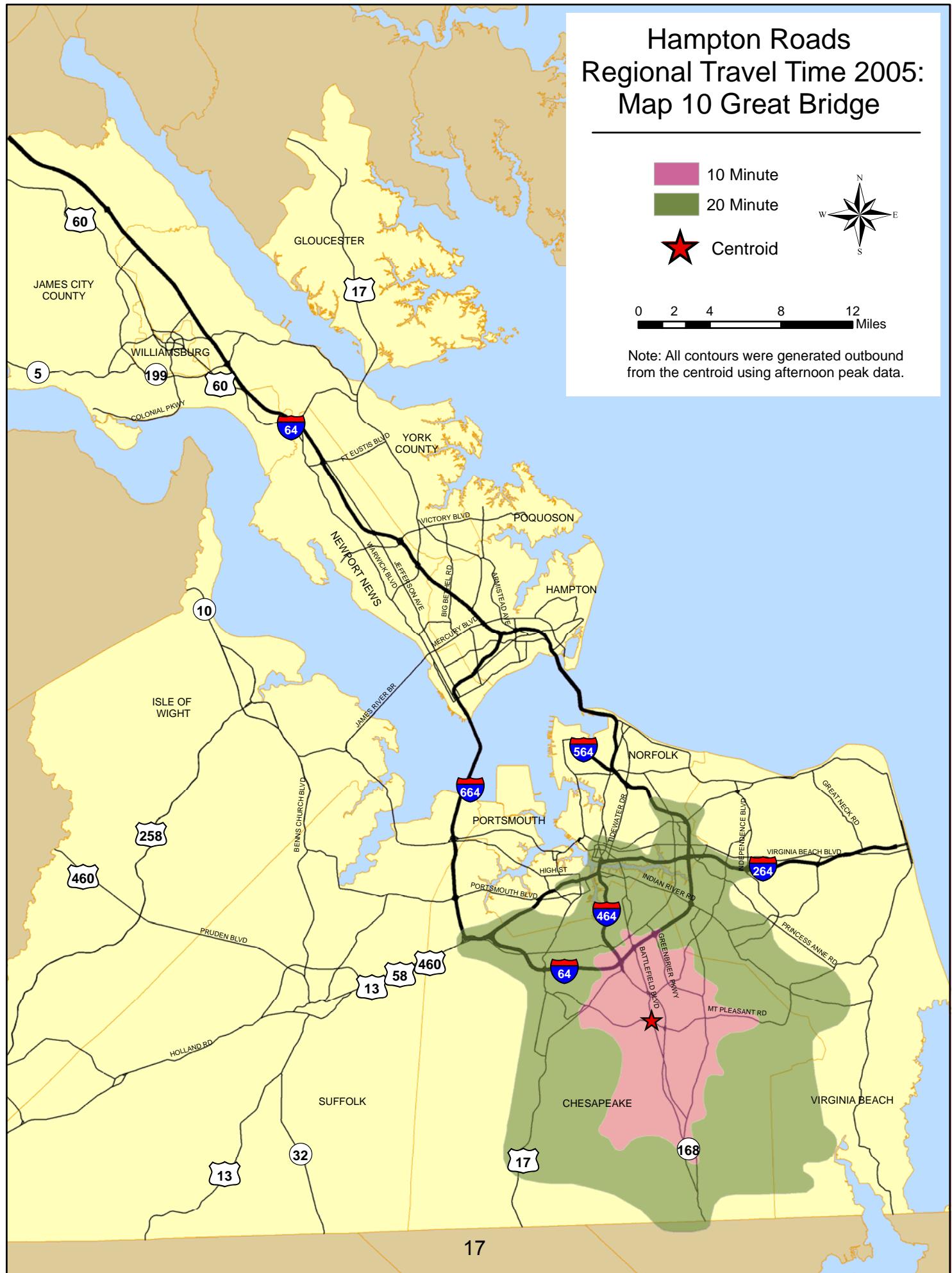
★ Centroid

0 2 4 8 12 Miles

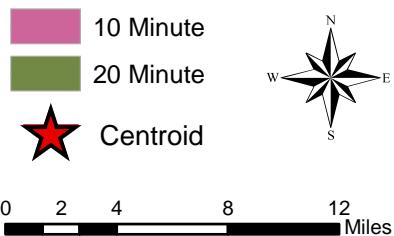


Note: All contours were generated outbound from the centroid using afternoon peak data.

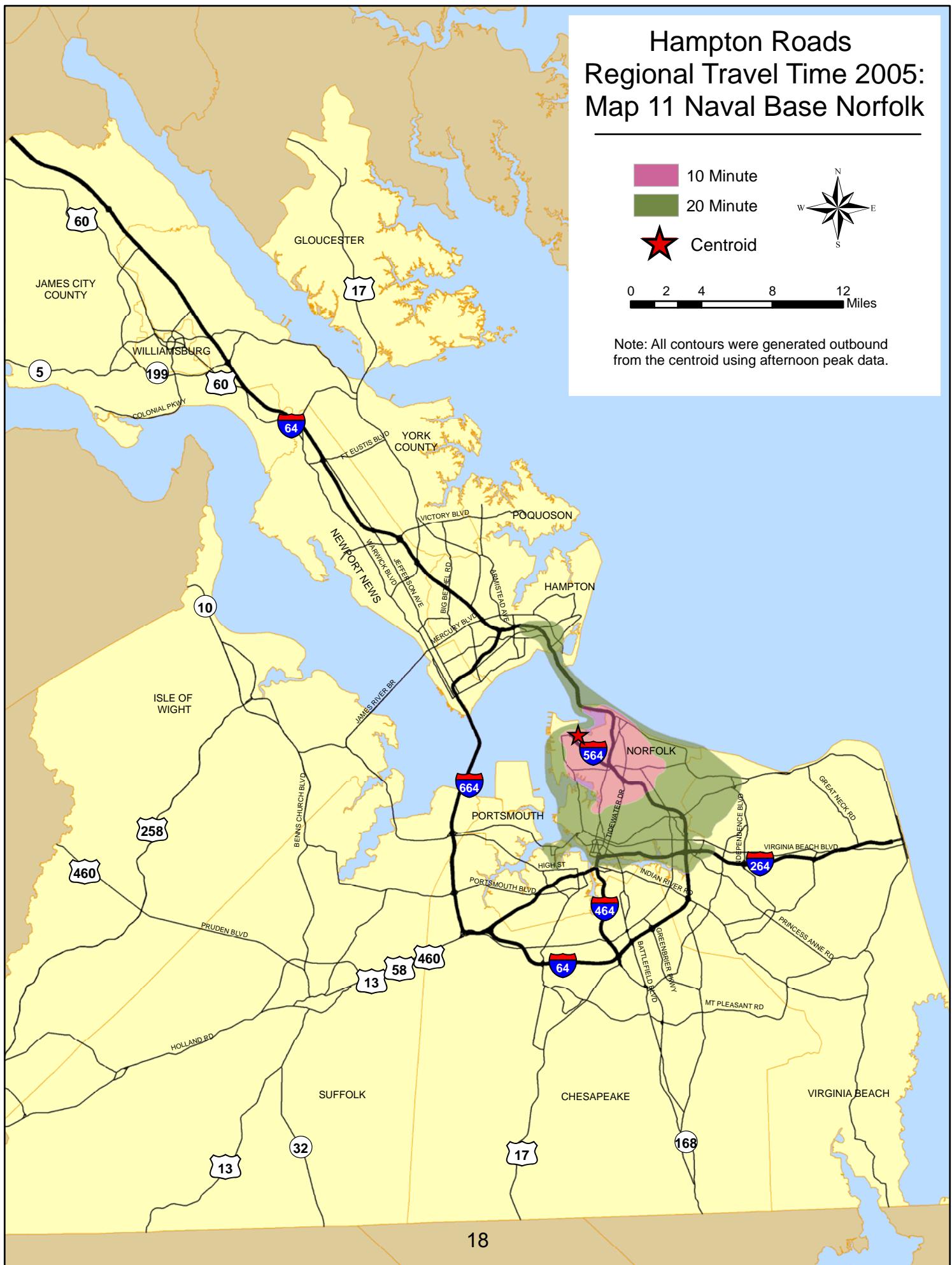




Hampton Roads Regional Travel Time 2005: Map 11 Naval Base Norfolk



Note: All contours were generated outbound from the centroid using afternoon peak data.



Hampton Roads Regional Travel Time 2005: Map 12 Norfolk International Airport

10 Minute

20 Minute

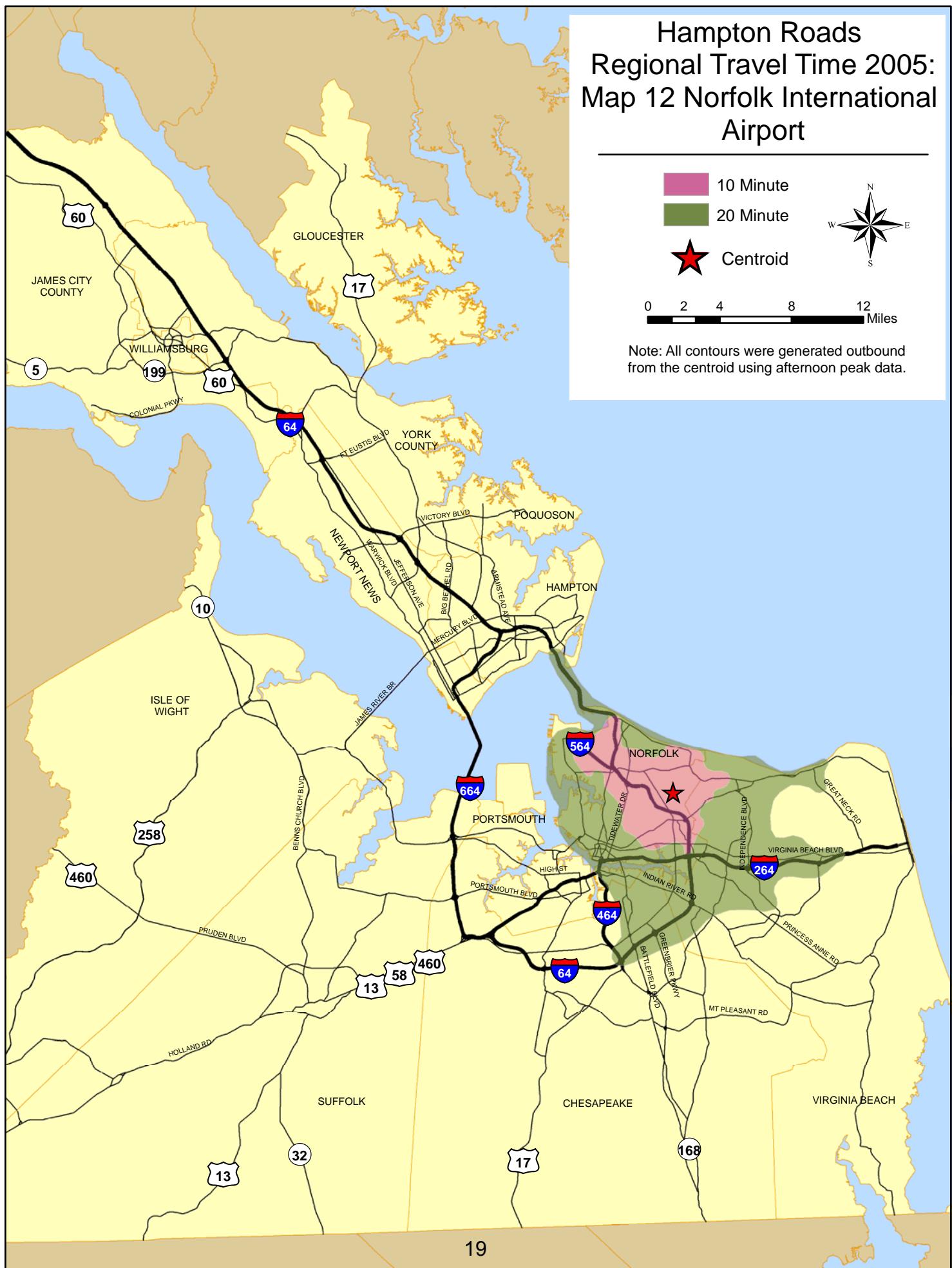


Centroid



0 2 4 8 12 Miles

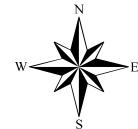
Note: All contours were generated outbound from the centroid using afternoon peak data.



Hampton Roads Regional Travel Time 2005: Map 13 Pembroke

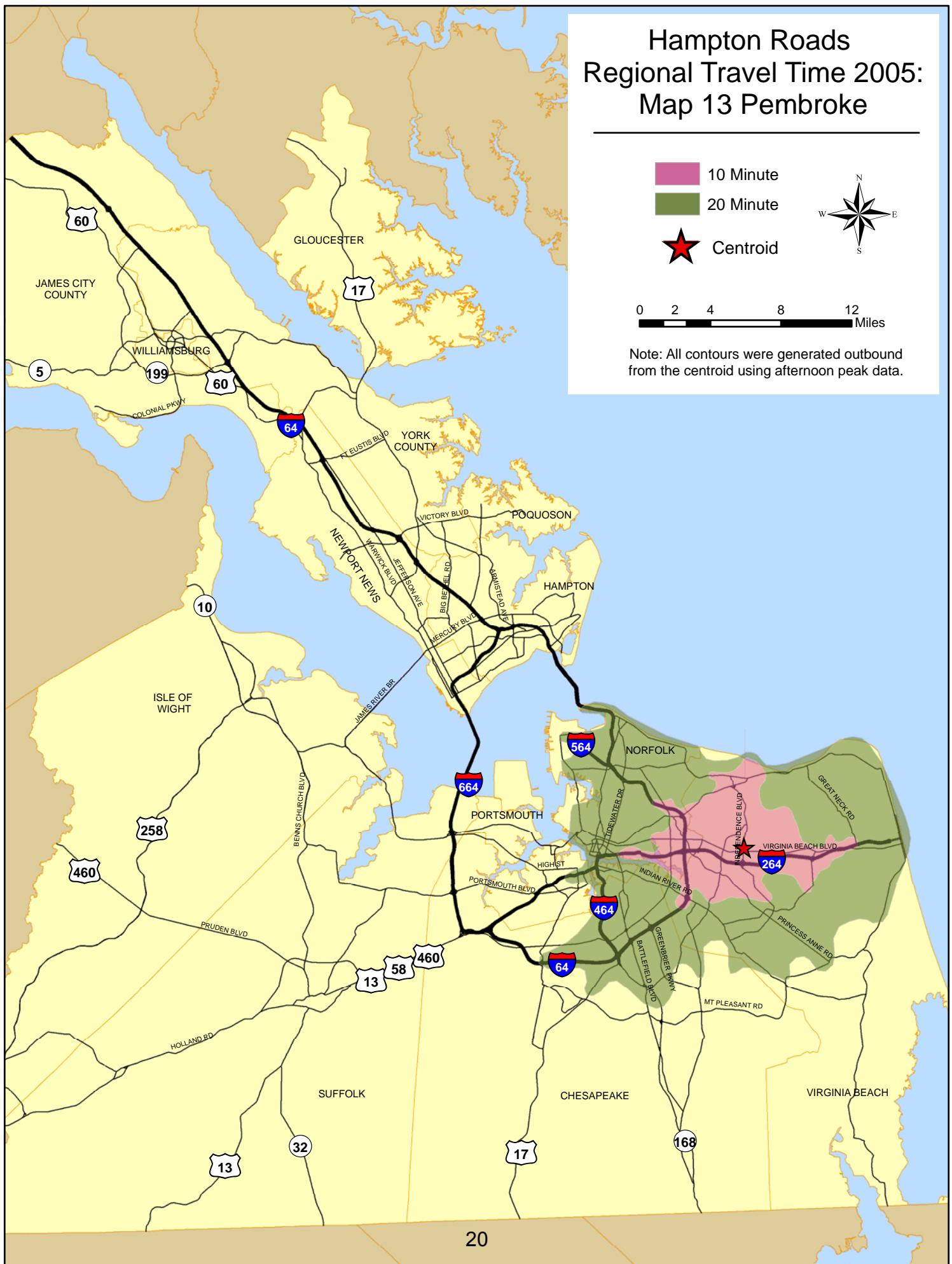
10 Minute
20 Minute

Centroid



0 2 4 8 12 Miles

Note: All contours were generated outbound from the centroid using afternoon peak data.

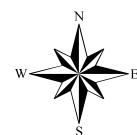


Hampton Roads Regional Travel Time 2005: Map 14 Lynnhaven

10 Minute

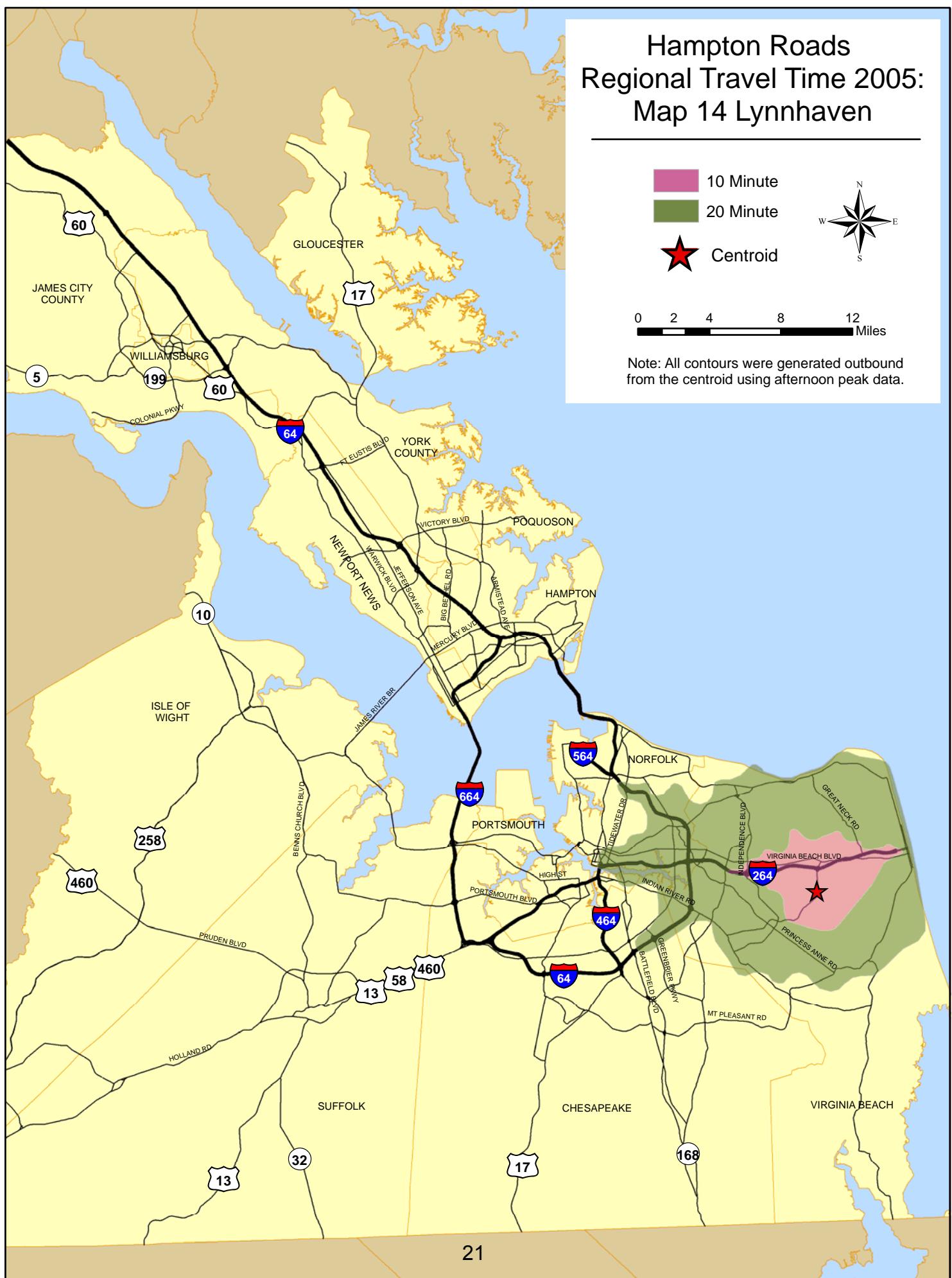
20 Minute

Centroid



0 2 4 8 12 Miles

Note: All contours were generated outbound from the centroid using afternoon peak data.



ELEMENTS OF ANALYSIS

Impacts of Major Transportation Projects

In the last five years between travel time studies, numerous projects and roadway improvements were completed. The addition of lane miles, via new road construction or road realignments, intersection improvements, and enhanced signal timing all impact travel times and average speeds.

Although this study saw the completion of fewer projects than the 2000 study, the projects that were completed impacted the routes taken and the speeds at which vehicles are able to travel just as much as projects of the past. Most projects completed during this study were road widenings and realignments. The largest and most notable completion was the Mercury Interchange rebuild and HOV lane additions on the Peninsula.

Highway Closing

Of additional notability is a change that is not a project at all. The closing of the King's Highway Bridge in Suffolk clearly made a difference in drive times in and around that area.

Change in Speed Limits

Another non-project change that impacted travel times throughout the region was the increase of posted speed limits along several of Hampton Road's interstate segments. This change was made after the 2000 study and applied to the road segments listed in **Table 1**.

Tables 2 and 3 on the following pages list the major highway improvement projects completed in the Hampton Roads region between January 2002 and March 2006.



Construction of new ramp at Mercury Blvd and Interstate 64.

Table 1. List of interstates with increase in posted speed limit since 2000 study.

Facility	From	To	New Posted Speed
Interstate 64	Hampton Roads Center Pkwy	Jefferson Ave	60 MPH
Interstate 64	Jefferson Ave	Northward	65 MPH
Interstate 464	Military Hwy	Poindexter St	60 MPH
Interstate 664	Airline Blvd	College Dr	60 MPH

TABLE 2
MAJOR HIGHWAY IMPROVEMENT PROJECTS:
January 2002 – March 2006
SOUTHSIDE

<u>JURISDICTION</u>	<u>IMPROVEMENT</u>
CHESAPEAKE	
Chesapeake Expwy: Opening of Eastbound Kempsville Rd off ramp	New Ramp
Battlefield Blvd: Wayne Ave to Albermarle Dr	5 L
Battlefield Blvd: Wayne Ave to Albermarle Dr	New Bridge
George Washington Hwy: NC State Line to Dominion Blvd	4 LD
Kempsville Rd: Greenbrier Pkwy to Battlefield Blvd	6 LD
Moses Grandy Trail: Dominion Blvd to Shipyard Rd	New 4 LD
ISLE OF WIGHT	
Route 258 (Great Mill Hwy): Route 58 Bus to Route 58	Realigned
NORFOLK	
Boush St: Brambleton Ave to York St	2-Way
PORTSMOUTH	
Pinners Point Interchange: Western Fwy to MLK Fwy	New Interchange
SUFFOLK	
Kings Highway Bridge	Bridge Closed
Southwest Suffolk Bypass: Suffolk Bypass to Carolina Rd	New 4 LD
VIRGINIA BEACH	
Great Neck/London Bridge Rd: London Bridge Rd to Great Neck Rd	Realigned
Great Neck/London Bridge Rd: International Pkwy to Potters Rd	4 LD
Great Neck/London Bridge Rd: Potters Rd to Virginia Beach Blvd	6 LD
London Bridge Blvd: Shipps Corner Rd to International Pkwy	4 LD
Oceana Blvd: Existing Oceana Blvd to First Colonial Rd	4 L realigned
South Plaza Trail: Princess Anne Rd to Independence Blvd	4 LD

Notes: L = Lanes
 D = Divided Roadway
 HOV = High Occupancy Vehicle

Source: Local jurisdiction staffs.
 Prepared By: Hampton Roads Planning District Commission, January 2007.

TABLE 3
MAJOR HIGHWAY IMPROVEMENT PROJECTS:
January 2002 – March 2006
PENINSULA

<u>JURISDICTION</u>	<u>IMPROVEMENT</u>
HAMPTON	
Commander Shepard Blvd: NASA Main Gate to Magruder Blvd/Semple Farm Rd Intersection	4 L
Semple Farm Rd: Magruder Blvd to Wythe Creek Rd	4 L
I-64: I-664 to Hampton Roads Center Pkwy incl. Mercury Blvd Interchange and Magruder Blvd exit	Extended HOV Lanes & Replaced Interchange
JAMES CITY COUNTY	
Grove Connector: Busch Gardens and Route 60	New Interchange
NEWPORT NEWS	
Hampton Roads Center Pkwy: Jefferson Ave to Hampton CL	4 LD
WILLIAMSBURG	
Route 199: Jamestown Rd to Route 60 (Lightfoot)	4 LD

Notes: L = Lanes
 D = Divided Roadway
 HOV = High Occupancy Vehicle

Source: Local jurisdiction staffs.

Prepared By: Hampton Roads Planning District Commission, January 2007.

Change in 20-Minute Travel Time

Contour Coverage: 2000 to 2005

To understand change within the region it is helpful to compare the previous study's data with that of the current study. To do this, the same activity centers for two 20-minute afternoon peak hour contours, one from the 2000 study and one from the 2005 study, were overlaid and the differences were analyzed.

In areas where the 2005 contour coverage extended beyond coverage of the 2000 contour, the area was shaded green. Where the opposite was true, the area was shaded red.

In this study, 13 of the 14 activity center contours were analyzed. Because Smithfield is new to the study, data from previous years was unavailable. For this reason, Smithfield was not included in this portion of the analysis.

Additionally, in order to accurately analyze change in the downtown areas of Norfolk and Portsmouth, new and separate 20-minute contours were created from the 2000 data to allow comparison to the 2005 contour coverage area.

Another important change resulted from the addition of Isle of Wight County to the study area. In previous studies the Downtown Suffolk contour stopped where data collection stopped--at the Isle of Wight County line. However, in the 2005 study, data was collected throughout Isle of Wight County. As a result, the area covered by Downtown Suffolk contour grew markedly along the Suffolk/Isle of Wight County border. Without earlier data to compare to, the true extent of change in that area is

unknown; therefore, that portion of the contour was not analyzed. The unanalyzed portion of the contour is noted in the legend of **Map 19**.

Maps 15 through 27 illustrate the changes between the two study years.

Map 15: Colonial Williamsburg exhibited little change in travel time. The two major improvement projects in the area, the widening of Route 199 to 4-lanes and the opening of the Grove Interchange, may have served to prevent an increase in overall travel times.

Map 17: Coliseum Mall displayed most of its delay at the three main river crossings: the Hampton Roads Bridge Tunnel, the Monitor-Merrimac Memorial Bridge Tunnel and the James River Bridge Tunnel. Delay increased 33%, 35%, and 12%, respectively, at these three facilities over the past five years. However, with the new, higher speed limits in place, a small improvement in travel time did occur on the Peninsula, north of Fort Eustis Boulevard.

Map 18: Newport News City Hall displayed the worst travel times in the region, showing no improvement at all. While some of the degradation in travel time on the Southside may be explained by an increase in tunnel and bridge crossing times, the degradation to the north is primarily attributed to an increase in travel time on arterial roads in Hampton, Poquoson, and Newport News. Roads within these jurisdictions, such as Big Bethel Road, Mercury Boulevard, Armistead Avenue, and King Street, all experienced an increase in travel time.

Map 19: Downtown Suffolk benefited from the addition of Isle of Wight County to the study area by increasing the western boundary of the contour as far out as the Route 460/258 intersection. Travel times along the northern edge of the contour declined, due in part to a 22% increase in travel time on Interstate 664 from Bowers Hill to Pughsville Road.

Map 20: Downtown Portsmouth and **Map 22: Greenbrier** both benefited from the widening of Kempsville Road, the widening of Battlefield Boulevard, and the opening of the new 5-lane Great Bridge Bridge on Battlefield Boulevard. The new bridge opens and closes faster than the old bridge and this improvement, coupled with the widening of the road, allows for more efficient movement of vehicles, even during peak hours. The contour coverages for both of these centroids indicated improvements in travel time in and around the Great Bridge and Greenbrier areas.

Map 24: Norfolk Naval Base encountered nearly all of its increase in travel time on the Peninsula, just after the Hampton Roads Bridge Tunnel. Since the 2000 study, the Hampton Roads Bridge Tunnel has experienced a 35% increase in travel time during the afternoon peak hour.

Map 25: Norfolk International Airport, much like the Naval Base, suffered from the increase in travel time delay through the Hampton Roads Bridge Tunnel. Additionally, other arterials, such as Tidewater Drive and Princess Anne Road also exhibited some amount of increased delay.

Map 27: Lynnhaven experienced the most delay south of Interstate 264. Major road improvements, including realignment and widening, occurred at Oceana Boulevard and Great Neck Road/London Bridge Road. While these improvements may have had an impact in and around the Interstate 264 area, their effects were not evident in the southern portion of the Lynnhaven contour. Degradation in other roads, such as the 28% increase in travel time along General Booth Boulevard, appears to be responsible for the increased delay in the southern portion of the contour coverage.

Change in 20-Minute Travel Time Contour Coverage 2000 to 2005

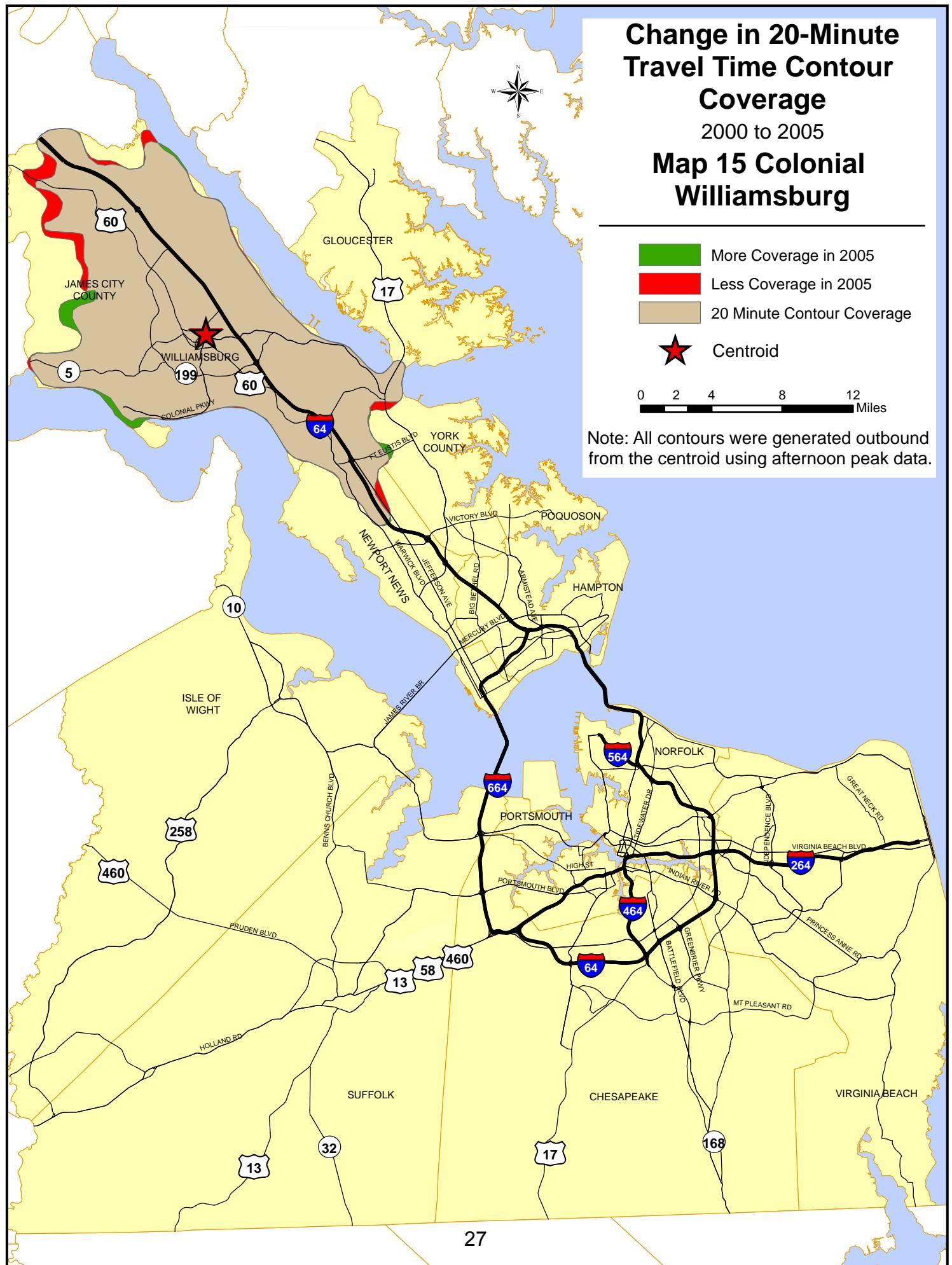
Map 15 Colonial Williamsburg

More Coverage in 2005
Less Coverage in 2005
20 Minute Contour Coverage

Centroid

0 2 4 8 12 Miles

Note: All contours were generated outbound from the centroid using afternoon peak data.



Change in 20-Minute Travel Time Contour Coverage

2000 to 2005

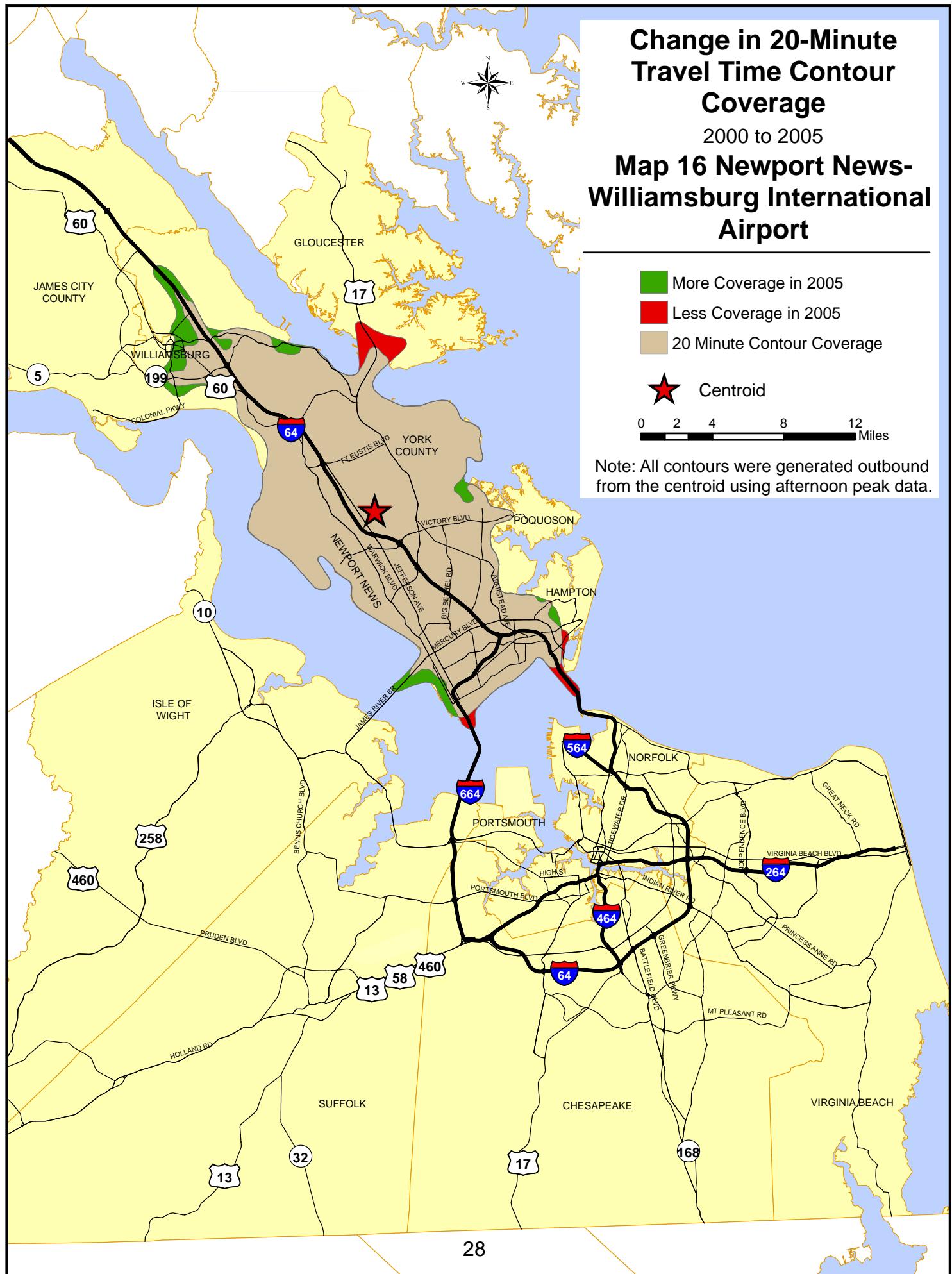
Map 16 Newport News-Williamsburg International Airport

- More Coverage in 2005
- Less Coverage in 2005
- 20 Minute Contour Coverage

Centroid

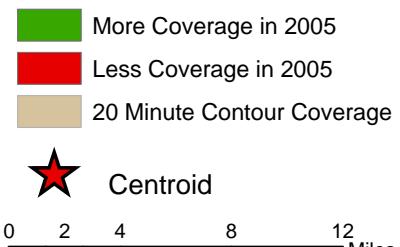
0 2 4 8 12 Miles

Note: All contours were generated outbound from the centroid using afternoon peak data.

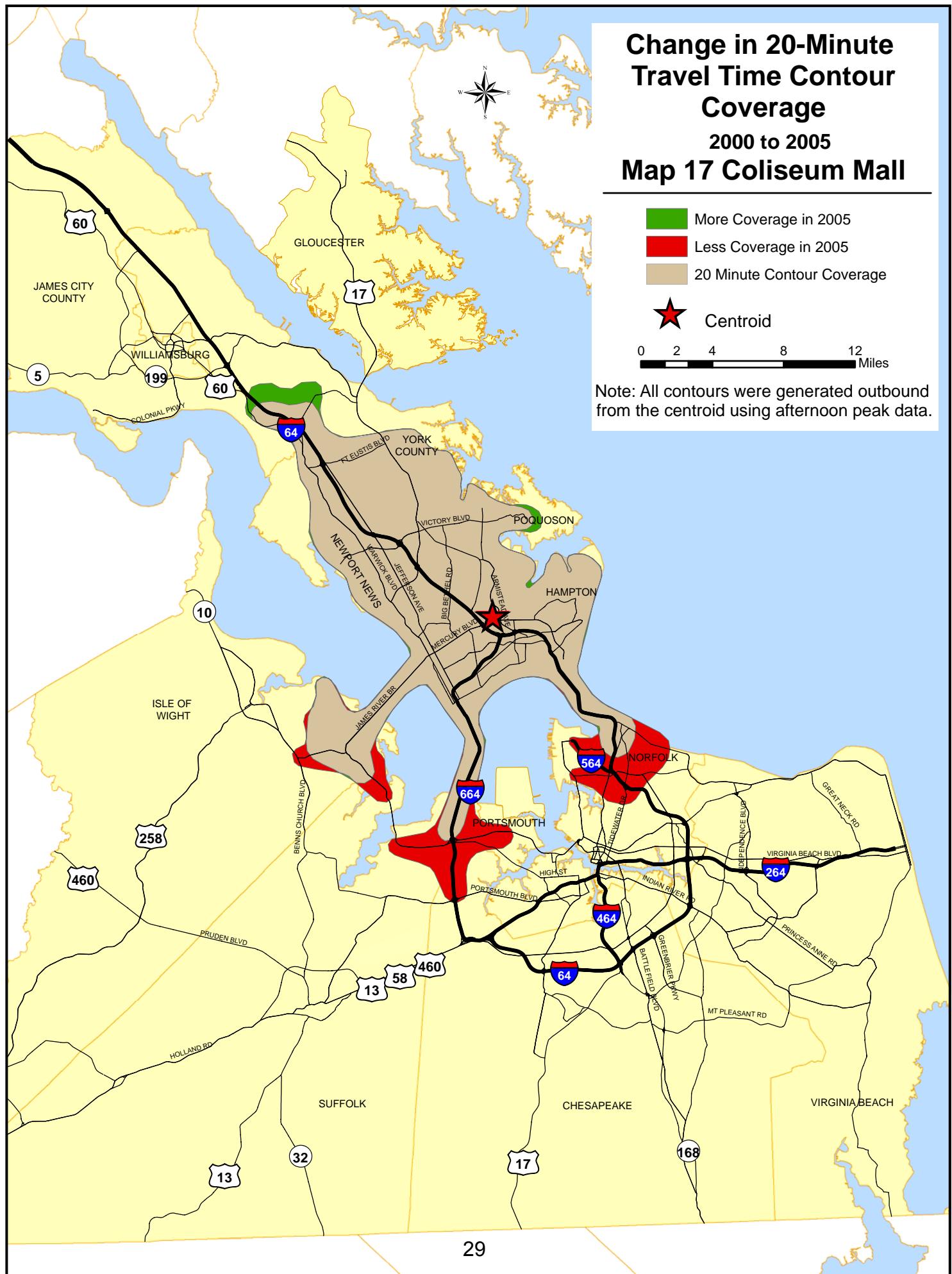


Change in 20-Minute Travel Time Contour Coverage 2000 to 2005

Map 17 Coliseum Mall



Note: All contours were generated outbound from the centroid using afternoon peak data.



Change in 20-Minute Travel Time Contour Coverage

2000 to 2005

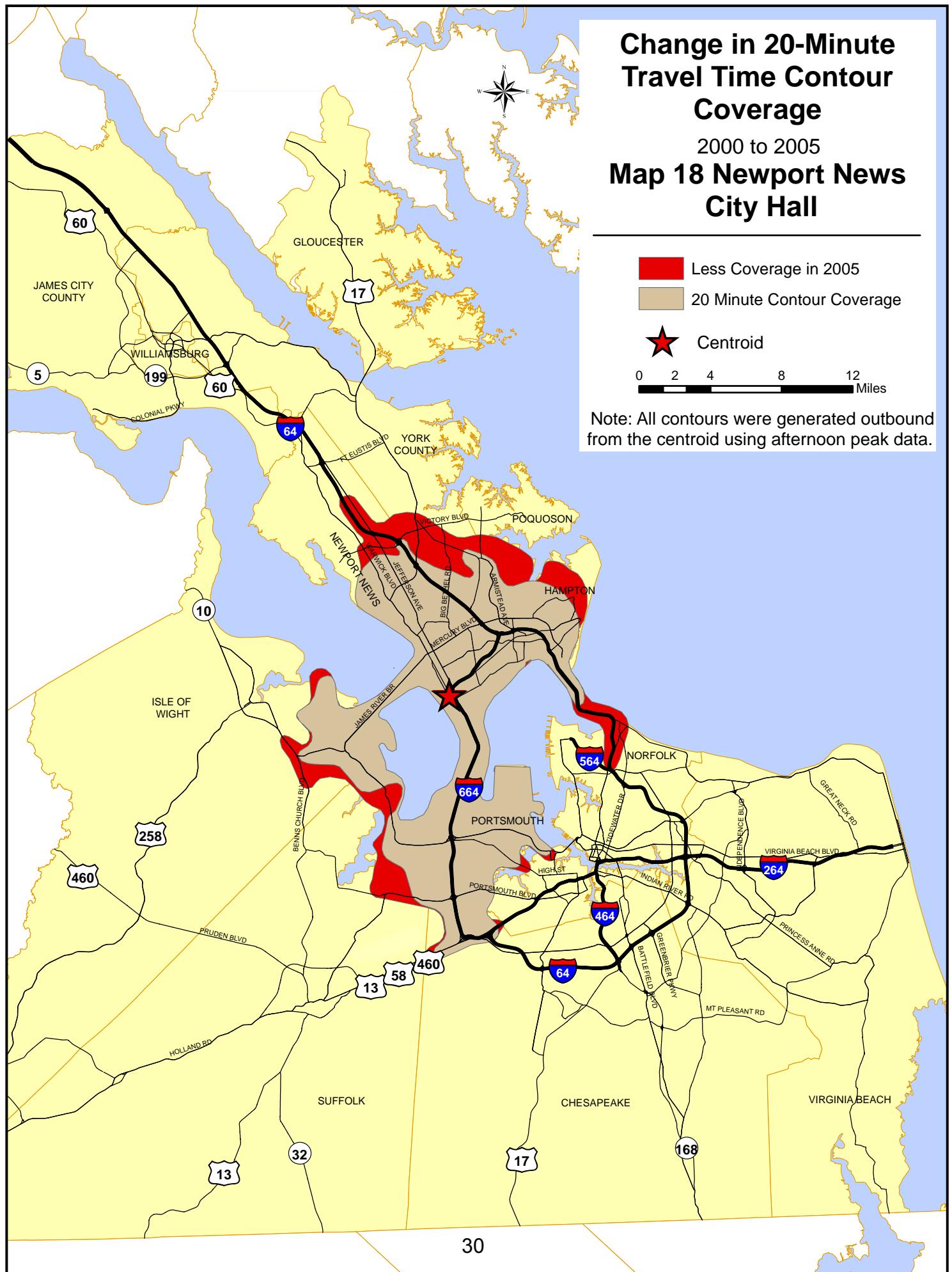
Map 18 Newport News City Hall

 Less Coverage in 2005
 20 Minute Contour Coverage

 Centroid

0 2 4 8 12 Miles

Note: All contours were generated outbound from the centroid using afternoon peak data.



Change in 20-Minute Travel Time Contour Coverage

2000 to 2005

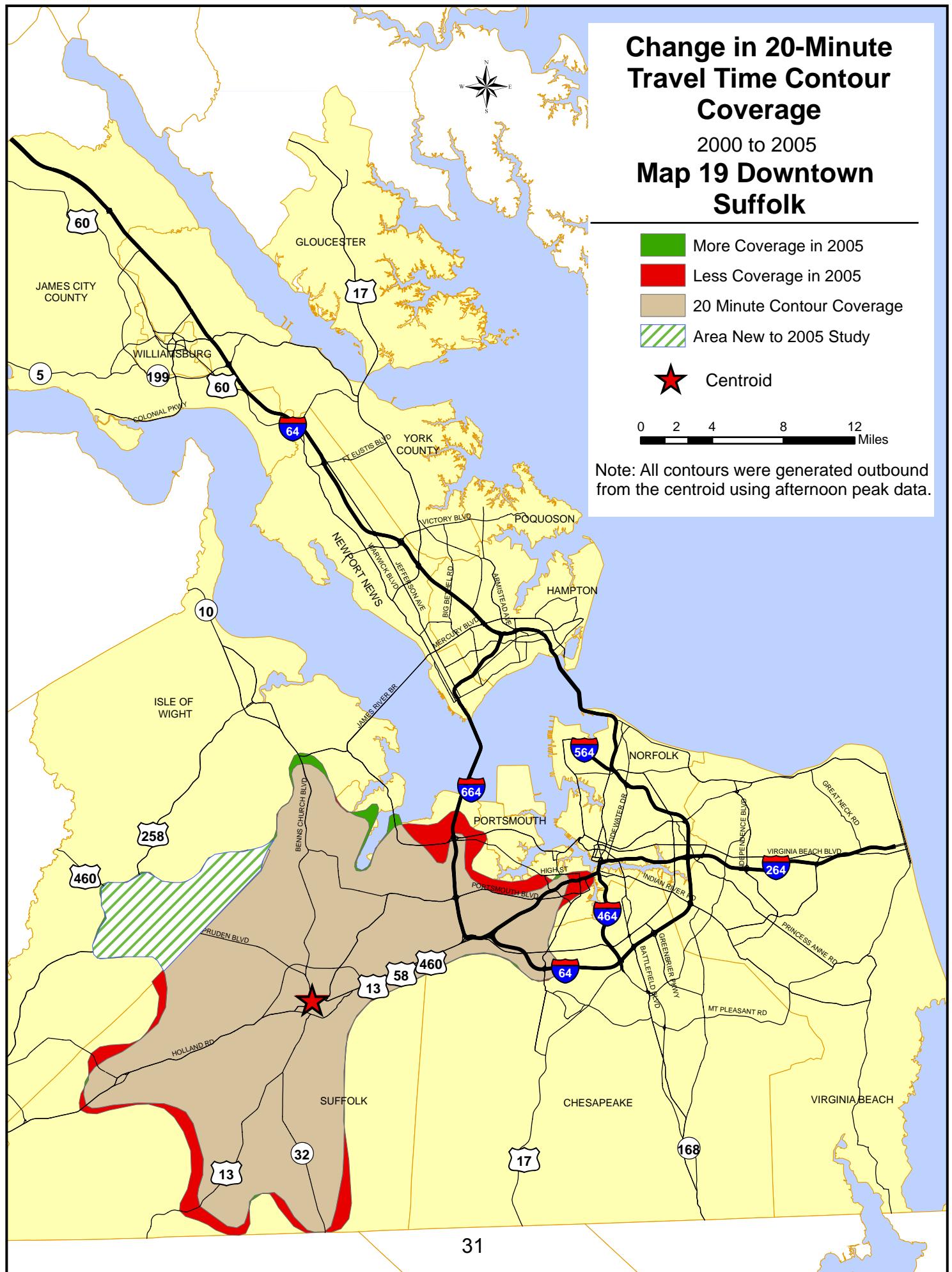
Map 19 Downtown Suffolk

- More Coverage in 2005
- Less Coverage in 2005
- 20 Minute Contour Coverage
- Area New to 2005 Study



0 2 4 8 12 Miles

Note: All contours were generated outbound from the centroid using afternoon peak data.



Change in 20-Minute Travel Time Contour Coverage

2000 to 2005

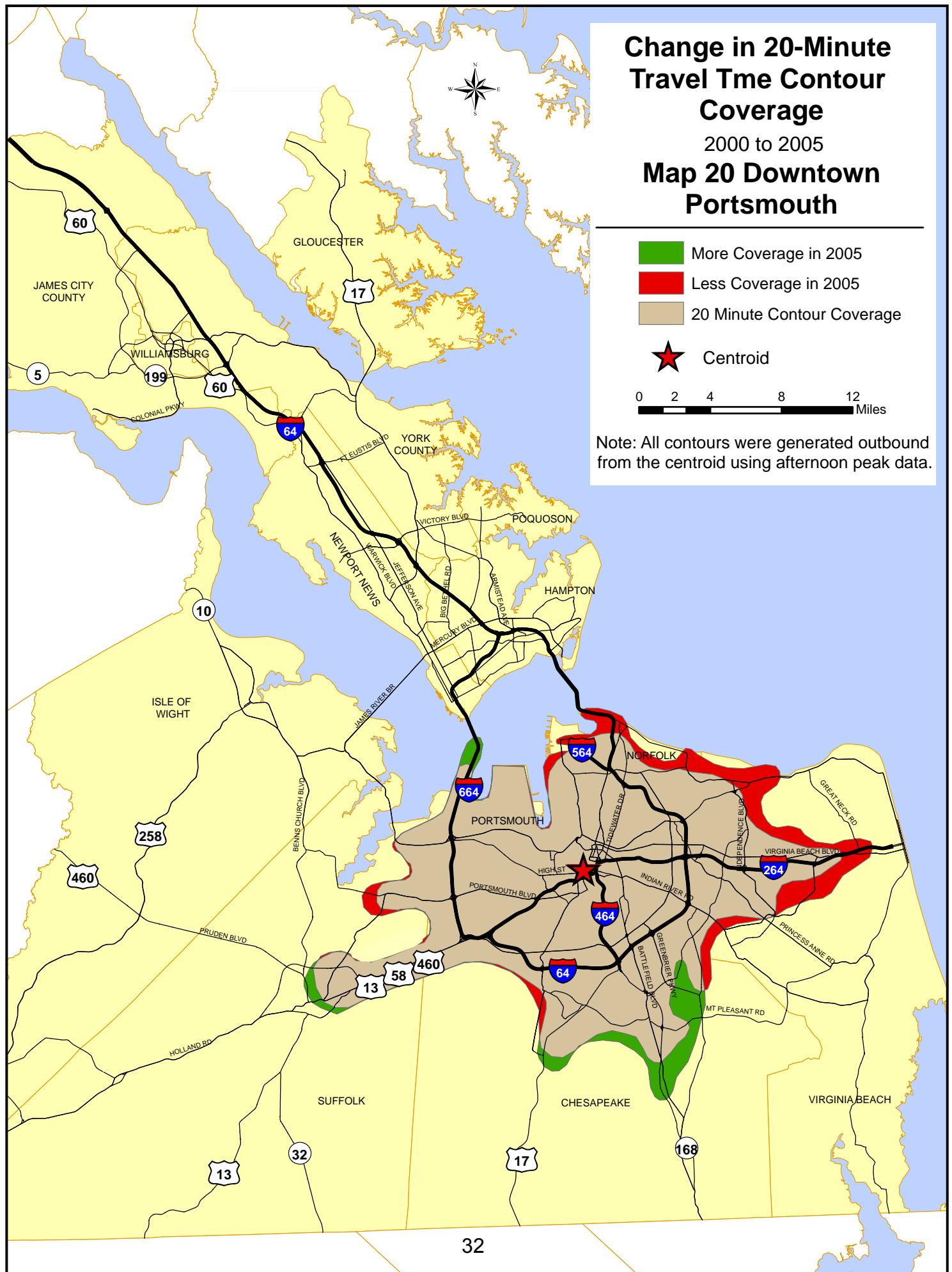
Map 20 Downtown Portsmouth

- More Coverage in 2005
- Less Coverage in 2005
- 20 Minute Contour Coverage

Centroid

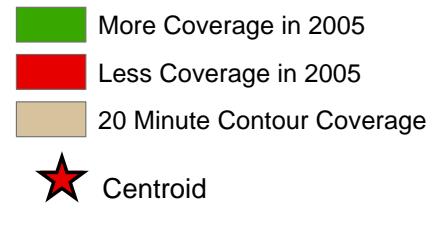
0 2 4 8 12 Miles

Note: All contours were generated outbound from the centroid using afternoon peak data.

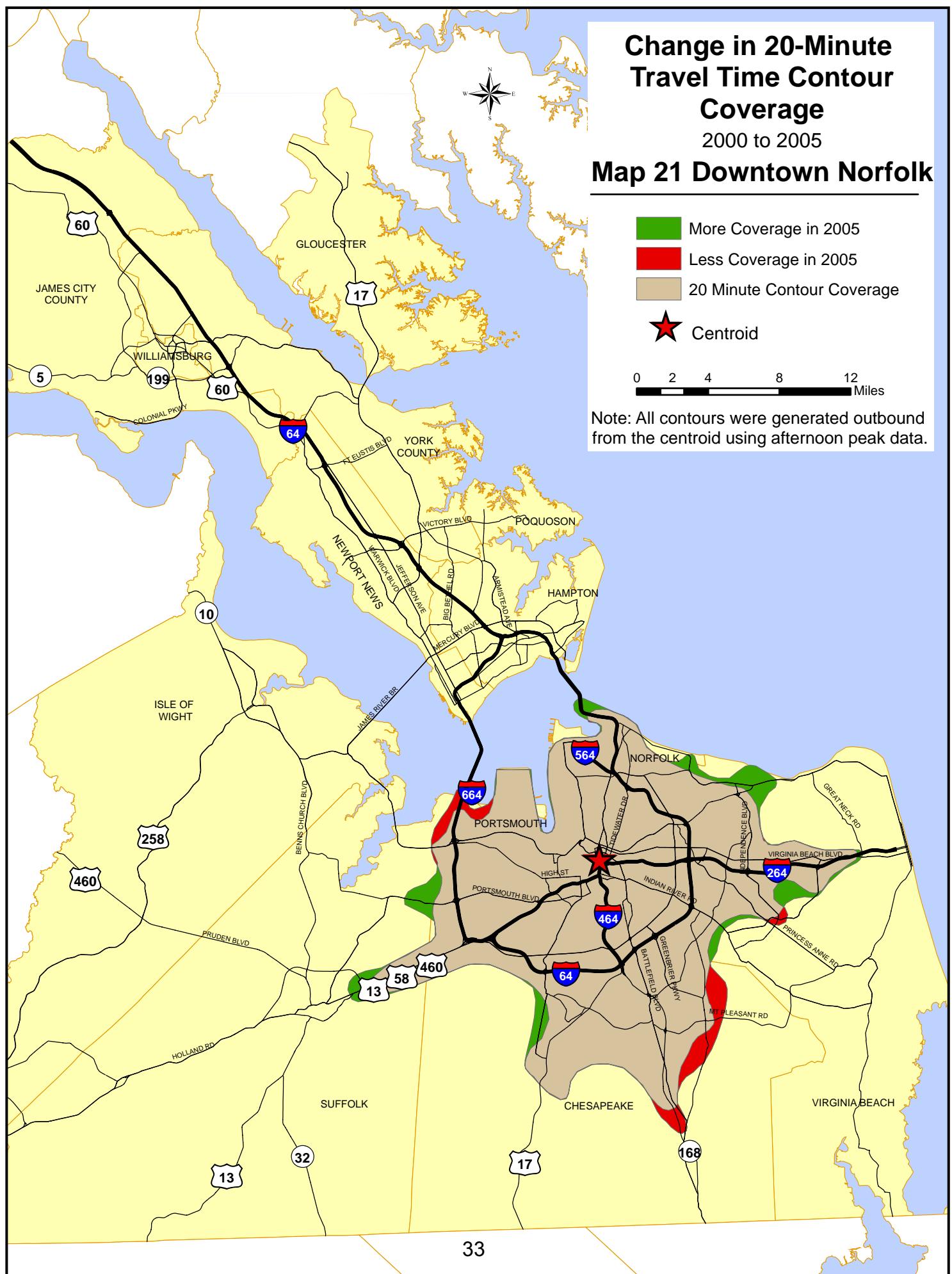


Change in 20-Minute Travel Time Contour Coverage 2000 to 2005

Map 21 Downtown Norfolk



Note: All contours were generated outbound from the centroid using afternoon peak data.



Change in 20-Minute Travel Time Contour Coverage 2000 to 2005

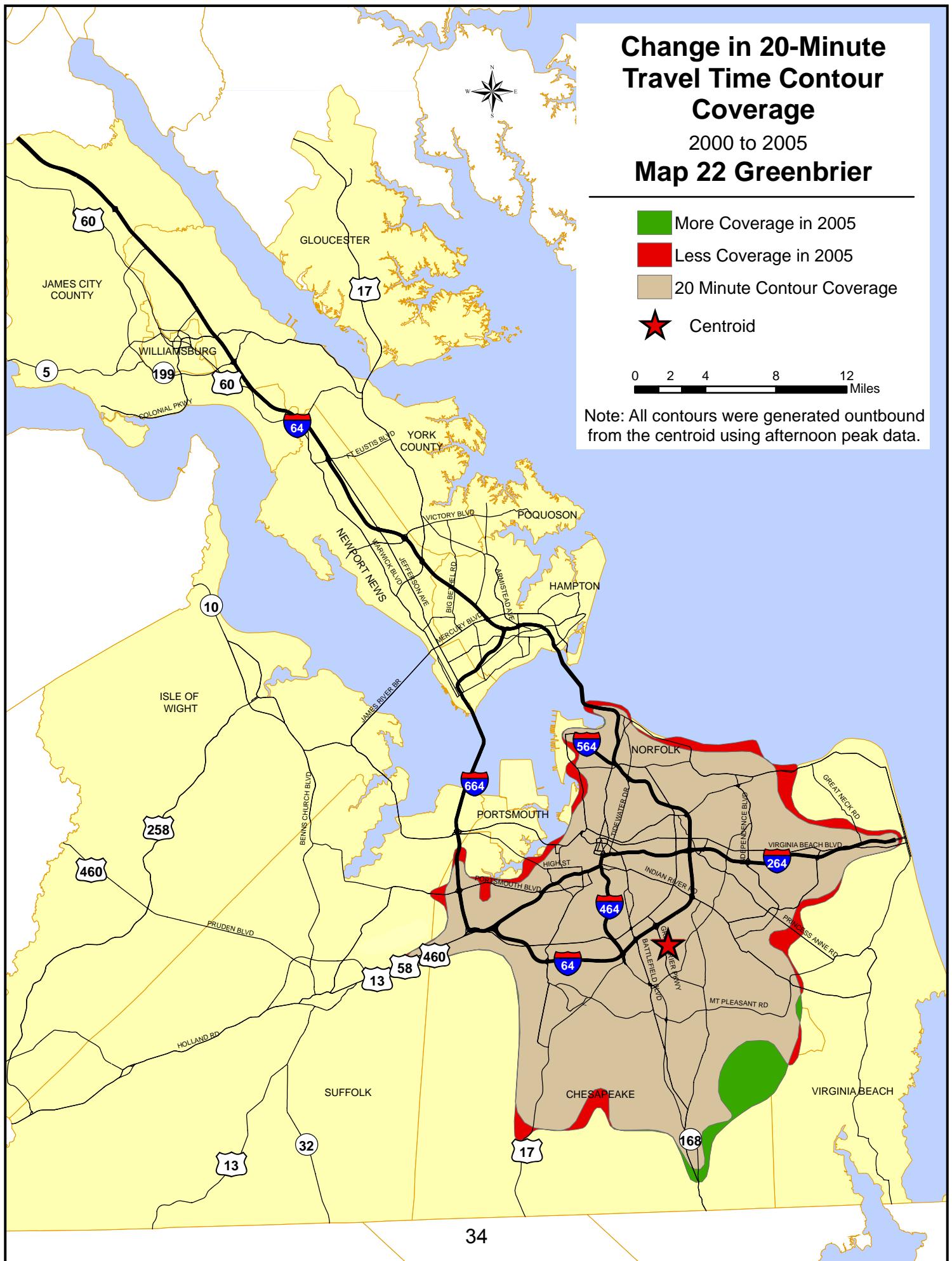
Map 22 Greenbrier

- █ More Coverage in 2005
- █ Less Coverage in 2005
- 20 Minute Contour Coverage

★ Centroid

0 2 4 8 12 Miles

Note: All contours were generated outbound from the centroid using afternoon peak data.



Change in 20-Minute Travel Time Contour Coverage 2000 to 2005

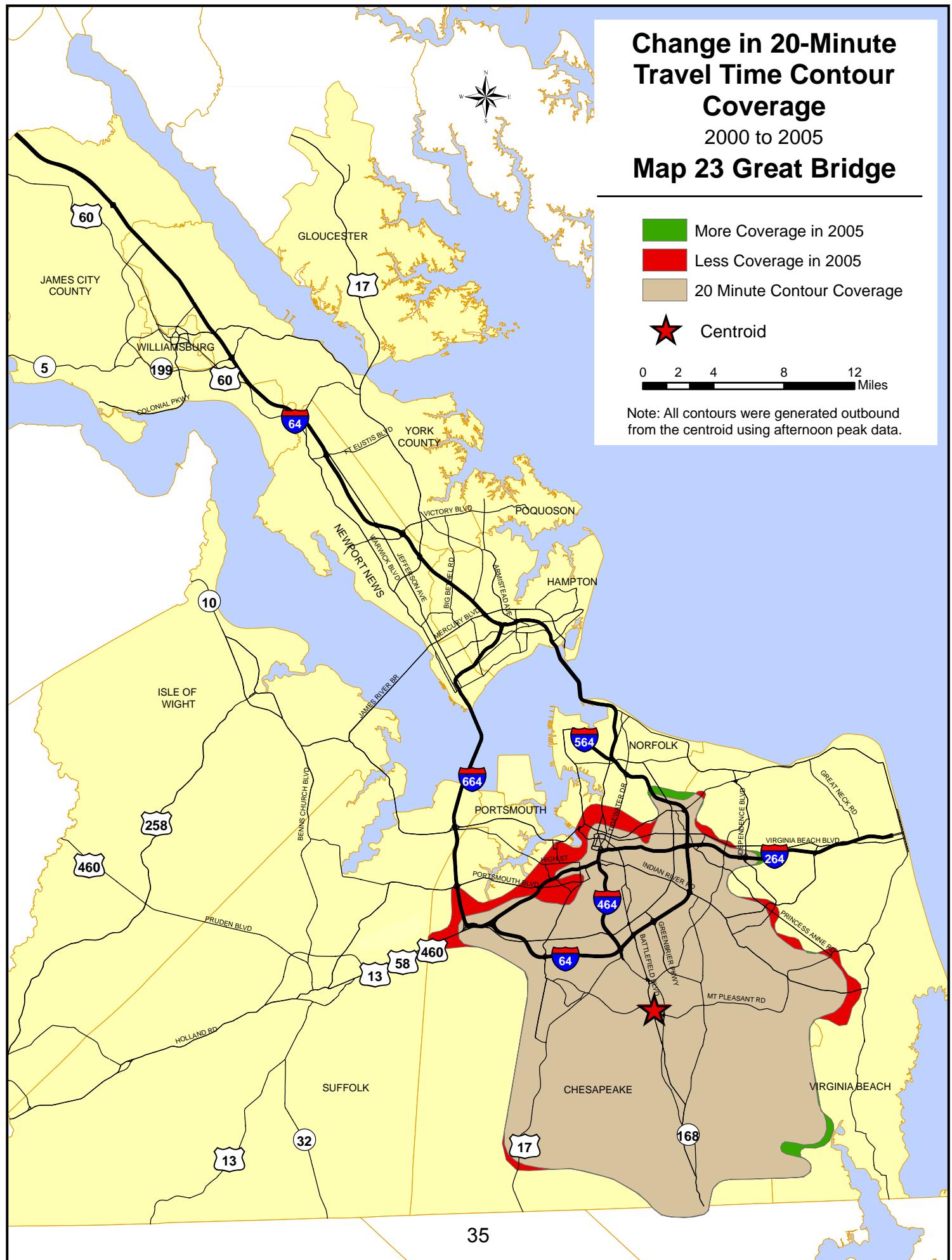
Map 23 Great Bridge

- █ More Coverage in 2005
- █ Less Coverage in 2005
- 20 Minute Contour Coverage

★ Centroid

0 2 4 8 12 Miles

Note: All contours were generated outbound from the centroid using afternoon peak data.



Change in 20-Minute Travel Time Contour Coverage 2000 to 2005

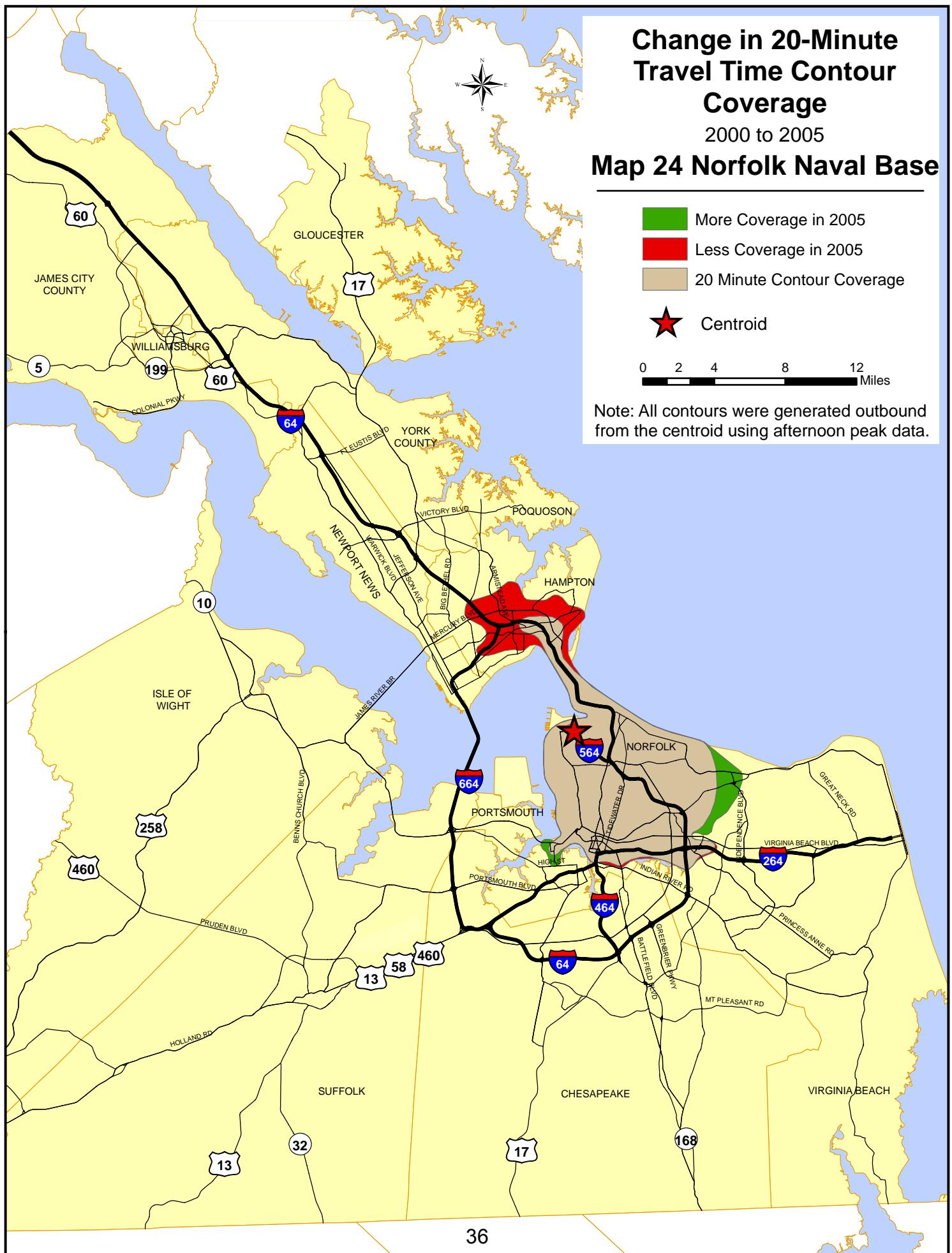
Map 24 Norfolk Naval Base

- More Coverage in 2005
- Less Coverage in 2005
- 20 Minute Contour Coverage



0 2 4 8 12 Miles

Note: All contours were generated outbound from the centroid using afternoon peak data.



Change in 20-Minute Travel Time Contour Coverage 2000 to 2005

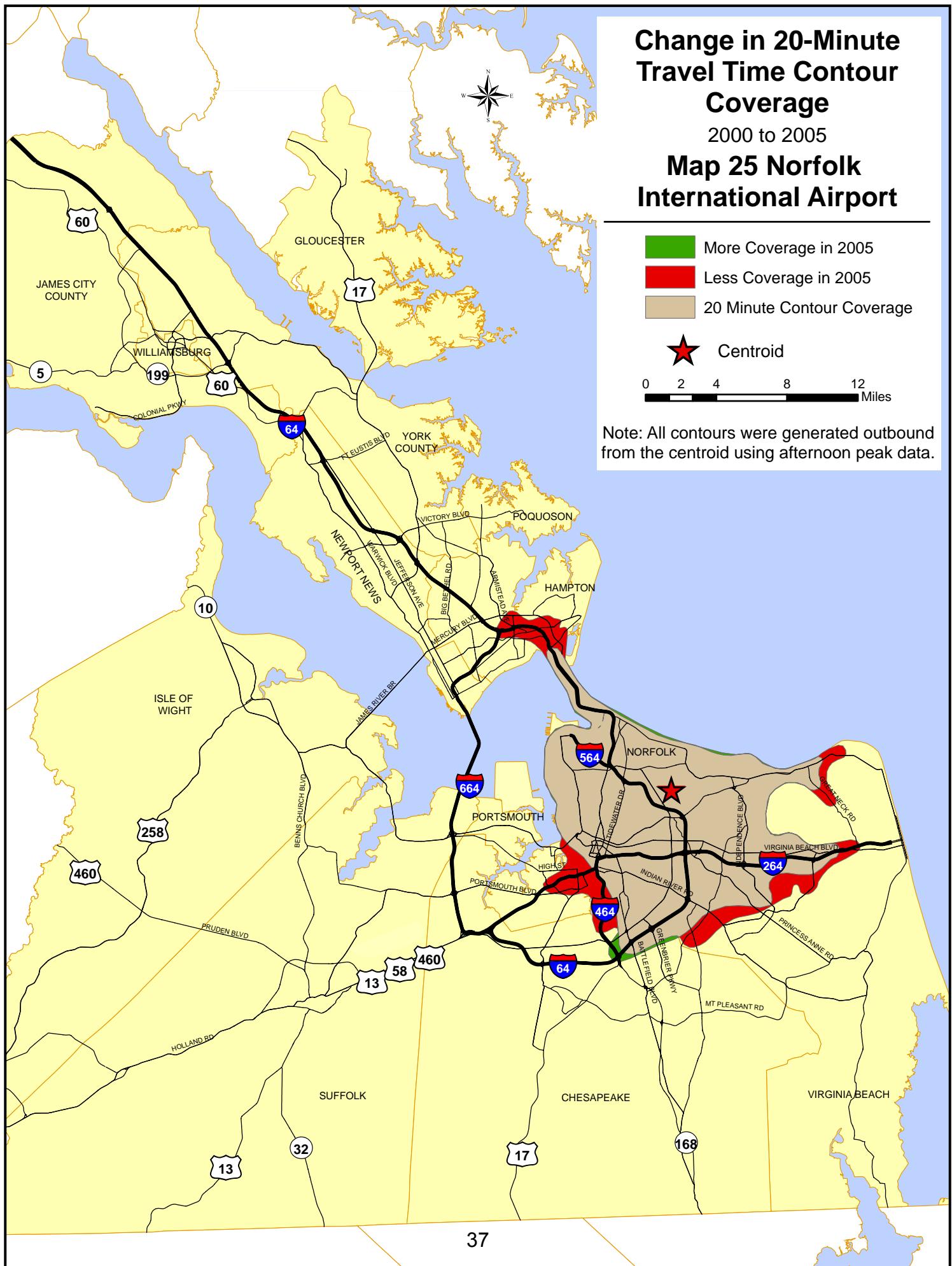
Map 25 Norfolk International Airport

- More Coverage in 2005
- Less Coverage in 2005
- 20 Minute Contour Coverage

Centroid

0 2 4 8 12 Miles

Note: All contours were generated outbound from the centroid using afternoon peak data.





Change in 20-Minute Travel Time Contour Coverage 2000 to 2005

Map 26 Pembroke

- More Coverage in 2005
- Less Coverage in 2005
- 20 Minute Contour Coverage

Centroid

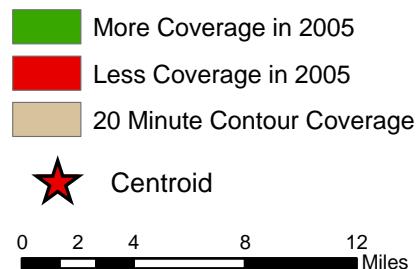
0 2 4 8 12 Miles

Note: All contours were generated outbound from the centroid using afternoon peak data.

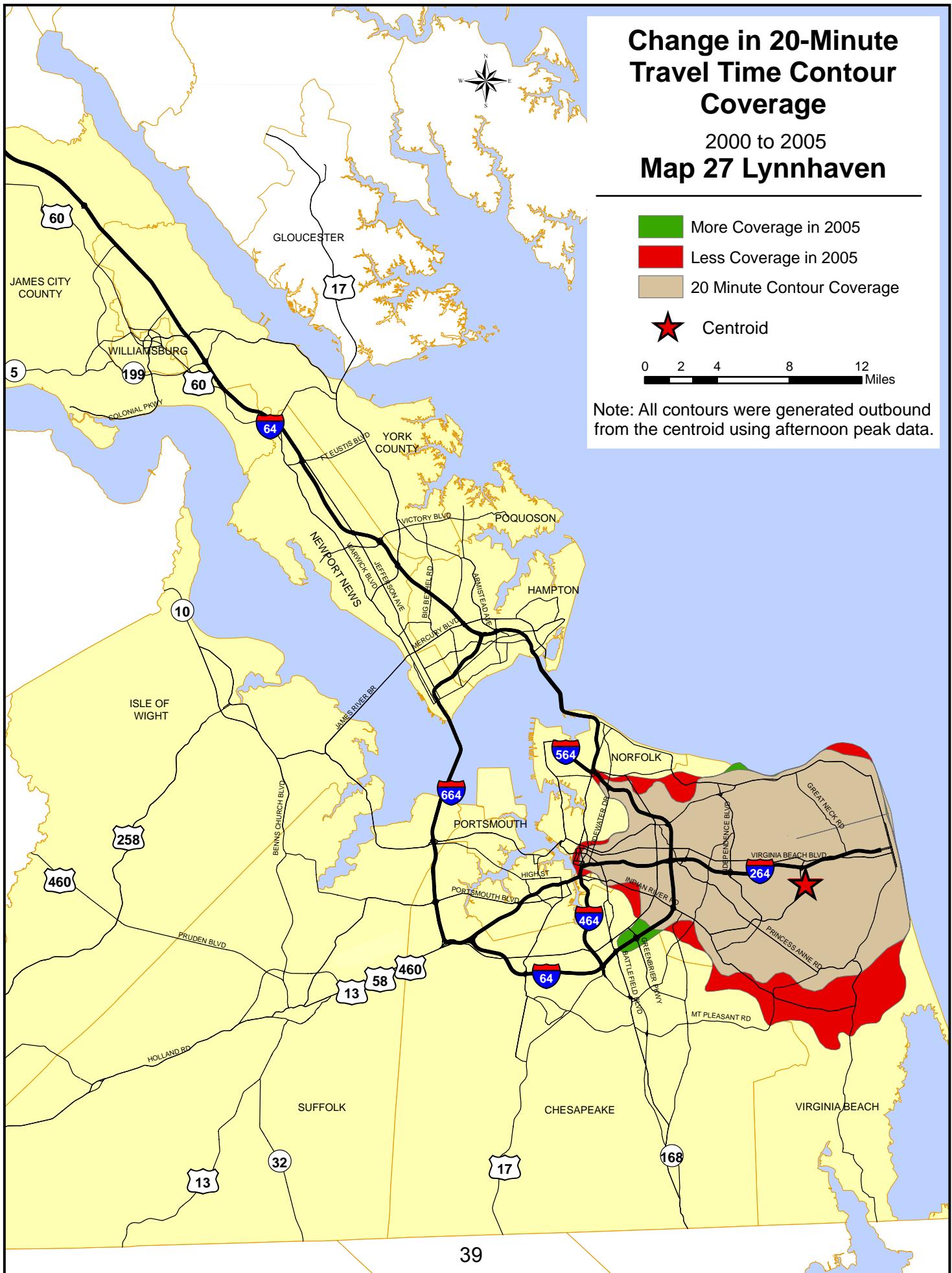
Change in 20-Minute Travel Time Contour Coverage

2000 to 2005

Map 27 Lynnhaven



Note: All contours were generated outbound from the centroid using afternoon peak data.



Speed Profile

Distance or Time? Was it a seven-mile backup at the Hampton Roads Bridge Tunnel or a 30-minute delay? Both. But as a driver, the answer to that question may depend upon your point of view. Some motorists measure delay as the extra time it took to make a trip. For others, delay is described in terms of how far traffic is backed up. In this section of the report, delay is visualized in terms of both distance and time.

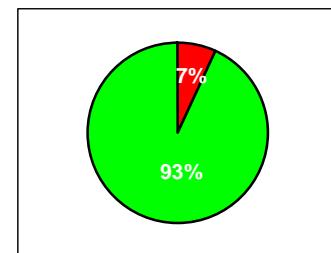
On the following pages are a series of speed profiles for the four main bridge-tunnels in Hampton Roads: the Hampton Roads Bridge Tunnel, the Monitor-Merrimac Memorial Bridge Tunnel, the Downtown Tunnel, and the Midtown Tunnel. For each facility, a speed profile was drawn using a measure of both time and distance versus speed. The profiles use afternoon peak hour data and are depicted by direction with the same end points used for data collection in the study.

With the exception of the Monitor-Merrimac Memorial Bridge Tunnel, which experienced only a small delay in the southbound direction and otherwise maintained fairly stable speeds, all other tunnels experienced some delay on the approach to the tunnel itself. This was true in at least one direction of travel, and in most cases it was true for both directions. Likewise, once traffic entered the tunnel, speeds tended to increase and stabilize.

Unique to the Monitor-Merrimac Memorial Bridge Tunnel was the delay experienced at the last segment of the run in the northbound direction. Whereas other tunnels experienced the

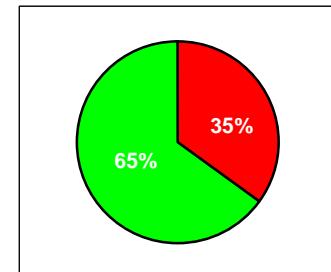
most delay on the approach to the tunnel, the Monitor-Merrimac Memorial Bridge Tunnel run exhibited the most delay on the approach to the Interstate 64 (Peninsula) Interchange. During the study period there were lane closures on Interstate 664 ramps and on westbound Interstate 64 due to construction in the area. As a result, speeds from Powhatan Parkway to I-64 (Peninsula), a 1.02 mile long segment, decrease from 57.6 mph on the previous segment, to a mere 8.4 mph on this segment. Equally noteworthy, is the time it took to cover this distance: 7.28 minutes. This segment of road comprises only 7% of the total distance of the run; yet, it takes 35% of the total time to cover it (**Figures 7 and 8**). This delay is plainly visible on the speed profiles (**Figure 13**).

Figure 7. Percentage of segment distance for I-664: Powhatan Pkwy to I-64 (Peninsula) as compared to total run distance.



Total Distance: 14.32 miles
Segment Distance: 1.02 miles
Percentage of Total Distance: 7%

Figure 8. Percentage of segment travel time (I-664: Powhatan Pkwy to I-64 (Peninsula)) as compared to total run time.



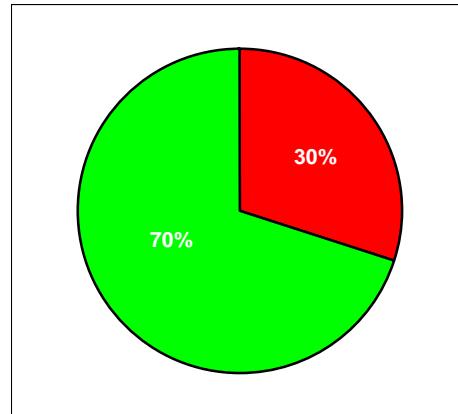
Total Time: 21.1 Minutes
Segment Time: 7.28 Minutes
Percentage of Total Time: 35%

Like the Monitor-Merrimac Memorial Bridge Tunnel, the Downtown Tunnel also showed a significant delay. From Brambleton Avenue to Interstate 464, speeds decreased by 84%, falling from 55.3 mph to 8.6 mph. The relatively short segment distance, 1.56 miles or 30% of the total distance, took an astonishing 67% of the total run time to complete. This dramatic decrease in speed occurs in the vicinity of the Berkley Bridge and results in a 10.8-minute delay on the approach to the tunnel entrance. This is clearly evident in the speed profiles featured in **Figure 15**. **Figures 9 and 10** illustrate the percentage of delay for this run segment.



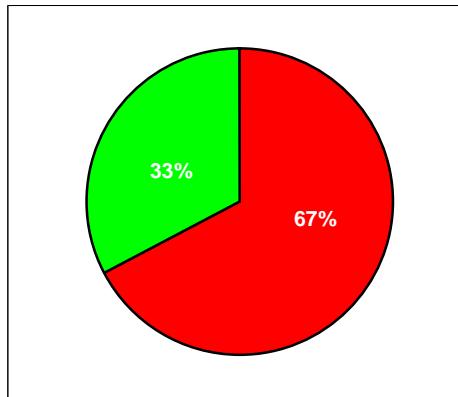
Downtown Tunnel

Figure 9. Percentage of segment distance for I-264: Brambleton Avenue to Interstate 464 as compared to total run distance.



Total Distance:	5.25 miles
Segment Distance:	1.56 miles
Percentage of Total Distance:	30%

Figure 10. Percentage of segment travel time for I-264: Brambleton Ave to Interstate 464 as compared to total run time.



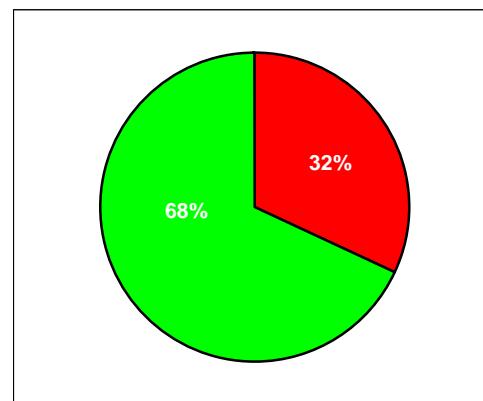
Total Time:	16.2 Minutes
Segment Time:	10.86 Minutes
Percentage of Total Time:	67%

One more example worth noting is the Midtown Tunnel/Martin Luther King Freeway run from Turnpike Road to Brambleton Avenue. For a run that spans less than 3 miles, more than one third of it exhibits speeds of less than 10 mph. Of even more interest is the pattern of delay. The first segment of the run, Turnpike Road to High Street, never achieves speeds higher than 5.8 mph and it takes more than a minute and a half to traverse its very short, 0.16-mile length. Thereafter, speeds increase nicely from High Street to Cleveland Street, before falling again after Cleveland Street. For the next two road segments, Cleveland Street through Pinners Point Interchange, to the tunnel entrance, speeds never exceed 7.7 mph. This segment, which is less than a mile long, takes nearly 8 minutes, of the total 12-minute travel time to complete. That is 63% of the total run time. This is easy to see in **Figure 17**. **Figures 11 and 12** display percentages of delay for the run segment in terms of distance and time, respectively.



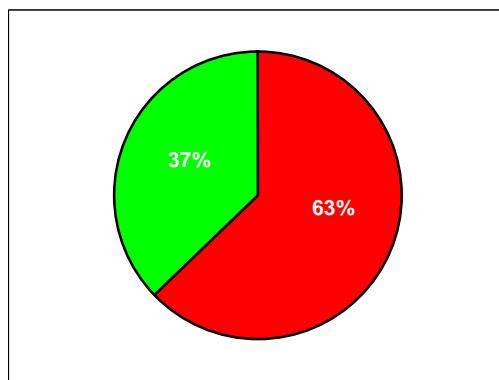
Midtown Tunnel

Figure 11. Percentage of segment distance for Midtown Tunnel/MLK Freeway: Cleveland Street to the tunnel entrance as compared to total run distance.



Total Distance:	2.79 miles
Segment Distance:	0.89 miles
Percentage of Total Distance:	32%

Figure 12. Percentage of segment travel time for Midtown Tunnel: Cleveland Street to the tunnel entrance as compared to total run time.



Total Time:	12.2 Minutes
Segment Time:	7.63 Minutes
Percentage of Total Time:	63%

FIGURE 13
SPEED PROFILES FOR THE
MONITOR-MERRIMAC MEMORIAL BRIDGE TUNNEL: PUGHSVILLE RD
TO I-64 (PENINSULA)

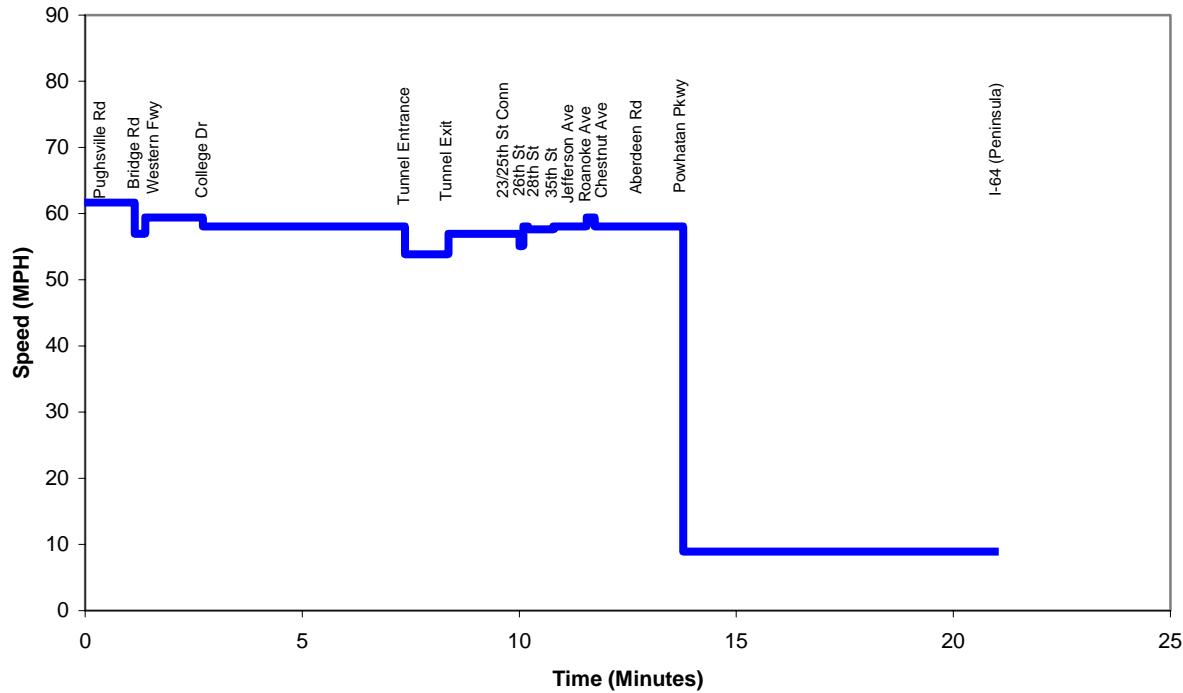
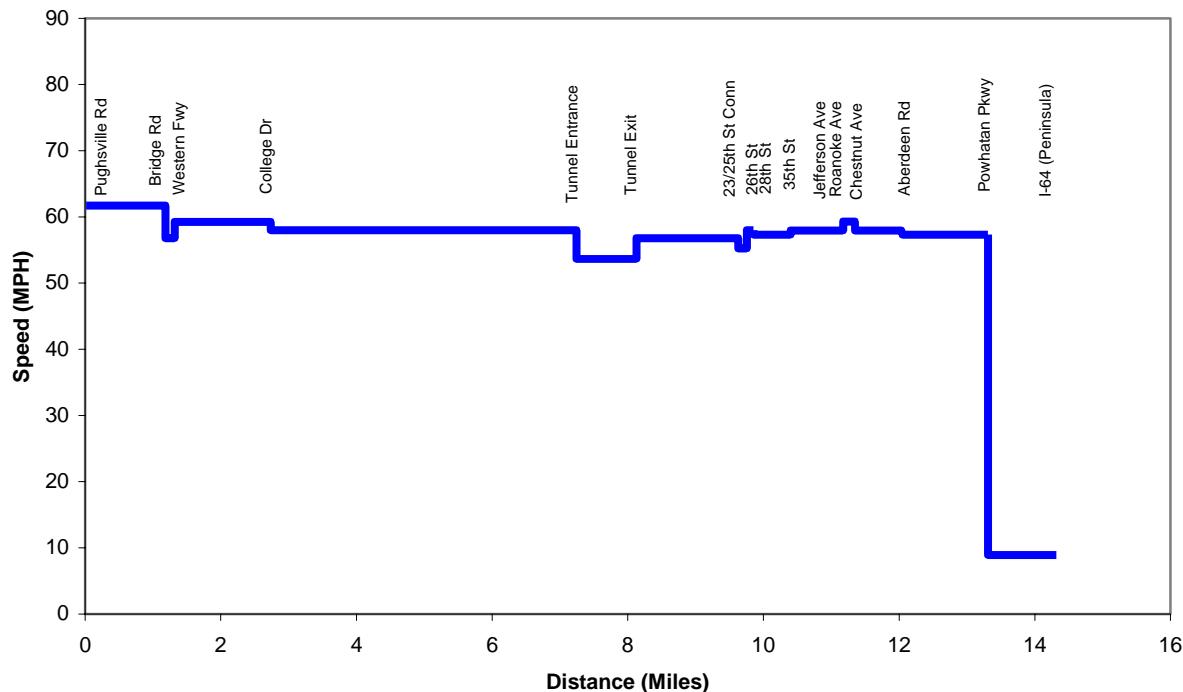


FIGURE 14
SPEED PROFILES FOR THE
MONITOR-MERRIMAC MEMORIAL BRIDGE TUNNEL: I-64 (PENINSULA)
TO PUGHSVILLE RD

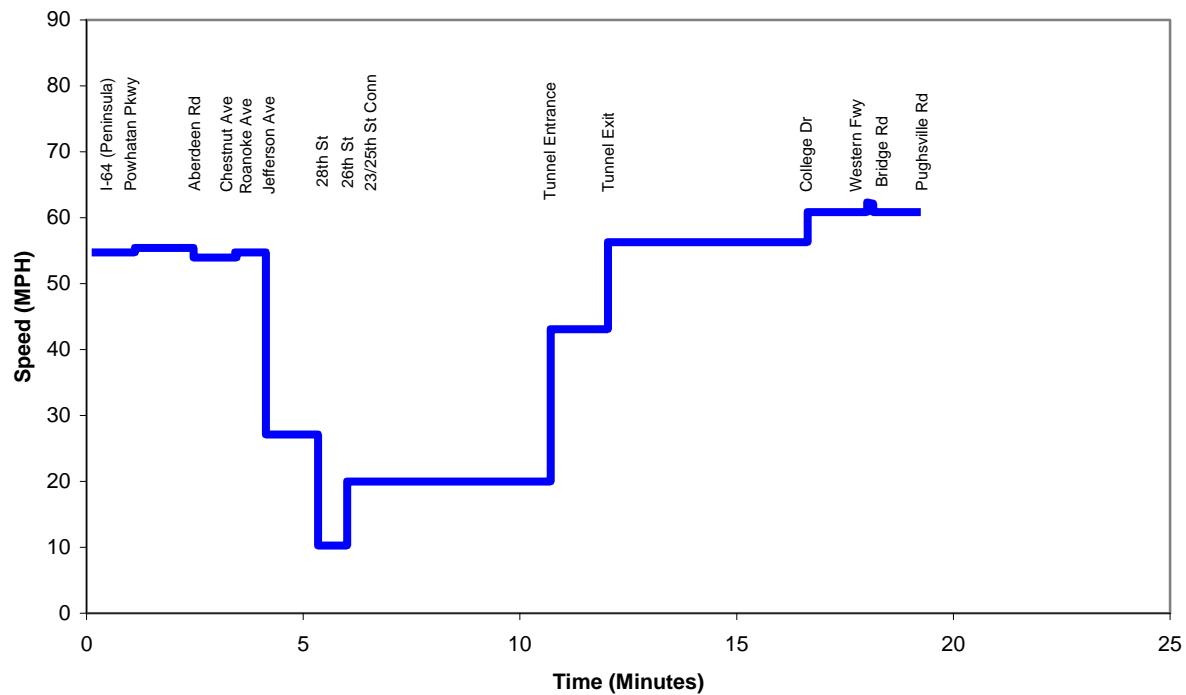
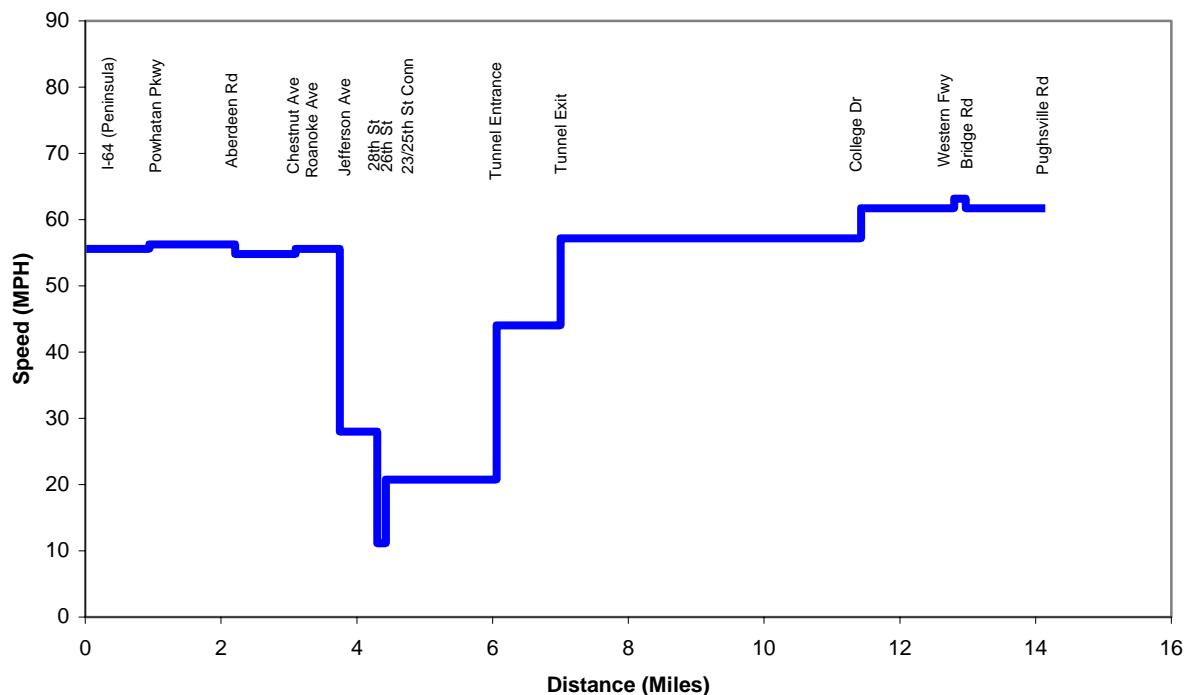


FIGURE 15
SPEED PROFILES FOR THE
DOWNTOWN TUNNEL: BALLENTINE BLVD TO FREDERICK BLVD

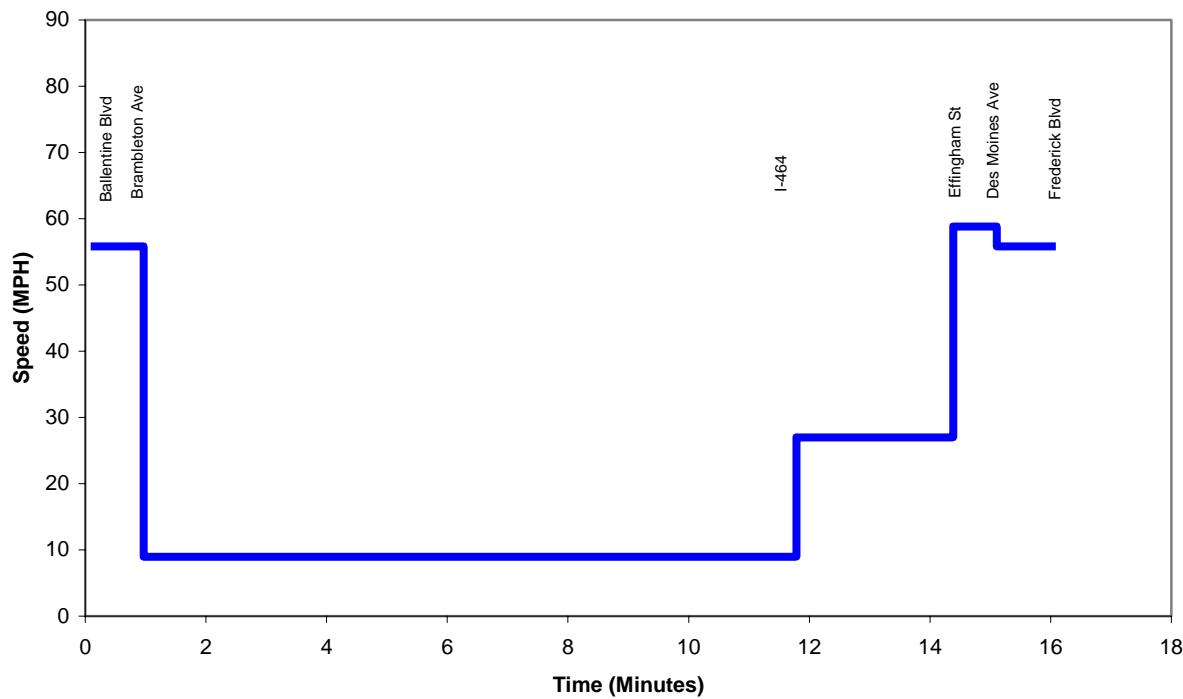
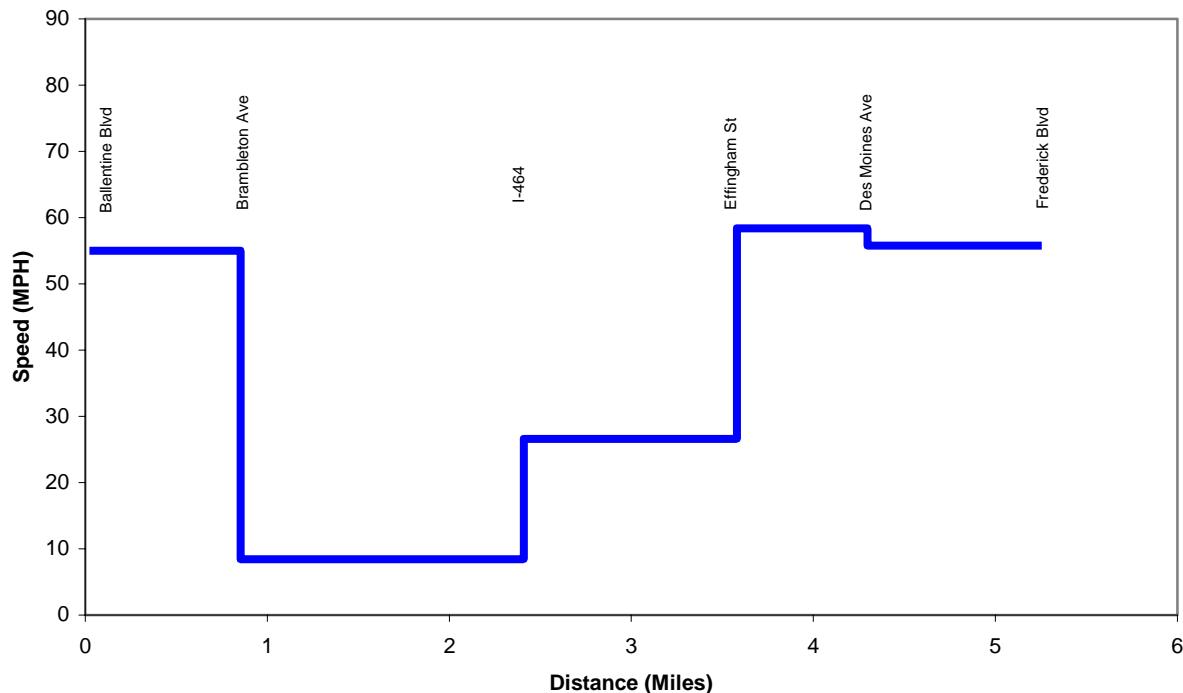


FIGURE 16
SPEED PROFILES FOR THE
DOWNTOWN TUNNEL: FREDERICK BLVD TO BALLENTINE BLVD

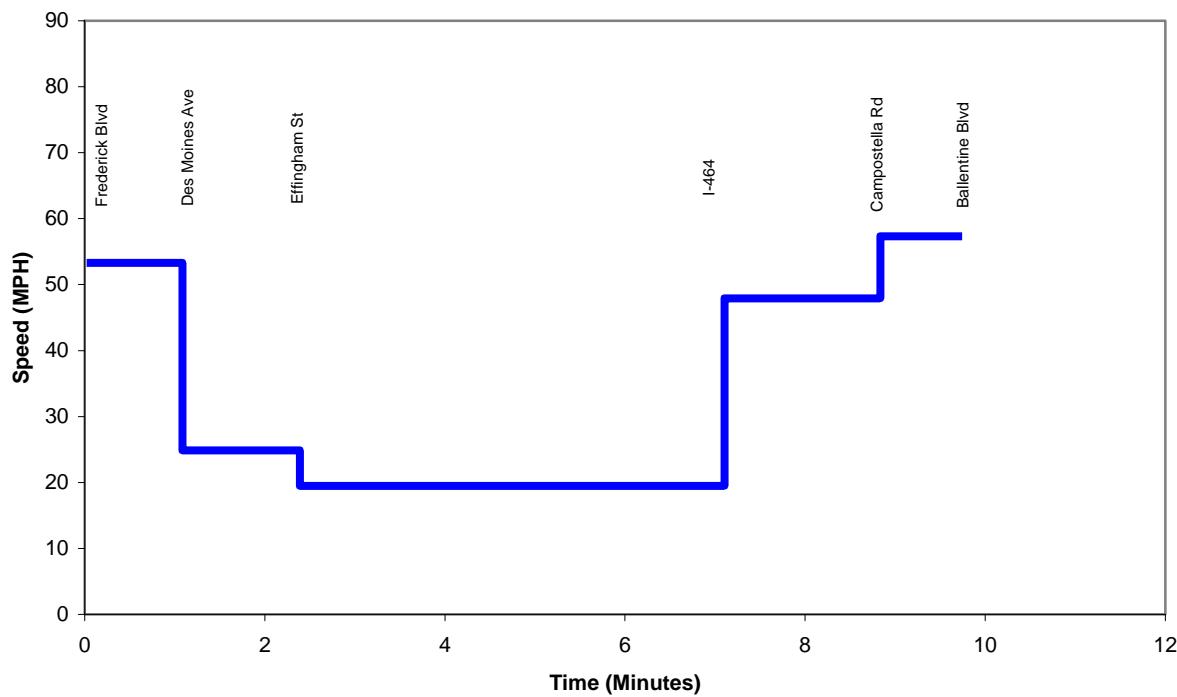
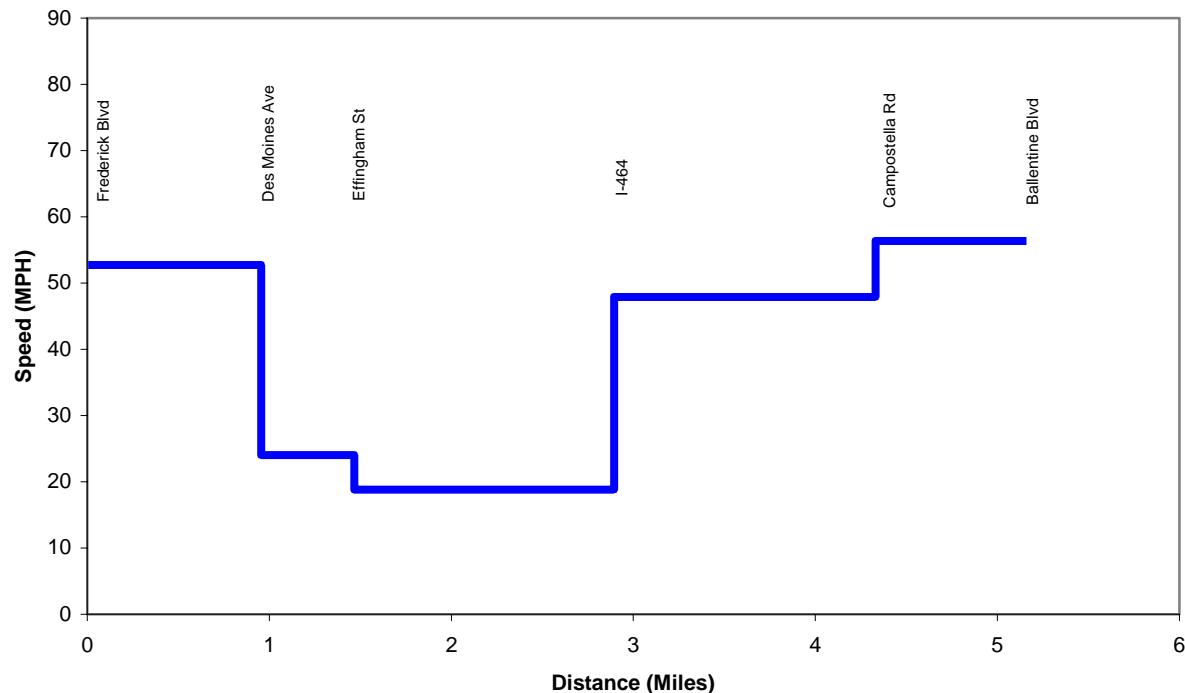


FIGURE 17
SPEED PROFILES FOR THE
MIDTOWN TUNNEL: TURNPIKE RD TO BRAMBLETON AVE

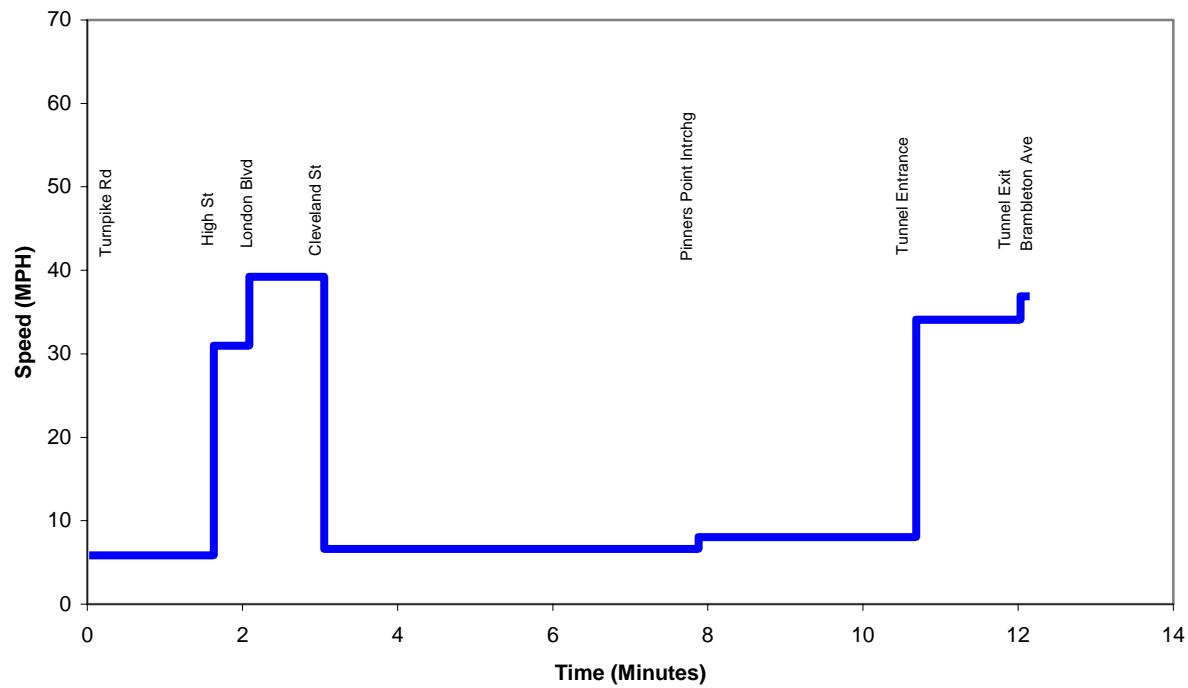
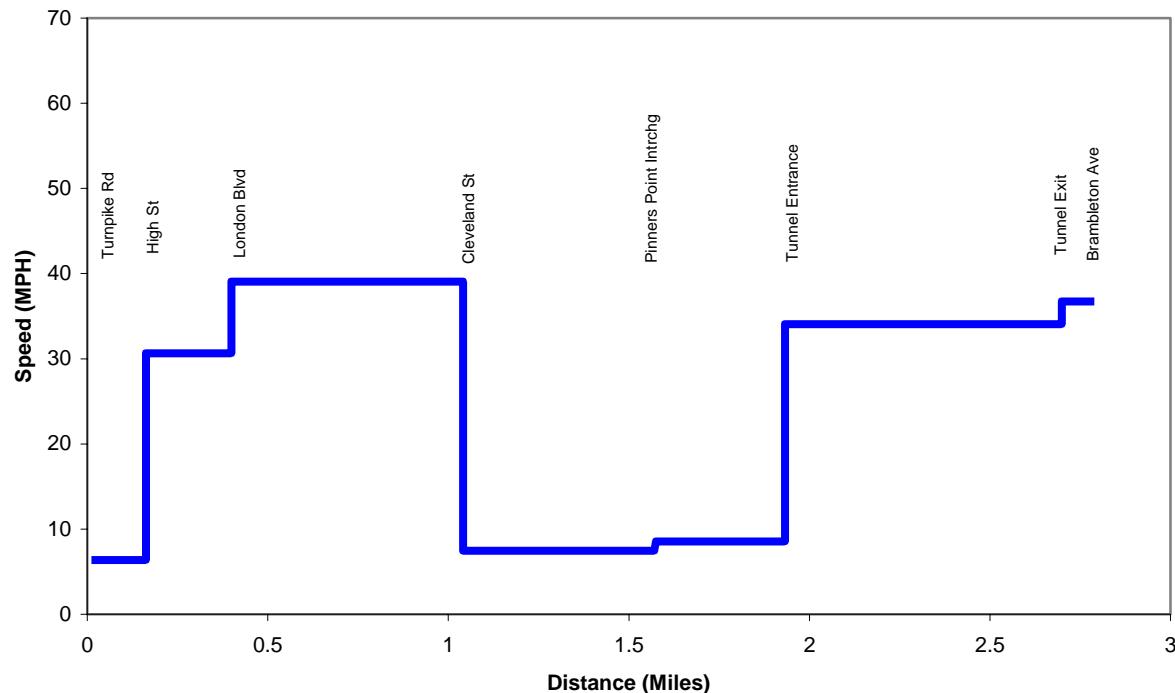


FIGURE 18
SPEED PROFILES FOR THE
MIDTOWN TUNNEL: BRAMBLETON AVE TO TURNPIKE RD

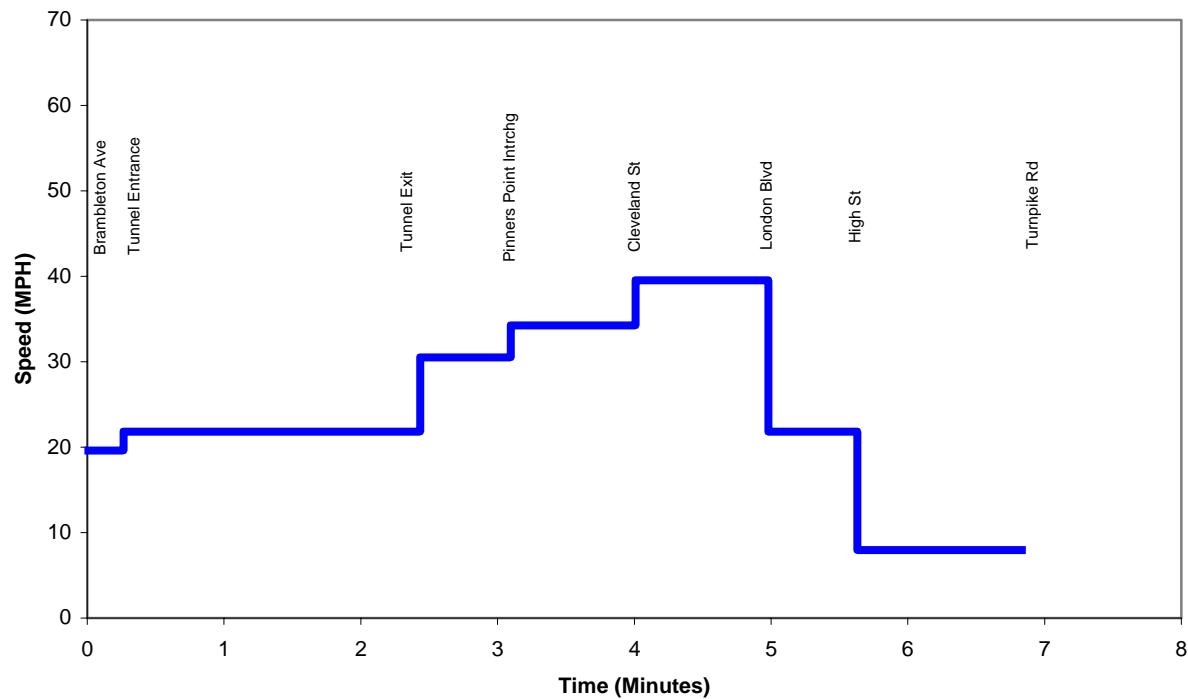
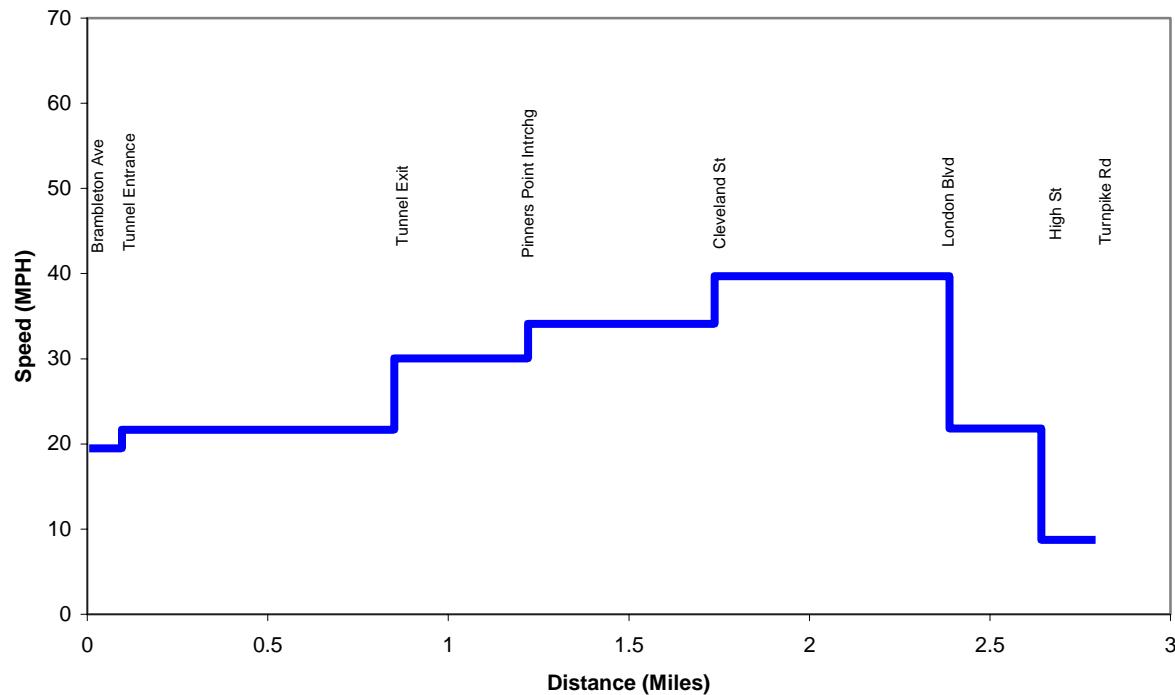


FIGURE 19
SPEED PROFILES FOR THE
HAMPTON ROADS BRIDGE TUNNEL: I-564 TO SETTLERS LANDING RD

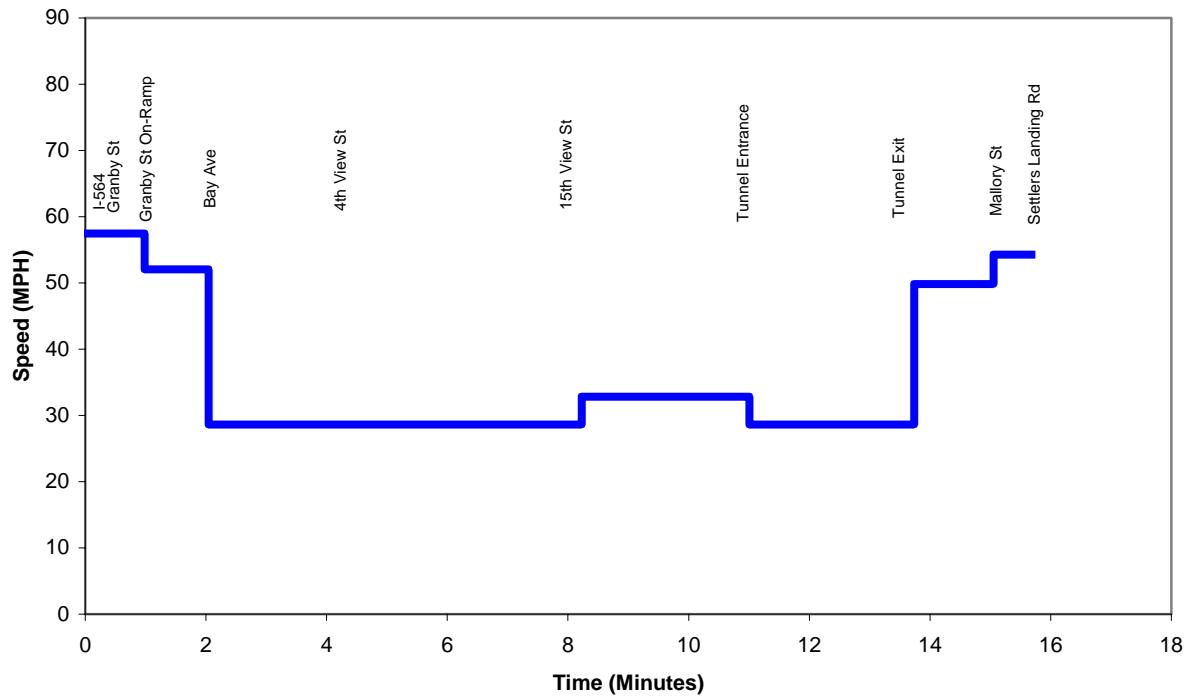
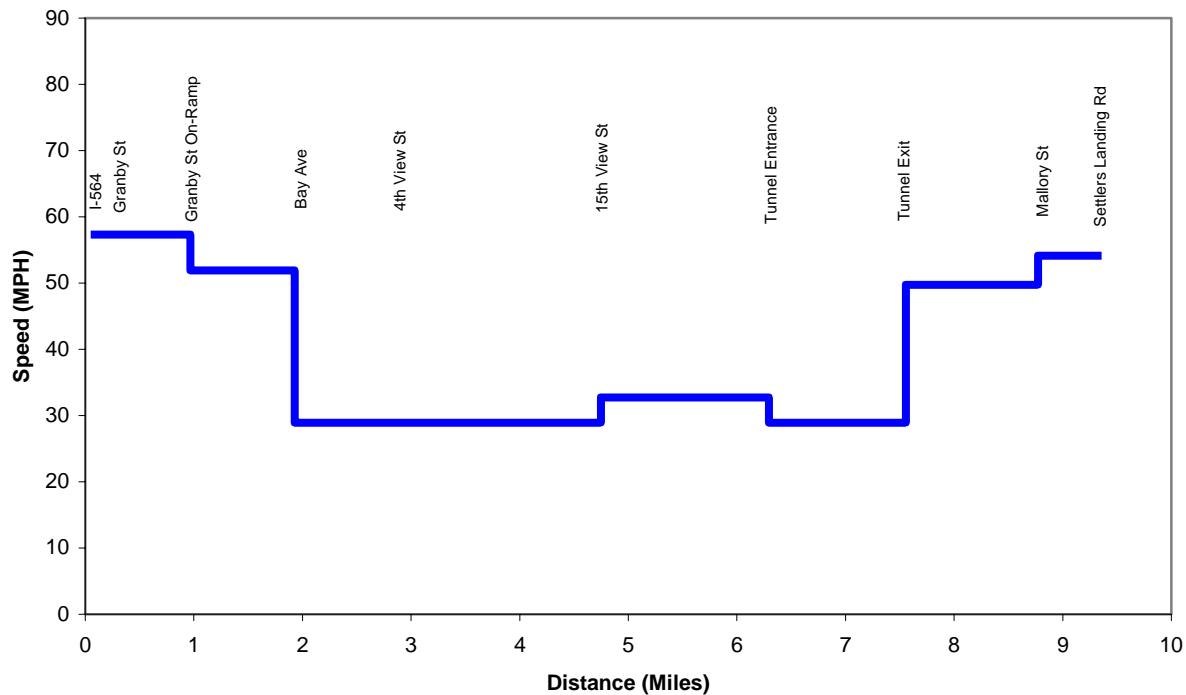
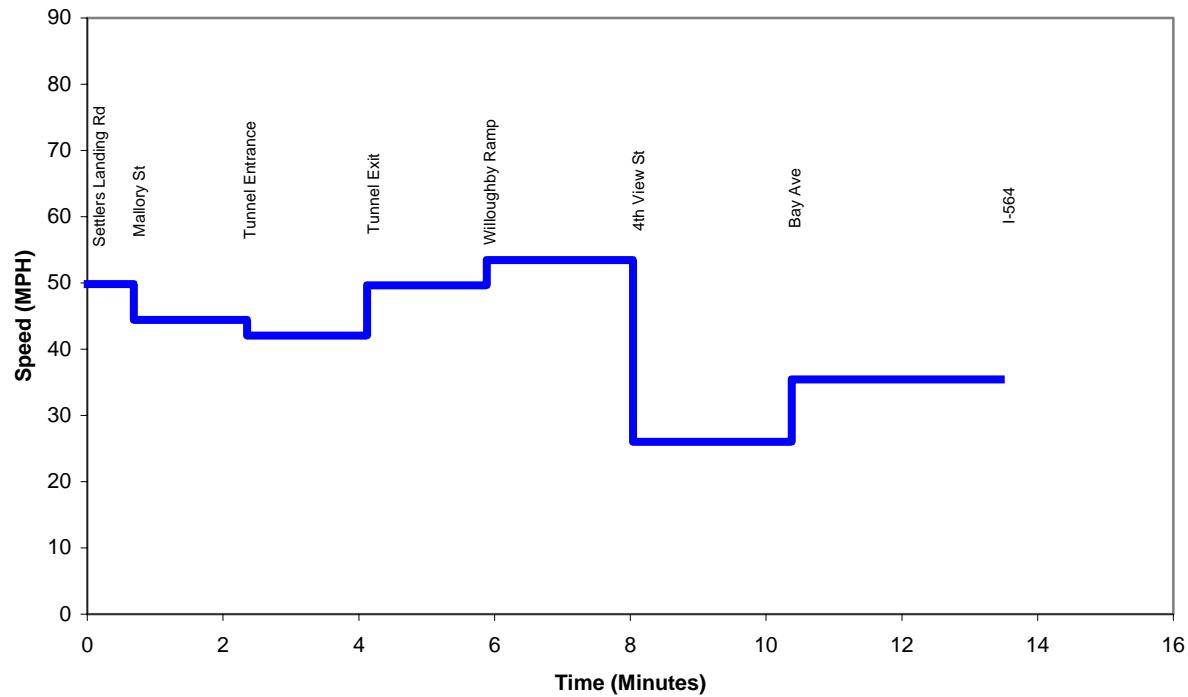
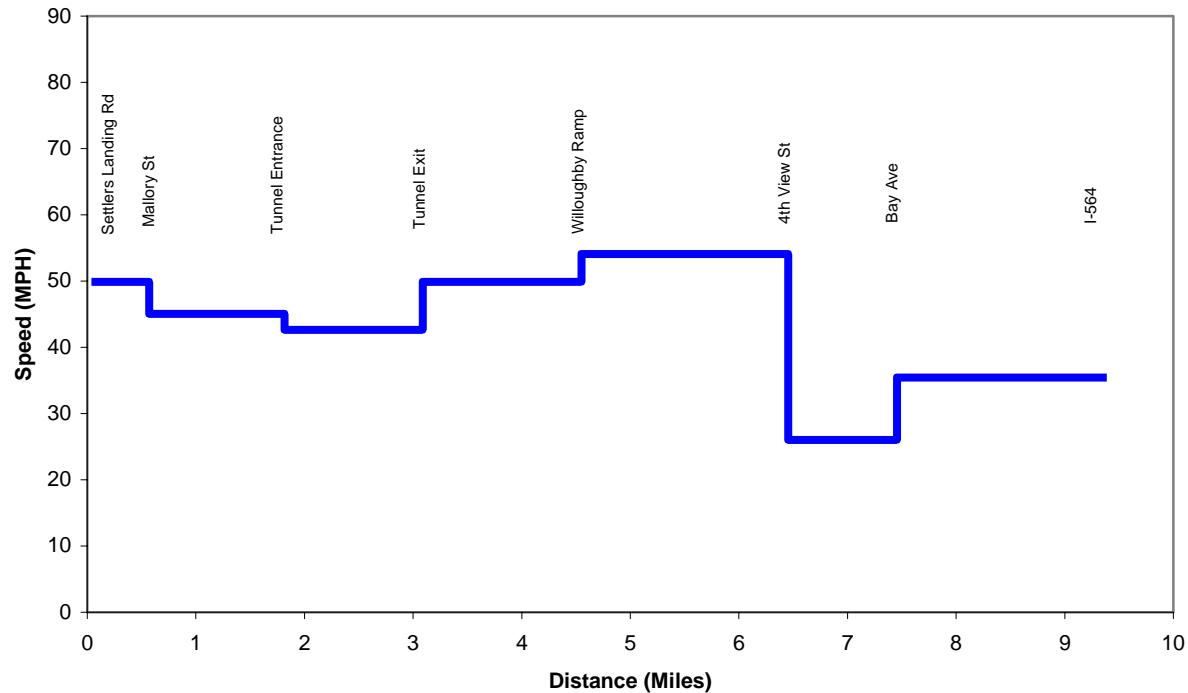


FIGURE 20
SPEED PROFILES FOR THE
HAMPTON ROADS BRIDGE TUNNEL: SETTLERS LANDING RD TO I-564



Speed Ratio

For the purposes of this study, a speed ratio is a comparison of the posted speed to the average traffic speed. If the average traffic speed was 20 mph in a 40 mph zone, then the speed ratio would be 50%.

The Speed Ratio function is a customized tool within the Travel Time ArcView 3.2 application. The tool allows the user to query for speed ratios by selecting from a set of predefined parameters, such as morning or afternoon peak, percentage of speed ratio, and jurisdiction(s) desired. The function is then employed and the results are displayed on the map and in a table within the project.

To better understand how much of the travel time road network falls below a 100% ratio, and just how far below it falls, data from each run, for each peak period and in both directions, was processed with the speed ratio tool and then evaluated.

The first step in the process was to divide the data into two categories, interstates and non-interstate (arterial) roads. Then, using four speed ratio ranges, 0-80%, 80-90%, 90-95% and 95% and higher, the percentage of roadway miles which fell into each range was calculated.

Tables 4 and 5 show the speed ratio ranges and the percentage of road miles that fell into each range.

Table 4: PERCENTAGE OF ARTERIAL MILES WITHIN EACH SPEED RATIO RANGE

SPEED RATIO→	0-80%	80-90%	90-95%	95% and higher
AM PEAK PERIOD	39.5%	14.6%	9.6%	36.3%
PM PEAK PERIOD	40.6%	18.2%	6.8%	34.4%

Table 5: PERCENTAGE OF INTERSTATE MILES WITHIN EACH SPEED RATIO RANGE

SPEED RATIO→	0-80%	80-90%	90-95%	95% and higher
AM PEAK PERIOD	4.5%	2.6%	3.6%	89.3%
PM PEAK PERIOD	13.5%	4.0%	5.7%	76.8%

Point-to-Point Travel Time

Another way of viewing travel time data is in the form of point-to-point travel time. **Figure 21** illustrates changes in travel time to and from different points throughout the region.

Figure 21 is a matrix that was assembled using morning peak hour travel times from the 2000 and 2005 studies. Times from each study and the percentage of change between the two study years are shown in the matrix. In addition, the cells in the matrix were color-coded to reflect the type of change that occurred. Red cells represent trips in which travel time was worse in 2005 than in 2000, while green cells represent trips that exhibited an improvement in travel time in 2005. The light blue cells represent trips for which the travel time

did not change. In this sample, 60% of the trips saw improved travel times. Only 30% of the trips saw an increase in travel time and 10% of the trips experienced no change at all.

In addition to the Transportation Improvement Projects mentioned earlier in this report, the increase in posted speed limits along several portions of area's interstates may be responsible for some of the improvement in trip travel times. For some trips, as little as a one or two minute increase in travel time, from one study year to the next amounted to as much as a 9% difference in the overall trip time. Below is a list of the ten trips with the greatest improvement in travel time, followed by a list of ten trips with the greatest degradation in travel time.

Ten Trips with the Greatest Improvement in Travel Time

1. Downtown Suffolk to Downtown Norfolk-Portsmouth
2. Downtown Norfolk-Portsmouth to Great Bridge
3. Newport News City Hall to Newport News-Williamsburg International Airport
4. Coliseum Mall to Newport News-Williamsburg International Airport
5. Greenbrier to Colonial Williamsburg
6. Lynnhaven to Pembroke
7. Newport News-Williamsburg International Airport to Newport News City Hall
8. Downtown Suffolk to Newport News City Hall
9. Downtown Suffolk to Newport News-Williamsburg International Airport
10. Downtown Suffolk to Norfolk International Airport

Ten Trips with the Most Degradation in Travel Time

1. Great Bridge to Colonial Williamsburg
2. Newport News City Hall to Great Bridge
3. Great Bridge to Newport News City Hall
4. Norfolk Naval Base to Downtown Norfolk-Portsmouth
5. Coliseum Mall to Norfolk Naval Base
6. Coliseum Mall to Norfolk International Airport
7. Great Bridge to Greenbrier
8. Newport News City Hall to Norfolk Naval Base
9. Newport News-Williamsburg International Airport to Greenbrier
10. Newport News City Hall to Downtown Norfolk-Portsmouth

FIGURE 21
HAMPTON ROADS REGIONAL TRAVEL TIME:
CHANGE IN POINT TO POINT TRAVEL TIMES, 2000 TO 2005
MORNING PEAK HOUR TRAVEL TIME IN MINUTES

TO →	Coliseum Mall	Colonial Williamsburg	Downtown Norfolk-Portsmouth	Downtown Suffolk	Great Bridge	Greenbrier	Lynnhaven	Newport News City Hall	NN - Wmbg International Airport	Norfolk International Airport	Norfolk Naval Base	Pembroke
FROM ↓												
Coliseum Mall		38 32 -16%	32 35 9%	36 32 -11%	46 42 -9%	31 35 13%	34 39 15%	9 8 -11%	17 12 -29%	22 27 23%	21 27 29%	29 33 14%
Colonial Williamsburg	31 30 -3%		62 62 0	67 60 -10%	77 69 -10%	70 62 -11%	67 66 -1%	33 34 3%	22 22 0	55 54 -2%	48 54 13%	61 60 -2%
Downtown Norfolk-Portsmouth	28 31 11%	66 60 -9%		27 21 -22%	19 12 -37%	14 12 -14%	17 18 6%	29 31 7%	44 40 -9%	14 14 0	19 21 11%	11 12 9%
Downtown Suffolk	35 29 -17%	73 59 -19%	32 20 -38%		34 28 -18%	31 26 -16%	46 37 -20%	29 22 -24%	51 39 -24%	44 34 -23%	41 41 0	40 32 -20%
Great Bridge	40 38	48 67 40%	14	29 24 -17%		10 12 20%	25 24 -4%	22 30 36%	56 47 -16%	23 21 -9%	28 29 4%	19 18 -5%
Greenbrier	31 32 3%	83 60 -28%	11	27 26 -4%	11 13 18%		18 18 0	30 27 -10%	46 45 -2%	15 14 -7%	21 21 0	12 12 0
Lynnhaven	35 35 0	73 61 -16%	20 18 -10%	44 38 -14%	29 24 -17%	20 22 10%		40 41 3%	51 48 -6%	21 22 5%	26 29 12%	11 8 -27%
Newport News City Hall	8 8 0	40 38 -5%	31 37 19%	30 24 -20%	25 35 40%	35 33 -6%	39 41 5%		25 17 -32%	27 29 7%	25 30 20%	34 36 6%
NN - Wmbg International Airport	13 11 -15%	24 24 0	44 43 -2%	48 41 -15%	58 51 -12%	41 49 20%	47 47 0	21 16 -24%		33 35 6%	31 36 16%	41 42 2%
Norfolk International Airport	22 23 5%	60 52 -13%	15 14 -7%	40 35 -13%	25 22 -12%	15 15 0	19 18 -5%	26 24 -8%	38 32 -16%		11 13 18%	14 13 -7%
Norfolk Naval Base	20 21 5%	54 50 -7%	19 25 32%	43 39 -9%	26 26 0	20 18 -10%	23 22 -4%	24 22 -8%	36 29 -19%	10 10 0		17 16 -6%
Pembroke	29 30 3%	67 59 -12%	14 12 -14%	38 33 -13%	23 20 -13%	14 12 -14%	8 9 13%	34 31 -9%	46 39 -15%	15 12 -20%	21 19 -10%	

2000 Travel Time
2005 Travel Time
Change (Percent)

Negative Change Indicates Reduction in Travel Time

Degradation in Travel Time
No Change in Travel Time
Improvement in Travel Time

APPENDIX A

THOROUGHFARE LIST

THOROUGHFARE	FROM	TO	JURISDICTION
4 th View St	Interstate 64	Ocean View Ave	NO
21 st St	Hampton Blvd	Monticello Ave	NO
25 th St (One-Way)	Huntington Ave	26 th St	NN
25 th St	26 th St	Pear Ave	NN
26 th St (One-Way)	25 th St	Huntington Ave	NN
26 th St (One-Way)	Hampton Blvd	27 th St	NO
27 th St (One-Way)	26 th St	Hampton Blvd	NO
38 th St	Hampton Blvd	Granby St	NO
39 th St	Huntington Ave	Chestnut Ave	NN
Aberdeen Rd/ Buxton Ave	Todds Ln	25 th St	HA/NN
Admiral Taussig Blvd	Hampton Blvd	Interstate 564	NO
Airline Blvd	Jolliff Rd	High St	CH/PR
Armistead Ave	Commander Shepard Blvd	Settlers Landing Rd	HA
Atlantic Ave	Campostella Rd (S)	Campostella Rd (N)	CH
Atlantic Ave	Shore Dr	5 th St	VB
Azalea Garden Rd	Virginia Beach Blvd	Little Creek Rd	NO
Bainbridge Blvd	Dominion Blvd	Main St	CH/NO
Ballentine Blvd	Interstate 264	Chesapeake Blvd	NO
Barhamsville Rd	Interstate 64	RT 60	JC
Battery Park Rd	S Church St	Country Way	IW
Battlefield Blvd	NC State Line	Hillwell Rd	CH
Battlefield Blvd	Hillwell Rd	Johnstown Rd	CH
Battlefield Blvd	Johnstown Rd	Great Bridge Blvd	CH
Battlefield Blvd	Great Bridge Blvd	Campostella Rd	CH
Baxter Rd	Princess Anne Rd	Independence Blvd	VB
Bay Ave	First View St	Interstate 64	NO
Bay Ave (One-Way)	Interstate 64	Granby St	NO
Bayview Blvd	Granby St	Chesapeake Blvd	NO
Belroi Rd	Hickory Fork Rd	RT 17	GC
Benefit Rd	Johnstown Rd	Centerville Tnpk	CH
Bennetts Pasture Rd	Kings Hwy	RT 17 (Bridge Rd)	SU
Berkley Ave	Interstate 464	Marsh St	NO
Berkley Ave Ext	Berkley Ave	Campostella Rd	NO
Big Bethel Rd	Victory Blvd	Briarfield Rd	HA/YC
Birdneck Rd	General Booth Blvd	Laskin Rd	VB
Blackwater Rd/ Fentress Airfield Rd	NC State Line	Mount Pleasant Rd	CH/VB
Bland Blvd	Warwick Blvd	Siemens Way	NN
Boundary St/Francis St/ York St	Jamestown Rd	Page St	WM
Brambleton Ave	Hampton Blvd	Interstate 264	NO
Briarfield Rd	Jefferson Ave	Power Plant Pkwy	HA/NN
Bruce Rd	Taylor Rd	Tyre Neck Rd	CH
Butts Station Rd	Kempsville Rd	Centerville Tnpk	CH

THOROUGHFARE	FROM	TO	JURISDICTION
Bypass Rd/Page St	Richmond Rd	York St	WM/YC
Campostella Rd	Great Bridge Blvd	Interstate 264	CH/NO
Canal Dr	Military Hwy	Geo Washington Hwy	CH
Capitol Landing Rd	Bypass Rd	RT 143 (Merrimac Trl)	WM
Carolina Rd	NC State Line	Fayette St	SU
Carys Chapel Rd	Victory Blvd	Wythe Creek Rd	PQ/YC
Cavalier Blvd	Military Hwy	Greenwood Dr	CH
Cedar Ln	High St	Western Fwy	PR
Cedar Rd	Geo Washington Hwy	Dominion Blvd	CH
Cedar Rd	Dominion Blvd	Battlefield Blvd	CH
Center Ave	Warwick Blvd	Jefferson Ave	NN
Centerville Rd	RT 5 (John Tyler Mem Hwy)	RT 60 (Richmond Rd)	JC
Centerville Tnpk	Battlefield Blvd	Mount Pleasant Rd	CH
Centerville Tnpk	Mount Pleasant Rd	Indian River Rd	CH/VB
Chesapeake Blvd	Ballentine Blvd	Ocean View Ave	NO
Chesapeake Expwy	Interstate 64	Mount Pleasant Rd	CH
Chesapeake Expwy	Mount Pleasant Rd	Gallbush Rd	CH
Chestnut Ave	39 th St	Mercury Blvd	NN
Church St	Brambleton Ave	Granby St	NO
Church St N	Main St	River Oaks Ln	SM
Church St S	RT 10 Bypass	Main St	SM
Churchland Blvd	Western Branch Blvd	High St	CH/PR
City Hall Ave/			
Tidewater Dr	Boush St	Tidewater/Brambleton	NO
Coliseum Dr	Mercury Blvd	H R Center Pkwy	HA
College Dr	RT 17 (Bridge Rd)	Armistead Rd	SU
Colley Ave/			
Jamestown Cres	Brambleton Ave	Hampton Blvd	NO
Colonial Pkwy	RT 359 (Jamestown)	RT 716 (Queens Dr)	JC/WM/YC
Colonial Pkwy	RT 716 (Queens Dr)	Ballard St	YC
Commander Shepard			
Blvd	Semple Farm Rd	Magruder Blvd	HA
Constance Rd	Washington St	Portsmouth Blvd	SU
Cook Rd (Rt 704)	RT 17	Ballard St	YC
County St	Woodland Rd	Mallory St	HA
County St	Constitution Ave	Effingham St	PR
Court St	Interstate 264	Crawford St	PR
Crawford Pkwy/			
Crawford St	Effingham St	Crawford Ct	PR
Crittenden Rd	Kings Hwy	RT 17 (Bridge Rd)	SU
Croaker Rd	RT 60	Interstate 64	JC
Cromwell Dr/			
Ingleside Rd	Chesapeake Blvd	Virginia Beach Blvd	NO
Cunningham Dr	Todds Ln	Mercury Blvd	HA
Dam Neck Rd	Princess Anne Rd	General Booth Blvd	VB
Deep Creek Blvd/			
Des Moines Ave	Victory Blvd	Interstate 264	PR
Denbigh Blvd	Warwick Blvd	RT 17	NN/YC
Diamond Springs Rd	Newtown Rd	Shore Dr	VB
Dock Landing Rd	Jolliff Rd	Portsmouth Blvd	CH

THOROUGHFARE	FROM	TO	JURISDICTION
Dominion Blvd	Geo Washington Hwy	Interstate 64	CH
Effingham St	Portsmouth Blvd	Interstate 264	PR
Effingham St	Interstate 264	Crawford Pkwy	PR
Elbow Rd	Centerville Tnpk	Indian River Rd	CH/VB
Elbow Rd	Indian River Rd	Salem Rd	VB
Elm Ave/Poindexter St (Jordan Bridge)	London Blvd	Interstate 464	CH/PR
Elmhurst Ln	Airline Blvd	Portsmouth Blvd	PR
Etheridge Manor Rd	Hillwell Rd	Centerville Tnpk	CH
Everets Rd	RT 604 (Lake Prince Dr)	Godwin Blvd	SU
Ferrell Pkwy	Indian River Rd	Princess Anne Rd	VB
Finney Ave	Main St	Pinner St	SU
First Colonial Rd	Oceana Blvd	Great Neck Rd	VB
Fort Eustis Blvd	Warwick Blvd	RT 17	NN
Fox Hill Rd	Mercury Blvd	Old Buckroe Rd	HA
Frederick Blvd	Geo Washington Hwy	High St	PR
Freeman Ave	Interstate 464	Bainbridge Blvd	CH
General Booth Blvd	Princess Anne Rd	Rudee Inlet Bridge	VB
George Washington Hwy (RT 17/RT 17 Bus)	NC State Line	Cedar Rd	CH
George Washington Hwy (RT 17 Bus)	Cedar Rd	Canal Dr	CH
George Washington Hwy	Canal Dr	Portsmouth Blvd	CH/PR
Goodwin Neck Rd	RT 17	Wolf Trap Rd	YC
Granby St	Church St	Thole St	NO
Granby St	Thole St	Ocean View Ave	NO
Great Bridge Blvd	Bainbridge Blvd	Battlefield Blvd	CH
Great Neck Blvd	Potters Rd	Shore Dr	VB
Greenbrier Pkwy	Kempsville Rd	Military Hwy	CH
Greenwood Dr	Airline Blvd	Geo Washington Hwy	PR
Guinea Rd	RT 17	Maryus Rd	GC
Hampton Blvd	Brambleton Ave	Little Creek Rd	NO
Hampton Blvd	Little Creek Rd	Admiral Taussig Blvd	NO
Hampton Roads Center Pkwy	Harpersville Rd	Armistead Ave	HA/NN
Hanbury Rd	Johnstown Rd	Hillwell Rd	CH
Harbour View Blvd	RT 17 (Bridge Rd)	Towne Point Rd	SU
Harpersville Rd	J Clyde Morris Blvd	Warwick Blvd	NN
Harris Creek Rd	Fox Hill Rd	Little Back River Rd	HA
Haygood Rd	Newtown Rd	Independence Blvd	VB
Hickory Fork Rd	RT 17	Belroi Rd	GC
High St	Tyre Neck Rd	Frederick Blvd	PR
High St	Frederick Blvd	Crawford St	PR
Holland Rd	Independence Blvd	Princess Anne Rd	VB
Huntington Ave (One-Way)	71 st St	23 rd St	NN
Interstate 64	New Kent CL	RT 607 (Croaker Rd)	JC
Interstate 64	RT 607 (Croaker Rd)	RT 199E (Exit 242)	JC/YC
Interstate 64	RT 199E (Exit 242)	Fort Eustis Blvd	JC/NN/YC

THOROUGHFARE	FROM	TO	JURISDICTION
Interstate 64	Fort Eustis Blvd	J Clyde Morris Blvd	NN
Interstate 64	J Clyde Morris Blvd	Settlers Landing Rd	HA/NN
Interstate 64 (HRBT)	Settlers Landing Rd	Interstate 564	HA/NO
Interstate 64	Interstate 564	Interstate 264	NO
Interstate 64	Interstate 264	Battlefield Blvd	CH/NO/VB
Interstate 64	Battlefield Blvd	I-264/I-664 (Bowers Hill)	CH
Interstate 264	Interstate 64/664	Frederick Blvd	CH/PR
Interstate 264 (DT)	Frederick Blvd	Ballentine Blvd	NO/PR
Interstate 264	Ballentine Blvd	Witchduck Rd	NO/VB
Interstate 264/21 st St/ 22 nd St	Witchduck Rd	Atlantic Ave	VB
Interstate 464	Interstate 64	Interstate 264	CH/NO
Interstate 564	Admiral Taussig Blvd	Interstate 64	NO
Interstate 664	Interstate 64/264	Pughsville Rd	CH/SU
Interstate 664 (MMMBT)	Pughsville Rd	Interstate 64 (Peninsula)	HA/NN/SU
Independence Blvd	Indian River Rd	Interstate 264	VB
Independence Blvd	Interstate 264	Shore Dr	VB
Indian Lakes Blvd	Providence Rd	Indian River Rd	VB
Indian River Rd	Marsh St	Interstate 64	CH/NO/VB
Indian River Rd	Interstate 64	Lynnhaven Pkwy	VB
Indian River Rd	Lynnhaven Pkwy	North Landing Rd	VB
Indian River Rd	North Landing Rd	Princess Anne Rd	VB
International Pkwy	Lynnhaven Pkwy	London Bridge Blvd	VB
International Terminal Blvd	Hampton Blvd	Interstate 564	NO
Ironbound Rd	Monticello Ave (RT 321)	Richmond Rd	JC/WM
Ironbound Rd/ Sandy Bay Rd	News Rd	Jamestown Rd	JC
J Clyde Morris Blvd	Interstate 64	Warwick Blvd	NN
Jamestown Rd	RT 359 (Jamestown)	Boundary St	JC/WM
Jefferson Ave	Interstate 64 (Exit 247W)	Denbigh Blvd	NN
Jefferson Ave	Denbigh Blvd	Harpersville Rd	NN
Jefferson Ave	Harpersville Rd	25 th St	NN
Johnstons Rd/ Halprin Dr	Sewells Point Rd	Little Creek Rd	NO
Johnstown Rd	Benefit Rd	Battlefield Blvd	CH
Jolliff Rd	Portsmouth Blvd	Airline Blvd	CH
Kecoughtan Rd	Pear Ave	Settlers Landing Rd	HA
Kempsville Rd	Battlefield Blvd	Centerville Tnpk	CH/VB
Kempsville Rd	Centerville Tnpk	Princess Anne Rd	VB
Kempsville Rd	Newtown Rd	Northampton Blvd	NO
King St	Pembroke Ave	Curtis Ln (LAFB Gate)	HA
Kings Fork Rd	Pitchkettle Rd	Godwin Blvd	SU
Kings Hwy (CLOSED)	Godwin Blvd	Nansemond Pkwy	SU
Lafayette Blvd	27 th St	Chesapeake Blvd	NO
Lafayette St	Richmond Rd	Page St	WM
LaSalle Ave	Kecoughtan Rd	Tide Mill Ln	HA
Laskin Rd	Virginia Beach Blvd	Atlantic Ave	VB
Liberty St	State St	Atlantic Ave	CH/NO
Little Back River Rd	King St	Harris Creek Rd	HA

THOROUGHFARE	FROM	TO	JURISDICTION
Little Creek Rd	Hampton Blvd	Shore Dr	NO
Little Florida Rd	Wythe Creek Rd	Poquoson Ave	PQ
Llewellyn Ave	Virginia Beach Blvd	Granby St	NO
London Blvd	High St	Crawford St	PR
London Bridge Rd	General Booth Blvd	Potters Rd	VB
Longhill Rd/Longhill Conn	RT 614 (Centerville Rd)	Ironbound Rd	JC
Lynnhaven Pkwy	Indian River Rd	Virginia Beach Blvd	VB
Main St	Fayette St	Godwin Blvd	SU
Main St S	Interstate 464	Berkley Ave	NO
Mallory St	Interstate 64	Pembroke Ave	HA
Market St	Washington St	Main St	SU
McManus Blvd/ Siemens Way	Bland Blvd	Denbigh Blvd	NN
Mellen St/Ingalls Rd	Mallory St	Mercury Blvd	HA
Mercury Blvd	Warwick Blvd	Mellen St/Ingalls Rd	HA/NN
Midtown Tunnel/ MLK Fwy	Turnpike Rd	Brambleton Ave	NO/PR
Military Hwy	Airline Rd	Interstate 464	CH
Military Hwy	Interstate 464	Lowery Rd	CH/NO/VB
Military Hwy	Lowery Rd	Little Creek Rd	NO
Monticello Ave	RT 5 (John Tyler Hwy)	RT 199	JC
Monticello Ave	RT 199	Richmond Rd	JC/WM
Monticello Ave	City Hall Ave	Church St	NO
Mooretown Rd	RT 199	Waller Mill Rd	YC
Moses Grandy Trl	Shipyard Rd	Sebriell Way	CH
Mount Pleasant Rd	Battlefield Blvd	North Landing Bridge	CH
Nansemond Pkwy/ Portsmouth Blvd	Wilroy Rd	Jolliff Rd	CH/SU
Newtown Rd	Princess Anne Rd	Haygood Rd	NO/VB
Nike Park Rd	Titus Creek Dr	Battery Park Rd	IW
Nimmo Pkwy	West Neck Rd	Princess Anne Rd	VB
Nimmo Pkwy	General Booth Blvd	Upton Dr	VB
Norfolk Ave (CONST)	Birdneck Rd	Atlantic Ave	VB
North Landing Rd	North Landing Bridge	Princess Anne Rd	VB
Northhampton Blvd	Military Hwy	CBBT Toll Plaza	NO/VB
Norview Ave	Tidewater Dr	Norfolk International Airport	NO
Ocean Ave (One-Way)	Granby St	Interstate 64	NO
Ocean View Ave	4 th View St	21 st Bay St	NO
Oceana Blvd	General Booth Blvd	First Colonial Rd	VB
Old Atlantic Ave	Atlantic Ave	Liberty St	CH
Old Buckroe Rd	Pembroke Ave	Fox Hill Rd	HA
Old Stage Rd (RT 30)	New Kent CL	Interstate 64	JC
Olde Towne Rd	Longhill Rd	Richmond Rd	JC
Olney Rd	Colley Ave	Boush St	NO
Oyster Point Rd	Warwick Blvd	Interstate 64	NN
Pacific Ave	Atlantic Ave	Rudee Inlet Bridge	VB
Park Ave	Brambleton Ave	Princess Anne Rd	NO
Pembroke Ave/39 th St	Chestnut Ave	Mallory St	HA/NN

THOROUGHFARE	FROM	TO	JURISDICTION
Pinner St	Washington St	Constance Rd	SU
Pitchkettle Rd	Constance Rd	Kings Fork Rd	SU
Plaza Trail	Princess Anne Rd	Virginia Beach Blvd	VB
Poindexter St	Interstate 464	Liberty St	CH
Poquoson Ave	Wythe Creek Rd	Little Florida Rd	PQ
Portcentre Pkwy	Portsmouth Blvd	Crawford St	PR
Portsmouth Blvd	Jolliff Rd	Interstate 264	CH/PR
Portsmouth Blvd	Interstate 264	Portcentre Pkwy	PR
Portsmouth Blvd	Pinner St	Suffolk Bypass	PR
Power Plant Pkwy	Interstate 664	Mercury Blvd	HA
Powhatan Pkwy	Kecoughtan Rd	Interstate 664	HA
Princess Anne Rd	Hampton Blvd	Military Hwy	NO
Princess Anne Rd	Newtown Rd	Lynnhaven Pkwy	VB
Princess Anne Rd	Lynnhaven Pkwy	General Booth Blvd	VB
Princess Anne Rd	General Booth Blvd	Indian River Rd	VB
Princess Anne Rd	Indian River Rd	NC State Line	VB
Providence Rd	Atlantic Ave	Princess Anne Rd	CH
Pughsville Rd	Shoulders Hill Rd	Taylor Rd	CH/SU
Pungo Ferry Rd	Blackwater Rd	Princess Anne Rd	VB
Quarterpath Rd	RT 199	York St	WM
Queen St	Power Plant Pkwy	Pembroke Ave	HA
Rescue Rd	Newport St	Smiths Neck Rd	IW
Richmond Rd	Olde Towne Rd (RT 658)	Boundary St	WM
Richneck Rd	Denbigh Blvd	Fort Eustis Blvd	NN/YC
Rip Rap Rd	Armistead Ave	King St	HA
Roanoke Ave	Interstate 664	Mercury Blvd	HA/NN
Robin Hood Rd	Chesapeake Blvd	Military Hwy	NO
Rosemont Rd	Dam Neck Rd	Virginia Beach Blvd	VB
RT 3/14	RT 17 Bus	RT 623	GC
RT 5 (J Tyler Mem Hwy)	Charles City CL	RT 199	JC
RT 10 (Old Stage Hwy)	River Oaks Ln	Surry CL	IW/SM
RT 10 Bypass	Church St S	RT 10 Bus	SM
RT 10/258 (Benns Church Blvd)	Brewers Neck Blvd	Church St	IW/SM
RT 10/32 (Godwin Blvd)	Pruden Blvd	Everets Rd	SU
RT 10/32 (Godwin/ Benns Church)	Everets Rd	Brewers Neck Blvd	IW/SU
RT 13/58/460	Suffolk Bypass	Jolliff Rd	CH/SU
RT 17	Interstate 64	Goodwin Neck Rd	NN/YC
RT 17/Coleman Bridge	Goodwin Neck Rd	RT 216 (Guinea Rd)	GC/YC
RT 17	RT 216 (Guinea Rd)	RT 17 Bus South	GC
RT 17	RT 17 Bus South	RT 606	GC
RT 17/James River Bridge	Warwick Blvd	Brewers Neck Blvd	IW/NN
RT 17	Brewers Neck Blvd	Churchland Blvd	CH/IW/SU
RT 17 Bus (Main St)	RT 17	Rt 3/14	GC
RT 32/258 (Brewers Neck Blvd)	RT 10/32	RT 17	IW
RT 58/RT 189	Southampton CL	RT 58 Bus (Ruritan Blvd)	SU
RT 58 (Holland Bypass)	W End of Holland Bypass	RT 647 W (Chappell Rd)	SU

THOROUGHFARE	FROM	TO	JURISDICTION
RT 58 (Holland Rd/ Washington St)	RT 647 W (Chappell Rd)	Constance Rd	SU
RT 58 Bus (Ruritan/ Holland Rd)	Franklin CL	RT 58 (E End of Holland Bypass)	SU
RT 60	New Kent CL	RT 30	JC
RT 60	RT 30	Olde Towne Rd (RT 658)	JC
RT 60 (Pocahontas Trl/ Warwick Blvd)	Quarterpath Rd	Yorktown Rd	JC/NN/YC
RT 132 (Henry St)	Lafayette St	RT 143	WM/YC
RT 132 Y	Colonial Pkwy	RT132 (Henry St)	WM
RT 134 (Hampton Hwy/ Magruder Blvd)	RT 17	Hardy Cash Dr	HA/YC
RT 143 (Merrimac Trl)	Interstate 64 (Exit 247 W)	Interstate 64 (Exit 238)	JC
RT 189	E End of Blackwater Bridge	Sandy Crest Ln	SU
RT 199	Interstate 64 (Exit 234)	RT 5 (J Tyler Mem Hwy)	JC/YC
RT 199	RT 5 (J Tyler Mem Hwy)	RT 641 (Penniman Rd)	JC/WM/YC
RT 238 (Yorktown/Old Wmbg/Goosley)	RT 60 (Warwick Blvd)	Cook Rd (RT 704)	NN/YC
RT 258	RT 58 Bus (Carrsville Hwy)	RT 460	IW
RT 258	RT 460	RT 709 (Waterworks Rd)	IW
RT 258 Truck (Great Mill Hwy)	RT 58 Bus (Carrsville Hwy)	Sandy Crest Ln	IW/SU
RT 258/Main St	RT 709 (Waterworks Rd)	Church St (Bus 10/258)	SM
RT 460	Southampton CL	RT 258	IW
RT 460 (Windsor Blvd/ Pruden Blvd)	RT 258	Godwin Blvd	IW/SU
RT 604 (Providence/ Lake Prince)	Kings Fork Rd	RT 603 (Everets Rd)	SU
RT 641 (Penniman Rd)	RT 199	Colonial Pkwy	YC
Salem Rd	North Landing Rd	Princess Anne Rd	VB
Sandbridge Rd	Princess Anne Rd	Sandpiper Dr	VB
Saunders Rd	Harpersville Rd	Big Bethel Rd	HA
Seaboard Rd	Princess Anne Rd (RT 149)	Princess Anne Rd (RT 615)	VB
Second St	Page St	Rt 143 (Merrimac Trl)	WM
Semple Farm Rd	Big Bethel Rd	Magruder Blvd	HA
Settlers Landing Rd	Pembroke Ave	Interstate 64	HA
Sewells Point Rd	Princess Anne Rd	Little Creek Rd	NO
Shore Dr	21 st Bay St	Great Neck Rd	NO/VB
Shore Dr	Great Neck Rd	Atlantic Ave	VB
Shoulders Hill Rd	Nansemond Pkwy	RT 17 (Bridge Rd)	SU
Smiths Neck Rd	Rescue Rd	RT 17	IW
St Pauls Blvd	Waterside Dr	Monticello Ave	NO
Suffolk Bypass (RT 58)	Holland Rd	RT 13/58/460	SU
Taylor Rd	Portsmouth Blvd	Pughsville Rd	CH
Thole St	Granby St	Tidewater Dr	NO
Tidewater Dr	Brambleton Ave	Ocean View Ave	NO
Titus Creek Dr	Smiths Neck Rd	Nike Park Rd	IW
Todd Ave/Warwick St	Country Way	Newport St (RT 1002)	IW
Todds Ln/Main St	Warwick Blvd	Mercury Blvd	HA/NN

THOROUGHFARE	FROM	TO	JURISDICTION
Towne Point Rd	Churchland Blvd	Harbour View Blvd	CH/PR/SU
Turnpike Rd	Portsmouth Blvd	County St	PR
Twin Pines Rd	Towne Point Rd	Hedgerow Ln	PR
Tyre Neck Rd	Bruce Rd	West Norfolk Rd	CH/PR
Upton Dr	Nimmo Pkwy	Princess Anne Rd	VB
Victory Blvd	Interstate 64	Wythe Creek Rd	NN/PQ/YC
Victory Blvd	Portsmouth Blvd	Elm Ave	PR
Virginia Beach Blvd	Olney Rd	Military Hwy	NO
Virginia Beach Blvd	Military Hwy	Rosemont Rd	NO/VB
Virginia Beach Blvd	Rosemont Rd	Atlantic Ave	VB
Volvo Pkwy	Battlefield Blvd	Kempsville Rd	CH
Warwick Blvd	Yorktown Rd	Oyster Point Rd	NN
Warwick Blvd	Oyster Point Rd	71 st St	NN
Warwick Blvd (One-Way)	23 rd St	Huntington Ave	NN
Washington St (CONST)	Constance Rd	Portsmouth Blvd	SU
Waterside Dr/Boush St	Interstate 264 Ramp	Brambleton Ave	NO
Wesleyan Dr	Northhampton Blvd	Haygood Rd	NO/VB
West Norfolk Rd	Churchland Blvd	Western Fwy	PR
Western Fwy	RT 17 (Bridge Rd)	Pinners Point Interchange	PR/SU
Western Branch Blvd	Churchland Blvd	Tyre Neck Rd	CH/PR
Whaleyville Blvd	NC State Line	Carolina Rd	SU
Willow Wood Dr	Granby St	Tidewater Dr	NO
Wilroy Rd	Constance Rd	Nansemond Pkwy	SU
Wilson Rd/22 nd St	Liberty St	Campostella Rd	CH/NO
Witchduck Rd/			
Pembroke Blvd	Princess Anne Rd	Independence Blvd	VB
Woodland Rd	Interstate 64	Foxhill Rd	HA
Wythe Creek Rd	Commander Shepard Blvd	Yorktown Rd	HA
York St	Page St	Quarterpath Rd	WM
Yorktown Rd	Victory Blvd	Wythe Creek Rd	PQ

NOTES:

CLOSED – Road was closed to traffic during the data collection period.

CONST – Road was under construction during the data collection period.