REGIONAL TRAVEL TIME COLLECTION FOR THE HAMPTON ROADS CONGESTION MANAGEMENT SYSTEM

Presented By

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INTRODUCTION

Hampton Roads is located in the southeastern corner of Virginia and is comprised of ten independent cities and five counties. The region has a population of over 1.4 million. Hampton Roads is divided geographically into two subregions: the *Peninsula* to the north of Hampton Roads harbor and the *Southside* to the south. The Peninsula includes the cities of Hampton, Newport News, Poquoson, and Williamsburg and the counties of James City and York. The Southside includes the cities of Chesapeake, Franklin, Norfolk, Portsmouth, Suffolk and Virginia Beach and the counties of Isle of Wight and Southampton. In addition, a portion of Gloucester County, located across the York River from the Peninsula, is included in Hampton Roads. Prior to 1990, each of the subregions was served by a separate planning district commission (PDC) – the Peninsula Planning District Commission and the Southeastern Virginia Planning District Commission. These two PDCs merged in 1990 to form the Hampton Roads Planning District Commission (HRPDC).

The first, regional travel time study for the Peninsula was published in 1991. The HRPDC has comprehensive travel time studies for the Southside for the years 1983, 1986, 1990, and 1995. The most recent study, **Hampton Roads Regional Travel Time**, Volumes I and II, published in 1995 and 1996, was the first to include the entire region in a single travel time study.

BACKGROUND ON THE STUDY

The information from **Hampton Roads Regional Travel Time** is an element of the Congestion Management System (CMS) for Hampton Roads. The roadway network used in the travel time study was made up of the CMS network plus several additional thoroughfares. The travel time network included 126 thoroughfares and a total of 768 miles of roadway.

Travel time data for the study was collected using the “floating car” method. In the floating car method, a “test” vehicle is driven along a roadway within the traffic stream. An attempt is made on the part of the driver of the test vehicle to drive “normally” for the given traffic conditions, passing approximately the same number of vehicles that pass him. The goal is to provide results that depict the actual, average driving experience for a particular roadway under particular conditions (for example, during the morning rush hour).

For the HRPDC regional study, one travel time run was made in each direction on each thoroughfare during the morning and afternoon peak hours. For the purposes of the study, peak hours were restricted to the commuting periods of 6 – 9 AM and 3 – 6 PM. Data was not collected on Friday afternoons or on holidays. It took seven months to complete the data collection effort.

EQUIPMENT

The equipment used in HRPDC travel time studies includes a test vehicle, a distance measuring instrument (DMI), a portable computer, and **MICROFLOAT** software. The DMI used for the most recent study was a Nu-Metrics Nitestar NS-60. It was calibrated for use in the test vehicle to a precision of plus or minus two feet per mile. The DMI was installed on the dashboard of the test vehicle with Velcro strips for ease of removal for storage when not in use.

The computer used in the study was an Austin notebook computer with a 486-66 MHz processor. A custom-made platform was installed in the test vehicle to securely hold the computer in place while the vehicle was in motion. The platform placed the computer to the right of the driver at a height that allowed for ease of use by the driver, without interfering with vehicle operation.

DATA COLLECTION PROCESS

Data collection utilizing the HRPDC travel time setup is a multi-step process. First, a ***learn-run*** is made in each direction for each thoroughfare. During the learn-run, points of interest called ***nodes*** are identified. Nodes are usually locations at which traffic may be caused to slow down or stop, such as signalized intersections, stop signs, at-grade railroad crossings, drawbridges, tunnels, etc. Nodes are also marked at interchanges and any other point of interest. The learn-run records the node-to-node distance for a specific roadway or section of roadway. Next, the learn run is ***configured***. During the configuration step, the name of the roadway and the names of the nodes (such as cross street names) are added to the learn-run. In addition, the direction in which the learn run was made is identified during the configuration step.

During the ***data-run***, the computer record the distance traveled per second as the vehicle is driven along the roadway. For special studies, multiple data-runs are usually made and averaged to provide the final average travel time and speed information for a specific roadway or roadway segment. For the purposes of the HRPDC regional study, one-data run was made in each direction during each peak hour for each roadway.

Once a configured learn-run and corresponding data-runs have been obtained for a roadway, the ***consolidation*** routine is performed. The software takes the learn-run information that tells the distance from one node to the next and merges it with the data-run information that tells the distance traveled per second. A summary report is printed showing the following information on a node-to-node basis as well as for the entire roadway: distance in feet, number of stops, delay time in seconds, travel time in seconds, average speed in miles per hour, and cruise speed in miles per hour. In addition, the program provides emissions data based on the 1986 **NETSIM** fuel model. The HRPDC does not use the emissions data produced by **MICROFLOAT**.

If multiple data-runs are performed for a roadway, a ***compilation*** routine is run. The compilation routine averages the results of the individual consolidated runs. Output from the compilation routine is similar to the output from the consolidation routine.

USES FOR TRAVEL TIME DATA

Among the many uses of regional travel time data are comparisons of travel time and speed for selected origins and destinations from one study year to the next, identification of transportation system congestion points, and the production of travel time contour maps.

Table 1 is taken from **Hampton Roads Regional Travel Time, Volume I: Analysis**, published by the HRPDC in January 1996. The table shows a comparison of origin-destination distance, travel time, and average speed for the years 1991 and 1995. The first column in the table lists three destinations --- each followed by three or four origins. The intersection used as the starting point is shown in parentheses below each origin. The travel time data used in Table 1 is for the morning peak hour, so the travel times and speeds listed are for the morning commute to work for each of the destinations. A careful look at the table will reveal one origin-destination pair for which the length of the trip decreased by six miles in 1995. This decrease was due to the opening of a new river crossing between the Southside and the Peninsula.

TABLE 1
HAMPTON ROADS REGIONAL TRAVEL TIME
ORIGIN-DESTINATION DATA FOR SELECTED SITES
PENINSULA
1991 VERSUS 1995
AM PEAK HOUR

	DISTANCE (Miles)		TRAVEL TIME (Minutes)		AVERAGE SPEED (MPH)	
DESTINATION	**1991**	**1995**	**1991**	**1995**	**1991**	**1995**
NEWPORT NEWS SHIPBUILDING						
From: Fox Hill (Fox Hill Rd & Woodland Rd)	8.9	8.9	12.4	13.2	43.1	40.7
From: Denbigh (Denbigh Blvd & Warwick Blvd)	16.4	16.4	26.2	21.2	37.5	46.2
From: Coleman Bridge (US 17 & Route 1206)	22.9	22.9	36.9	41.1	37.3	33.5
From: Suffolk (US 17 & Shoulders Hill Rd)	16.9	10.9	22.9	12.0	44.4	54.7
NASA/LANGLEY						
From: Fox Hill (Fox Hill Rd & Woodland Rd)	6.8	6.8	13.9	12.1	29.2	33.6
From: York Co. (US 17 & Dare Rd)	8.5	8.5	27.4	20.0	18.6	25.5
From: Wards Corner (Granby St & Little Creek Rd)	16.9	16.9	20.9	19.8	48.8	51.4
OYSTER POINT						
From: Fox Hill (Fox Hill Rd & Woodland Rd)	10.7	10.7	17.1	19.2	37.6	33.6
From: Williamsburg (US 60 & Route 199)	16.5	16.5	21.2	17.6	46.5	56.2
From: Denbigh (Denbigh Blvd & Warwick Blvd)	6.0	6.0	14.9	9.7	24.3	37.1

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DEVELOPING TRAVEL TIME CONTOURS

The current method employed by the HRPDC for producing travel time contour maps is a time-consuming, manual operation. An overlay is placed on a large map of the region and the travel time roadway network is drawn on the overlay. Nodes are placed where travel time network roadways intersect (these nodes are different from the ones discussed earlier in the section on data collection). Then node-to-node travel time, in seconds, is drawn on the overlay for both directions along each roadway segment. Separate overlays must be made for morning and afternoon peak periods.

Once the overlay has been completed, travel time contours can be developed. A clear acetate sheet is placed over the overlay and a centroid is marked. The centroid is a point of interest from which travel time will be computed. The centroid may be a place, such as a shopping center, hospital, fire station, etc., or it may be the assumed center of an area, such as a business district.

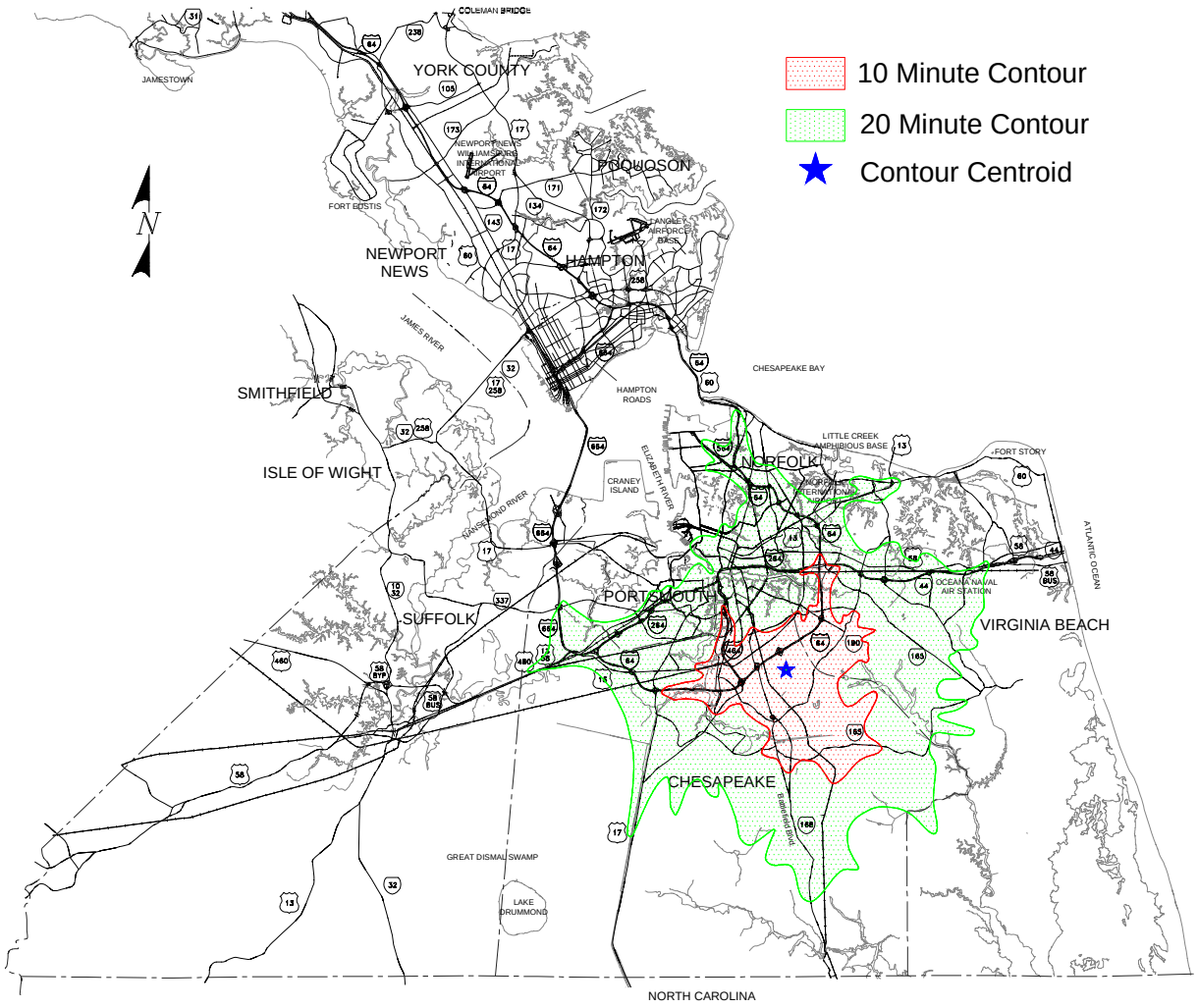
The contour type may be *toward the centroid* or *away from the centroid*. For a toward the centroid contour, travel time is summed in all directions radiating away from the centroid, but using the travel time for the direction pointing toward the centroid. For an away from the centroid contour, travel time is again summed in all directions radiating away from the centroid, but the travel time for the direction pointing away from the centroid is used. The shortest travel time path is always selected when there are multiple ways to reach a node.

When the summed travel time equals a predetermined value, such as 600 seconds (ten minutes), a data point is drawn on the acetate sheet with a marking pen. Once data points have been drawn for every roadway radiating from the centroid, the points are connected by a contour line. Judgement is used when drawing in the contour lines, taking into account estimated speeds along roads not included in the travel time study and access to certain areas (for instance, bridges at water crossings). After the contour map for a particular centroid is completed, it is digitized into a CAD system for storage and final printing of the map.

USES FOR TRAVEL TIME CONTOUR MAPS

Travel time contours may be used for determining service areas for things such as shopping centers, hospitals, industrial parks, schools, fire stations, police substations, etc. For instance, a developer may be considering several sites for the placement of a new shopping mall. A travel time contour could be produced for each site, showing the area included within a certain time contour, such as a twenty-minute contour. By referencing census information, population and average income for the area within the contour could be determined. This kind of data could help the developer select the site for the new mall. Contours maps could be used similarly for the other types of facilities listed above. Depending on the type of facility, either a toward the centroid or an away from the centroid contour would be developed.

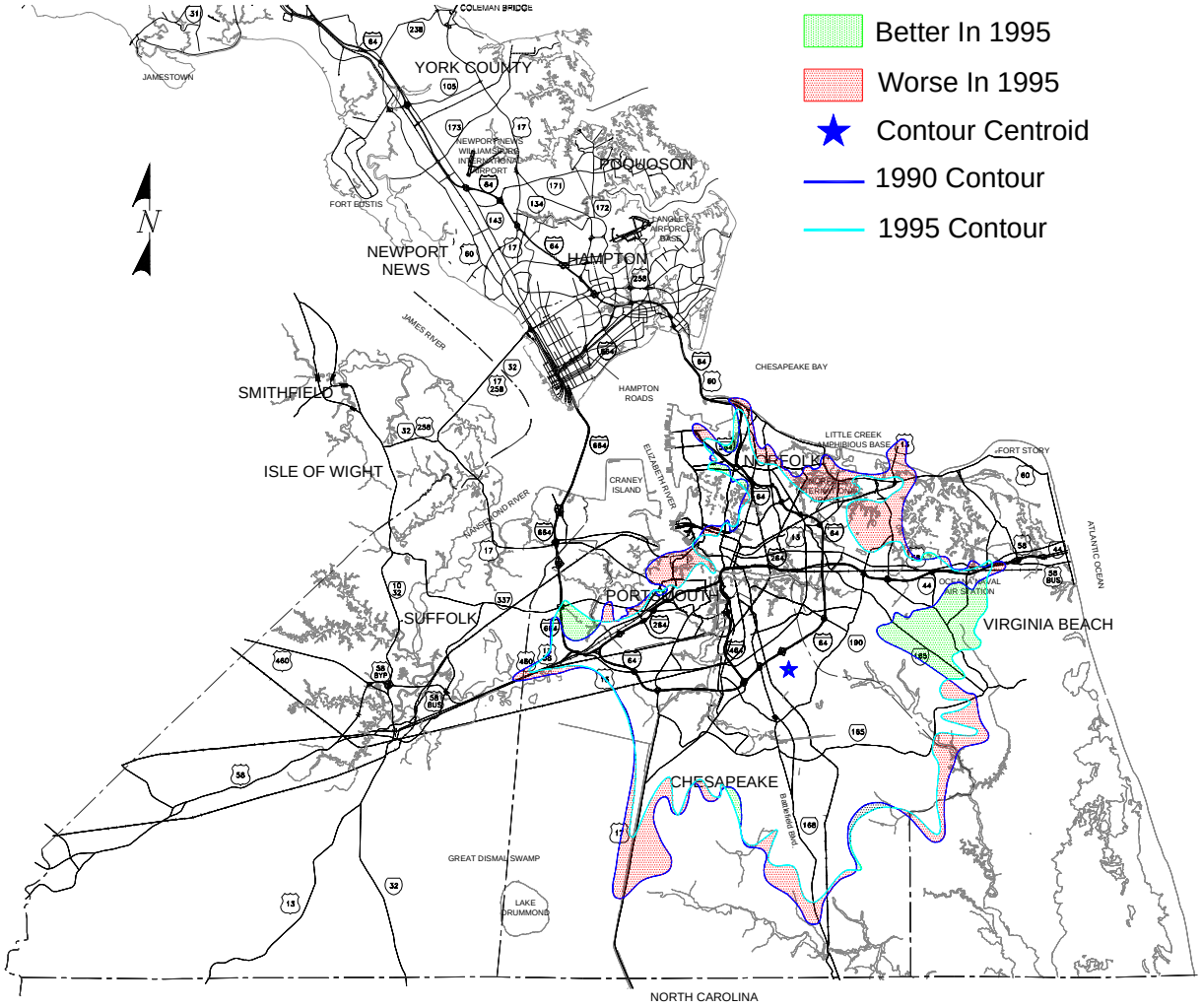
The following travel time contour map was taken from **Hampton Roads Regional Travel Time, Volume I: Analysis**, published by the HRPDC in January 1996. The map shows ten and twenty-minute travel time contours for the Greenbrier area, using data collected in 1995. The contour shown is for the afternoon peak period and is an away from the centroid contour.



The area shaded in red is within the ten-minute contour. This means a motorist leaving the Greenbrier area should be able to reach any point within the red-shaded area within ten minutes. Similarly, a motorist leaving the Greenbrier area should be able to reach any point in the green-shaded area within twenty minutes. Note how the contours are elongated along interstates and expressways due to their generally higher operating speeds.

Another use for travel time contour maps is for regional transportation planning. Travel time contour maps can help to monitor travel time and speed trends along the region's roadways. In addition, contour maps can be used to help evaluate the effects of transportation improvement projects.

The following map is a sample taken from **Hampton Roads Regional Travel Time, Volume I: Analysis**, published by the HRPDC in January 1996. Like the previous map, this one is for the Greenbrier area, however, this map shows a comparison of the twenty-minute contours for 1990 versus 1995.



In the map, the red-shaded areas indicate worse travel time in 1995, while the green-shaded areas indicate better travel time in 1995. Using maps like this one, analyses can be performed to determine why certain areas improved and others got worse. This type of map can also help indicate thoroughfares in need of improvements.

THE FUTURE OF REGIONAL TRAVEL TIME IN HAMPTON ROADS

Travel time is an element of the Congestion Management System (CMS) for Hampton Roads, and the HRPDC plans to continue collecting regional travel time on a regular basis (currently every five years). In addition:

- The HRPDC is in the beginning stages of developing a regional geographic information system for transportation (GIS-T). The initial data set for the GIS-T will be the CMS, including travel time.

- The HRPDC is currently investigating the use of global positioning system (GPS) technology for its next regional travel time study, to be performed in 2000.

- It is expected that travel time contours will be able to be produced by the GIS, making it easier to produce them for special studies or by request.

FOR MORE INFORMATION

For more information on Hampton Roads or the Hampton Roads Planning District Commission, please visit our website at www.hrpdc.org.