FINAL REPORT

ALBEMARLE COUNTY/CITY OF CHARLOTTESVILLE TRANSPORTATION PLANNING COMPACT DISC

John S. Miller, Ph.D.
Research Scientist

Michael J. Demetsky, Ph.D.
Faculty Research Scientist and Professor of Civil Engineering

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ABSTRACT

This report describes transportation planning data, available in numerous files and formats stored on the accompanying compact disc, that have been compiled from planning studies for the Charlottesville/Albemarle area done in 1967, 1979, and 1990. These data were used by the authors for *Using Historical Data to Measure Transportation Infrastructure Constraints on Land Use* (VTRC 98-R32) and a dissertation entitled *Reversing the Direction of the Transportation Planning Process: Measuring Transportation Infrastructure Constraints on Land Use With Historical Data* by Dr. Miller.

Data development for this project became a labor-intensive task. For that reason, and because subsequent research using the same data sets is to be encouraged, the data used for the project are described in this report.

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INTRODUCTION

Data can be hard to come by. Unfortunately, this also holds true for the transportation planning sector. Published information regarding the development of theoretical models is fairly easy to find, and certain types of census data that feed these models are also readily available. Yet, unless you want to settle for synthetic numbers generated from assumptions, real data can be surprisingly troublesome to obtain, especially from more than a few years back.

This compact disc (CD) contains historical planning data for the geographical area encompassing the City of Charlottesville and portions of Albemarle County. These data were available for use in our report *Using Historical Data to Measure Transportation Infrastructure Constraints on Land Use* (VTRC 98-R32) and reflect three planning efforts conducted in approximately 1967, 1979, and 1990. These data also served as the basis for Dr. Miller's dissertation entitled *Reversing the Direction of the Transportation Planning Process: Measuring Transportation Infrastructure Constraints on Land Use With Historical Data*, University of Virginia, Charlottesville, January 1998. This document outlines the data available so you can use them to conduct your own research.

We outline the data themselves and how to manipulate or use them. Each section contains a description of the data set and any coding that needs to take place or any assumptions that have been made. Although we have tried to be as accurate as possible, we guarantee we have missed mistakes. Where possible, you should use these data as a guide but then refer to the source documents for additional information.

You can find complete documentation in the dissertation file *finaldis7.doc*, which is readable in Microsoft Word format, or *finaldis7.rtf*, which is a more flexible file format. To save you from wading through this entire file, however, or to help those of you who are interested in other types of data applications we did not pursue, this report outlines how these data are organized.

These data are presented in a variety of computer formats: GIS (geographic information system) compatible with Arc/Info version 7.0 on a Unix platform running on an RS-6000

machine, spreadsheet (Microsoft Excel), software specific (MINUTP graphics files accessible with the NETVUE module and text files that reflect Maple V version 4.0 commands), text files readable with any word processor or text editor, Microsoft Word files, and paper formats. We did not choose to use these multiple formats; they reflect the many forms in which transportation planning data may be found. We did not include proprietary software; we refer you to the appropriate vendor in such instances.

Although many of these data were used for the original dissertation effort, some are included because they may be useful for future studies. These data are presented both in their original format and as they were used in the 50-zone layout we developed. Hence, these data cut across three time periods and are organized in the following format:

- *Zonal linkage data.* A key challenge was linking the data among the various time studies.

- *Planning effort data*. The data are presented in their unaltered form as they were originally used in the planning studies.

- *50-zone data*. We aggregated or disaggregated the planning data from each study such that they were compatible with the study area divided into 50 zones.

- *Paper data*. Many of the data are available only in paper format, yet the box where they are found is rather thick. Especially with the 1967 and earlier studies, a variety of data for further work are available.

Finally, this document is stored on the compact disc as *readme.doc* (for Microsoft Word format) and *readme.rtf* (for a more flexible file format).

What Purpose Do these Data Serve?

Taken as an ensemble, these data describe transportation and land use activity between 1967 and 1990. Other data are available prior to that time, such as information that may be gleaned from the 1947 *Traffic Survey of Charlottesville, Virginia* (Traffic and Planning Division of the Virginia Department of Highways, Richmond, Virginia) and the 1957 *Report Upon Major Streets, Parking and Transportation, Charlottesville, Virginia* (Harland Bartholomew and Associates, published in Atlanta, Georgia). Other studies of the Charlottesville area may be undertaken in the late 1990s. If so, approximately 50 years of transportation and land use interactions will be available from all these sources. Such a data set, imperfect as it is, represents a good starting point for many studies.

For example, how have population centers dispersed since the conclusion of World War II? We know intuitively that the increased role of the automobile accelerated suburbanization, but it may be possible to quantify this impact with a decent set of time series data. Or how has transportation system usage changed with decreased dwelling unit size? To answer this, a researcher might first develop a metric for quantifying transportation system usage and then

measure that metric as a function of population, dwelling unit size, and so forth. The nature of this metric might be constrained only by the data available; e.g., vehicle miles traveled per person might be a suitable rough initial decision. A third type of question concerns the interaction of land use patterns in the absence of transportation: Can we separate the effects of the automobile from land use changes that would have occurred in any event, such as the construction of new homes to meet labor demands. The question of where these homes were built and the ensuing density could then be addressed in light of their accessibility to various modes of transportation.

Year Nomenclature

One of the weaknesses of this data set is that the nomenclature is not uniform. These data reflect three key snapshots in time, but because each study was conducted over a period of years, sometimes an earlier year was used in a particular study rather than a later year. Yet, all of this can be rectified with the following convention:

- the 1967 study is consistently denoted as 1967
- the 1979 study is denoted as 1974 or 1979
- the 1990 study is denoted as 1987 or 1990.

As explained in Chapter 3, page 1, of *Reversing the Direction of the Transportation Planning Process: Measuring Transportation Infrastructure Constraints on Land Use With Historical Data*, this confusion stems from the following:

> In retrospect, a big problem with this effort may have been the disparity between the base year when the socioeconomic parameters were developed and the base year where the traffic counts were taken. For example, a study referred to as "1979" in this paper was fully initiated in 1974 and published in 1985. Census data from 1970 were extrapolated and sometimes collected for a 1974 socioeconomic year, but 1979 traffic counts *appear* to have been actually used for the study. Thus a five-year lag exists between counts and socioeconomic parameters for 1979; this lag is substantial when compared to the eleven-year lag between the dates of the actual studies. Compounding this issue is the fact that the "1979" study shows counts from 1984; it appears based on the unpublished 1981 technical report and its projections that the 1979 study is aptly named as it appears to have used 1979 counts.

ZONAL LINKAGE DATA

Matching the zone layouts from the various planning studies was essential but time-consuming because the study area grew and changed as time passed. Two sets of data are relevant: the explanations of how these zones are related and the accompanying GIS coverages.

Explanation of GIS Linkages

The file *gissize.doc* (or *gissize.rtf*) lists select transportation analysis zone data for 1967, 1979, and 1990. The first column contains the GIS record number, the second column contains the area for each polygon, the third column contains the area for each polygon, and the fourth column is not very useful. The last two columns are what denote each zone: the column Zone1967-ID has a zone number, but it was created numerically. Hence, the alphanumeric field, which is the last column, is called ADDTAZ, and it is that column which relates the particular polygon to the planning study. For example, the shaded column with record number 73 under the 1967 study is a polygon that encompasses what the 1967 study called zone 17 and what the 1967 study called zone 20; hence the ADDTAZ field contains 17.20. Although the 1979 (shown as 1974) data follow the same logic, the 1990 data (shown as 1987) are denoted by two fields together: the ZONE1987-ID field and the ADDTAZ field.

The file *gis back.doc* (or *gis back.rtf*) is similar to the previous file, except that the global zones are now related to the specific zones from each study area. The global zones are the 50 zones shown on the map. For example, consider this shaded area from the file:

1974	1987	1967	Global Number
1	1	01 (-4)	*1
2	part of 2	01 (-4)	
3	other part of 2	01 (-4)	
4-9	each 4-9	01 (-4)	

This means that zone 1 shown on the master map encompasses zones 1 through 9 from the 1974 study, zones 1 through 9 from the 1987 study, or zone 1 from the 1967 study. In addition, in case you wish to subdivide the study area into more than 50 zones, the links are shown for each row; i.e., from the shaded area, zones 2 and 3 from the 1974 study are the same as zone 2 from the 1987 study.

The file *gis back.doc* (or *gis back.rtf*) has other notes that are relevant to manipulating these zonal coverages in a GIS format. The section "Specific Zone Coverage Notes" explains limitations and difficulties found in doing some of the manipulations between zones; an example is where examining streams, roads, and jurisdiction boundaries still did not resolve how two zones from two different studies were related.

The remaining sections are useful if you wish to do manipulations in a GIS environment. The section "GIS Notes for Using a Remote Station" shows how to use these data if you are not seated at the host terminal, and the section "Sample GIS Commands" has examples for creating maps, doing projections, and importing or exporting files. This last section was left intact as some of the code may be useful to various analysts.

You may find the linkages between the zone numbering for the individual planning studies and the master 50-zone numbering system in Table 3-1 (Zonal Linkages Among the Three Planning Studies) in *Reversing the Direction of the Transportation Planning Process: Measuring Transportation Infrastructure Constraints on Land Use With Historical Data*.

GIS Coverages

The coverages developed in the course of this study are described in the last file mentioned but warrant some explanation here. These files were exported; they need to be imported into the GIS environment to render them useful. The import/export commands for ArcInfo are given in the file *gis back.doc* (or *gis back.rtf*).

The GIS files are:

jabound.e00	jzone1967.e00	jzone65.e00
jroads1987.backup.e00	jzone1974.backup.e00	jzoneall.2.backup.e00
jroads1987.e00	jzone1974.e00	jzoneall.2.e00
jticcov.e00	jzone1987.backup.e00	jzoneall.backup.e00
jzone1967.backup.e00	jzone65.cln.e00	jzoneall.e00

The *jabound.e00* file refers to the Albemarle County boundary, and the *roads* files refer to the 1987 roadway network. The *zone* files refer to the 1967, 1974 (1979), and 1987 (1990) zone layouts, with the *zoneall* file referring to the 50-zone layout. The *ticcov* file and the *zone65* file were experimental and were left in case you wish to do additional analysis.

PLANNING EFFORT DATA FILES

In addition to relating the zonal structures of the studies, we developed planning data for all three studies using MINUTP software. These data are stored in the cville\1967, 1974, and 1987 subdirectories, respectively.

The text files are readable by any text editor, but the network files are readable only with MINUTP software. MINUTP is proprietary software and may be purchased from COMSIS Corporation, 8737 Colesville Road, Suite 1100, Silver Spring, MD, 20910, FAX 301-588-5922.

1967 Data

The 1967 data contain six files, and at least one contained a misprint. The best file is *trips66.txt*. The only exception is that if you add up tables C-1, C-2, and C-3 shown in the 1967 planning study (see Virginia Department of Highways, 1967, *Major Arterial Street and Highway Plan, Charlottesville, Virginia*) and subtract the intrazonal trips, you obtain 135,688 trips from the planning study but 135,999 trips from the computer file. This is explained by examining the trips from zone 31 in the computer file: the discrepancy is for trips to zones 44, 45, 46, 47, 48, 49, and 50. It appears that the values were all shifted one “place” to the left and 11 extra trips were inserted. The paper data appear more credible than the computer data because it seems unlikely that zone 48 would have 77 trips (according to the computer) from zone 31 when in fact it has only 5 trips total! Zero seems more appropriate, as indicated by the 1967 planning study, and this bookkeeping renders column totals accurate.

The other files shown for the 1967 data do have potential for further analysis. For example, the file *trip6546.txt* somewhat matches the 1967 table C-1, shown on page 64 of the 1967 planning study, for all internal zones (e.g., through 44) except zones 35 and 37. Yet, there is no correspondence between the external stations (numbered as 45-57).

Although not explicitly used in this study, we examined the other four files shown in the cville\1967 subdirectory. These reveal projections into the future and alternatives considered in 1967 and may be useful for future reference; these files are *trips65.txt*, *trips85.txt*, *org1965.txt*, and *tray.txt*.

Almost all 1967 roadway data are hardcoded in the Appendix of the 1967 planning study. There are, however, a set of July/August 1969 average daily traffic counts (ADTs) that are stored within the file *count69.doc* (or *count69.doc*). These counts reflect the study area within the City of Charlottesville only.

1979 Data

The file *unbtotrp.txt* shows the 1979 trip origin-destination data between the various zones and is readable in ASCII format. The file *output.txt* contains more detailed origin-destination data. Finally, the file *uroadhr.txt* contains roadway data that, in conjunction with the roadway network, can be very useful. Numerous additional files are also shown for the 1979 data in the *cville\1974\exefiles* subdirectory. You may produce the text output by simply typing the name of the executable file at the DOS prompt. These data represent alternatives and predictions that were examined during the 1979 study.

1990 Data

Within the subdirectory cville\1987, the MINUTP output files have a *.dat* suffix. Not all of these are readable in ASCII; for some of these files, we had to make translations from binary to ASCII. The file *intraod.dat* combines the home-based work, home-based other, and non-home based trips into a single matrix for all 228 zones; the file *outjsmfi* combines these data into the 50-zone global data set. If you want to examine the individual 1990 trip purposes, then see the individual trip files such as *rt2914.dat* (home-based work trips for the PM peak hour), *rt2915.dat* (home-based other trips for the PM peak hour), and *rt2916.dat* (non-home based trips for the PM peak hour). Although these descriptions can be obtained by examining the files without doing a binary conversion, you should consult the appendix of the 1990 *Route 29 Corridor Study* (Comsis Corporation, Silver Spring, Maryland) for more information about these files.

The roadway data are summarized over a 24-hour period in the file *rt2924.dat*. To observe this and the other files mentioned in this paragraph, you will need to run MINUTP. You can do this by typing the command *netvue* at the command line. Then, you must enter the file name, such as *rt2924.dat*, upon which the screen will draw the links of the network. You may then click on the individual links by selecting the LINKS command at the bottom, then selecting the LST command at the bottom, and then moving the mouse pointer to the appropriate link. Several variables to the right side of the screen will be of interest: CNT shows half the total

volume, TSVA gives an indication of speed, and DIST gives the distance of the link. Keep in mind that these 1990 data are in computer format whereas the 1967 data are in paper format in the report. If you wish to see an overview of the 1990 network without using the MINUTP software, the file *minu90.doc* contains a drawing of the network viewable in Microsoft Word format and the file *minu90.rtf* may be of interest if you do not have Microsoft Word.

For the 1990 data, a variety of additional information is available from the MINUTP documentation. Each file in the cville\1987 subdirectory follows a specified format as explained in the *Technical Reference Manual*, published by COMSIS Corporation, Silver Spring, Maryland. For example, the file *rt2909.dat* contains the Charlottesville friction factors used in the study. You can also use the MINUTP data files in conjunction with the Appendix of the 1990 Route 29 Corridor study; from there, you may find, for example, that the file *rt2910.dat* contains mostly the revised productions and attractions stratified by trip purpose.

A good example of why both the 1990 documentation and the MINUTP manual are needed is with file *rt2908.dat*. In this file, when there is a "1" in the first column, you may simply add all the numbers across to obtain the total number of dwelling units. When there is a "2" in the first column, the numbers refer, in order, to total employment, retail employment, and school attendance. This is explained on page 6-7 in reference to the trip generation module of the *Technical Reference Manual*. Yet, the reason the 1990 planning study (i.e., the *Route 29 Corridor Study*) needs to be examined is evident from Appendix C, Annex A, page A-20: HBO (home-based other) and NHB (non-home based) trips were multiplied by approximately 1.7 to reconcile the difference between computed trips and actual trips.

Finally, the file *fqsplan.prn* was provided by the Albemarle County Planning Office and contains, for Albemarle County only, the Comprehensive Plan Land Use designation, valid for 1989 and projected into year 2010. Each line of this text file is split by a comma into five categories:

1. the 1990 transportation analysis zone for the relevant portion of Albemarle County
2. the census tract and block
3. the acreage of the area
4. the land use designation
5. the number of dwelling units situated in the area.

Since census blocks are smaller than zones, there may be several lines of text that denote different census blocks within the same transportation analysis zone. The land use designation is a two-digit code reflected by the following (this list is provided courtesy of the Albemarle County Planning Office):

01	=	village residential
02	=	low density residential

03	=	low-medium density residential (we observed none within the 50-zone planning area)
04	=	medium density residential
05	=	high density residential
06	=	commercial (none observed within the 50-zone planning area)
07	=	commercial office (none observed within the 50-zone planning area)
08	=	planned commercial (none observed within the 50-zone planning area)
09	=	industrial
10	=	public/semi-public
11	=	public/semi-public institution
12	=	public/semi-public recreation
13	=	public/semi-public University of Virginia
14	=	open space
15	=	proposed road improvement (none observed within the 50-zone planning area)
16	=	rural area (many observed within the 50-zone planning area)
17	=	village service (many observed within the 50-zone planning area)
18	=	neighborhood service
19	=	community service
20	=	regional service
21	=	office/regional
22	=	office service.

Finally, the two files *chaequiv.txt* and *albequiv.txt* appear to relate the census tract and blocks to the various 1990 transportation analysis zones for the City of Charlottesville and the County of Albemarle, but this is not definite as these data were not ultimately used in the course of this research.

50-ZONE DATA FOR 1967, 1979, AND 1990 PLANNING STUDIES

Trip Matrices

From the trip tables within the studies, we combined select data to link the 43 zones from 1967, the 142 zones from 1979, and the 228 zones from 1990 each into a 50-zone study area. For 1967, you may view this file using Maple software as *ansod67*. You may view the 1979 trip distribution table in Maple using the file *ansod74*. Finally, you may view the 1990 trip distribution table using the file *ansod87*. You may find a map of this study area in Figure 3-1 of the dissertation, shown as file *finaldis7.doc* or *finaldis7.rtf.*

Socioeconomic and Land Use Data

Compilation files written in Microsoft Excel also contain data for the three time periods (1967, 1979, and 1990) by zone where the study area is categorized into 50 zones regardless of the time period.

The file *selu1967.xls* (or *selu1967.txt*) contains several variables that directly relate to socioeconomic data:

du (dwelling units)
pop (population)
per5 (total persons over five)
cars (number of passenger automobiles)
wlabor (white collar labor)
bluelab (blue collar labor)
labor (total labor force)
wemp (white collar employment)
blueemp (blue collar employment)
emp (employment)
prespop (pre-school population)
elmspop (elementary school population)
hischpop (high school population)
colspop (college population)
presatt (pre school attendance)
elmsatt (elementary school attendance)
hisatt (high school attendance)
colsatt (college attendance)
schatt (total school attendance)
convsale (retail sales of converted goods, in millions of dollars)
hardsale (retail sales of hard goods, in millions of dollars).

Land use data for 1967 include:

hidenres (number of acres that are high density residential)
lodenres (low density residential acreage
comm (commercial acreage)
industry (industrial acreage)
public (public acreage)
openrec (acreage that is open space or recreational).
*totphi (*percentage of total amount of high density residential acreage occupied by zone)
totplo (percentage of total amount of low density residential acreage occupied by zone)
totpcom (percentage of total amount of commercial acreage occupied by zone)
totpind (percentage of total amount of industrial acreage occupied by zone)
totppub (percentage of total amount of public acreage occupied by zone)
totpopen (percentage of total amount of open space and recreational acreage occupied by zone)
zonphi (percentage of the zone acreage that is high density residential)
zonplo (percentage of zone that is low density residential)
zonpcom (percentage of zone that is commercial)
zonpind (percentage of zone that is industrial)
zonppub (percentage of zone that is public)
zonpopen (percentage of zone that is open space and recreational).

The 1979 data, stored in the file *selu1974.xls* (or *selu1974.txt*), start off with the variable *zone*, which designates each row with a specific zone of the 50 zones from the study area. (The *zone* variable is also given with the 1967 and 1990 data.)

Socioeconomic data include:

poptot (total population)
popgroup (population in group quarters)
dutot (total dwelling units)
dusfdup (single family and duplex dwelling units)
dumulti (multifamily dwelling units)
emptot (total employment)
empret (retail employment)
autos (number of automobiles)
students (number of students).

Land use data include:

lusf (acreage for single family dwelling units)
lumulti (acreage for multiple family dwelling units)
lugroup (acreage for group quarters)
lucomm (commercial acreage)
luindustry (industrial acreage)
lupub (public acreage)
luvacant (vacant acreage)
lutotal (total acreage for zone).

These land use categories are not identical with those used in the 1967 study.

The 1990 data, stored in the file *selu1990.xls* (or *selu1990.txt*), contain scant socioeconomic and land use data for each zone. These variables include:

emp (employment)
empre (retail employment)
empnre (nonretail employment)
schatt (school attendance)
autos (automobiles)
pop (population)
du (dwelling units)
landdev (percentage of land developed within zone).

The file *popemp677990.xls* (or *popemp677990.txt*) combines select socioeconomic data for the 1967, 1979, and 1990 studies.

Roadway Network Data

An overview of the roadway network is given as figure 3-2 in the file *finaldis7.doc* (or *finaldis7.rtf*). The actual coded network, replete with node numbers and zone centroid connections, is given in hardcopy format and is coded on this diskette as *img0001.tif*. The *.tif* file extension means the image is readable in a variety of formats, such as Microsoft Image Composer or Microsoft Photo Editor. If you have more than 75 M of disk space available, the file *img0002.tif* should be readable, which is the same as file *img0001.tif* but at a higher resolution. The yellow links denote roads present in 1967, the blue links denote roads present and employed in the 1979 study (but not in 1967), and the pink links denote roads present and employed in the 1990 study (but not in 1967 or 1979). Each link has an "e" preceding it, and a link is denoted by the two node numbers at either end of the link.

You have several options for determining the coding of the roadway network. You can look in the appendices of the 1967 and 1979 planning studies to build a network from scratch. For the 1979 study, you can also look at the file *uroadhr.txt* for the MINUTP network. For the 1990 study, you can find some roadway information in the 1990 report, but mostly your only choice is to look at the 1990 MINUTP files; a key example is *rt2924.dat*.

Finally, you can also look at the network files we created for use with our map. They are readable in any format, and the code may be executed with Maple software. The 1967 network is coded in Appendix D of the files *finaldis7.doc* and *finaldis7.rtf*. You can also obtain these network data from the file *hope67.txt*.

The 1967 network really used only 43 zones: zones 44 through 50 did not come into play until the 1979 study. To see the network using only these 43 zones but for 1979, use the file *hope79.txt*; to see the 1990 network using 43 zones only, use the file *hope90.txt*. To see the entire 50-zone network for 1979, use the file *hope7950.txt*; to see the entire 50-zone network for 1990, use the file *hope9050.txt*. The file *hope9050f.txt* has about 214 instead of 202 links: the 12 links present in 1990 that were not present in 1979. The file *capacity.txt* is the 1990 network loaded to capacity; to change the volumes, change the "g" constraints in the program.

Finally, the subdirectory *mapledata* contains a variety of programs written in Maple. These programs are not suggested as data sources but may be useful as a reference for those who may use the Maple software to accomplish some of the network calculations with these data.

SELECTED DATA SOURCES AND CITATIONS

Data for the Charlottesville area come in a variety of forms including published reports, unpublished technical reports, memoranda, maps, and notebooks found in a warehouse. We list these notes in chronological order. We did not use all of these references in the study, but they all have historical value for the Charlottesville data. We also used unpublished notes, which are boxed separately and should reside either at the Virginia Transportation Research Council, 530 Edgemont Road, Charlottesville, VA 22903, (804) 293-1900, or the Virginia Department of

Transportation's Traffic Engineering Division, 1401 East Broad Street, Richmond, VA 23219. We found them in VDOT's Fulton Warehouse in Richmond, Virginia.

1947. The Traffic and Planning Division of the Virginia Department of Highways. *A Traffic Survey of Charlottesville, Virginia*. Richmond (July).

1957. Harland Bartholomew and Associates. *A Report Upon Major Streets, Parking and Transportation: Charlottesville, Virginia.* Atlanta.

1964. Traffic and Planning Division of the Virginia Department of Highways. *Charlottesville Traffic and Parking Survey: 1963.* Richmond.

1965. The following source was used to infer speeds when only geometric characteristics were available and adjacent roadway links were not adequate predictors of speed: Highway Research Board. *Highway Capacity Manual: 1965.* National Research Council, Washington, D.C., 1966.

1966. Wilbur Smith and Associates. *Planning Projections and 1985 Land Use Plan*: *Charlottesville, Urban Area.* Columbia, South Carolina (March).

1967. Virginia Department of Highways. *Major Arterial Street and Highway Plan, Charlottesville, Virginia*. Richmond.

1967. Virginia Department of Highways. *Major Arterial Street and Highway Plan: Functional Plans, Charlottesville, Virginia*. Richmond.

1968. Tables 1-1j, *Existing Land Use*, Charlottesville, Virginia Urban Area, January 1. (These are typed notes describing land use districts employed in the 1967 planning effort.)

1970. Memorandum to Joseph Allen (Virginia Department of Highways) from Thomas Dooney (Charlottesville City Hall), May 11, 1970. We know that this memo corresponds to the 1967 planning study because the zones match up when we compare the 1985 projected populations in the memo to the same on page 69 of the planning study (*Major Arterial Street and Highway Plan, Charlottesville, Virginia*); the confusion is that the memo refers to zones 44, 45, 46, 47, and 48, which do not exist in the 1967 study.

1970. Memorandum to Joseph Allen (Virginia Department of Highways) from Thomas Dooney (Charlottesville City Hall), May 22. The memorandum links zones and districts for the 1968 year, which based on the May 11, 1970, memorandum reflects the 1967 zone layout.

1970. Federal Highway Administration. *Transportation Planning Data for Urbanized Areas Based on 1960 Census.* U.S. Government Printing Office, Washington, D.C. (November).

1971. Payne, R. H., Jr., of A.I.P. and Associates. *A Comprehensive Plan for the County of Albemarle, Virginia*, Warrenton, Virginia (January).

1971. Memorandum to Joseph Allen, Virginia Department of Highways, from Thomas Dooney, Charlottesville City Hall, May 22, 1970.

1975. Memorandum to Hugh W. Adams, City of Charlottesville Department of Community Development, from Satyendra S. Huja, Director of Community Development, City of Charlottesville, September 5.

1975. Memorandum to the Policy and Technical Committee from Satyendra Huja, Director of Community Development, City of Charlottesville. September 10.

1975. Unpublished data (p. 13), from a folder labeled *Occupancy Rates and Transit Ridership*, from VDOT's Fulton Warehouse, Richmond.

1975. VDOT's Transportation Planning Division. *Financial, Operating, and Statistical Data* (9/1/75-6/30/76), p. 2. VDOT's Fulton Warehouse, Richmond.

1976. *Charlottesville Population Distribution Data: Sequential Run 1 of Population Distribution Program*: 1/6/1976. VDOT's Fulton Warehouse, Richmond.

1976. Hoel, L.A., Demetsky, M., Morris, D., and List, D. *Evaluation of Transit System Coordination and Future Services in the Charlottesville Urbanized Area*. University of Virginia, Department of Civil Engineering, Charlottesville.

1979. *1974-1985 Link Node Map*. VDOT's Fulton Warehouse, Richmond.

1979. Department of Community Development. *City of Charlottesville Comprehensive Plan*. Charlottesville (October 1).

1980. *Route 20/240 Study (Draft)*. Information is available in the files of VDOT's Charlottesville Residency.

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OVERVIEW OF DATA AVAILABILITY

Chapter 3 of the file *finaldis7.doc* describes the availability of the Charlottesville planning data by study period. The next five tables summarize these data in part, first by planning study and then by functionality within the planning studies.

Table 1 gives an overview of each study's frame of reference, such as its base year, when it was published, the transportation data used, and the socioeconomic data available. The one confusing aspect is the 1979 study: as explained previously, it uses 1974 socioeconomic data in conjunction with 1979 traffic counts.

Table 2 describes the transportation system data available for the 1967, 1979, and 1990 studies: you can see that the 1967 study, for example, is available only in a paper format (except where the links have been coded by the authors as described previously in this document).

Table 3 outlines the various trip distribution matrices available for each study: note that in 1990 there were at least three major trip tables by purpose (home-based work, home-based other, and non-home based) whereas for the 1967 effort there was only one such trip table.

Table 4 summarizes the various methods used for generating trips within each study: the key aspect is the available data.

Table 5 describes the land use data, such as the number of acres for each transportation analysis zone for each study.

ADDITIONAL EXPLANATORY NOTES

Addendum: Speed Computation for Certain 1967 Links

This section explains how the speeds for the 1967 study were obtained.

First, page 4 of 1967 study (*Major Arterial Street and Highway Plan, Charlottesville, Virginia*) notes that only "supplementary traffic volumes" were taken beyond what is in the 1963 study (*Charlottesville Traffic and Parking Survey: 1963*) with respect to traffic performance. This implies that speeds from 1963 study are the basis for some of the 1967 speeds.

Second, page 6 of the same 1967 study notes that only "slight variations were observed" between 1963 and 1965.

Third, page 9 of the 1967 study summarizes the various segments as a "freeway, expressway, or arterial" with no freeways shown and about 5 miles of expressways shown.

Fourth, page 31 of the 1967 study mentions the use of the 1965 *Highway Capacity Manual* (HCM) for "urban arterial streets and highways." This latter source implies that "urban

Table 1. Available Charlottesville Data by Zone for Studies in 1967, 1979, and 1990 According to Paper Studies Only

Characteristic	1967 Study	1979 Study	1990 Study
Base year	1965	1974 and 1979	1987
Forecast year	1985	2000	2010
Number of external stations	12	14	56
Number of traffic analysis zones	43	128	223 (13 districts)
Population	population total persons over [age of] five [years]	population living alone population in group quarters (derived from occupancy rates)	district population persons per dwelling unit estimated dwelling unit-size classes
Schools	students in preschool students in grades 1-7 students in grades 8-12 students in college openings for preschool openings for grades 1-7 openings for grades 8-12 openings for college students	openings for all students	district openings for all students
Housing	occupied dwelling units persons per dwelling unit (dwelling unit.)	single family, duplex & trailers multifamily dwelling units (Charlottesville: based on tax maps & spot checks; Albemarle: based on field survey)	district dwelling units
Auto ownership	passenger cars cars per person	passenger cars (Charlottesville coded directly from DMV; Albemarle uses auto ownership rates)	district autos 1980 census tract autos 1980 census tract family size (iteratively guesses TAZ autos) average number of autos per dwelling unit estimated auto size classes
Employment	white collar workers blue collar workers white collar jobs blue collar jobs	retail jobs non-retail jobs	district retail jobs district non-retail jobs
Traffic flow (24 hour counts)	between zones between stations between zones & stations	14 screen lines 1 cordon count external survey stations	24 hr counts for 18 external stations by purpose (from roadside surveys)
Home survey data (household information)	see 1965 survey	borrowed and synthesized	number of persons/dwelling units auto ownership income
Home survey data (travel information)	see 1965 survey	borrowed except internal-external and external-external trips	trip rates by dwelling unit size & autos mode of travel occupancy by purpose trip length by purpose trips by time period & purpose
Trips for Barracks Road and Fashion Square Shopping Centers	N/A	N/A	auto trips by time of day 24 hr auto trips Truck trips by time of day Auto & truck occupancies

Table 2. Traffic Assignment Data for 1967, 1979, and 1990

Year	Data Type	Source
1967	115 roadway links totaling 60 miles. For each link: length, number of lanes, average operating speed, ADT, directional distribution, peak hour volume	1967 Planning Study: figure 5, p. 10 (detailed map) figure 17, p. 37 (detailed map) figure 18, p. 43 (CBD map) figure 19, p. 45 (map of significant roads) 1965 Charlottesville city map
	Implied AM, PM, off-peak speeds	1963 Charlottesville Parking Study
	July-August 1969 partial set of city counts	Handwritten notes
1979	390 roadway links, where only following are available: length, number of lanes, 1974 ADT or assigned volumes, LOS, an indirectly computed capacity, 1979 ADT, 1984 ADT	1974 Worksheet with determined and projected volumes 1981 Technical Report, pp. 107-117 1985 Planning Study, pp. 115-128
1990	77 roadway links that have ADTs only	Charlottesville 24 Hour Traffic Volumes (counts taken during March, April, and May)
	assorted secondary road links that have ADTs only	Reduced Secondary Traffic Tabulation for Albemarle County 1988 (counts taken during April and May)
	128 roadway links with posted speeds, peak hour speeds, and average travel speeds	1990 Route 29 Corridor Study, pp. I-14, I-15
	74 screen line counts only	1990 Route 29 Corridor Study, pp. 5-9, 5-10 (counts), p. 5-2 (associated map)
	electronic format: links with distance, speed, volume, lanes, and *derived* capacity	1987 Minutp file: cville\1987 *rt2921.dat--rt2924.dat*
	splits of HBW, HBO, NHB trips by AM Peak, PM peak, off-peak	1990 Route 29 Corridor Study, p. A-7 in appendix C, annex A

Table 3. Trip Distribution Data for 1967, 1979, and 1990

Year	Data Type	Source
1967	single 24-hour trip table between zones (all purposes lumped together)	1967 Planning Study, Table C-1, p. 64
	1963 table that breaks down trips by purpose	1963 Charlottesville Traffic and Parking Survey, Table 45, p. 138
	"assumed" percentage of trips by purpose: HW 18%, HBO 40%, NHB 42%	Handwritten graphs from 1967
1979	single aggregate trip table between zones that has been thoroughly balanced (paper format)	1981 Charlottesville Technical Report (unpublished)
	computer file with mostly balanced trip tables	Computer file cville\1974*output.doc*
1990	auto occupancy rates	1990 Route 29 Corridor Study, p. 5-5
	friction factors as they correspond to travel times	1990 Route 29 Corridor Study, pp. 4-8 through 4-12, cville\1987\RT2909.DAT
	trip tables for three purposes	See *charrun.drv* for description. See *outjsmin* for original zones by trip purpose, see *outjsmfi* for 50 zones and aggregated purposes. (All files in cville\1987 subdirectory.)

Table 4. Trip Generation Data for 1967, 1979, and 1990

Year	Data Type	Source
1967	single aggregate table giving trip generation rates as function of auto ownership and persons per household zonal population, dwelling units, blue and white collar workers, blue and white collar employment, school age population, school attendance, retail sales	1967 Planning Study p. 23, aggregate trip generation table pp. 62, 63, 66, other statistical data
1979	equations for HW, HO, NHB productions and attractions, truck trips, taxi trips, statistics by zone, population, dwelling units, retail and nonretail employment, students by zone of attendance, number of parks, automobile ownership	Handwritten notes describing computations 1985 Planning Study, pp. 23-28
1990	HBW, HBO, NHB productions and attractions by zone	1990 Route 29 Corridor Study, appendix C, annex A, p. A-20 first half of file cville\1987*rt2910.dat*
	HBW, HBO, NHB productions and attractions by zone	See c:\cville\1987*outjsmin*. See also 1.7315 multiplying factor shown in text (p. A-16)
	production classification tables for HBW, HBO, NHB	1990 Route 29 Corridor Study, appendix C, annex A, p. A-17
	attraction equations for HBW, HBO, NHB	1990 Route 29 Corridor Study, appendix C, annex A, p. A-15-16
	socioeconomic data by zone	City-County Spreadsheets cville\1987*rt2908.dat*, which has dwelling units, population, auto ownership, retail and non-retail employment, school attendance

Table 5. Zonal Acreage and Land Use Data for 1967, 1979, and 1990

Year	Data Type	Source
1967	estimate of external trips used by 1963 survey	Superimpose GIS-based zonal map within Albemarle county over photocopied 1963 voting districts
	area in acres for each of 16 districts	Tables 1-1j, Existing Land Use, Charlottesville, Virginia Urban Area, January 1, 1968
	percentage of area by land use (residential, commercial, manufacturing, schools, etc.) for each of 10 districts in city only	May 11, 1970, Memo to Joseph Allen (VDOT) from Thomas Dooney (Charlottesville City Hall)
	general land use map	Planning Projections and 1985 Land Use Plan, March 1966, p. 7
	16 "districts" cover total zonal area, with first 9 districts appearing to correspond to census tracts, 1 district corresponding to UVa, and remaining 6 districts covering indeterminate portions of Albemarle County (a "WSA" study is mentioned)	May 22, 1970, Memo from Thomas Dooney (Charlottesville City Hall) to Joseph Allen (VDOH) and May 11, 1970, Memo "Districts" referred to in 1967 planning study and figure 2, p. 3, of Planning Projections and 1985 Land Use Plan, which details same map
1979	for every zone: area in acres and area used by residences	Charlottesville Population Distribution Data, Computer Run, January 6, 1976
	for zones in Albemarle County: percentage of area by land use	Handwritten notes, undated (but some duplicate information matches that in previous source)
	for zones in Charlottesville City: percentage of area by land use	City of Charlottesville Comprehensive Plan, October 1, 1979, pp. 35-46, 72-73, 82, 93-95
	for census tracts within city: percentage by land use (residential, commercial, industrial, etc.)	Memo to Policy and Technical Committee by Satyendra Huja, September 10, 1975
1990	for zones in Albemarle County only: area in acres, type of land use, and estimate of number of structures	Albemarle County Planning Data Computer files: *fqsfplan.prn*.

and suburban arterials" as defined on page 318 of the HCM are appropriate to compute speeds. For verification of the 1963 study, you may use pages 18-20 of the 1963 study and East High Street as an example. It appears that AM peak, PM peak, and off peak are averaged to yield the speeds in the 1967 study. The data shown on page 160 (table 77) of the 1963 study appear unreliable.

Therefore, separate speed equations were established for two lane links containing flow rates of 600-699, 700-799, and 1100-1199 vehicles per hour. Based on service volume, the R^2 values were approximately 0.6, 0.5, and 0.88 for 600, 700, and 1100 vehicles per hour, respectively. Possible reasons for relatively low values for the first two cases are discontinuity in speed-flow curves as the geometric characteristics are different for many of these segments or more likely, that these segments are in different portions of the study area. The third case (1100 vph) may have worked well because none of the links in that category is in the CBD. That equation is given as: Speed = -11.1 • (1963 volume-to-service-volume ratio) + 31.3.

Addendum: 1967 Land Use Descriptions

The following steps were used to develop the 1967 land use descriptions.

From *Tables 1-1j, Existing Land Use, Charlottesville, Virginia Urban Area, January 1, 1968,* you can ascertain the land use for each district by type (residential [one family, two family, multifamily], commercial, manufacturing, recreational, and schools). Unfortunately, this gives use by each district and not by each zone, where a district may contain several zones. Further, these data are only available for 10 of the 16 districts. We do, however, know the zones that correspond to each district according to a table in a May 11, 1970, memorandum to Joseph Allen (VDOT) from Thomas Dooney (Charlottesville City Hall). Thus, the first problem is to allocate the district totals to the zone totals. Fortunately, a map in the *Planning Projections and 1985 Land Use Plan, March 1966* (page 7) shows a picture of the 43 zones from 1967 along with the associated land use: residential (high or low density), commercial, industrial, public, and "open & recreational." Also, the portions of each zone that are not developed are also shown. Therefore, we used this map to estimate the percentage of land use by type for each zone, admitting that this method is prone to error. For the first 10 districts, however, a way to make this method more accurate is available.

For each of the first 10 districts, you may employ the observable land use estimates gleaned from the map in conjunction with the district totals to determine the number of acres for each land use type. You could summarize this as the following formula:

$$A_{z,L} = \frac{\text{(percent of developed } z \text{ that has land use } L)\bullet\text{(Percent of z that is developed)}\bullet\text{(size of z/size of the district)}}{\sum_{\text{all zones in the district}}\text{(percent of developed } z \text{ that has land use } L)\bullet\text{(Percent of z that is developed)}\bullet\text{(size of z/size of the district)}}$$

where A denotes the land use in acres, z denotes the zone, and L denotes the land use type.

Unfortunately, these totals were not available for the remaining 6 districts, but they tended to be less developed than the previous 10 districts and hence easier to document. The outcome of these computations is the number of acres for each district by land use and a measure of the degree of "mix" of land uses. These are given for 32 of the 43 zones from 1967. Special consideration had to be made for zone 32, which had been allocated, to other zones in the overlays; so its area was set to zero and its land use was spread among the other zones in the district. Further, since zone 17 and 20 had been combined, they were split based on apparent area.

For more information, see Chapter 3 of the file *finaldis7.doc* or *dissingle.doc*.

Addendum: 1979 Land Use Descriptions

First, a computer run shows the amount of acres for each zone and the amount of land that is developed. (This computer run is given previously as the *Charlottesville Population Distribution Data: Sequential Run 1 of Population Distribution Program*: *1/6/1976,* VDOT's Fulton Warehouse, Richmond.)

Second, handwritten notes from VDOT's Fulton Warehouse show both acreage and land use for the Albemarle County zones, and the acreage totals match the computer printout totals.

Third, land uses are also shown in a memorandum for the city of Charlottesville. (See the memorandum from Satyendra S. Huja to Hugh W. Adams, City of Charlottesville Department of Community Development, September 5, 1975.) These three items together produce estimates of land use for the study area in 1979. These data were preferred over the comparable census data as they are zonal specific. The existence of the 1975 memos is fortuitous also because of a state policy "that dictates that employment data be withheld from the public if a situation exists where one firm has 80% or more of a traffic zone's employment or if one employment category has less than three firms in a traffic zone." (See page 25 of the 1985 *Charlottesville Area Planning Study*.) Thus, where employment data were not available from the Planning Study they could be gleaned from the memorandum (for the City of Charlottesville only).

Addendum: Error Estimates for Land Use Between the 1967 and 1979 Studies

Toward the conclusion of this effort, we took advantage of an opportunity to have a rough estimate of how well the zones had been overlaid between two of the planning studies. As stated previously, census tract roads, streams, and jurisdictional boundaries had been selectively examined to create the 1967, 1979, and 1990 zonal overlays. This allows you to know, for example, which 1979 zones correspond to which 1967 zones, how those same zones relate to the 1990 zones, and so on. For 10 of the 16 "districts" from 1967, where a district is a grouping of zones, the total amount of acreage from that district is available. Although the sizes of the 1967 zones could not be obtained, the sizes of the 1979 zones, in acres, are available. Thus, the 1967 "given" district area totals were compared to the 1967 "computed" area totals, where the latter

was based on area totals by relating 1979 zones (whose areas are known) to 1967 zones (whose areas are not known). The following results were obtained.

For example, consider district 1 as shown in Table 6. From Table 3 of the May 22, 1970, memo cited previously, it was determined that district 1 refers to 1967 zones 1, 10, and 23. Then, from the GIS overlays, it became clear that zones 1, 10, and 23 in 1967 corresponded to zones 1 through 9, 10, and 16, respectively, in 1979. The acreages for these three groups in 1979 were 76.5 (zones 1-9), 33.2 (zone 10), and 47.0 (zone 16). These 1979 figures sum to 156.7 acres, whereas the 1967 table 1a gives the area as being 177.3 acres.

Table 6. Select Error Estimates

District	Given Area	Computed Area	% Error
1	156.7	177.3	13
2	519.2	539.8	4
3	862.9	826.0	4
4	892.9	926.7	4
5	1054.9	1121.6	6
6	216.0	245.4	14
7*	1021.0	1042.5	2
8	1018.9	1033.6	1
9	571.9	544.4	5
10	346.3	324.6	6

*District 7 was challenging because one of the five 1967 zones, zone 32, was difficult to place. Hence there might be more (or less) error in this computation than what is shown here.

Addendum: 1963/1967 External Zones

If you examine both the 1967 *Major Arterial Street and Highway Plan, Charlottesville, Virginia* and the *1963 Charlottesville Traffic and Parking Survey* (in the latter, see figure 38 on page 131), you notice the following. External stations for the 1967 data produced additional zonal data, but they could also include trips from beyond the zone in which they are located. Therefore, we used the 1963 study, which did include zonal data, to correct for beyond-zonal trips: this gave a reasonable "external" database for verification. In other words, the following was assumed: Trips going through zone 1110 that began or ended beyond the study area would likely have ends in zones 2137, 2109, 7000, 8000, or 9800. Therefore, such trips need to be subtracted from stations 44, 45, 53, and 54. These stations are located in global zones 45, 47, 37, and 44, so it is here that the subtractions need to be made. Yet, overall, when the percentages were finally computed as shown in bold in the lower right quadrant of the table, these extra trips were quite small in relation to all of the other phenomena going on in the study; hence this entire section is presented under the "Addendum."

Station	Add to Global Zone	Subtract 1963 Zones
1/2 of 44	45*	1/8 of 2137,2109+1/16[7000] +1/16[8000+9800]
1/2 of 44	47*	1/8 of 2137,2109+1/16[7000] +1/16[8000+9800]
45	45*	1/4 of 2137,2109+1/8[7000] +1/8[8000+9800]
46	48*	1/3[1160,2015,2079,2113,2165]+1/6[3000,4000,9900]+1/10[8000+9800]
1/2 of 47	50*	1/6[1160,2015,2079,2113,2165]+1/12[3000,4000,9900] +1/20[8000+9800]
1/2 of 49	43*	1/6[2125]+1/6[3000,4000,9900]+1/6[5000]+1/4[9700]
52	44*	1/2[2029,2065]+1/2[6000]+1/4[7000+9700]+
1/2 of 53	37*	1/8 of 2137,2109+1/16[7000] +1/16[8000,9800]
1/2 of 53	44*	1/8 of 2137,2109+1/16[7000] +1/16[8000,9800]
55	50*	1/6[1160,2015,2079,2113,2165]+1/6[3000,4000,9900] +1/10[8000,9800]

Station	Add to Global zone	Subtract 1963 Zones	Trip Percent
1/2 of 44	45*	1/8 of .02,.019+1/16[.023] +1/16[.014+.01]	= **.024**
1/2 of 44	47*	1/8 of .02,.019+1/16[.023] +1/16[.014+.01]	= **.024**
45	45*	1/4 of .02,.019+1/8[.023] +1/8[.014+.01]	= **.027**
46	48*	1/3[.053,.031,.021,.007,.006]+1/6[.006,.003,.003]+1/10[.014+.01]	= **.044**
1/2 of 47	50*	1/6[.053,.031,.021,.007,.006]+1/12[.006,.003,.003] +1/20[.014+.01]	= **.022**
1/2 of 49	43*	1/6[.018]+1/6[.006,.003,.003]+1/6[.011]+1/4[.005]	= **.008**
52	44*	1/2[.005,.026]+1/2[.005]+1/4[.023+.005]	= **.025**
1/2 of 53	37*	1/8 of .02,.019+1/16[.023] +1/16[.014,.01]	= **.024**
1/2 of 53	44*	1/8 of .02,.019+1/16[.023] +1/16[.014,.01]	= **.024**
55	50*	1/6[.053,.031,.021,.007,.006]+1/6[.006,.003,.003] +1/10[.014,.01]	= **.024**

Addendum: Additional Growth Information Between 1970 and 1980

The Charlottesville/Albemarle area grew substantially between 1970 and 1980, which may pose some problem with the 1974 study using upgraded 1970 census information and 1984 or 1979 traffic counts. Although Charlottesville's population stayed relatively constant (38,880 in 1970 and 39,916 in 1980) Albemarle's population grew almost 48%, from 37,780 in 1970 to 55,783 in 1980, according to Martin and Spar (*Growth in Virginia 1970-1980*, University of Virginia). As you might expect, housing unit and population trends were similar: Charlottesville went from 14,291 units in 1970 to 16,001 units in 1980, and Albemarle went from 11,738 units in 1970 to 20,360 units in 1980, a 73% increase. Charlottesville's density remained comparable over the decade, whereas Albemarle's increased almost 48%. Although Albemarle encompasses a portion greater than the study area, this suggests that the growth between 1970 and 1980 represented an increase in urban sprawl. Surprisingly, though, Charlottesville population figures appear to have the ability to be predicted: the 1947 transportation study stated that the predicted population for Charlottesville would be approximately 33,000: a figure close to the 1970 figure of 38,880.

Addendum: Additional Transit Information

The last portion of Chapter 3 mentions the use of transit in the Charlottesville area, but additional information is available from the U.S. Census. For example, although the Charlottesville urbanized area did receive attention in the 1970, 1980, and 1990 censuses, it was not consider an urbanized area in 1960. However, data from the Roanoke and Lynchburg areas in Virginia studied in the 1960 transportation portion of the Census suggest that at the time about 75% of all work trips may have been made by automobile as reflected in Table 7. For the United States as a whole in 1960, about 85% of persons made work trips by private vehicle, compared with 90.5% in 1970 and 93% in 1980. Separate figures based only on the 34 largest standard metropolitan statistical areas (SMSAs) show lower tabulations of 62%, 74%, and 81%, respectively, for 1960, 1970, and 1980. A separate table shows that "percent travel by private vehicle" is smaller for some larger areas, although the trend is by no means linear. Between 1980 and 1990, the percentage of commuters driving alone to work had increased from 64% to 73% for the 34 largest SMSAs. Thus, given these patterns, it seems reasonable to assume that a very small portion of the trips in Charlottesville were occupied by transit.

Table 7. Selected Trip Data from the 1960 Census

City	Pop. (1000s)	Autos/ HH	Pers/ Auto	Works Auto	% Trips Auto	% Trips Rail	% Trips Bus	% Households (HH) 0	1	2	3+
Lynchburg	55	0.9	4.0	1.7	75.6	0.3	21.6	30.5	54.7	13.4	1.3
Roanoke	117	0.9	3.6	1.4	77.5	0.3	19.8	26.1	57.4	15.3	1.3
Newport News	207	1.0	3.8	1.2	80.9	0	16.5	20.8	61.6	16.0	1.6
Richmond	332	0.9	3.6	1.5	71.8	0.1	25.9	27.9	53.5	16.8	1.8
Norfolk	494	0.9	4.2	1.2	75.9	0.1	20.9	26.9	58.0	13.5	1.5

Source. Transportation Planning Data for Urbanized Areas Based on 1960 Census, 1970.