Enhancement of DVRPC'S
Travel Simulation Models

TASK 11

1995 -1996
HIGHWAY TRAVEL TIME SURVEY

PREPARED FOR
DELAWARE VALLEY REGIONAL
PLANNING COMMISSION

BY
URBAN ENGINEERS, INC.
AND CAMBRIDGE SYSTEMATICS, INC.

DECEMBER 1996

Delaware Valley Regional Planning Commission

Enhancement of DVRPC'S
Travel Simulation Models

TASK 11

1995 -1996
HIGHWAY TRAVEL TIME SURVEY

PREPARED FOR
DELAWARE VALLEY REGIONAL
PLANNING COMMISSION

BY
URBAN ENGINEERS, INC.
AND CAMBRIDGE SYSTEMATICS, INC.

DECEMBER 1996

Delaware Valley Regional Planning Commission
The Bourse Building
111 S. Independence Mall East
Philadelphia, PA 19106-2515

This report has been prepared by Urban Engineers, Inc. and Cambridge Systematics, Inc., in partial fulfillment of the contract between the Delaware Valley Regional Planning Commission and Cambridge Systematics, Inc. to enhance DVRPC's travel simulation models. The preparation of this report was funded through federal grants from the U.S. Department of Transportation's Federal Highway Administration (FHWA) and the Pennsylvania and New Jersey Departments of Transportation. Cambridge Systematics, Inc. however is solely responsible for its findings and conclusions, which may not represent the official views or policies of the funding agencies.

Created in 1965, the Delaware Valley Regional Planning Commission (DVRPC) is an interstate, intercounty, and intercity agency which provides continuing, comprehensive and coordinated planning for the orderly growth and development of the Delaware Valley region. The region includes Bucks, Chester, Delaware, and Montgomery counties, as well as the City of Philadelphia in Pennsylvania; and Burlington, Camden, Gloucester, and Mercer counties in New Jersey. The Commission is an advisory agency which divides its planning and service functions between the Office of the Executive Director, the Office of Public Affairs, and three line Divisions: Transportation Planning, Regional Planning, and Administration. DVRPC's mission for the 1990s is to emphasize technical assistance and services, and to conduct high priority studies for member state and local governments, while determining and meeting the needs of the private sector.

The DVRPC logo is adapted from the official seal of the Commission and is designed as a stylized image of the Delaware Valley. The outer ring symbolizes the region as a whole while the diagonal bar signifies the Delaware River flowing through it. The two adjoining crescents represent the Commonwealth of Pennsylvania and the State of New Jersey. The logo combines these elements to depict the areas served by DVRPC.

DELAWARE VALLEY REGIONAL PLANNING COMMISSION

Publication Abstract

TITLE	Date Published: April, 1997
1995-1996 Highway Travel Time Survey	**Publication No.** 96015

Geographic Area Covered:

Delaware Valley Region

Key Words:

Travel demand models, Highway travel time survey, Highway network, Highway functional classification

ABSTRACT

This report documents the procedures and results of a travel time survey conducted between October 1995 and June 1996. The primary goal of this survey is to provide information on speeds for various roadway and area types in the DVRPC region. This information will be used to enhance the highway network and assignment procedures in the DVRPC travel model system. The survey was conducted by driving on selected routes during the morning and afternoon peak periods and off-peak periods.

In addition, the report describes the procedures used to conduct the travel time runs, including the use of an automatic time recording device. The method for selecting the sample of routes that were surveyed is also presented. The results of the survey are presented by showing samples of the data output forms and providing the travel time estimates from the survey between selected points in the region. The procedures for converting the data to the formats required by the travel modeling software package, TRANPLAN, are also discussed..

For More Information Contact:

Delaware Valley Regional Planning Commission
Regional Information Services Center
The Bourse Building
111 South Independence Mall East
Philadelphia, PA 19106-2515
Telephone: (215) 592-1800 FAX: (215) 592-9125

Table of Contents

List of Tables

Executive Summary

This report documents the procedures and results of a highway travel time survey conducted between October 1995 and June 1996. The survey was conducted by the firm of Urban Engineers, Inc. under subcontract to Cambridge Systematics, Inc. as Task 11 of a project to enhance the Delaware Valley Regional Planning Commission (DVRPC) travel model system.

The primary goal of this survey is to provide information on speeds for highways of various roadway and area types in the DVRPC region during peak and off-peak hours. The speed data are important inputs for the highway network used for traffic assignment in the model system. The enhancement of the highway network and the model system's assignment procedures is the focus of Task 1 of the model enhancement project.

Travel time runs were conducted for a sample of approximately 1,700 miles of roadway in the nine-county DVRPC Region. The sample was chosen to provide an adequate sample of roadways of all of the functional classes and area types in the region, as defined both by the DVRPC model system and the Federal functional classification system.

The surveys were conducted by the Average Vehicle Method, in which a test vehicle is driven along each route, with the driver attempting to maintain the average travel speed. Electronic equipment was used to automatically record travel information as the routes were driven. Data were collected along all routes for three time periods: AM peak (7:30 to 9:30), PM peak (4:30 to 6:30), and midday (10:00 a.m. to 3:30 p.m.). Data were collected Monday through Friday, and days with adverse weather conditions were omitted.

The sample of roadways was developed to obtain a statistically significant sample of mileage within each functional class and area type for both the DVRPC and federal classification systems. Routes were chosen from roadways comprising a "spider network" developed by DVRPC which connects primary and secondary centers in the nine county DVRPC region.

The travel time data collected during the survey was compiled and summarized and is stored on CDs. Data items collected and stored include, for each route segment: length, overall running time and speed, and number and duration of stops. The data were compiled to correspond with the link-node coding of the highway network in the DVRPC model system. This enabled the summary of speed information by functional class and area type categories.

1.0 Introduction

In conjunction with a project to enhance their travel model system, the Delaware Valley Regional Planning Commission (DVRPC) in 1995 and 1996 conducted a travel time survey. The survey was implemented by the firm of Urban Engineers, Inc. under subcontract to Cambridge Systematics, Inc., the consultant for the model enhancement project. The travel time survey constituted Task 11 of this project. This report documents the survey effort.

The main purpose of the travel time survey was to estimate travel speeds on the region's highway system during peak and off-peak hours. The speed data are important inputs for the highway network used for traffic assignment in the model system. The enhancement of this highway network and the model system's assignment procedures is the focus of Task 1 of the model enhancement project.

Travel time runs were conducted for a sample of 1,700 miles of roadway in the nine-county DVRPC Region. All of the roadways included in the travel time survey are identified by the area type and functional classification. A sampling process, described in Section 2.3 of this report, identified sample quotas for each sample cell.

The results from this survey are critical input to the highway assignment, modal split, and trip distribution components of the modeling chain and to the vehicular emissions models. This information has been formatted to facilitate comparisons with past and future travel time surveys. Results of the survey will be placed in the regional database for use in travel simulation and mobile source emissions models and other projects. The survey results will also be used for Congestion Management System (CMS) analysis, travel time and speed monitoring, and accessibility studies to important regional centers.

This report is organized as follows. Section 2.0 describes the survey methods, including the field procedures and the sampling methods. Section 3.0 describes the data outputs and analysis. The appendices provide a sample analysis spreadsheet, the complete list of surveyed routes, and sample outputs from the software used in data collection.

2.0 Survey Methodology

2.1 Sampling Universe

The roadway and area types defined in the DVRPC travel model system differ from those used in the Federal functional classification. The DVRPC model roadway classification scheme is useful for modeling purposes, in contrast to the Federal functional classification which is more appropriate for summarizing roadway statistics. Use of the Federal system is required for funding purposes and VMT estimation.

The DVRPC model system has eight categories of roadways. Ramps, dummy links, and approach links were omitted, leaving five applicable roadway categories for purposes of this study. These categories constitute a total of 13,968 miles from which to sample. In summaries of the survey results, DVRPC's freeway category is combined with the expressway category and labeled "expressway." The DVRPC roadway categories are defined as shown in Table 2.1.

The Federal functional system is more detailed and differs for urban and rural areas. The 12 categories are described in Tables 2.2 and 2.3.

Area types differ with regard to density and types of land use, density of street and highway networks, and the nature of travel patterns. DVRPC defines six area types, primarily based on population and employment per square mile. These area types are: Central Business District (CBD), fringe, urban, suburban, rural, and open rural. Adjustments to area type definitions are made based on land use characteristics and traffic patterns. For summary purposes in reporting results, DVRPC's fringe area type is combined with CBD, and open rural is combined with rural.

The Federal system has two area types: urban and rural. Urban areas have a population of 5,000 or more, and are further categorized as: 1) urbanized areas that have populations of 50,000 and over, and 2) small urban areas that have populations between 5,000 and 50,000.

The Urban area is divided into four sections:

- Philadelphia/Trenton urban area;
- Outside Philadelphia/Trenton urban area;
- Pottstown urban area; and
- Outside Pottstown urban area.

Rural areas are considered those areas outside the boundaries of urban areas.

Table 2.1 DVRPC Roadway Classification System

Freeway	Includes limited access facilities such as interstates and turnpikes. Examples are NJ 55, PA Route 309, I-95, and the Schuylkill Expressway.
Parkway	High type facilities with access control from abutting land uses and selected grade separated intersections. An example is 26th Street leading to the Schuylkill Expressway.
Principal Arterial	At grade facilities with two or more lanes and traffic signals. Examples are U.S. Route 1, Roosevelt Boulevard, and some sections of Routes 202 and 322.
Secondary Arterial	Two lane, high type facilities. Examples include PA Routes 413, 252, and 320, and NJ 73.
Collector/Local	Provides access to adjacent land, with travel characterized by more moderate speeds and shorter travel distances than on arterials. Collector and Local were separate classifications that DVRPC combined in the model system. An example is Lockwood Avenue in Bordentown, NJ.

Table 2.2 Federal Functional Systems for Rural Areas

Principal Arterial **- Interstate** **- Other**	Corridor movement with trip length and density suitable for substantial statewide or interstate travel. Includes freeways and non-freeway principal arterials. The Federal functional coding system provides two codes for the principal arterial category to separate interstate and other facilities. Examples include sections of the NJ Turnpike and Swamp Road (PA 313).
Minor Arterial	Links cities and larger towns, with trip lengths and travel densities greater than those predominantly served by collector or local streets. An example is Hellertown Road (PA 412).
Collector **- Major** **- Minor**	Serves travel of primarily intra-county rather than statewide importance, with travel distances shorter and speeds more moderate than on arterial routes. The federal functional coding system provides two codes for the collector category to separate between major and minor facilities. Examples include Richlandtown Pike and Slifer Valley Road.
Local	Primarily provides access to land adjacent to the collector network and serves travel over relatively short distances. An example is Cedarville Road in Pottstown.

Table 2.3 Federal Functional Systems for Urban Areas

Principal Arterial **- Interstate** **- Other Freeways and Expressways** **- Other**	Serves major centers of activity of urbanized areas, with the highest traffic volume corridors and the longest desired trip lengths. Carries most of the trips entering and leaving the urban area, as well as most of the through movements bypassing the central city. The federal functional coding system provides three codes for the principal arterial category to differentiate interstate, other freeways and expressways, and other facilities. Examples include Easton Road (PA 611) and Penrose Avenue (Route 291).
Minor Arterial	Interconnects with and augments the urban principal arterial system, with trips of moderate length at lower level of travel mobility than principal arterials. An example is Island Avenue in Philadelphia.
Collector	Provides both land access service and traffic circulation within residential neighborhoods and commercial and industrial areas. May penetrate residential neighborhoods. Examples include 40th Street in Philadelphia and Manoa Road in Havertown.
Local	All facilities not in one of the higher systems, with direct access to abutting lands and lowest level of mobility. An example is East Reeseville Road in West Brandywine Township.

2.2 Travel Data Collection

Travel time studies can be carried out using any one of several possible techniques, including Average Vehicle, Moving Vehicle, License Plate, Direct Observation, and Interview. The Average Vehicle Method was chosen for this survey. Drivers traveled along each route, attempting to maintain the average traffic speed. Electronic equipment was used to record travel time information.

Travel time data were collected using the JAMAR Technologies, Inc. "TDC-8" in conjunction with the PC-Travel software. Currently, this equipment is one of the most cost effective systems available on the market. The automated system reduced driver requirements for the actual equipment operation, and the driver was therefore able to fully concentrate on driving. The driver was required to press a check button for each intersection only during one "primary" run. For the other runs, the driver needed to check only the beginning and end points of the run.

To ensure data accuracy, the equipment was recalibrated regularly. The speed estimates are dependent on distance, which depends on the tire radius of the survey vehicle. Because driving so many miles causes significant changes in tire pressure, it is necessary to check and reinflate tires frequently. Each time tires were checked, the equipment was recalibrated to reflect current tire conditions. The calibration factor was also checked during downloading of data from the TDC-8 to the computer.

Once data were downloaded, travel time data were input into a spreadsheet. An example Lotus 1-2-3 spreadsheet is presented in Appendix A. To enhance data accuracy, DVRPC road segment distances and measured field distances were computed in the spreadsheet. In addition, AM, Midday, and PM data were compared. Lotus 1-2-3 macros were created to perform all comparisons against preset accuracy thresholds. Generally, up to 10 percent variation was considered satisfactory although that standard varied with link length.

Data collection started in the fall of 1995, at which time about 200 miles of roadway were surveyed. This period was used to finalize the sample size for each data cell and to test equipment and overall operation of data collection. In January of 1996, the second phase of data collection was begun. For the remainder of the survey, three vehicles were used every day. Daily data collection activities, for both the fall of 1995 and spring of 1996, included the AM peak period from 7:30 AM to 9:30 AM, the midday period from 10:30 AM to 3:30 PM, and the PM peak period from 4:30 PM to 6:30 PM. For each surveyed route, travel times were collected three times per direction for each survey period.

Since DVRPC recommended that all weekdays be included in the survey, data was collected Monday through Friday. Days with adverse weather conditions such as snow, ice, rain, and fog were omitted from the survey since adverse weather conditions can significantly impact travel speed. Each survey vehicle was equipped with a cellular phone, and the drivers were trained to report any change in weather conditions. The survey supervisor decided if it was necessary to cancel data collection.

All drivers sent into the field were equipped with maps and route descriptions. Route itineraries were obtained by consultant team staff making untimed runs prior to the days on which the routes were to be surveyed. These itineraries were sent to DVRPC for review before the runs were made. Drivers were required to confirm their knowledge of each data point on their routes. This procedure ensured accuracy of the data collected.

During the data collection, drivers were instructed to perform the "primary" run for the second of three runs. The first run was used to clarify any possible uncertainty of check point locations since only the beginning and end points were necessary to be recorded. The third run was left as a safety, in case an error occurred during the second "primary" run. In that case, the third run would become the "primary" run.

2.3 Choice of Roadways

Table 2.4 provides a summary of the key elements of the sampling plan. To accommodate the need to use the federal system for funding purposes and the DVRPC classifications for modeling purposes, the roadways in the DVRPC functional classes and areas were cross-tabulated with the federal functional system. This resulted in 24 DVRPC cells and 12 federal cells from which to select the roadway sample.

The approximately 1,700 miles of roadway to be included in the travel time survey were identified by area type and functional classification. The sample was stratified and spread over the two categories, DVRPC or federal. Every road segment was identified according to the two categories. The goal of the sampling strategy was to come up with a sample that is a reasonable representation of the defined population. Using a stratified sample was more efficient in terms of the number of cases needed for a given level of error since the strata were selected to include cases similar to one another. With this lowered variation within strata, fewer cases were needed for accuracy, although the selection included an oversample since an attrition rate due to accidents, construction, or other events was expected. The limited distribution of roadway classes in certain area type categories precluded the use of a proportionate sample; therefore, a disproportionate sample was chosen. The sizes of the sample in each cell defined for sample selection purposes were based on the expected coefficients of variation and total numbers of roadway segments in each cell.

The Project Team determined the sampling rate for each cell, with the quotas based on the selected cell definitions in the federal and DVRPC classification systems. The sampling process met quotas in both systems, based on a predetermined level of confidence. Each of the nine counties in the region was represented in the sample, but there was not a quota relative to sampling by county.

The selection of roadways was not a truly random sample in that:

- Some roadways were not available due to construction activity;
- Roadway segments had to meet criteria for length of test run;

Table 2.4 Key Elements of the Sampling Plan

Population	All roadways in the nine-county DVRPC region
Cell Variables	Roadway classification and area type
Units in Population	Roadway segments totaling 13,968 centerline miles
Selection Strategy	Disproportionate sample
Sample Size Requirement	That which will minimize error over the full set of sampling cells

- Only segments that were on the network in 1990 were included (e.g., the Blue Route (I-476) was not yet opened); and

- Sampling considered what was practical and efficient for the conduct of the survey.

A system of radial and circumferential routes, similar to that used in previous DVRPC travel time surveys, was used to determine the sample. DVRPC provided a "spider network" that identifies two locations in each of the nine counties. The county seat was the primary location, and a township or borough building in the rural portion of the county was the secondary location. These survey locations formed the nodes, and the links in this spider network formed the actual routes from which the facilities to survey were selected. A list of the counties and network nodes is presented in Table 2.5.

For each link in the spider network, the Project Team surveyed portions of two different routes. The first route made maximum use of any freeway or high-type arterial facilities available. The second route followed more localized facilities not included in the first route. After plotting the routes on the map, segment mileage by route and area type was tabulated and compared to the total universe by route and area type. Some segments had to be omitted to keep within the overall total distance of 1,700 miles, and additional segments were added to the sample for route types and areas that were not sufficiently represented, to make up the required 1,700 miles. Short spurs were added to the major routes to serve such areas and to increase the sample of collector and local roads.

The method for choosing specific roadway segments to be included in the survey involved the following steps:

- Setting quotas for each cell from the DVRPC Federal Classification Summaries by County;

- Using as many roadways in the DVRPC spider network as possible to meet the quotas; and

- Selecting additional facilities to completely fill the quotas.

These steps are discussed below.

Practical considerations, such as connectivity of the individual speed runs and varying segment sizes by location, affected the number of miles of facility by category which could be included in the survey. In addition, it was necessary to ensure a reasonable spread of facilities by category and by county.

Step 1. Setting Quotas by Cell

Statistical sampling theory was used to determine the number of miles of roadway to be sampled in each of the DVRPC and Federal cells. The following information, and the sources for each, were required:

Table 2.5 County Seats and Network Nodes

County	Primary Location/ County Seat	Secondary Location/ Township/Borough
Pennsylvania		
Bucks	Doylestown Borough	Quakertown Borough
Chester	West Chester Borough	City of Coatesville
Delaware	Media Borough	Birmingham Township
Montgomery	Norristown Borough	Pottstown Borough
Philadelphia	City Hall	NE Philadelphia Airport
New Jersey		
Burlington	Mount Holly Borough	Pemberton Township
Camden	City of Camden	Winslow Township
Gloucester	Woodbury Borough	Franklin Township
Mercer	City of Trenton	West Windsor Township

- Number of two-way miles by category, available from summaries prepared from the DVRPC TRANPLAN highway network.

- Average segment sizes by category in miles, where the length of a highway segment is defined as the distance between signalized intersections on non-freeways (as in the *Highway Capacity Manual)* and as the distance between entrance ramps on freeways.

- The coefficients of variation for individual speed observations by category, where the coefficient of variation is defined as the standard deviation divided by the mean value. Limited information in the *Manual of Transportation Engineering Studies* and *Highway Capacity Manual* suggested that a coefficient of variation of 0.2 was a reasonable estimate for speeds on all facility types. Actually, since a constant value was assumed for all categories, the quotas by category did not depend on the exact value of the coefficient of variation;

- The confidence level to be used in specifying the precision of the mean travel speeds by facility type/area type category. A value of 95 percent was used in the preliminary calculations; the quotas by category are also independent of this value.

- The total two-way miles to be included in the sample (1,700).

A final quantity of interest was the precision of the average speed estimates to be expected for each category, expressed as a fraction of the mean values by category. This quantity was kept constant for all categories, but varied overall to allow the total sample size to be kept at 1,700 miles. Thus, the outputs of the quota setting process were the miles of roadway to be sampled in each category, and the expected precision of the resulting mean values by category at the specified confidence level.

Because both the miles of roadway by category and the number of segments by category were relatively small compared with the 'populations' normally used in sample size determinations, the relationship used to compute quotas by category is the standard statistical equation for sampling from a finite population (See, for example, *Elementary Sampling for Traffic Engineers*, Eno Foundation, 1962, page 63). Tables 2.6 and 2.7 provide the results of using this relationship on a trial and error basis to obtain a total sample size of exactly 1,700 miles. Table 2.6 provides the preliminary estimates for the DVRPC classifications; Table 2.7 deals with the Federal classifications. These tables show that the precision obtained for the averages in the DVRPC categories is 3.2 percent of the mean (at the 95 percent confidence level). For the Federal categories, the corresponding precision is 2.8 percent of the mean.

Tables 2.6 and 2.7 also compare the sample requirements with the miles per category in DVRPC's 'spider network' of connections between county seats and township/boroughs in each of the nine counties in the DVRPC study area. These comparisons show that the spider network had to be augmented with additional facilities in 13 of the 16 DVRPC categories, and in 10 of the 12 Federal categories. In the remaining three DVRPC categories and two Federal categories, some of the specified miles of spider network facilities did not have to be surveyed. These categories are Principal Arterials in area types Urban, Suburban and Rural for the DVRPC classification system; also Principal Arterials (Other) and Minor Arterials, both in the Urban area type, for the Federal classification system.

Table 2.6 Sample Size Determination for DVRPC Travel Speed Survey Based on the DVRPC Facility Type/Area Type Classifications

DVRPC Classifications						DVRPC Spider Network			
Facility Type	Area Type	Roadway Distance (miles)	Average Segment Size (miles)	Distance in Sample (miles)	Percent of Cell Total	Primary	Secondary	Total	Sample Minus Spider Total
Expressway	CBD	18.7	0.50	14.9	79.6%	7.2	0.0	7.2	7.7
	Urban	108.8	1.00	62.4	57.3%	44.3	0.4	44.6	17.8
	Suburban	528.7	2.00	188.3	35.6%	130.4	5.2	135.6	52.8
	Rural	449.3	4.00	254.1	56.6%	95.4	2.3	97.6	156.5
Princ. Arterial	CBD	43.4	0.20	17.5	40.3%	3.5	2.0	5.5	12.0
	Urban	613.1	0.50	65.3	10.7%	25.2	67.0	92.2	-26.9
	Suburban	1,462.9	1.00	133.0	9.1%	103.5	164.3	267.8	-134.8
	Rural	1,191.8	2.00	234.9	19.7%	159.7	158.2	317.9	-83.0
Sec. Arterial	CBD	70.6	0.20	20.7	29.3%	0.0	1.5	1.5	19.2
	Urban	586.8	0.50	65.0	11.1%	0.3	13.3	13.6	51.5
	Suburban	1,915.1	1.00	135.9	7.1%	28.4	45.7	74.0	61.9
	Rural	2,567.6	2.00	262.6	10.2%	45.3	110.4	155.7	107.0
Collector/Local	CBD	7.6	0.10	5.0	65.8%	0.0	0.0	0.0	5.0
	Urban	258.3	0.25	32.0	12.4%	0.0	0.0	0.0	32.0
	Suburban	1,316.0	0.50	69.3	5.3%	0.0	3.9	3.9	65.4
	Rural	2,841.2	1.00	139.1	4.9%	6.0	32.8	38.8	100.4
Totals		**13,979.9**		**1700.0**		**648.9**	**606.7**	**1,255.6**	**444.4**

d = precision	= 0.0324
cv = coefficient of variation	= 0.20
alpha = confidence level	= 95%
z (conf. level)	= 1.96
(cv*z)**2	= 0.1537

Table 2.7 Sample Size Determination for DVRPC Travel Speed Survey Based on the Federal Facility Type/Area Type Classifications

Federal Classifications							DVRPC Spider Network			
Code	Facility Type	Area Type	Roadway Distance (miles)	Average Segment Size (miles)	Distance in Sample (miles)	Percent of Cell Total	Primary	Secondary	Total	Sample Minus Spider Total
1	Princ. Art. Int.	Rural	75.8	4.00	69.1	91.2%	7.3	0.0	7.3	61.9
2	Princ. Art. Oth.	Rural	644.9	3.00	307.6	47.7%	83.3	51.3	134.5	173.1
6	Minor Arterial	Rural	732.3	2.00	255.3	34.9%	38.1	61.4	99.5	155.8
7	Major Collector	Rural	1,103.0	1.50	232.2	21.0%	9.4	37.2	46.5	185.7
8	Minor Collector	Rural	1,231.8	1.00	169.1	13.7%	1.3	11.3	12.6	156.6
9	Local	Rural	147.1	1.00	84.0	57.1%	0.0	2.7	2.7	81.3
11	Princ. Art. Int.	Urban	426.0	1.00	134.3	31.5%	126.2	0.0	126.2	8.1
12	Princ. Art. Exp.	Urban	427.2	1.00	134.4	31.5%	104.2	6.6	110.8	23.6
14	Princ. Art. Oth.	Urban	2,515.0	0.75	138.9	5.5%	204.9	252.3	457.2	-318.3
16	Minor Arterial	Urban	3,315.1	0.50	95.2	2.9%	59.9	160.9	220.8	-125.6
17	Collector	Urban	2,779.6	0.30	57.6	2.1%	11.5	18.6	30.1	27.5
19	Local	Urban	51.7	0.20	22.3	43.1%	0.0	0.0	0.0	22.3
Totals			**13,979.9**		**1700.0**		**645.9**	**602.2**	**1,248.0**	**452.0**

d = precision = 0.0280
cv = coefficient of variation = 0.20
alpha = confidence level = 95%
z (conf. level) = 1.96

(cv*z)**2 = 0.1537

Steps 2 and 3 discuss how subtractions and additions were made to the spider network to obtain the final survey sample.

Step 2. Deleting Spider Network Facilities

Table 2.6 indicates that 244.7 miles of spider network facilities in three DVRPC categories were not required in the sample, while Table 2.7 shows that 443.9 miles in two Federal categories were not required. It was not possible to meet both of these criteria; in order to provide the greatest opportunity to meet all quotas, approximately 444 miles were deleted from the spider network. The facilities deleted were ones which had codes in both of the following subsets of the two classification systems:

- In the DVRPC system, Principal Arterials in area types Urban, Suburban, or Rural; and
- In the Federal system, Principal Arterials (Other) or Minor Arterials in the Urban area.

Table 2.7 provides the numbers of facilities deleted from each of the Federal classifications. Table 2.6 indicates that most deleted facilities were Suburban, followed by Rural and Urban facilities.

Step 3. Selecting Additional Facilities for the Sample

The final step in the sample selection process involved choosing the additional facilities required to reach 1,700 miles of facilities for inclusion in the travel time survey sample. About 689 miles had to be added in this step. Each cell of this table was processed in turn as follows:

- From the cell total, the smallest of 1) the cell value; 2) the remaining total needed in the cell's DVRPC category; or 3) the remaining total needed in the cell's Federal category was determined. This was the desired number of miles of facilities in the cell to be included in the sample.
- The cell value and the remaining totals required in each classification system were determined by subtracting the amount to be sampled from each.
- The next cell was considered until all cells had been completed or until all sampling requirements were met.

Once these desired sample sizes by cell were determined, the maps and total network data base were used to select specific facilities and routes to be included in the sample.

Detailed descriptions of the routes surveyed were transmitted to DVRPC for review and concurrence prior to actual data collection. A list of the surveyed routes is provided in Appendix B.

3.0 Summary of Results

The travel time survey data collected was compiled and stored on a CD. While it is impossible to present all of the data in this report, this section provides a summary of the data outputs of the survey and the analysis performed with the data.

3.1 Data Outputs

The PC-Travel software produces a number of tables that summarize each travel-time run and are also available to compare runs of the same segment. A computer printout documenting the data collected were produced for each run. Summary tables documenting the numerical data collected include the following elements for the overall run and for each link:

- Length;
- Overall running speed (travel time);
- Stops;
- Time below 0, 10, and 30 mph; and
- Fuel consumption.

Summary graphics were also produced for a selected set of road segments for demonstration and presentation purposes. The summary graphics included:

- Summary speed/distance profiles;
- Time/space trajectories;
- Speed profiles; and
- Time-based speed profiles.

A sample of PC-Travel software output and summary graphics is presented in Appendix C.

3.2 Conversion to Network Data Formats

Data outputs from the PC-Travel software were analyzed and reduced onto spreadsheets. Travel time information based on run check points were correlated to the travel time information based on DVRPC model network map. A Lotus macro system was created to ensure satisfactory accuracy of input data. A Lotus file documenting the travel time based on the DVRPC network map was provided to DVRPC on a CD. A sample of the Lotus file is presented in Appendix A. Data items included in spreadsheet are:

- Roadway name
- Direction of travel
- ANODE and BNODE of each corresponding network link;
- Federal and DVRPC simulation functional class and area type;
- The type of intersection traffic control; and
- DVRPC model distances.

3.3 Summary of Observed Travel Times

Table 3.1 shows the average travel speeds by area type, functional classification, and time of day obtained from the highway travel time survey. These speeds will be used in updating the speed-capacity lookup tables for the DVRPC model highway network in Task 1 of the Model Enhancement project.

Tables 3.2 through 3.4 show the travel times between the 18 "centers" listed in Table 2.5 for the a.m. peak, p.m. peak, and midday periods respectively. Tables 3.5 through 3.7 show the average travel speeds between the 18 "centers" for the a.m. peak, p.m. peak, and midday periods respectively. The information in these tables is weighted by link length. Since other weighting methods produce different results, DVPRC should investigate other procedures before using these travel times and speeds in detailed traffic studies.

Table 3.1 Average Travel Speeds from Survey by Functional Classification and Area Type

Functional Classification	Area Type				
	CBD	Fringe	Urban	Suburban	Rural
AM Peak					
Freeway	35.5	41.3	40.5	53.7	59.9
Parkway		26.3	47.3	59.7	54.4
Principal Arterial	15.2	19.6	19.8	30.4	39.4
Secondary Arterial	12.0	13.6	18.6	30.8	41.1
Collector/Local		15.8	17.9	32.9	38.9
Midday					
Freeway	39.1	51.7	54.5	57.7	62.7
Parkway		54.1	53.5	57.5	56.9
Principal Arterial	14.1	21.9	20.1	30.3	40.1
Secondary Arterial	11.6	12.9	18.9	31.2	40.9
Collector/Local		14.1	18.2	32.6	38.3
PM Peak					
Freeway	27.4	40.8	49.8	54.0	60.6
Parkway		52.3	52.9	57.0	53.9
Principal Arterial	13.1	18.8	19.8	28.8	39.0
Secondary Arterial	11.4	14.5	19.2	30.3	40.7
Collector/Local		8.5	17.5	31.1	37.8

Table 3.2 Travel Time Matrix (Minutes)

AM Peak Hour – County Seat/Township

County Seat	City Hall	NE Phila. Airport	Media	Birmingham	West Chester	Coatesville	Norristown	Pottstown	Quakertown	Doylestown	Trenton	West Windsor	Pemberton	Mount Holly	Camden	Winslow	Woodbury	Franklin
City Hall		42.72	48.73	73.44	69.03	83.12	46.46	74.34	83.60	59.95	54.11	65.22	55.00	46.62	17.75	61.23	40.64	62.81
NE Phila. Airport	57.03		95.26	119.97	115.56	128.83	92.17	103.61	65.85	42.20	28.60	39.71	61.40	52.82	49.79	87.80	72.68	94.85
Media	50.66	76.69		26.61	26.53	48.76	49.33	63.46	99.38	97.64	88.08	99.19	100.74	92.16	63.49	78.42	53.22	58.48
Birmingham	78.31	104.34	29.55		27.02	25.16	55.04	63.41	99.33	98.13	115.73	126.84	113.75	105.17	75.79	79.65	54.45	59.71
West Chester	75.67	101.70	30.75	21.44		23.24	33.56	39.47	75.39	76.65	113.09	124.20	114.95	106.37	76.99	80.85	55.65	60.91
Coatesville	94.78	122.82	53.07	24.76	26.66		45.01	41.04	76.96	88.10	131.73	143.77	137.32	128.74	99.36	103.22	78.02	83.28
Norristown	49.79	89.86	47.33	53.66	32.75	45.31		29.81	61.83	54.10	97.64	109.68	102.14	93.56	64.89	108.37	84.11	89.37
Pottstown	84.17	103.85	68.14	61.96	41.73	40.73	35.37		35.94	60.35	102.66	114.70	136.52	127.94	99.27	118.29	93.09	98.35
Quakertown	100.11	67.93	105.90	99.72	79.49	78.49	70.45	37.78		24.43	66.74	78.78	125.09	115.66	115.21	156.05	130.85	136.11
Doylestown	76.20	44.02	110.95	105.45	84.54	97.10	70.96	61.93	24.17		44.05	56.09	102.40	92.97	91.30	134.03	114.19	136.36
Trenton	74.75	29.95	108.00	132.71	128.30	143.94	118.04	103.23	65.47	47.10		14.37	60.68	51.25	81.64	94.71	104.53	118.83
West Windsor	85.64	40.84	118.89	143.60	139.19	155.73	129.83	115.02	77.26	58.89	14.17		48.65	39.22	69.61	82.68	92.50	106.80
Pemberton	56.16	58.62	102.01	112.87	115.89	136.21	99.55	127.43	126.34	102.69	66.14	54.04		13.72	38.23	42.54	61.12	66.66
Mount Holly	47.84	50.30	93.69	104.55	107.57	127.89	91.23	119.11	118.02	94.37	56.63	44.53	13.95		29.91	43.48	52.80	67.60
Camden	18.77	46.37	64.62	74.37	77.39	98.82	62.16	90.04	92.54	68.89	63.08	73.58	37.59	29.01		43.82	22.62	44.79
Winslow	64.30	85.78	81.89	80.18	83.20	105.32	107.69	120.13	138.07	114.42	98.61	86.51	41.78	42.00	46.37		40.78	24.14
Woodbury	41.95	69.42	54.80	53.09	56.11	78.23	84.13	93.04	115.72	92.07	86.26	96.63	60.64	52.06	22.68	41.18		22.19
Franklin	68.25	90.72	60.89	59.18	62.20	84.32	90.22	99.13	135.05	113.37	107.56	110.34	65.61	65.83	43.98	23.85	21.32	

Table 3.3 Travel Time Matrix (Minutes)

PM Peak Hour – County Seat/Township

County Seat	City Hall	NE Phila. Airport	Media	Birmingham	West Chester	Coatesville	Norristown	Pottstown	Quakertown	Doylestown	Trenton	West Windsor	Pemberton	Mount Holly	Camden	Winslow	Woodbury	Franklin
City Hall		47.27	50.35	78.34	69.73	83.83	43.41	72.82	103.79	72.64	58.19	69.21	62.86	54.67	20.56	71.48	43.35	65.01
NE Phila. Airport	44.91		74.70	102.69	96.06	119.72	87.43	115.43	78.97	47.82	28.42	39.44	57.54	49.35	44.81	87.06	67.60	89.26
Media	49.75	77.25		29.87	28.52	52.18	42.00	66.30	103.29	102.44	88.17	99.19	105.60	97.41	63.30	81.40	56.61	62.33
Birmingham	77.21	104.71	29.34		24.90	22.80	55.06	62.12	99.11	101.89	115.63	126.65	117.06	108.87	73.99	79.23	54.44	60.16
West Chester	72.36	99.86	31.64	21.92		25.35	36.95	41.62	78.61	83.78	110.78	121.80	121.03	112.84	77.96	83.20	58.41	64.13
Coatesville	89.95	120.71	52.10	22.78	27.64		48.24	41.68	78.67	95.07	131.63	142.65	139.82	131.63	96.75	101.99	77.20	82.92
Norristown	41.73	86.99	50.99	55.89	34.34	48.44		32.06	68.31	60.46	97.91	108.93	102.58	94.39	60.28	111.20	83.07	93.49
Pottstown	70.86	105.24	67.15	60.69	42.30	41.72	33.98		37.01	62.18	103.15	114.17	131.71	123.52	89.41	120.52	95.73	101.45
Quakertown	96.23	68.25	103.61	97.15	78.76	78.18	65.53	36.48		25.19	66.16	77.18	128.16	119.97	111.10	156.98	132.19	137.91
Doylestown	71.56	43.58	107.75	105.18	83.63	97.73	66.58	68.13	31.67		43.50	54.52	103.49	95.30	86.43	133.01	109.22	130.88
Trenton	58.64	31.23	88.43	116.42	109.79	133.45	102.03	108.72	72.26	49.28		14.56	66.01	57.49	67.11	102.44	89.90	111.56
West Windsor	68.72	41.31	98.51	126.50	119.87	143.53	121.11	118.80	82.34	59.36	13.64		53.83	45.31	75.31	90.26	98.10	114.47
Pemberton	53.87	57.06	96.30	117.57	117.66	134.48	94.06	123.47	132.26	106.90	63.56	52.30		13.52	37.66	43.91	60.45	68.12
Mount Holly	46.11	49.30	88.54	109.81	109.90	126.72	86.30	115.71	122.19	99.14	53.49	42.33	13.70		29.90	44.85	52.69	69.06
Camden	17.09	48.47	59.52	79.66	80.88	97.70	57.28	86.69	110.55	79.40	63.07	74.09	42.69	34.50		51.31	22.54	44.20
Winslow	61.71	85.00	87.52	85.88	88.22	108.66	101.90	126.00	155.17	124.02	96.03	84.77	42.33	42.56	44.50		40.87	24.23
Woodbury	38.76	70.14	60.35	58.71	61.05	81.49	78.95	98.83	132.22	101.07	84.74	95.76	64.21	56.02	21.14	40.75		21.68
Franklin	60.06	91.44	66.35	64.71	67.05	87.49	97.21	104.83	141.82	122.37	106.04	109.13	66.69	66.92	42.44	24.38	21.32	

Table 3.4 Travel Time Matrix (Minutes)

Midday – County Seat/Township

County Seat	City Hall	NE Phila. Airport	Media	Birmingham	West Chester	Coatesville	Norristown	Pottstown	Quakertown	Doylestown	Trenton	West Windsor	Pemberton	Mount Holly	Camden	Winslow	Woodbury	Franklin
City Hall		45.26	48.71	75.36	63.53	78.15	37.91	66.38	92.37	66.68	55.79	66.38	63.23	55.01	22.47	70.82	44.61	66.00
NE Phila. Airport	46.49		76.85	103.50	97.98	122.34	82.10	104.88	70.17	44.48	28.48	39.07	61.14	51.78	47.26	90.25	69.40	90.79
Media	52.01	78.67		28.53	27.24	51.97	43.00	63.02	100.25	95.45	89.20	99.79	107.65	99.43	66.89	80.37	55.73	60.72
Birmingham	81.12	107.78	30.99		23.37	24.22	52.03	59.15	96.38	91.58	118.31	128.90	116.16	107.94	74.69	79.97	55.33	60.32
West Chester	73.16	99.82	33.42	21.91		24.86	35.14	41.30	78.53	74.69	110.35	120.94	118.59	110.37	77.12	82.40	57.76	62.75
Coatesville	87.29	122.24	56.21	25.24	28.90		47.45	40.90	78.13	87.00	127.54	138.13	141.38	133.16	99.91	105.19	80.55	85.54
Norristown	39.86	82.44	47.46	53.93	34.06	48.68		30.97	62.35	52.98	92.97	103.56	100.41	92.19	59.65	108.00	81.79	91.10
Pottstown	69.38	100.69	70.79	62.70	43.14	41.63	33.73		37.25	61.14	99.54	110.13	129.93	121.71	89.17	119.83	95.19	100.18
Quakertown	89.47	63.46	105.50	97.41	77.85	76.34	63.28	34.73		23.91	62.31	72.90	121.42	112.92	108.03	154.54	129.90	134.89
Doylestown	66.08	40.07	99.82	93.87	74.00	88.62	56.57	60.92	26.21		40.96	51.55	100.07	91.57	84.64	132.46	106.78	128.17
Trenton	58.71	30.17	89.07	115.72	110.20	134.93	96.60	102.18	67.47	46.84		13.94	62.46	53.96	67.60	98.30	89.74	111.13
West Windsor	67.72	39.18	98.08	124.73	119.21	143.94	105.61	111.19	76.48	55.85	12.38		50.80	42.30	72.20	86.64	94.34	111.33
Pemberton	51.96	57.07	94.89	112.19	112.41	127.32	87.08	115.55	124.81	103.49	60.71	50.61		12.99	36.55	42.94	58.69	67.63
Mount Holly	44.89	50.00	87.82	105.12	105.34	120.25	80.01	108.48	114.84	94.21	50.74	40.64	13.32		29.48	44.36	51.62	69.05
Camden	16.23	47.75	59.16	75.51	75.73	91.59	51.35	79.82	98.65	72.96	60.00	70.59	41.11	32.89		48.70	22.01	43.40
Winslow	60.10	86.73	82.60	79.74	79.96	103.94	95.22	115.74	142.52	116.83	95.02	84.92	43.90	44.30	44.69		41.49	24.71
Woodbury	37.64	68.94	57.83	54.97	55.19	79.17	72.76	90.97	120.06	94.37	81.41	92.00	62.30	54.08	20.83	41.06		21.41
Franklin	58.68	89.98	61.84	58.98	59.20	83.18	87.86	94.98	132.21	115.41	102.45	109.31		68.69	41.87	24.41	21.06	

Table 3.5 Average Speed Matrix (MPH)

AM Peak Hour – County Seat/Township

County Seat	City Hall	NE Phila. Airport	Media	Birmingham	West Chester	Coatesville	Norristown	Pottstown	Quakertown	Doylestown	Trenton	West Windsor	Pemberton	Mount Holly	Camden	Winslow	Woodbury	Franklin
City Hall		23.1	20.5	27.9	26.2	31.6	26.4	32.4	31.5	28.7	46.6	46.7	34.7	32.0	17.8	28.0	20.2	30.0
NE Phila. Airport	16.4		19.7	24.4	23.2	27.2	22.4	31.4	33.6	30.7	51.6	50.4	32.0	29.2	19.4	26.9	20.2	26.7
Media	19.9	24.9		41.2	34.0	35.3	24.4	36.7	33.9	27.9	37.7	38.8	28.1	26.2	19.5	33.6	32.7	45.1
Birmingham	26.7	28.7	38.2		36.1	37.3	41.5	37.3	38.0	38.0	38.1	38.9	34.4	33.3	30.7	40.5	41.3	44.6
West Chester	24.6	27.2	32.8	40.2		35.3	44.2	38.0	38.6	38.2	36.9	37.8	32.0	30.7	27.2	39.1	39.2	42.6
Coatesville	27.9	28.9	33.9	37.8	34.3		42.4	39.9	39.6	38.0	36.9	37.8	32.6	31.5	29.0	38.3	38.1	40.6
Norristown	25.5	24.8	29.2	44.5	47.0	44.5		39.9	35.1	31.0	32.6	34.3	30.8	29.2	24.0	27.3	24.5	35.0
Pottstown	28.9	32.6	34.7	39.0	40.2	40.2	34.4		39.3	38.8	37.0	38.1	31.6	30.4	27.3	34.8	34.6	42.2
Quakertown	26.9	32.5	33.2	38.3	38.8	38.8	31.2	37.4		38.1	35.7	37.6	33.8	32.9	25.9	28.1	26.6	33.5
Doylestown	23.4	29.2	24.8	35.2	33.8	34.3	23.6	37.7	38.4		34.5	37.4	32.3	31.1	22.6	25.8	22.5	26.7
Trenton	33.3	49.9	31.2	33.3	32.5	34.3	27.8	36.6	36.2	34.1		41.4	43.5	47.1	30.9	41.4	28.9	34.4
West Windsor	35.1	49.2	32.7	34.4	33.7	35.4	29.6	37.8	38.0	36.9	41.2		43.3	48.0	43.5	45.2	38.1	43.0
Pemberton	32.7	32.4	27.2	33.9	30.9	32.3	30.8	33.3	33.0	31.7	39.8	39.0		36.6	41.1	43.7	33.8	41.6
Mount Holly	29.6	29.4	25.2	32.6	29.4	31.2	29.0	32.1	31.8	30.0	42.1	41.9	36.2		38.5	42.7	31.2	40.2
Camden	14.7	20.7	18.8	30.5	26.2	28.8	24.1	29.8	30.1	27.2	39.6	40.5	42.6	40.8		32.1	22.1	35.0
Winslow	25.6	27.2	31.6	40.2	38.7	37.3	26.6	33.8	30.1	28.3	39.2	42.8	44.1	43.8	29.7		38.9	38.0
Woodbury	18.6	21.1	31.4	42.1	39.8	37.6	23.8	34.3	28.4	25.8	34.8	36.0	34.6	32.3	22.0	38.6		48.1
Franklin	29.2	27.9	43.8	45.0	42.6	39.8	34.0	40.8	32.2	30.3	37.8	41.2	42.0	41.7	35.5	38.4	49.9	

Table 3.6 Average Speed Matrix (MPH)

PM Peak Hour – County Seat/Township

County Seat	City Hall	NE Phila. Airport	Media	Birmingham	West Chester	Coatesville	Norristown	Pottstown	Quakertown	Doylestown	Trenton	West Windsor	Pemberton	Mount Holly	Camden	Winslow	Woodbury	Franklin
City Hall		20.9	19.8	26.2	25.9	31.3	28.2	33.1	25.4	23.6	43.3	44.0	30.4	27.3	15.4	24.0	18.9	29.0
NE Phila. Airport	20.9		25.1	28.5	28.0	29.3	23.6	28.2	28.0	27.1	51.9	50.8	34.1	31.3	21.5	27.1	21.7	28.4
Media	20.2	24.7		36.7	31.6	33.0	28.7	35.1	32.7	26.6	37.6	38.8	26.8	24.8	19.5	32.4	30.7	42.4
Birmingham	27.1	28.6	38.5		39.2	41.2	41.5	38.1	38.1	36.6	38.1	38.9	33.5	32.1	31.4	40.7	41.3	44.2
West Chester	25.7	27.7	31.9	39.3		32.4	40.2	36.0	37.0	34.9	37.6	38.6	30.4	28.9	26.8	38.0	37.4	40.5
Coatesville	29.4	29.4	34.5	41.0	33.0		39.6	39.3	38.8	35.2	36.9	38.1	32.0	30.8	29.7	38.7	38.5	40.8
Norristown	30.5	25.6	27.1	42.7	44.8	41.6		37.1	31.7	27.7	32.5	34.6	30.7	28.9	25.8	26.6	24.8	33.4
Pottstown	34.3	32.2	35.2	39.8	39.7	39.2	35.8		38.2	37.7	36.8	38.3	32.7	31.5	30.4	34.1	33.6	40.9
Quakertown	28.0	32.3	33.9	39.4	39.2	39.0	33.5	38.7		37.0	36.0	38.4	33.0	31.7	26.9	27.9	26.4	33.0
Doylestown	24.9	29.5	25.5	35.2	34.2	34.1	25.2	34.3	29.3		34.9	38.5	32.0	30.3	23.9	26.0	23.5	27.8
Trenton	42.5	47.9	38.1	38.0	38.0	37.0	32.2	34.8	32.8	32.6		40.9	40.0	42.0	37.6	38.3	33.6	36.7
West Windsor	43.8	48.7	39.4	39.0	39.1	38.4	31.8	36.6	35.7	36.6	42.8		39.2	41.6	40.2	41.4	35.9	40.1
Pemberton	34.1	33.2	28.8	32.6	30.5	32.7	32.5	34.4	31.5	30.4	41.4	40.3		37.1	41.7	42.3	34.2	40.7
Mount Holly	30.7	30.0	26.6	31.1	28.8	31.4	30.6	33.1	30.7	28.6	44.6	44.0	36.9		38.5	41.4	31.3	39.3
Camden	16.1	19.8	20.4	28.5	25.0	29.1	26.2	31.0	25.2	23.6	39.6	40.3	37.5	34.3		27.4	22.2	35.5
Winslow	26.7	27.4	29.5	37.5	36.5	36.2	28.2	32.2	26.8	26.1	40.3	43.7	43.5	43.2	31.0		38.8	37.9
Woodbury	20.2	20.9	28.5	38.1	36.6	36.1	25.4	32.3	24.9	23.5	35.4	36.3	32.7	30.0	23.6	39.0		49.3
Franklin	30.7	27.7	40.2	41.2	39.5	38.4	31.6	38.5	30.7	28.1	38.3	41.6	41.4	41.0	36.8	37.6	49.9	

Table 3.7 Average Speed Matrix (MPH)

Midday – County Seat/Township

County Seat	City Hall	NE Phila. Airport	Media	Birmingham	West Chester	Coatesville	Norristown	Pottstown	Quakertown	Doylestown	Trenton	West Windsor	Pemberton	Mount Holly	Camden	Winslow	Woodbury	Franklin
City Hall		21.8	20.5	27.2	28.4	33.6	32.3	36.3	28.5	25.8	45.2	45.9	30.2	27.1	14.0	24.2	18.4	28.6
NE Phila. Airport	20.2		24.4	28.3	27.4	28.6	25.2	31.0	31.5	29.2	51.8	51.2	32.1	29.8	20.4	26.2	21.2	27.9
Media	19.4	24.3		38.4	33.1	33.1	28.0	36.9	33.6	28.5	37.2	38.5	26.3	24.3	18.5	32.8	31.2	43.5
Birmingham	25.8	27.8	36.5		41.7	38.8	43.9	40.0	39.2	40.7	37.2	38.3	33.7	32.4	31.1	40.4	40.7	44.1
West Chester	25.4	27.7	30.2	39.4		33.0	42.2	36.3	37.1	39.2	37.8	38.8	31.1	29.6	27.1	38.4	37.8	41.4
Coatesville	30.3	29.0	32.0	37.0	31.6		40.2	40.1	39.0	38.5	38.1	39.4	31.6	30.4	28.8	37.5	36.9	39.6
Norristown	31.9	27.0	29.1	44.3	45.2	41.4		38.4	34.8	31.7	34.3	36.3	31.4	29.6	26.1	27.4	25.2	34.3
Pottstown	35.0	33.6	33.4	38.5	38.9	39.3	36.1		37.9	38.3	38.1	39.7	33.2	31.9	30.4	34.3	33.8	41.4
Quakertown	30.2	34.7	33.3	39.3	39.7	39.9	34.7	40.6		38.9	38.2	40.6	34.8	33.7	27.6	28.4	26.8	33.8
Doylestown	26.9	32.1	27.5	39.5	38.6	37.6	29.7	38.4	35.4		37.1	40.7	33.1	31.6	24.4	26.1	24.1	28.4
Trenton	42.5	49.6	37.8	38.2	37.9	36.6	34.0	37.0	35.2	34.3		42.7	42.3	44.8	37.3	39.9	33.7	36.8
West Windsor	44.4	51.3	39.6	39.6	39.3	38.2	36.4	39.1	38.4	38.9	47.2		41.5	44.5	41.9	43.2	37.4	41.2
Pemberton	35.4	33.2	29.3	34.1	31.9	34.6	35.2	36.8	33.4	31.4	43.3	41.6		38.7	42.9	43.3	35.2	41.0
Mount Holly	31.6	29.5	26.8	32.4	30.1	33.1	33.0	35.3	32.6	30.1	47.0	45.9	37.9		39.0	41.9	32.0	39.3
Camden	17.0	20.1	20.5	30.1	26.7	31.0	29.2	33.7	28.2	25.6	41.6	42.3	39.0	36.0		28.9	22.7	36.1
Winslow	27.4	26.9	31.3	40.4	40.3	37.8	30.1	35.0	29.1	27.7	40.7	43.6	42.0	41.5	30.8		38.2	37.1
Woodbury	20.8	21.3	29.8	40.7	40.5	37.2	27.6	35.1	27.4	25.2	36.9	37.8	33.7	31.1	23.9	38.7		49.9
Franklin	31.4	28.1	43.1	45.2	44.8	40.4	34.9	42.5	32.9	29.8	39.7	41.6	40.4	39.9	37.3	37.6	50.5	

Appendix A

Sample Analysis Spreadsheet

checked by: WMP 02/14/96

ROUTE 1
US 322: Comm. Barry Bidge to Baltimore Pike

INTERSECTION	CONTROL	NODE	DIST.	AREA TYPE	FFC	FC	EASTBOUND AM TRAVEL TIME [SEC]	EASTBOUND AM SPEED [MPH]	EASTBOUND MD TRAVEL TIME [SEC]	EASTBOUND MD SPEED [MPH]	EASTBOUND PM TRAVEL TIME [SEC]	EASTBOUND PM SPEED [MPH]	WESTBOUND AM TRAVEL TIME [SEC]	WESTBOUND AM SPEED [MPH]	WESTBOUND MD TRAVEL TIME [SEC]	WESTBOUND MD SPEED [MPH]	WESTBOUND PM TRAVEL TIME [SEC]	WESTBOUND PM SPEED [MPH]	AVERAGE DAILY EASTBOUND TRAVEL TIME [SEC]	AVERAGE DAILY EASTBOUND SPEED [MPH]	AVERAGE DAILY WESTBOUND TRAVEL TIME [SEC]	AVERAGE DAILY WESTBOUND SPEED [MPH]
WESTBOUND	One Way Section																					
PA 352	Overpass	*n.i.n.*																				
(pa 352 / pa 320)	SB Onramp	2021	0.15	Urban			NA	NA	NA	NA	NA	NA	8.2	61.6	8.7	57.5	8.4	59.8	NA	NA	8.4	59.6
(kerlin st)	SB Onramp	3678	1	Urban	11	1	NA	NA	NA	NA	NA	NA	55.0	61.6	58.2	57.7	56.3	59.8	NA	NA	56.5	59.7
(comm. barry br)	SB Offramp	2067	0.23	Urban	11	1	NA	NA	NA	NA	NA	NA	12.6	61.6	13.4	57.7	13.0	59.8	NA	NA	13.0	59.7
Comm. Barry Br.	@ 90 angle	3703	0.39	Urban	11	1	NA	NA	NA	NA	NA	NA	21.5	61.6	22.7	57.7	22.0	59.8	NA	NA	22.1	59.7
(comm. barry br)	SB Onramp	4357	0.18	Urban	11	1	NA	NA	NA	NA	NA	NA	10.5	55.0	11.7	54.7	12.0	52.7	NA	NA	11.4	54.1
(highland ave)	SB Offramp	3681	0.7	Urban	11	1	NA	NA	NA	NA	NA	NA	41.1	55.0	45.6	54.7	46.5	52.7	NA	NA	44.4	54.1
I-95 / US 322	Divergence	2010	0.16	Urban	11	1	NA	NA	NA	NA	NA	NA	9.4	55.0	10.4	54.7	10.5	52.7	NA	NA	10.1	54.1
(highland ave)	WB Onramp	2024	0.2	Suburban	14	8	NA	NA	NA	NA	NA	NA	14.2	58.5	14.8	52.6	25.2	31.3	NA	NA	18.1	47.5
(us 322 splt by dir)		3863	0.14	Suburban	14	1	NA	NA	NA	NA	NA	NA	10.0	58.5	10.4	52.6	17.6	31.3	NA	NA	12.7	47.5
EASTBOUND	One Way Section																					
(us 322 split by dir)		3863																				
(13th st)	Offramp	2015	0.15	Suburban	14	1	18.5	58.0	11.6	52.3	11.5	55.7	NA	NA	NA	NA	NA	NA	13.9	55.3	NA	NA
I-95 / US 322	Merge	2013	0.25	Urban	14	2	30.8	58.0	19.5	52.3	19.2	55.7	NA	NA	NA	NA	NA	NA	23.2	55.3	NA	NA
(highland ave)	NB Onramp	3634	0.2	Urban	11	1	12.6	60.0	12.3	56.6	11.3	58.1	NA	NA	NA	NA	NA	NA	12.1	58.2	NA	NA
(comm. barry br)	NB Offramp	3680	0.54	Urban	11	1	33.9	60.0	33.4	56.6	30.7	58.1	NA	NA	NA	NA	NA	NA	32.7	58.2	NA	NA
Comm. Barry Br.	@ 90 angle	*n.i.n.*	0.2	Urban	11	1	12.6	60.0	12.3	56.6	11.3	58.1	NA	NA	NA	NA	NA	NA	12.1	58.2	NA	NA
(comm. barry br)	NB Onramp	2069	0.15	Urban	11	1	8.0	68.0	9.1	60.7	9.0	61.1	NA	NA	NA	NA	NA	NA	8.7	63.3	NA	NA
(kerlin st)	NB Offramp	4368	0.6	Urban	11	1	31.9	68.0	36.4	60.7	36.1	61.1	NA	NA	NA	NA	NA	NA	34.8	63.3	NA	NA
pa 352 / pa 320)	NB Offramp	4370	0.5	Urban	11	1	26.5	68.0	30.3	60.7	30.1	61.1	NA	NA	NA	NA	NA	NA	29.0	63.3	NA	NA
PA 352	Overpass	*n.i.n.*	0.35	Urban			18.6	68.0	21.2	60.7	21.1	61.1	NA	NA	NA	NA	NA	NA	20.3	63.3	NA	NA
EB/WB	Two Way Section																					
(us 322 splt by dir)		3863																				
(bethel rd)	WB Onramp	2026	0.16	Suburban	14	1	10.9	58.0	12.5	52.3	12.3	55.7	11.4	58.5	11.9	52.6	20.1	31.3	11.9	55.3	14.5	47.5
PA 452	Underpass	3684	0.6	Suburban	14	1	40.9	58.0	46.7	52.3	46.0	55.7	42.7	58.5	44.6	52.6	75.4	31.3	44.5	55.3	54.2	47.5
Cherry Tree Rd	Signalized	4000	0.71	Suburban	14	3	60.0	44.0	61.3	43.5	52.3	50.3	93.3	28.1	69.0	37.7	278.0	9.5	57.9	45.9	146.8	25.1
Larkins Corner Mall	Signalized	3685	0.5	Suburban	14	3	117.0	20.0	75.7	25.2	109.7	17.4	77.7	25.7	72.3	27.6	68.0	29.2	100.8	20.9	72.7	27.5
PA 261	Overpass	3686	1.67	Suburban	14	3	143.0	44.0	146.0	42.4	122.7	50.3	139.0	44.0	153.0	40.1	126.0	48.4	137.2	45.6	139.3	44.2
(garnet mine rd)	EB Onramp	6560	0.23	Rural	14	3	16.6	50.8	32.5	52.1	16.1	52.5	17.1	49.8	19.1	44.1	16.1	52.4	21.7	51.8	17.4	48.8
Featherbed / Mattson		*n.i.n.*	0.8	Rural	14	3	57.7	50.8	40.2	52.1	56.2	52.5	54.9	49.8	66.6	44.1	56.2	52.4	51.4	51.8	59.2	48.8
(station rd s)		10924	1.27	Rural	14	3	89.8	51.2	94.3	48.4	87.1	52.7	94.7	48.9	97.8	46.7	99.3	46.2	90.4	50.8	97.3	47.3
(station rd n)		10923	0.18	Rural	14	3	12.7	51.2	13.4	48.4	12.3	52.7	13.4	48.9	13.9	46.7	14.0	46.2	12.8	50.8	13.8	47.3
Spring Valley Rd		10922	0.29	Rural	14	3	20.5	51.2	21.6	48.4	19.9	52.7	21.6	48.9	22.3	46.7	22.7	46.2	20.7	50.8	22.2	47.3
Baltimore Pike	Signalized	10921	0.6	Rural	14	3	47.0	47.3	46.3	49.1	45.3	49.4	101.3	22.1	94.3	24.8	144.0	16.1	46.2	48.6	113.2	21.0
Brinton Lake Rd	Signalized	10919	0.44	Rural	14	3	48.0	34.6	46.7	35.6	42.0	39.7	43.3	36.0	55.3	29.8	61.3	27.0	45.6	36.6	53.3	30.9
			7.45																			

n.i.n. = not in network

= ONLY 2ND AND 3RD RUN USED DUE TO ACCIDENT

Appendix B

List of Surveyed Routes

Appendix B. DVRPC Routes

Filename	Rte #	Route Name	Direction	Endpoint 1	Endpoint 2
12TH13TH	51	13th St.	NB	Tasker St.	Market St.
		12th St.	SB	Chestnut St.	Tasker St.
5TH-6TH	50	5th St. and 6th St.	B	Snyder Ave.	Girard Ave.
		7th St. and 8th St.	B	Snyder Ave.	Dauphin
		Snyder Ave.	B	9th St.	Passyunk Ave.
		Passyunk Ave.	B	17th St.	Scott Way/Tinicum Island Rd.
91CAMDEN	91	Camden City	B	Wayne and State	Harris and Clark
BALTMRE	2	Baltimore Pike	B	Media	Rte. 10
BROADWAY	75	Rte. 551/45	B	Cooper St.	Rte. 534
CLAYTON	86	Rte. 541/Main St. (Clayton Ave. New Jersey)	B	U.S. 30	Jackson Ave.
CR534	77	Rte. 534/Cooper St. (New Jersey)	EB/WB	U.S. 130	CR 689 - Cross Keys Rd.
CR534532	78	Rte. 534/Cooper St. (New Jersey)	EB/WB	CR 534/NJ 73	CR 648
CR537	70	CR 537	EB	CR 537/Haddon	Market St.
			WB	Market St.	7th-Haddon/CR 537
			EB/WB	Newton Ave.	Pine Glen Rd.
CR541NO	71	High St., Rte. 541, Rte. 691	B	PA 413/Old Rte. 13	Washington St.
CR541SO	73	Rte. 541 (Main St.)	B	CR 691-King/CR 626-Rancocas	U.S. 206
CR553538	61	Rte. 553, Rte. 47, Rte. 538	B	CR 553/Morgan Ave.	2nd St.
CR579	81	W. State/Rte. 579/Rte. 569	B	Trenton - E. State St./Chancery La.	Lawrence - U.S. 206/Concord Ave.
CR630	72	Rte. 630/Woodlane Rd.	EB/WB	CR 630/Oak St.	Sheldon Rd.

Appendix B. DVRPC Routes (continued)

Filename	Rte #	Route Name	Direction	Endpoint 1	Endpoint 2
EGYPT	30	Egypt Rd.	EB/WB	Egypt Rd./U.S. 422 rmps	Main St.
GEIGLHIL	23	Geigle Hill Rd., PA Rte. 611	B	Geigle Hill/PA 32	Harrison Rd.
			SB	Harrison	Easton Rd./PA 313
			NB	PA 313/Easton Rd.	PA 611 Bypass
		2-way Easton Rd.	B	Easton Rd./PA 313	Sugar Bottom/LWR Mntn.
GIRARD	53	Baltimore Pike/U.S. 13	EB/WB	Baltimore Pike/Vernon St.	34th St.
			NB	33rd St.	34th St.
			SB	34th St./Mantua Ave.	Powelton Ave.
		U.S. 13	EB/WB	Girard Ave.	U.S. 1
GLOULOCL	79	Rte. 551/Kings Hwy. Rte. 655/Fries Mill Rd. Rte. 612/Corkey Ln.	EB/WB	Prince St./Linda Ln.	CR 536 - New Brooklyn Rd.
HIGHRDGE	17	Ridge Pike/High St.	EB/WB	High/Hanover	Forrest Ave.
			EB	Hamilton St.	Cherry/Airy
			WB	Airy St./Barbadoes	Forrest Ave.
I-295	74	I-295 from Rte. 541 to Rte. 545	B	U.S. 130/CR 545	I-295 (dummy)
			SB	Rising Sun Rd.	CR 656 - Florence - Columbus Rd.
			NB	CR 656 - Florence - Columbus Rd.	U.S. 130
		2-way I-295	B	"Dummy"	CR 541/burlington Bypass
I-76&476	37	I-76/I-476	EB	I-76/U.S. 202	I-476
			WB	Plymouth (I-476)	U.S. 202
I-76	38	I-76: I-476 to I-95	EB	I-76/I-476	Belmont Ave.
			WB	Belmont Ave.	I-476

Appendix B. DVRPC Routes (continued)

Filename	Rte #	Route Name	Direction	Endpoint 1	Endpoint 2
I-95MERC	59	I-95: Taylorsville Rd. to Nassau Park Rd.	EB/WB	Taylorsvill Rd./Woodside Rd.	Nassau Park Rd.
I-676&I-95	48	I-676 SB	B	I-76/Girard Ave.	Walt Whit. Approach
		I-676 Continuation	B	U.S. 130	Oregon/Broad
I-95NORTH	33	I-95: PA 611 to NJ 579	NB	I-95/PA 611	NJ 579
I-95SOUTH	33	I-95: NJ 579 to PA 611	SB	NJ 579	Broad St
KUSCR660	83	Yardville Allentown Rd/Route 660	Both	U.S. 130/So Gold Rd	U.S. 206/NJ 68
LEHNENBG	21	Thatcher Rd., Lehnenberg Rd., Rte. 611	Both	Main St/Juniper St	Geigel Hill/PA 32
MARKET	57	Market Street	EB	PA 3/Cardington Rd	Chestnut Street
			EB	Chestnut St/41st St	41st St/Market St
			EB	Market St/40th St	20th St
			EB	19th St	JFK Blvd/Broad
			WB	JFK Blvd/15th St	20th St/Market St
			WB	20th St	Market St/40th St
			WB	Market St/41st St	42nd St/Chestnut St
			WB	Chestnut St	PA 3/Cardington Rd
MECHANIC	19	PA 232/Mechanicsville Rd	Both	PA 313/Cold Spring Creamery	Swamp/Dark Hollow
NIELDS	42	Nields Street, Airport Road	Both	Nields St/Walnut St	PA 352
NJ-42	62	Rt 42 (New Jersey)	SB	Market St	
NJ-55	63	RT 55 (NEW JERSEY)	Both	CR 553/CR 676	U.S. 40/Oak La
NJ-68	67	Rt 68/Fort Dix Hwy	Both	U.S. 206/CR 660	Antiss St
NJ-TPKE	82	West Windsor to Washington	Both	CR 638-Clarksville-Grovers Mill/Grebart Rd	NJ 33-Nottingham Way

Appendix B. DVRPC Routes (continued)

Filename	Rte #	Route Name	Direction	Endpoint 1	Endpoint 2
NJ38	69	NJ 38	Both	CR 530/Springfield Rd	Euclid Ave
NJ73	65	NJ Route 73	WB	CR 536/Myers Ave	Church Rd
			WB	NJ 73	Hylton Rd
			WB	River Rd	(Levick/cent load)
			WB	Keystone St/Hellerman St	Frankford/Robbins
			EB	Robbins/Erdrick St	Keystone/Levick
			EB	(Levick/cent load)	River Rd
			EB	Hylton Rd	(U.S. 130 nb)
			EB	Church Rd	CR 536/Myers Ave
PA100	5	PA 100: West Chester to Pottstown	NB	Darlington/Dean	Church/Price
			NB	Price St	High/Charlotte
			NB	High/Evans	King/Charlotte
			NB	King/Penn	King/Hanover
			SB	King/Hanover	King/Penn
			SB	High/Charlotte	Price St
			SB	Church/Price	Dean/Church
PA132	25	PA. RTE. 132/STREET RD.	Both	PA 132/PA 611	County Line Rd
PA152	35	Rt 152 , Susquehanna Rd, Levick St	Both	Ferry Rd/Gordon Rd	Sanger St
PA252	39	PA 252/NEWTOWN STREET	Both	Henderson/Pr Frederick	Bullens La

Appendix B. DVRPC Routes (continued)

Filename	Rte #	Route Name	Direction	Endpoint 1	Endpoint 2
PA252320	47	PA 252/320	Both	King Rd/Cottonwood Dr	PA 352
			SB	Ave of the States/11th St	Madison St
			SB	Madison St	3rd St/Madison St
			NB	3rd St/Madison St	Madison St/4th St
			NB	Madison St/4th St	PA 352
PA263	34	PA. ST. RTE. 263	Both	PA 263/Quarry Rd	Welsh Rd
PA3	46	Gay St, Rt 3/West Chester Pike	EB	Market St/Darlington	Paoli Pike(Market St eb)
			EB	PA 3/U.S. 202	Kent Rd
			WB	Kent Rd	PA 3/U.S. 202
			WB	(Paoli Pike) Gay St/Westtown Rd	New St/Market St
PA309152	22	PA 309/PA 152	Both	PA 309/PA 663	U.S. 202
PA313	13	PA 313	Both	Elm St	Rte. 202/Rte. 313
PA340	40	Route 340/Kings Highway	Both	3rd Ave/Harmony St	Mellen Dr
PA363	14	PA 363	Both	New Galena/PA 313	PA 363/U.S. 422
PA41	41	PA 41	EB	PA 82/U.S. 30 BU.S.	Brandywine Ave
			EB	Brandywine/Market	High St/Miner St
			WB	Miner St/New St	Miner St/Brandywine
			WB	Brandywine Ave	PA 82/U.S. 30 BU.S.
PA413611	11	PA 413 from Sycamore St to PA 611	Both	Sycamore/Richboro	PA 113
PA532332	24	PA 32	Both	PA 532/PA 32	PA 32
PA563	12	PA 563/PA 412: PA 413 to Penn Ridge H.S.	Both	RTE. 113	PA 313

Appendix B. DVRPC Routes (continued)

Filename	Rte #	Route Name	Direction	Endpoint 1	Endpoint 2
PA611	9	PA 611: City Hall to Doylestown	NB	So. Penn Sq	Oakland Ave
			NB	Oakland/Pine	Pine/State
			NB	Pine/Court	Court/Church
			SB	Court/Church	Pine/Court
			SB	State/Main	Pine/State
			SB	Oakland Ave	So. Penn Sq
PA663	8	PA 663: Pottstown to Quakertown	NB	High/Penn	High/Charlotte
			NB	High/Evans	Beech St
			NB	Oak St	Hellertown/Broad
			SB	Hellertown/Broad	Oak St
			SB	Beech St	King/Charolette
			SB	High/Charlotte	High/Penn
PA724	32	RT 724	Both	PA 724/Coventry Sq SC	U.S. 1
PA73	15	PA 73 from Rt 663 to Rt 202	Both	PA 663	U.S. 202
PA82	16	PA. ST. ROUTE 82	Both	Hanover/Beech	U.S. 1
PA9	6	PA TURNPIKE - NE EXT.: Germantown Pike to Quakerstown	Both	Germantown/Butler	PA 663/Weiss
PA926	55	Rt 926/Street Rd	Both	PA 926/New St	Plumstock Rd
PATRNPKE	29	PA TURNPIKE: U.S. 1 to Germantown Pike	Both	I-276/U.S. 1	Plmth/Grmntwn
PEMBERTN	68	Rt 646 /New Lisbon-Four Mile Rd.,Rt 70 (New Jersey)	Both	CR 646/CR 530	CR 646/CR 530

Appendix B. DVRPC Routes (continued)

Filename	Rte #	Route Name	Direction	Endpoint 1	Endpoint 2
PENNIGTN	84	Calhoun St. Pennington Rd(New Jersey)	NB	Trenton Ave/PA 32	Upper Ferry-Ewingville
			NB	Upper Ferry-Ewingville	I-95
			SB	I-95	Upper Ferry-Ewingville
			SB	Upper Ferry-Ewingville	Trenton Ave/PA 32
REWHMOMI	88	Reed St./Wharton St.	Both	Broad St/Reed St	16th St/Wharton St
RIDGE	31	Ridge Pike/Conshohocken Road	Both	Main St/DeKalb Pk	Allegheny Ave
ROOSVELT	58	Grant Ave., Algon Ave., Levick St., Castor Ave., Wyoming Ave., U.S.1	SB	Grant Ave/Bluegrass Rd	5th St
			SB	5th/Roosevelt Blvd NB local	I-76
			SB	I-76	I-76/City Ave
			NB	I-76/City Ave	I-76
			NB	I-76	5th St
			NB	5th St	Grant Ave/Bluegrass Rd
SANSCHRI	87	Sansom St./Christian St.	Both	6th St/Chestnut St	5th St/Queen St
STATE	60	GRANT AV/RT 13	Both	Grant Ave/Bluegrass Rd	U.S. 206
STHLMBRD	54	Spruce St.,South St., Lombard St.	EB	Spruce St/39th St	27th St
			EB	26th St	Front St/Lombard St
			WB	Lombard/2nd St	27th St/South St
			WB	27th St	Spruce St/39th St

Appendix B. DVRPC Routes (continued)

Filename	Rte #	Route Name	Direction	Endpoint 1	Endpoint 2
TEMPLT	50	5th & Snyder to I-95 Ramps	NB	McKean St	Girard Ave
			NB	Snyder Ave/7th St	Germantwn/Dauphin
			SB	Girard Ave/6th St	Snyder Ave
			SB	8th St	Snyder Ave
			Two way	Snyder Ave/9th St	Scott Wy/Tinicum Isl Rd
TRENT90	90	Trenton City	NB	Kent/Anderson	Cedar/Irving
			NB	Cedar/Irving	Manual/Franklin
			NB	Franklin/Manual	Beal/Olden
			NB	Franklin/Olden/Beal	Beal/Wesley
			NB	Wesley/Beal	Liberty/Charlotte
			NB	Liberty/Charlotte	Hamilton/Charlotte
			NB	Charlotte/Hamilton	Norway/Greenwood
			NB	Norway/Greenwood	Walnut/Connecticut
			NB	Walnut/Connecticut	Walnut/Garfield
			SB	Walnut/Garfield	Walnut/Connecticut
			SB	Walnut/Connecticut	Greenwood/Norway
			SB	Norway/Greenwood	Charlotte/Hamilton
			SB	Charlotte/Hamilton	LIberty/Charlotte
			SB	Liberty/Charlotte	Wesley/Beal
			SB	Wesley/Beal	Beal/Olden
			SB	Beal/Olden	Franklin/Manual
			SB	Franklin/Manual	Bergen/Irv/Cedar
			SB	Cedar/Irving	Kent/Anderson
TRUMBAUR	20	TRUMBAUERSVILLE	Both	PA 309/Hillcrest	Neiffer/Ridge Pike

Appendix B. DVRPC Routes (continued)

Filename	Rte #	Route Name	Direction	Endpoint 1	Endpoint 2
U202-322	3	U.S. 202/U.S.322: West Chester to Baltimore Pike	Both	Spring Valley Rd	Gay St
UDARBY89	89	Upper Darby	NB	Bywood Avenue	State Rd/Beverly
			NB	State Rd/Beverly	Carol/Merion
			NB	Carol/Merion	Bywood
			SB	Bywood	Carol/Merion
			SB	Hazel/Carol	State/Beverly
			SB	State Rd/Beverly	Bywood Avenue
US-1MERC	66	U.S. 1 (New Jersey)	EB/WB	U.S. 1/So. Penn. Ave.	U.S. 1/I-295
US-30	45	U.S. Route 30	EB	U.S. 30 Byp/PA 82	U.S. 30 Business
			EB	U.S. 30 Offrmp/Quarry	U.S. 30/U.S. 30 Byp Rmp
			EB	Colebrook Rd	Frame Ave
			WB	Frame Ave	Colebrook Rd
			WB	Quarry Rd	Rt 30 By-Pass
			WB	U.S. 30 Business	U.S. 30 Byp/PA 82
US13	56	U.S. 13	Both	U.S. 1/Wingohocking Terr	Cambridge St
US130	80	Route 130 from Clarksville to Pennsauken	NB	CR 638/Quaker Bridge Mall	CR 607 - Church Rd
			NB	(NJ 90)	(NJ 73 ramp)
			NB	Union Ave	Federal/26th St
			SB	Federal/26th St	Union Ave
			SB	NJ 73	(NJ 90)
			SB	CR 607 - Church Rd	CR 638/Quaker Bridge Mall
US1BUCKS	28	U.S. 1 BUCKS COUNTY	Both	U.S. 1/S Pennsylvania	Grant Ave
US1KENBY	36	U.S. ROUTE 1/BALTIMORE PIKE	Both	U.S. 1/Webb Rd	Newlinville/PA 82

Appendix B. DVRPC Routes (continued)

Filename	Rte #	Route Name	Direction	Endpoint 1	Endpoint 2
US202-BU	18	U.S. 202/PA 32: Doylestown to Morrisville	Both	East State/East	Trenton Ave E
US202-MI	10	U.S. 202: Wilmington Pk to Norristown	NB	Stetson School	DeKalb Pike
			NB	Crooked Ln	Airy/Cherry
			SB	PA 23	Airy/DeKalb
			SB	DeKalb Pike	Stetson School
US202-NO	4	U.S. 202: Norristown to Doylestown	NB	Main/Cherry	Johnson Highway
			NB	Johnson Highway	Court/Clinton
			NB	Clinton/Mary	Oakland/Pine
			NB	Pine/State	Court/Church
			SB	Court/Church	Pine/State
			SB	Pine/State	State/Main
			SB	Court/Clinton	Johnson Highway
			SB	Johnson Highway	Main/Cherry
US206B	64	Rt 546, Rt 533, U.S. 206	Both	PA 532/Gen Greene	U.S. 206
			Both	CR 533/Quaker Bridge Mall	U.S. 206-CR 524
			Both	CR 630-N. Pemberton Rd	Quaker Bridge Rd
US30	45	U.S. Route 30	EB	U.S. 30 Byp/PA 82	U.S. 30 Business
			EB	U.S. 30 Offrmp/Quarry	U.S. 30/U.S. 30 Byp Rmp
			EB	Colebrook Rd	Frame Ave
			WB	Frame Ave	Colebrook Rd
			WB	Quarry Rd	Rt 30 By-Pass
			WB	U.S. 30 Business	U.S. 30 Byp/PA 82

Appendix B. DVRPC Routes (continued)

Filename	Rte #	Route Name	Direction	Endpoint 1	Endpoint 2
US30BUS	44	U.S. BUSINESS ROUTE 30	Both	U.S. 30 Bus/Church	Sheree Blvd
US322	1	U.S. 322: Comm. Barry Bidge to Baltimore Pike	Both	Brinton Lake Rd	PA 352
US322BUS	43	Rt 322	Both	U.S. 322/U.S. 30	Darlington St
US322NJ	85	U.S. 322 (New Jersey)	Both	U.S. 322 Bridge	U.S. 206
US422B	7	U.S. 422: Valley Forge to Pottstown	EB	Val Frge/Chstrbrk	Val Frge/202 SB
			EB	U.S. 202/U.S. 422	Val Frge/202 SB
			EB	PA Turnpike	King St
			WB	King St	PA Turnpike
			WB	val frge/swedesf	U.S. 202/U.S. 422
			WB	Val Frge/202 SB	Val Frge/Chstrbrk
WOODBRNE	27	PA 413/WOODBOURNE RD	Both	State St/Center Ave	State Rd
WOODHAVN	26	Route 63/Woodhaven Road	Both	Byberry Rd/PA 532	I-95
YORKDAUP	52	11th St., 12th St., Fisher Ave., Chelten Ave., Ogontz Ave., 22nd St., 19th St.	NB	York St/7th St	Glenwood Ave
			NB	Glenwood/Germantown	Lehigh Ave
			NB	20th St/Green St	22nd St
			SB	Sedgley Ave	20th St
			SB	Lehigh Ave	Glenwood/Germantown
			SB	Glenwood Ave/11th St	7th St

Appendix C

Sample PC-Travel Output Forms

PC-Travel, Version 2.0

Summary of Travel Study: C:\TRAVEL\1A1_WB.TRV

Date/Time of Report: 10/17/95; 14:32

Study Description:

Primary (Learn) Run: 2 **Total Length of Study:** 56646

Before Runs (*=Designated as a Primary Run):

Num	Pulse File	Title	Date	Time
1.	1A1_WB1.PLS	1.1-1 WB I-95 to Baltimore Pike	10/17/95	8:24
2.	1A1_WB2.PLS	*1.1-2 Wb I-95 to Baltimore Pike	10/17/95	9:00
3.	1A1_WB3.PLS	1.1-3 WB I-95 to Baltimore Pike	10/17/95	9:36

After Runs (*=Designated as a Primary Run):

Num	Pulse File	Title	Date	Time

Sections (*=Link Ignored):

#	Len.	Name
1.	8792	Commo. Barry Bridge
2.	4923	Merge at I-95
3.	6717	Route 452
4.	3848	Cherry Tree Rd.
5.	2923	Larkins Corner Mall
6.	8977	Route 261
7.	5601	Featherbed/Matson Rd
8.	9294	Spring Valley Rd
9.	3280	Baltimore Pike
10.	2291	Brinton Lake Rd

PC-Travel, Version 2.0
Summary of Travel Study: C:\TRAVEL\1A1_WB.TRV
Date/Time of Report: 10/17/95; 14:32

Overall Output Statistics:

Section			Before Runs						After Runs					
Num	Length	Name	Travel Time	Stops	Speed (mph)	Time Below 0 mph	Time Below 10 mph	Time Below 30 mph	Travel Time	Stops	Speed (mph)	Time Below 0 mph	Time Below 10 mph	Time Below 30 mph
1	8792	Commo. Barry Bridge	97.3	0.0	61.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	4923	Merge at I-95	61.0	0.0	55.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	6717	Route 452	78.3	0.0	58.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	3848	Cherry Tree Rd.	93.3	1.0	28.1	20.0	30.0	43.0	0.0	0.0	0.0	0.0	0.0	0.0
5	2923	Larkins Corner Mall	77.7	0.7	25.7	9.7	13.7	35.3	0.0	0.0	0.0	0.0	0.0	0.0
6	8977	Route 261	139.0	0.0	44.0	0.0	0.0	6.3	0.0	0.0	0.0	0.0	0.0	0.0
7	5601	Featherbed/Matson Rd	76.7	0.0	49.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	9294	Spring Valley Rd	129.7	0.0	48.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	3280	Baltimore Pike	101.3	1.0	22.1	37.0	42.7	57.0	0.0	0.0	0.0	0.0	0.0	0.0
10	2291	Brinton Lake Rd	43.3	0.3	36.0	0.7	5.0	9.0	0.0	0.0	0.0	0.0	0.0	0.0
Overall			897.7	3.0	43.0	67.3	91.3	150.7	0.0	0.0	0.0	0.0	0.0	0.0

Number of Before Runs: 3; Number of After Runs: 0

PC-Travel, Version 2.0
Summary of Travel Study: C:\TRAVEL\1A1_WB.TRV
Date/Time of Report: 10/17/95; 14:32

Fuel Consumption and Emissions:

Section			Before Runs				After Runs			
Num	Length	Name	Fuel	Emissions (grams)			Fuel	Emissions (grams)		
			gal.	HC	CO	NOx	gal.	HC	CO	NOx
1	8792	Commo. Barry Bridge	0.0924	4.8739	90.9024	2.5600	0.0000	0.0000	0.0000	0.0000
2	4923	Merge at I-95	0.0499	3.3628	58.5110	1.9470	0.0000	0.0000	0.0000	0.0000
3	6717	Route 452	0.0698	4.4051	80.6576	2.4858	0.0000	0.0000	0.0000	0.0000
4	3848	Cherry Tree Rd.	0.0428	3.7729	51.9641	2.0575	0.0000	0.0000	0.0000	0.0000
5	2923	Larkins Corner Mall	0.0282	2.6071	25.0820	1.4347	0.0000	0.0000	0.0000	0.0000
6	8977	Route 261	0.0830	6.9669	100.1133	4.2796	0.0000	0.0000	0.0000	0.0000
7	5601	Featherbed/Matson Rd	0.0517	3.7705	60.0230	2.1690	0.0000	0.0000	0.0000	0.0000
8	9294	Spring Valley Rd	0.0859	6.3619	99.4814	3.6785	0.0000	0.0000	0.0000	0.0000
9	3280	Baltimore Pike	0.0380	3.3002	38.3909	1.6010	0.0000	0.0000	0.0000	0.0000
10	2291	Brinton Lake Rd	0.0257	2.7971	35.8401	2.0164	0.0000	0.0000	0.0000	0.0000
Overall			0.5674	42.2181	640.9680	24.2295	0.0000	0.0000	0.0000	0.0000

Number of Before Runs: 3; Number of After Runs: 0

PC-Travel, Version 2.0
Summary of Travel Study: C:\TRAVEL\1A1_WB.TRV
Date/Time of Report: 10/17/95; 14:32

Average Total Delay (Normal Speed 50 mph):

Section			Before Runs	After Runs
Num	Length	Name	Delay sec/veh	Delay sec/veh
1	8792	Commo. Barry Bridge	0.00	0.00
2	4923	Merge at I-95	0.00	0.00
3	6717	Route 452	0.00	0.00
4	3848	Cherry Tree Rd.	41.33	0.00
5	2923	Larkins Corner Mall	37.67	0.00
6	8977	Route 261	17.00	0.00
7	5601	Featherbed/Matson Rd	3.67	0.00
8	9294	Spring Valley Rd	4.00	0.00
9	3280	Baltimore Pike	56.33	0.00
10	2291	Brinton Lake Rd	12.33	0.00
Overall			125.09	0.00

Number of Before Runs: 3; Number of After Runs: 0
Section delay may not add up to Overall value. See Manual for definitions.

PC-Travel, Version 2.0
Summary of Travel Study: C:\TRAVEL\1A1_WB.TRV
Date/Time of Report: 10/17/95; 14:32

Detailed Statistics By Run:

Travel Time (sec) by Section

Run Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	OVERALL
1.	98	60	78	109	91	159	87	138	101	53							974
2.	99	59	81	119	87	124	72	128	92	35							896
3.	95	64	76	52	55	134	71	123	111	42							823

PC-Travel, Version 2.0
Summary of Travel Study: C:\TRAVEL\1A1_WB.TRV
Date/Time of Report: 10/17/95; 14:32

Detailed Statistics By Run:

Stops by Section

Run Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	OVERALL
1.	0	0	0	2	1	0	0	0	1	1							5
2.	0	0	0	1	1	0	0	0	1	0							3
3.	0	0	0	0	0	0	0	0	1	0							1

PC-Travel, Version 2.0
Summary of Travel Study: C:\TRAVEL\1A1_WB.TRV
Date/Time of Report: 10/17/95; 14:32

Detailed Statistics By Run:

Speed (mph) by Section

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	OVERALL
Run Number																	
1.	61	56	59	24	22	38	44	46	22	29							40
2.	61	57	57	22	23	49	53	50	24	45							43
3.	63	52	60	50	36	46	54	52	20	37							47

PC-Travel, Version 2.0
Summary of Travel Study: C:\TRAVEL\1A1_WB.TRV
Date/Time of Report: 10/17/95; 14:32

Detailed Statistics By Run:

Time Below 0 mph by Section

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	OVERALL
Run Number																	
1.	0	0	0	22	15	0	0	0	36	2							75
2.	0	0	0	38	14	0	0	0	32	0							84
3.	0	0	0	0	0	0	0	0	43	0							43

PC-Travel, Version 2.0
Summary of Travel Study: C:\TRAVEL\1A1_WB.TRV
Date/Time of Report: 10/17/95; 14:32

Detailed Statistics By Run:

Time Below 10 mph by Section

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	OVERALL
Run Number																	
1.	0	0	0	41	21	0	0	0	41	15							118
2.	0	0	0	49	20	0	0	0	37	0							106
3.	0	0	0	0	0	0	0	0	50	0							50

PC-Travel, Version 2.0
Summary of Travel Study: C:\TRAVEL\1A1_WB.TRV
Date/Time of Report: 10/17/95; 14:32

Detailed Statistics By Run:

Time Below 30 mph by Section

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	OVERALL
Run Number																	
1.	0	0	0	60	48	16	0	0	53	21							198
2.	0	0	0	69	52	3	0	0	48	3							175
3.	0	0	0	0	6	0	0	0	70	3							79

PC-Travel, Version 2.0
Summary of Travel Study: C:\TRAVEL\1A1_WB.TRV
Date/Time of Report: 10/17/95; 14:32

Detailed Statistics By Run:

Fuel Consumption by Section

Run Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	OVERALL
1.	0.0924	0.0509	0.0671	0.0460	0.0294	0.0782	0.0492	0.0837	0.0353	0.0271							0.5594
2.	0.0870	0.0506	0.0652	0.0441	0.0314	0.0888	0.0533	0.0906	0.0406	0.0280							0.5796
3.	0.0977	0.0483	0.0772	0.0383	0.0239	0.0820	0.0525	0.0833	0.0381	0.0219							0.5632

PC-Travel, Version 2.0
Summary of Travel Study: C:\TRAVEL\1A1_WB.TRV
Date/Time of Report: 10/17/95; 14:32

Detailed Statistics By Run:

Hydrocarbons (grams) by Section

Run Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	OVERALL
1.	4.7040	3.5723	3.5557	4.4975	2.7318	6.7666	4.1328	6.8477	2.7562	2.9426							42.507
2.	3.7919	3.0807	3.7107	3.6338	3.1784	7.2726	3.8545	7.2796	3.9981	3.1431							42.944
3.	6.1258	3.4355	5.9490	3.1873	1.9111	6.8615	3.3242	4.9585	3.1462	2.3056							41.205

PC-Travel, Version 2.0
Summary of Travel Study: C:\TRAVEL\1A1_WB.TRV
Date/Time of Report: 10/17/95; 14:32

Detailed Statistics By Run:

Carbon Monoxide (grams) by Section

Run Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	OVERALL
1.	87.813	63.210	61.525	60.205	24.831	84.258	60.127	102.84	27.674	36.968							609.46
2.	63.871	55.739	63.167	43.027	28.889	113.30	65.489	118.80	54.812	43.269							650.37
3.	121.02	56.584	117.28	52.660	21.526	102.78	54.452	76.798	32.687	27.283							663.08

PC-Travel, Version 2.0
Summary of Travel Study: C:\TRAVEL\1A1_WB.TRV
Date/Time of Report: 10/17/95; 14:32

Detailed Statistics By Run:

Nitrous Oxide (grams) by Section

Run Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	OVERALL
1.	2.3893	2.1255	1.8378	2.5457	1.3798	4.0301	2.4541	4.0816	1.1545	2.0131							24.012
2.	1.7507	1.6857	1.9460	1.6223	1.9128	4.6217	2.2344	4.4235	2.2827	2.4263							24.906
3.	3.5401	2.0299	3.6737	2.0045	1.0116	4.1870	1.8187	2.5305	1.3657	1.6097							23.771

PC-Travel, Version 2.0
Summary of Travel Study: C:\TRAVEL\1A1_WB.TRV
Date/Time of Report: 10/17/95; 14:32

Detailed Statistics By Run:

Delay; Normal Speed 50 mph by Section

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	OVERALL
Run Number																	
1.	0	0	0	57	51	37	11	11	56	22							202
2.	0	0	0	67	47	2	0	1	47	4							123
3.	0	0	0	0	15	12	0	0	66	11							51

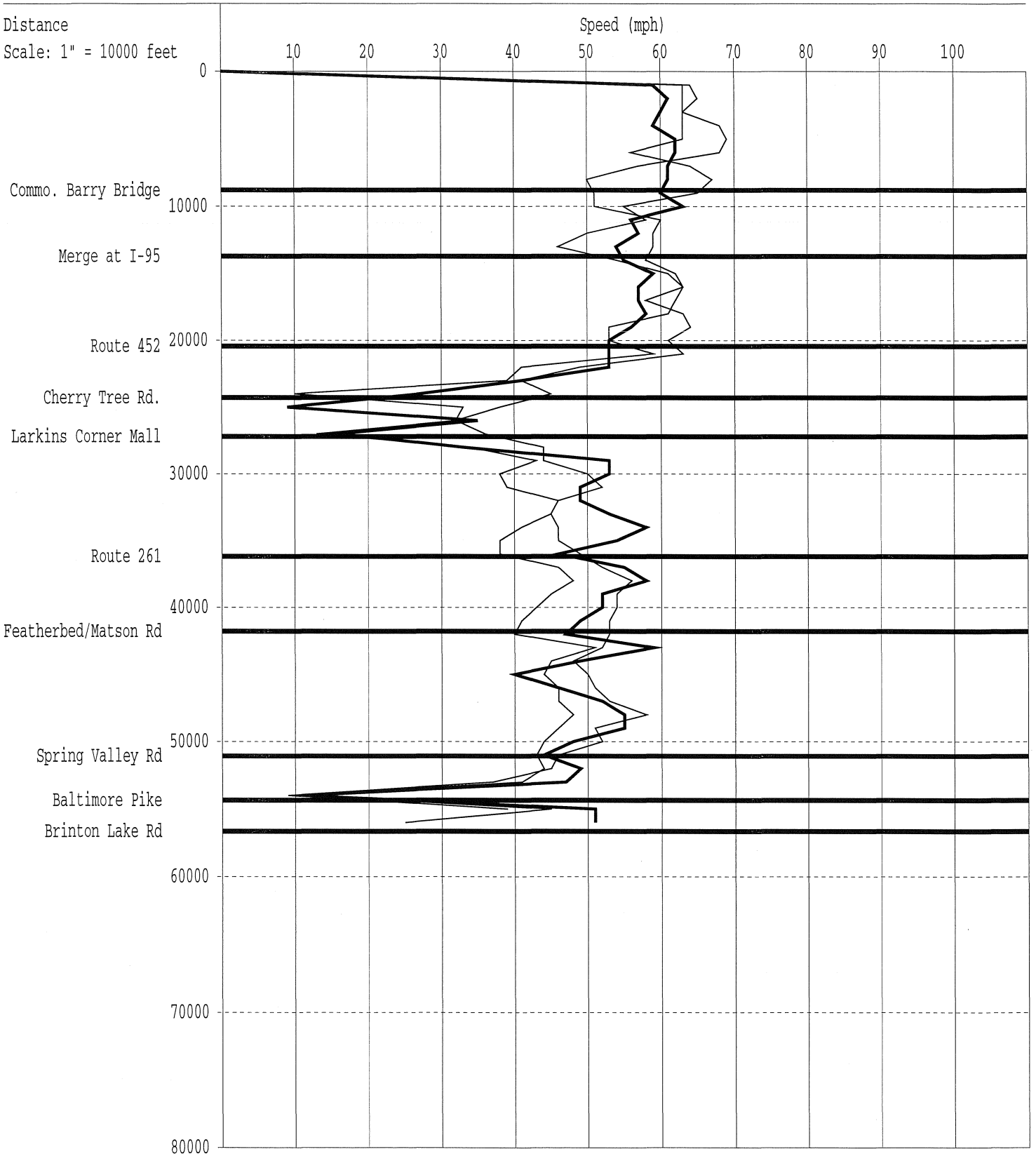
PC-Travel, Version 2.0

Summary of Travel Study: C:\TRAVEL\1A1_WB.TRV

Date/Time of Report: 10/17/95; 14:32

Summary Speed/Distance Profiles of All Runs

Solid lines: Before Runs, Dashed lines: After Runs, Thick Line: Primary Run



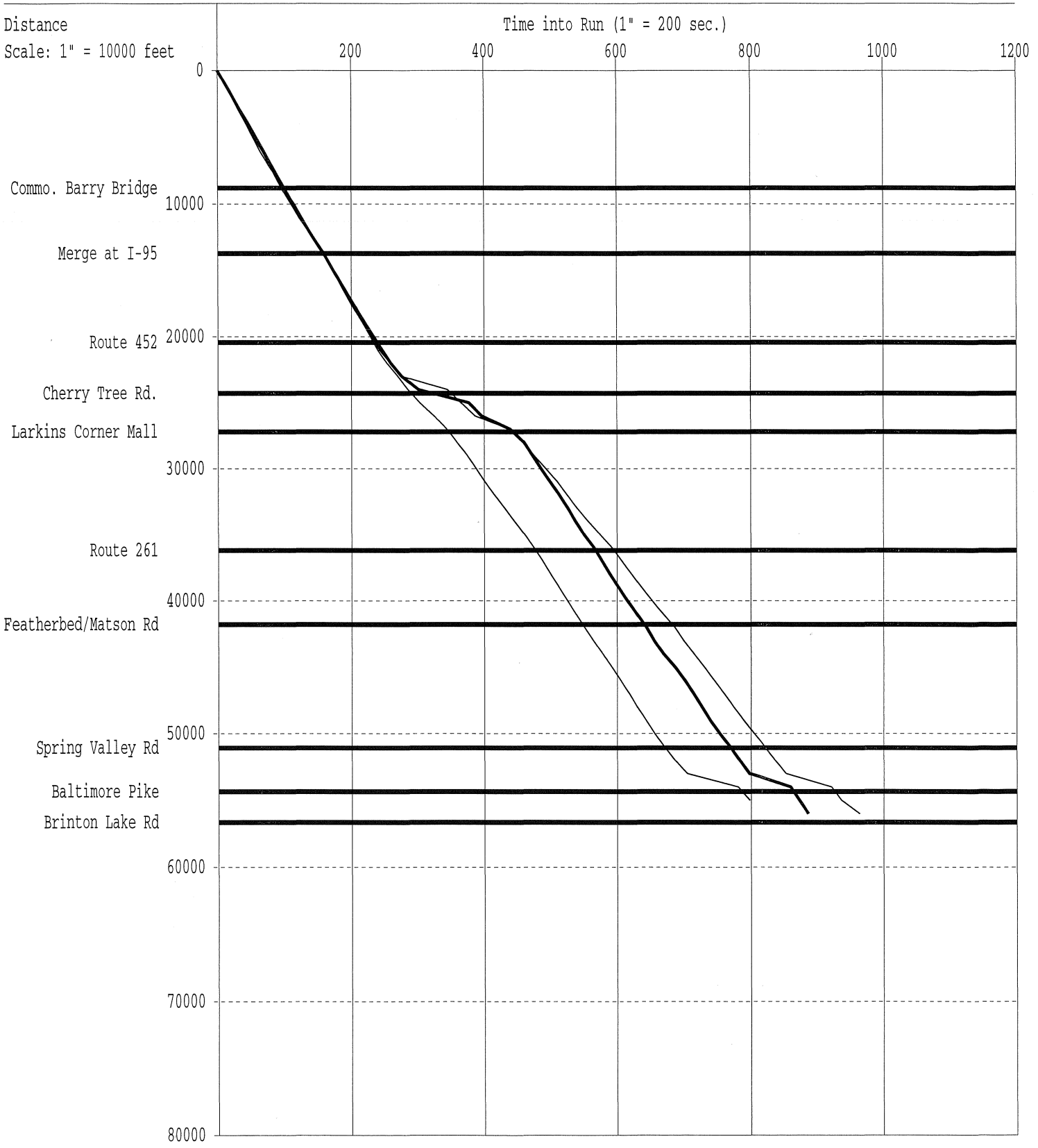
PC-Travel, Version 2.0

Summary of Travel Study: C:\TRAVEL\1A1_WB.TRV

Date/Time of Report: 10/17/95; 14:32

Time/Space Trajectories of All Runs

Solid lines: Before Runs, Dashed lines: After Runs, Thick Line: Primary Run



PC-Travel, Version 2.0

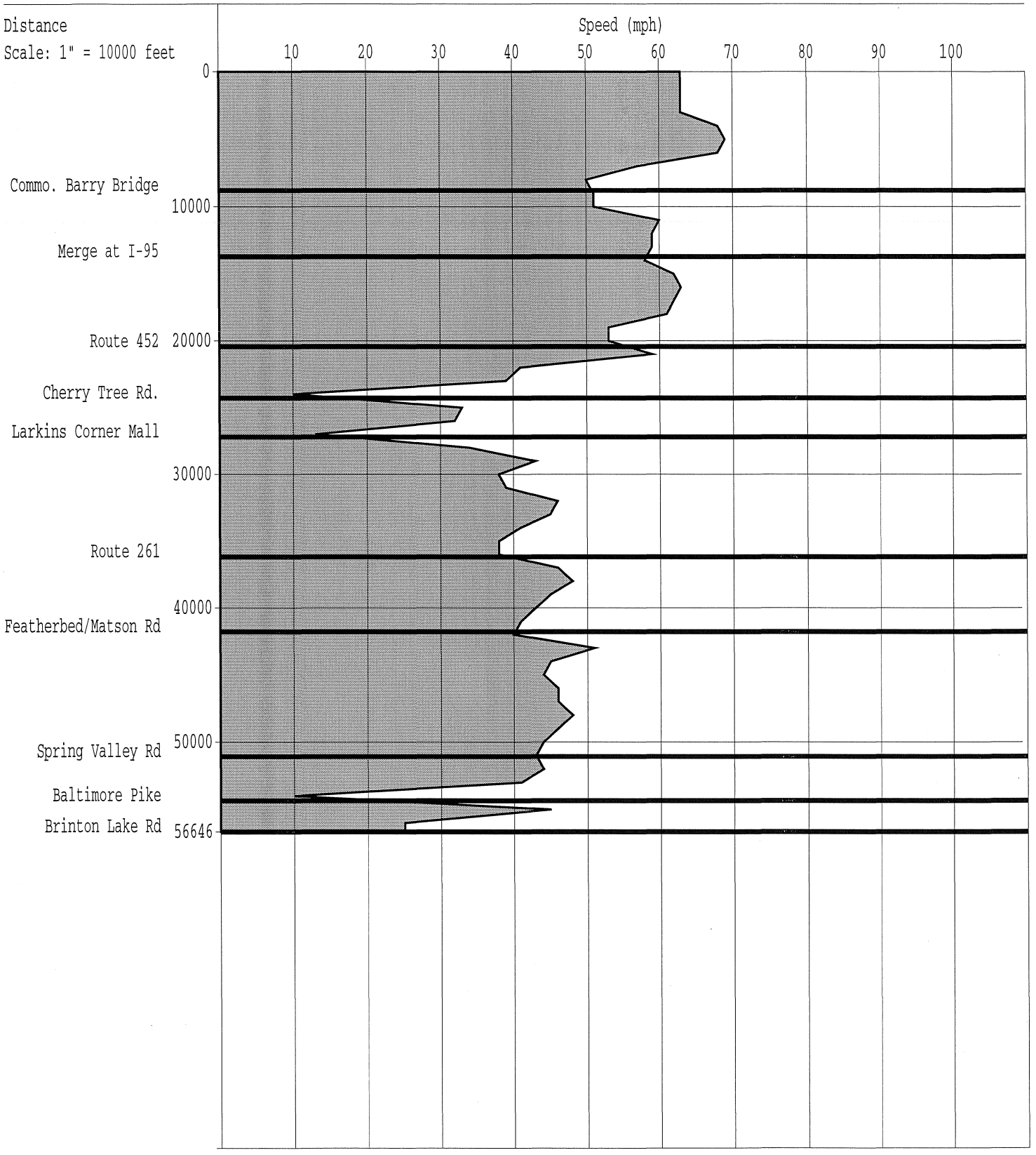
Summary of Travel Study: C:\TRAVEL\1A1_WB.TRV

Date/Time of Report: 10/17/95; 14:32

Speed Profile for Run: 1. **Pulse Data File:** 1A1_WB1.PLS

Run Title: 1.1-1 WB I-95 to Baltimore Pike

This is a Before Run.



PC-Travel, Version 2.0

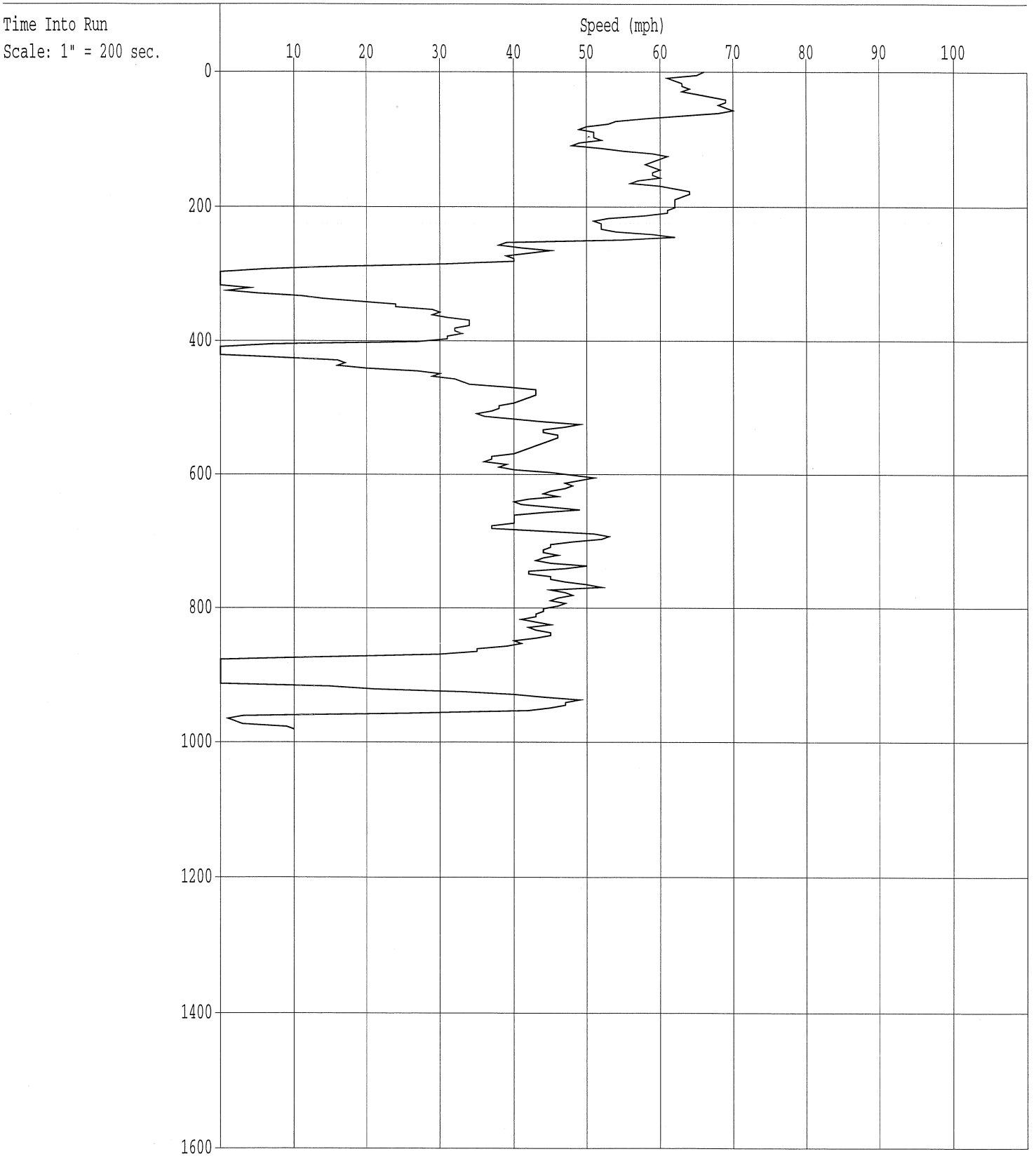
Summary of Travel Study: C:\TRAVEL\1A1_WB.TRV

Date/Time of Report: 10/17/95; 14:32

Time-Based Speed Profile for Run: 1. **Pulse Data File:** 1A1_WB1.PLS

Run Title: 1.1-1 WB I-95 to Baltimore Pike

This is a Before Run.



PC-Travel, Version 2.0

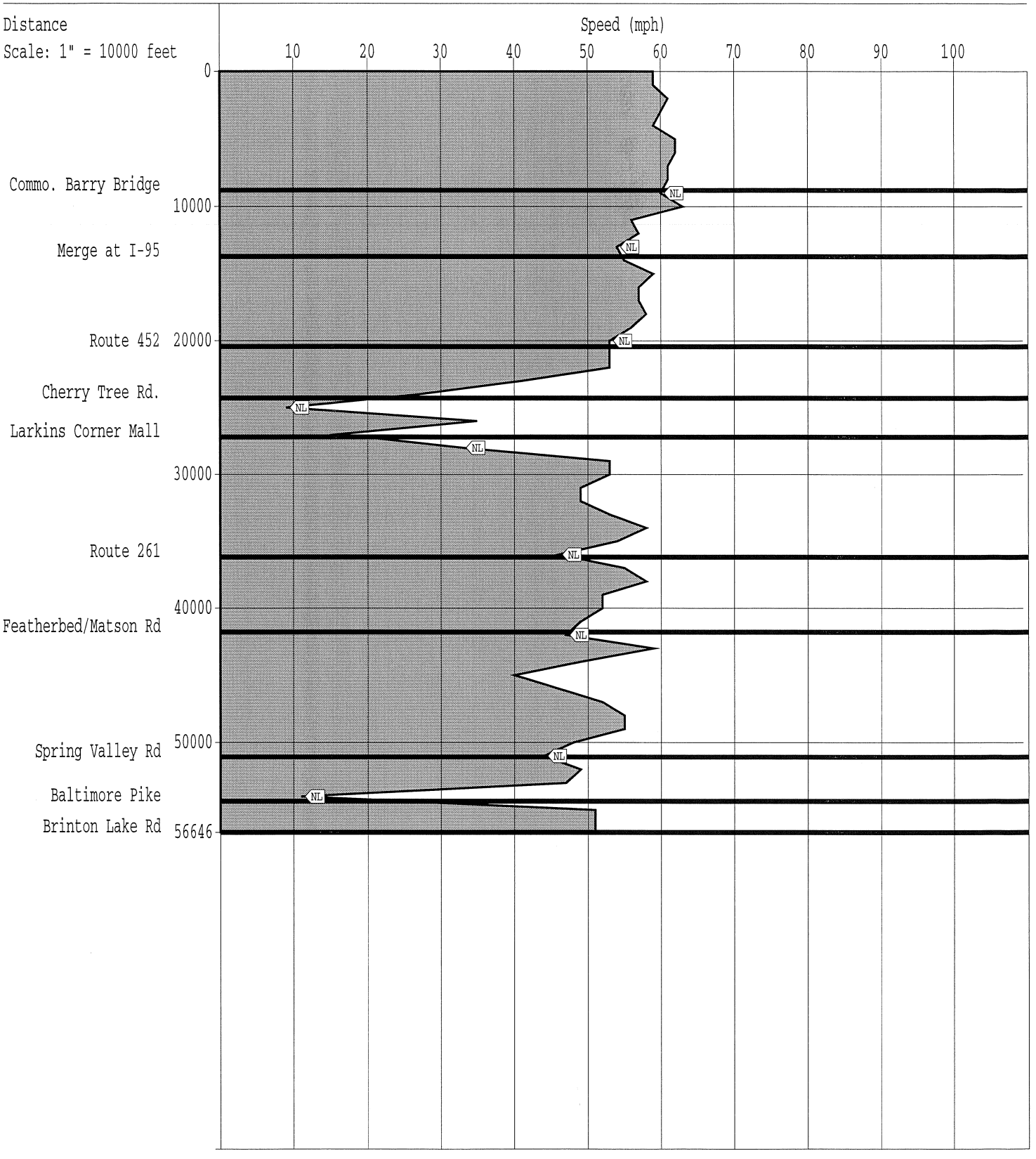
Summary of Travel Study: C:\TRAVEL\1A1_WB.TRV

Date/Time of Report: 10/17/95; 14:32

Speed Profile for Run: 2. **Pulse Data File:** 1A1_WB2.PLS

Run Title: 1.1-2 Wb I-95 to Baltimore Pike

This is a Before Run. This is also the Primary (Learn) Run.



PC-Travel, Version 2.0

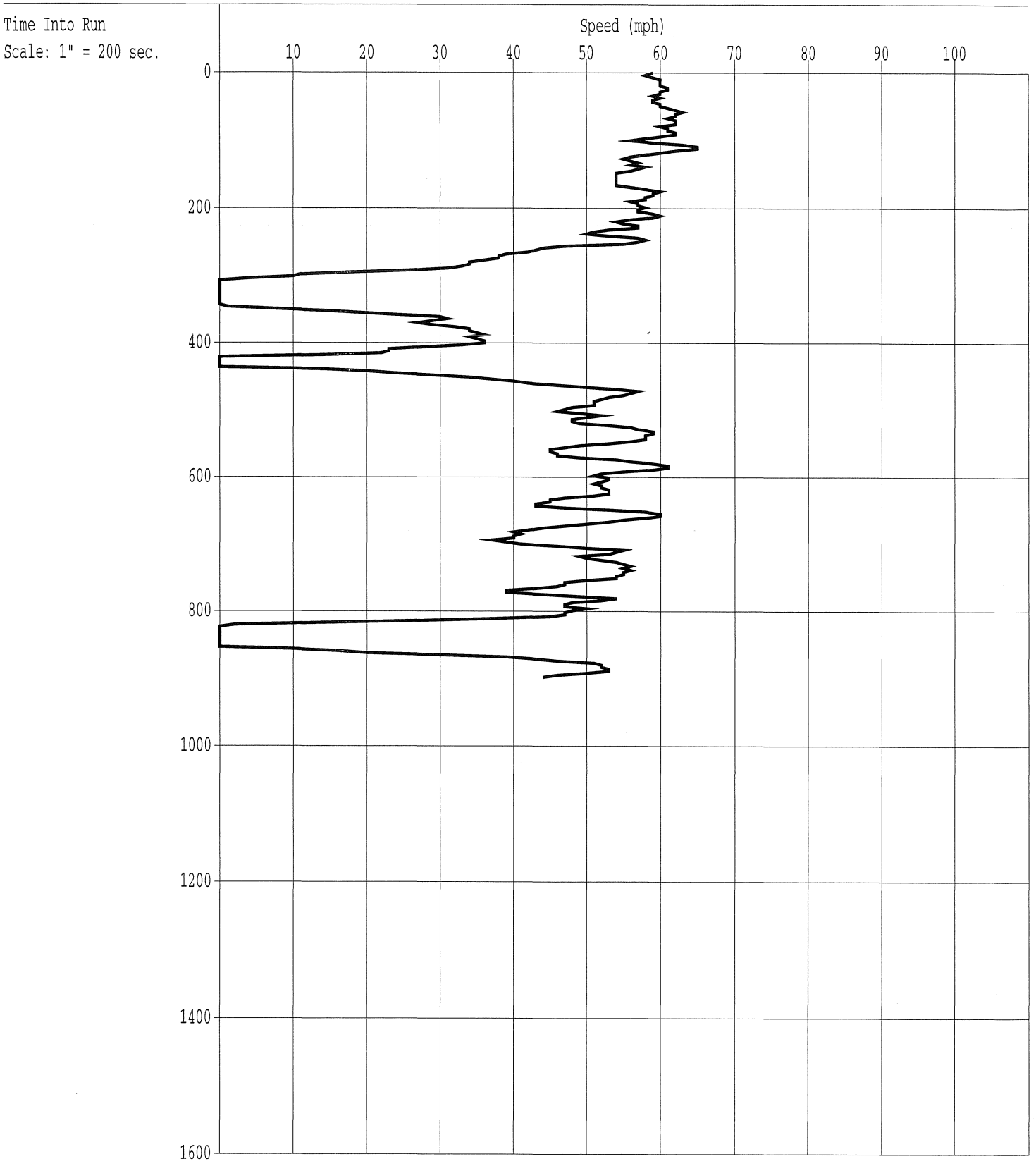
Summary of Travel Study: C:\TRAVEL\1A1_WB.TRV

Date/Time of Report: 10/17/95; 14:32

Time-Based Speed Profile for Run: 2. **Pulse Data File:** 1A1_WB2.PLS

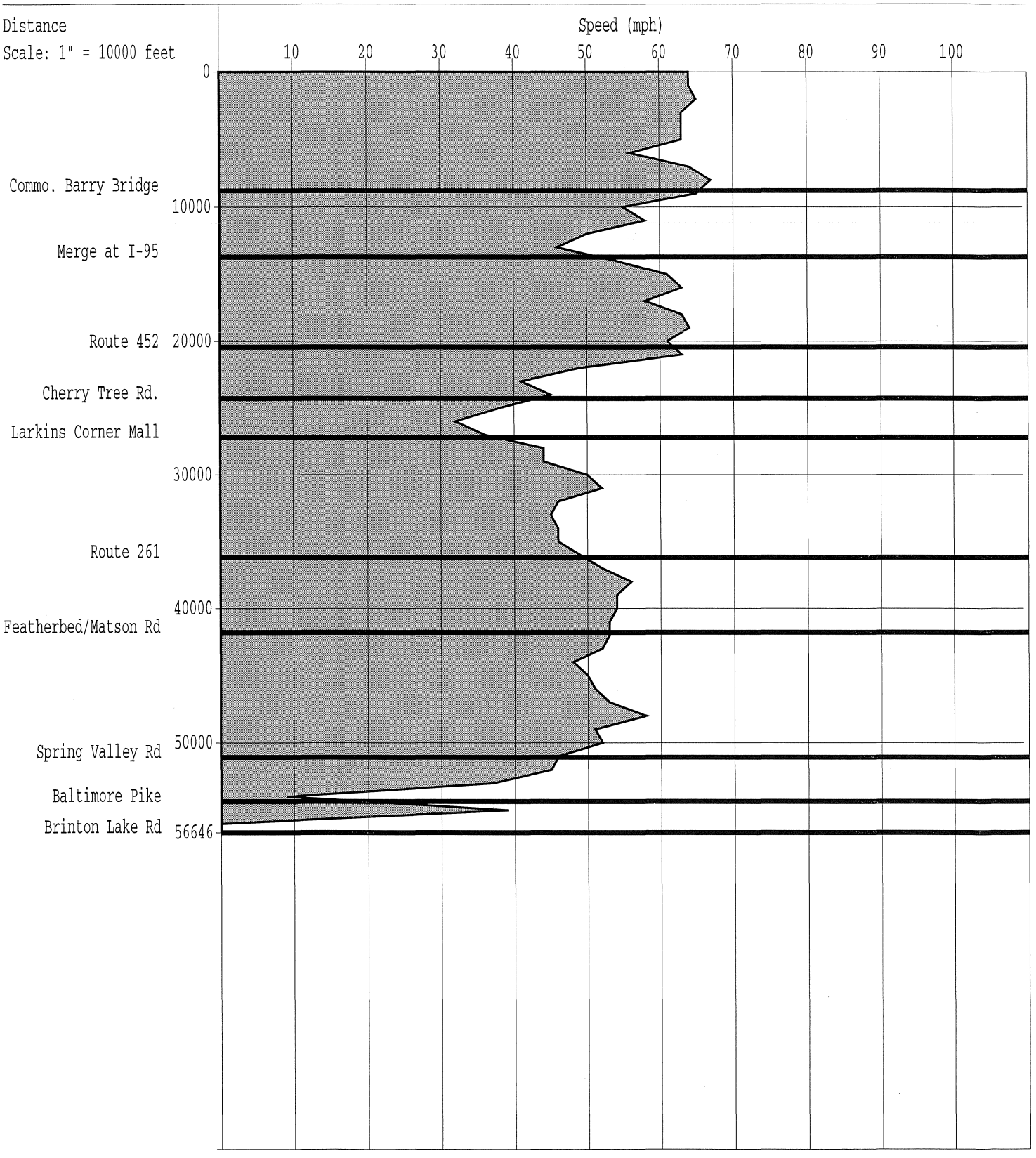
Run Title: 1.1-2 Wb I-95 to Baltimore Pike

This is a Before Run. This is also the Primary (Learn) Run.



PC-Travel, Version 2.0

Summary of Travel Study: C:\TRAVEL\1A1_WB.TRV
Date/Time of Report: 10/17/95; 14:32
Speed Profile for Run: 3. **Pulse Data File:** 1A1_WB3.PLS
Run Title: 1.1-3 WB I-95 to Baltimore Pike
This is a Before Run.



PC-Travel, Version 2.0

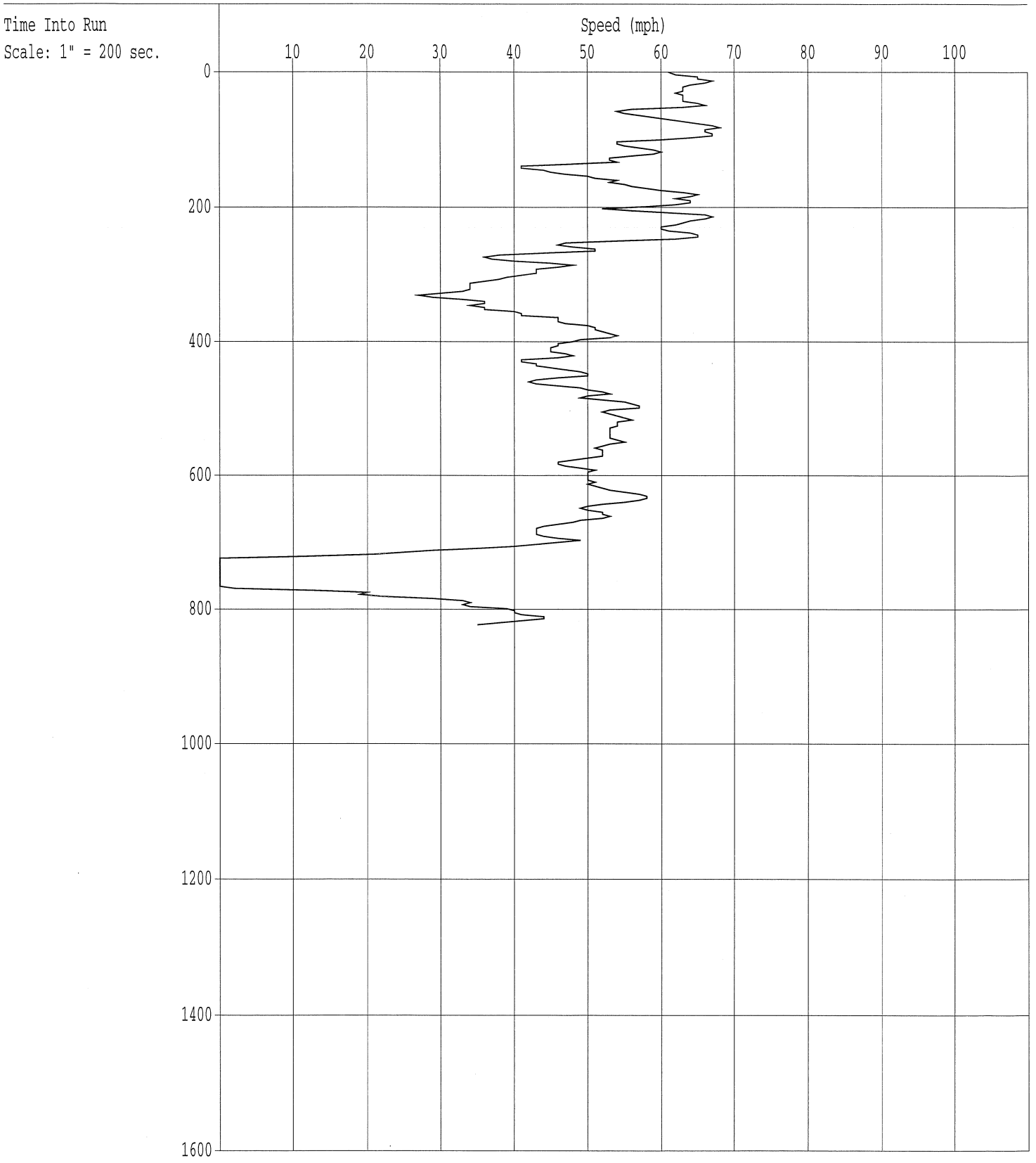
Summary of Travel Study: C:\TRAVEL\1A1_WB.TRV

Date/Time of Report: 10/17/95; 14:32

Time-Based Speed Profile for Run: 3. **Pulse Data File:** 1A1_WB3.PLS

Run Title: 1.1-3 WB I-95 to Baltimore Pike

This is a Before Run.



PC-Travel, Version 2.0
Summary of Travel Study: C:\TRAVEL\1A1_WB.TRV
Date/Time of Report: 10/17/95; 14:32

List Button Labels

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.
13.
14.
15.
16.
17.
18.
19.
20.
21.
22.
23.
24.
25.
26.
27.
28.
29.
30.
31.
32.