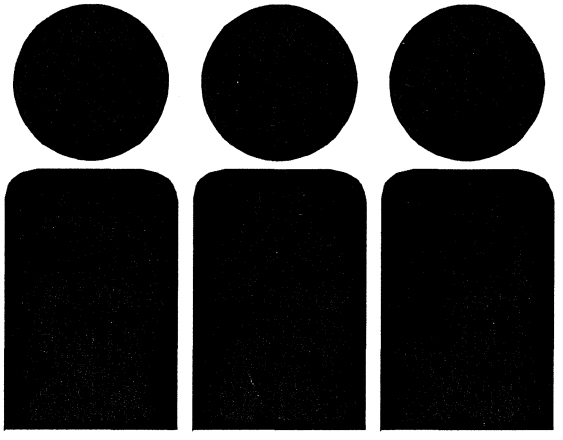
AVERAGE VEHICLE OCCUPANCY ANALYSIS FOR THE DELAWARE VALLEY



July 1993

Delaware Valley Regional Planning Commission

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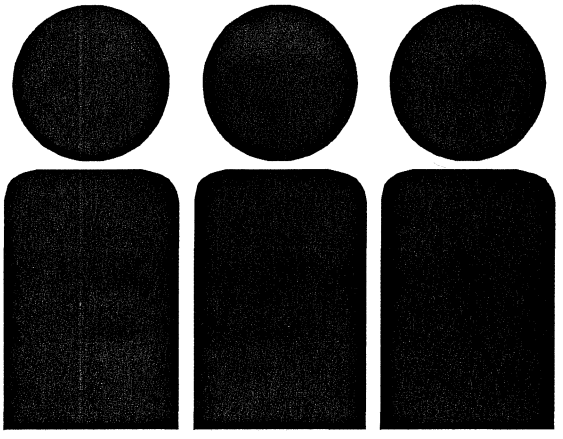

July 1993

Delaware Valley Regional Planning Commission
The Bourse Building
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Philadelphia, Pennsylvania 19106

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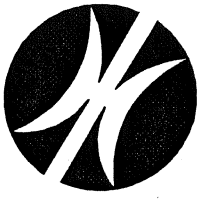
Created in 1965, the Delaware Valley Regional Planning Commission (DVRPC) is an interstate, intercounty and intercity agency which provides continuing, comprehensive and coordinated planning for the orderly growth and development of the Delaware Valley region. The region includes Bucks, Chester, Delaware, 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 among the Office of the Executive Director, the Office of Public Affairs, and four line Divisions: Finance and Administration, Regional Information Services Center, Regional Planning, and Transportation Planning. 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: July 1993
AVERAGE VEHICLE OCCUPANCY ANALYSIS FOR THE DELAWARE VALLEY	Publication No. 93012

Geographic Area Covered:

Bucks, Chester, Delaware, Montgomery, and Philadelphia counties in Pennsylvania and Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, Mercer, and Salem counties in New Jersey.

Key Words:

A.M. peak period commuting trips, average vehicle occupancy (AVO), Clean Air Act Amendments of 1990, Philadelphia severe ozone nonattainment area, random household telephone survey, travel mode

ABSTRACT

The purpose of this report is to establish 1992 vehicle occupancy rates for A.M. peak period work trips in 13 counties and two sub-county areas in the Philadelphia and Atlantic City Nonattainment Areas. The rates are prerequisite to the implementation of trip reduction programs mandated by the Clean Air Act Amendments of 1990. The basis for the study is a random household telephone survey totalling 5,500 respondents. The study affords occupancy rates for each individual county and sub-county area and the basis for calculating rates for various combinations thereof.

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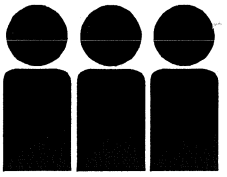


INTRODUCTION

The objective of this study is to determine 1992 average vehicle occupancy rates for AM peak period work trips for portions of the Philadelphia and Atlantic City regions. Determination of these rates supports the formulation of Employer Trip Reduction Programs (ETRP) or Employee Commute Options (ECO) required by the *Clean Air Act Amendments of 1990* (CAAA) in the Philadelphia Ozone Nonattainment Area.

The Philadelphia region is classified as a severe ozone nonattainment area by the CAAA. In order to reduce emissions and improve air quality, the CAAA require employers of 100 or more persons at one site to maintain AM peak period vehicle occupancy levels above the regional average. This can be achieved by reducing the number of employees who drive alone and by increasing the number of employees who use alternative means such as public transit and carpooling.

The measure of vehicle occupancy for all work trips in a given geographic area between the hours of 6 and 10 AM is average vehicle occupancy (AVO). Average passenger occupancy (APO) is the vehicle occupancy of employees at a single site from 6 to 10 AM. The CAAA require the APO of firms with 100 or more employees to exceed the AVO by at least 25%. Employers who do not exceed the average by the requisite 25% must institute programs to increase vehicle occupancy.

AVO is calculated by dividing the number of commuting employees by the number of vehicles used to arrive at work. In calculating AVO, public transit vehicles and vans are not counted as vehicles. Persons who walk, bicycle, or work at home are also counted as having used no vehicle. Carpools and small vans are tallied as portions of vehicles depending upon the number of riders.

The analysis was conducted in thirteen counties in two states (Figure 1). The study area contains the following areas: the Pennsylvania portion of the Philadelphia Nonattainment Area (i.e., Bucks, Chester, Delaware, and Montgomery counties and the City of Philadelphia), the New Jersey portion of the Philadelphia Nonattainment Area (Burlington, Camden, Cumberland, Gloucester, Mercer, and Salem counties), and the Atlantic City Nonattainment Area (Atlantic and Cape May counties).

The analysis was generally conducted at the county level. However, the following geographic areas were treated at the sub-county level: Philadelphia Central Business District (CBD) including the University City area, the remainder of the City of Philadelphia, Atlantic City, and the remainder of Atlantic County. These areas received special consideration because it is recognized that AVO rates within heavily urbanized areas might vary markedly from immediately surrounding areas.

TELEPHONE SURVEY

The method used to establish the region's AVO was a telephone survey of randomly selected households in the study area (Table 1). The survey questionnaire contained 16 questions limited almost exclusively to determining AVO rate(s). In the survey process, the interviewer would first establish that the respondent commuted to work within the requisite time period (i.e., 6-10 AM on weekdays). Subsequent questions focused on the means of commuting and place of work and residence.

Table 1: AVO Survey Fast Facts

- AVO=no. of employees÷no. of vehicles used
- target year: 1992
- method: random household telephone survey
- 6-10 AM weekday work trips only
- 13 counties, 2 sub-areas
- 370 completed surveys per county, sub area
- 5,500 valid surveys

The survey was conducted between July and September of 1992. These months coincide with the peak ozone period.

The telephone survey was conducted using a computer-assisted telephone interview (CATI) program developed specifically for this survey. The program displayed the scripted questions and interviewer directions on individual user terminals, along with the telephone number to be dialed. The program allowed the interviewer to record responses to survey questions while the interview was being conducted. In addition, the program automatically followed scripted skip patterns, reducing the risk that the interviewer would accidentally ask an inappropriate question or record a response in an incorrect location.

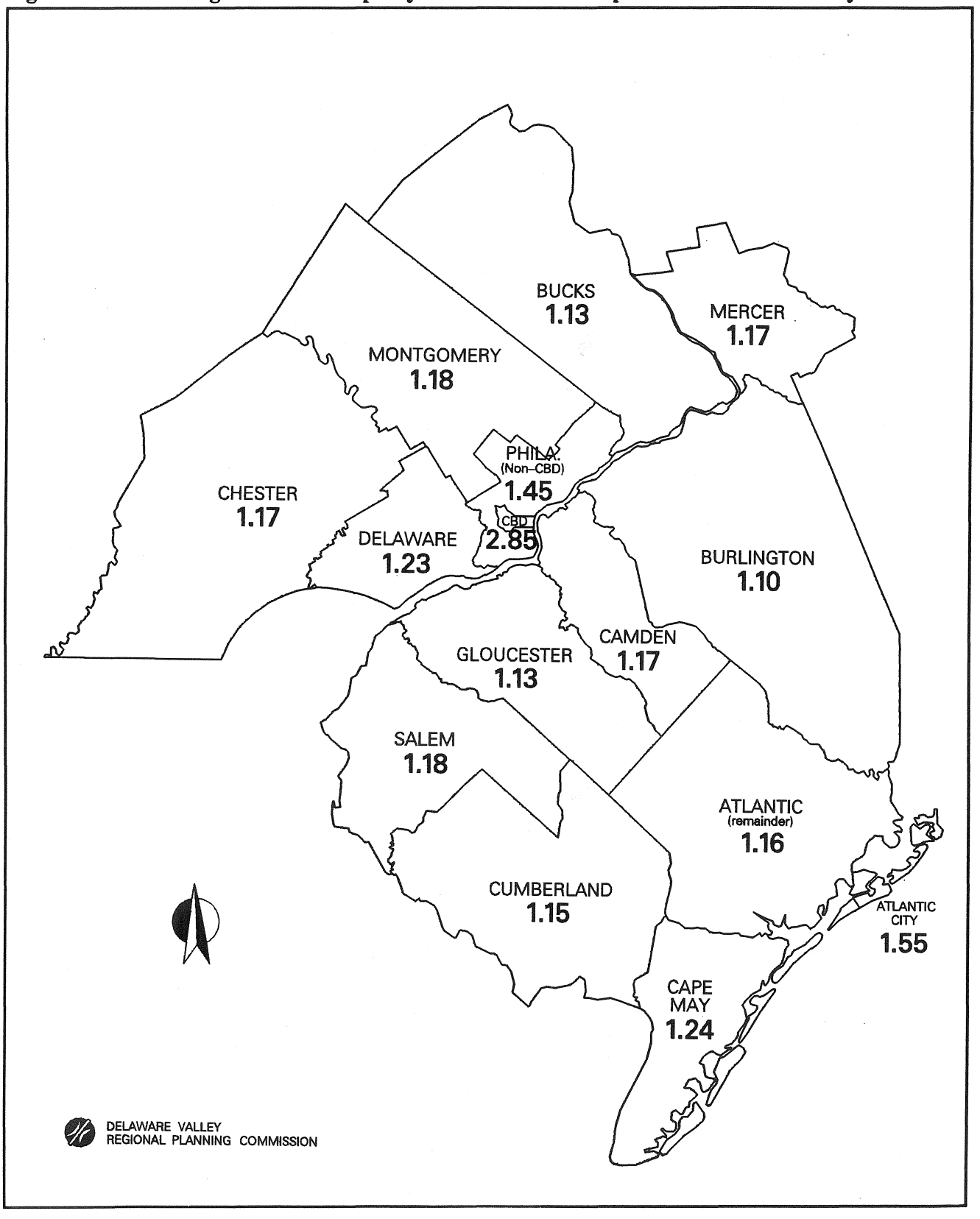
The survey consisted of two phases. Phase I of the survey entailed separate, equal sized samples for the 13 counties within the survey area such that each sample was representative of all eligible persons who worked in that county. This required that the sample for each county be distributed across all counties that contributed to the work force of that county in proportion to each county's relative contribution to that county's work force. Data from the 1990 US Census showing the distribution of each county's workforce across the other counties in the survey area were used to determine the expected distribution of completed interviews in each county of employment across the other counties.

Phase II of the survey entailed the contact of additional surveys for work trips to four sub-county areas, the Philadelphia central business district (CBD) including University City, the remainder of Philadelphia County, Atlantic City, and the remainder of Atlantic County. This afforded distinct AVO rates for these four sub-areas.

The survey was conducted using telephone numbers randomly generated using exchanges serving the survey area. This ensured that unlisted telephone numbers were called in proportion to their incidence in the population. In addition, the survey was conducted during evenings and weekends, when eligible respondents were most likely to be at home.

Quality controls were implemented at several points in the survey process. First, the survey instrument was scrutinized for wording that was ambiguous, misleading, or liable to result in non-response. Second, the instrument was tested using randomly selected telephone numbers. Third, a CATI system was developed to ensure that the proper sequence of questions was followed, that all skip patterns were properly executed, and that illegal or out-of-range values were not accidentally entered into the data base. Fourth, interviewers were rigorously trained using interactive oral presentations, written handouts, hands-on instruction in and practice with the CATI system, and mock interviewing. Fifth, interviewers were closely supervised and provided with feedback throughout the survey. Sixth, at the midpoint of the survey, data were examined for evidence of bias or significant deviation from expected results.

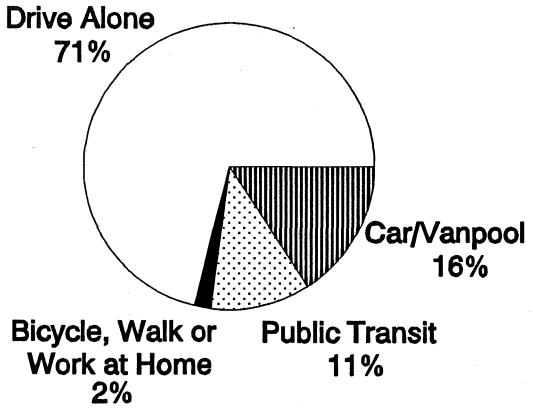
Figure 1: 1992 Average Vehicle Occupancy Rates for Work Trips in the Delaware Valley



RESULTS

In the study area, "drive alone" is the most common mode of commute (Figure 2). According to the survey, 71% of the work trips in the Philadelphia Nonattainment portion of the study area are "drive alone." Car and van pools account for 16% of the trips, and 11% of the trips are by public transit.

Figure 2: 1992 Travel Mode for Work Trips in the Philadelphia Nonattainment Area Portion of Survey Area



Prepared by DVRPC

Based on data from the random phone survey, 1992 AVO rates were derived for each county and sub-county area in the study area (Table 2). The Philadelphia CBD, including University City, possesses the region's highest AVO at 2.85. The next highest AVO rates are also urbanized areas: Atlantic City (1.55) and the remainder of Philadelphia (1.45). The suburban county rates range from 1.10 in Burlington County to 1.24 in Cape May County. The AVO rate for the portion of the Philadelphia Nonattainment Area in the study area is 1.30 and 1.27 for the Atlantic City Nonattainment Area. This rate is derived from aggregating county and sub-county AVO rates and "weighting" by employment.

Table 2: 1992 Average Vehicle Occupancy Rates for Work Trips in the Delaware Valley

Bucks County	1.13
Chester County	1.17
Delaware County	1.23
Montgomery County	1.18
Philadelphia CBD	2.85
Philadelphia Non-CBD	1.45
Burlington County	1.10
Camden County	1.17
Gloucester County	1.13
Mercer County	1.17
Cumberland County	1.15
Salem County	1.18
Phila. NAA Portion	**1.30**
Atlantic City	1.55
Atlantic County (remainder)	1.16
Cape May County	1.24
Atlantic City NAA	**1.27**

The AVO rates specified herein are based on 1992 data and adhere to available guidance on determining AVO. The rates and survey data support New Jersey and Pennsylvania efforts to establish ETRPs. AVO rates are key prerequisites for ETRPs.

Ultimately, it may be desirable to create AVO zones which do not correspond to the county or sub-county areas contained in this report. The AVO rates presented herein admit to such aggregations, provided the aggregations draw from a sufficient number of household phone surveys. In performing such aggregations, the equation for estimating aggregated AVO rates presented in this study should be employed. □

DELAWARE VALLEY
REGIONAL PLANNING COMMISSION

This report was written by the Delaware Valley Regional Planning Commission under contract to the Pennsylvania and New Jersey departments of transportation.

July, 1993

1. INTRODUCTION AND BACKGROUND

The objective of this study is to determine 1992 average vehicle occupancy (AVO) rates for AM peak period work trips for portions of the Philadelphia and Atlantic City regions. Determination of these rates supports the formulation of Employer Trip Reduction Programs (ETRPs) or Employee Commute Options (ECOs) required by the *Clean Air Act Amendments of 1990* (CAAA) in the Philadelphia Ozone Nonattainment Area. The employed methodology is consistent with all available federal and state guidance on vehicle occupancy determination.

The report is divided into four chapters. Chapter 1 provides information regarding the purpose of the study. Chapter 2 details the study methodology, a telephone survey of randomly selected area households. Survey results are furnished in Chapter 3. Chapter 4 contains the AVO rates determined by the survey.

Average Vehicle Occupancy (AVO)

The Philadelphia region is classified as a severe ozone nonattainment area by the CAAA. In order to reduce emissions and improve air quality, the CAAA require employers of 100 or more persons at one site to reduce the number of their employees who drive alone to work and to increase the number of employees who use alternative modes such as public transit and carpooling. The statutory language from the CAAA regarding this requirement states:

> *Within two years after the date of enactment of the Clean Air Act Amendments of 1990, the State shall submit a revision requiring employers in such area to implement programs to reduce work-related vehicle trips and miles traveled by employees. Such revision shall be developed in accordance with guidance issued by the Administrator pursuant to section 108(f) and shall, at a minimum, require that each employer of 100 or more persons in such area increase average passenger occupancy per vehicle in commuting trips between home and the workplace during peak travel periods by not less than 25 percent above the average vehicle occupancy for all such trips in the area at the time the revision is submitted.*[1]

Consistent with available guidance and literature for ETRPs, vehicle occupancy is expressed by the following measures: average vehicle occupancy (AVO) and average passenger occupancy (APO). AVO is the measure of vehicle occupancy for all work trips in a given geographic area between the hours of 6 and 10 AM. APO represents the vehicle occupancy of only those employees from a single work site between 6 and 10 AM. The CAAA require the APO of affected firms (namely, firms with 100 or more employees at one site) to exceed the AVO by at least 25%. Employers who do not exceed the average by the requisite 25% must institute programs to increase vehicle occupancy.

Regional vehicle occupancy, AVO, is calculated by dividing the number of commuting employees by the number of vehicles used to arrive at work (Appendix A). AVO includes all journey-to-work trips, regardless of firm size, which occur between the hours of 6 and 10 AM on a weekday. In

[1] Section 182 (d) (1) (B) of the Clean Air Act.

calculating AVO, public transit vehicles and large vans are not counted as vehicles. Persons who walk, bicycle, or work at home are also counted as having used no vehicle. Carpools and small vans are tallied as portions of vehicles depending upon the number of riders. Some additional caveats apply to the calculation of AVO; for example, if a child is dropped off at a day care facility within one half mile of the work site, the child is counted as a passenger and the trip is treated as a carpool trip.

States with severe ozone nonattainment areas are required to submit a State Implementation Plan (SIP) revision to EPA which includes a commitment to institute an ETRP or ECO. The SIP revision must specify the AVO rate(s) for the affected area at the time of the submittal. The CAAA state that the revision should be submitted in 1992; therefore, the AVO rate(s) should also be for 1992.

Study Area

The analysis was conducted in thirteen counties in two states. The study area contains the following areas: the Pennsylvania portion of the Philadelphia Nonattainment Area (i.e., Bucks, Chester, Delaware, and Montgomery counties and the City of Philadelphia), the New Jersey portion of the Philadelphia Nonattainment Area (Burlington, Camden, Cumberland, Gloucester, Mercer, and Salem counties), and the Atlantic City Nonattainment Area (Atlantic and Cape May counties) (Figure 1).

The analysis was generally conducted at the county level. However, the following geographic areas were treated at the sub-county level: Philadelphia Central Business District (CBD) including the University City area[2], the remainder of the City of Philadelphia, Atlantic City, and the remainder of Atlantic County. These areas received special consideration because of the recognition that AVO rates within heavily urbanized areas might vary markedly from immediately surrounding areas.

Study Methodology

Undertaking a survey of the entire worker population within the study area to determine AVO would be extremely costly and time consuming. Therefore, several alternative techniques to establish the region's AVO were considered. Among these were roadside observations of vehicle occupancy, employer surveys, and extrapolation of 1980 U.S. Census data. A poll of other regions in the United States confronted with establishing an AVO revealed that there was no decided preference for methodology.

1990 US Census journey-to-work data were also considered. However, the 1990 data were not available for the destination portion of the trip at the time of the study. Furthermore, the 1990 US Census data would not coincide with the year of the SIP revision (i.e., 1992), nor would it address all the relevant features of AVO calculation. For example, AVO rates are based on morning peak trips only, whereas US Census data do not distinguish work trips by time of day.

The methodology used for the analysis was a telephone survey of randomly selected households. This method had been successfully employed in other regions for the same purpose (e.g., the Houston-Galveston region). A telephone survey offers several advantages over other methods.

[2] Note: all subsequent references to the Philadelphia CBD include University City.

These include the acquisition of actual data for the target year (i.e.,1992), the ability to precisely adhere to guidance on the estimation of AVO, and an ease in obtaining data.

In implementing the survey, specific location data at the U.S. Census tract level were requested. Respondents were asked to provide the street address of both their job site and their residence. This permits comparison of the survey results with 1990 U.S. Census data and also precise mapping of the survey findings.

A total of 5,500 completed household surveys were necessary to afford the desired statistical validity. Place of employment served as a control mechanism in examining survey returns. Return targets for completed surveys were defined for each county, based on expected travel distributions from county work trip patterns. To obtain the desired statistical significance, it was estimated that 370 surveys were needed per county or sub-county of employment.

Actual telephone surveying was performed by Biospherics, Inc. under contract with DVRPC. The survey work was split into two phases. Phase I provided the required number of completed surveys for each county. Phase II entailed the conduct of additional surveys to assure statistically valid survey results for the Philadelphia Central Business District,the remainder of Philadelphia County, Atlantic City, and the remainder of Atlantic County.

The survey questionnaire contained 16 questions limited primarily to determining the AVO rate(s). In the survey process, the interviewer would first establish that the respondent commuted to work within the requisite time period (i.e., 6-10 AM on weekdays). The survey then focused on the means of commuting and place of work and residence, with some special follow-up questions (e.g., number of people in a carpool or vanpool). The final questions were not essential in the computation of AVO. However, they required relatively short answers and provided useful planning data (i.e., car ownership, household income, and sex of respondent).

The survey was conducted between July and September of 1992. These months coincide with the peak ozone period.

Coordination

The study was coordinated with the DVRPC Board, DVRPC's Regional Transportation and Citizen committees, and a special steering committee. The steering committee was made up of technical representatives from: the New Jersey Department of Environmental Protection and Energy, New Jersey Department of Transportation, Pennsylvania Department of Environmental Resources, Pennsylvania Department of Transportation, Regions II and III of the Environmental Protection Agency, some counties and cities within the nonattainment area, and the private business sector. The steering committee assisted with all phases of the study including selection of the study methodology and selection of the consultant to perform the telephone survey.

The study was also coordinated with a similar AVO survey of northern New Jersey undertaken by the Eagleton Institute for the New Jersey Department of Transportation. The DVRPC and northern New Jersey survey efforts were similar. Both were based on random household telephone surveys conducted concurrently and with identical survey questionnaires.

Since portions of the states of Delaware and Maryland fall in the Philadelphia Nonattainment Area, transportation and environmental agencies from these states were apprised of DVRPC's AVO study. These states are also required to determine AVO rates in anticipation of ETRPs.

Use of AVO Rates

The CAAA permit each nonattainment area to specify the number of AVO rates within the nonattainment area. Multiple AVOs, rather than a single region-wide rate, may be desirable depending upon factors such as transit availability, land use patterns, and observed occupancy rates. Due to the importance of AVO rates and resulting target rates, AVO zones must be carefully selected and delineated. APO target rates for affected firms may vary significantly depending upon how the region is divided.

This study does not develop AVO zone scenarios for the study area. It is limited to the presentation of all technical results of the analysis and AVO rates for each county and sub-county area. However, the study does contain the necessary data and methodology to determine AVO rates for other geographic aggregations of the region. □

2. RANDOM HOUSEHOLD TELEPHONE SURVEY

The method employed to determine county and sub-county AVO rates in the study area was a telephone survey of randomly selected households. The following section summarizes the salient features of the survey. The sampling plan is described, as well as the survey procedures and materials.

Sampling Plan

In any survey, it is essential that the final sample be representative of the population of interest. This requires that both the sampling plan and the data collection procedures be designed to minimize bias in the final sample. Various measures were introduced into this survey to assure accurate and reliable results.

The survey consisted of two phases. Phase I entailed separate samples of equal size for each county which reflected the composition (i.e., county of residence) of the county's work force. Thus, the sample households for each county were distributed across all counties that contributed to the work force of that county in proportion to each county's relative contribution to that county's work force (Table 3). Data from the 1990 US Census regarding the distribution of each county's workforce across the other counties in the survey area were used to determine the expected distribution of completed interviews in each county of employment (Appendix C). The expected total number of interviews completed in each county of residence was determined by summing the expected numbers of completed interviews for that county across the 13 counties of employment. This number was used to determine the number of households from that county that would be contacted for the survey, using a predetermined ratio of expected completed interviews per contact.

One limitation of the sampling plan was the exclusion of work trips with external origins. Individuals residing in locations outside the study area, yet who worked in the study area were not surveyed. However, it was determined that the exclusion of workers with external trip origins would not significantly impact the estimation of AVO rates.

Phase II of the survey focused on four sub-areas (i.e., Atlantic City, the remainder of Atlantic County, Philadelphia CBD, and Philadelphia outside of the central business district). The sample design for this phase was similar to that for Phase I. For example, for Atlantic City, the expected distribution of completed interviews across the counties of residence was based on the distribution of the Atlantic City work force across the other counties in the survey area.

Confidence Level and Sampling Error

The sampling plan is based on the attainment of 370 surveys per county or sub-area of employment. The plan yields a confidence interval for the New Jersey and Pennsylvania portions of the Philadelphia Nonattainment Area and the Atlantic City Nonattainment Area of 95% with a sampling error of $\pm 3\%$. An equivalent confidence interval with a $\pm 5\%$ sampling error is achieved for each county and sub-area in the study area and for any breakdown of the region provided there are a sufficient number of valid surveys for that geographic area (e.g., an aggregation of minor civil divisions in more than one county). This level of statistical significance affords a sufficient level of accuracy, and fixes the sampling plan at a reasonable cost level.

Table 3: Expected Number of Completed Interviews by County of Residence and County of Employment

County of Residence	County of Employment												
	Bucks	Chester	Dela.	Mont.	Phil.	Atlant.	Burl.	Camden	C. May	Cumb.	Glouc.	Mercer	Salem
Bucks	267	5	4	40	15	0	9	5	1	1	3	52	1
Chester	2	273	34	25	6	0	1	2	0	0	1	1	2
Delaware	4	34	269	23	30	1	3	5	2	1	5	1	5
Montgomery	37	42	21	221	28	0	3	5	0	0	2	2	0
Philadelphia	42	12	28	52	255	3	11	18	3	1	7	4	1
Atlantic	0	0	0	0	1	290	2	3	27	16	5	1	2
Burlington	7	1	3	3	8	6	261	51	1	2	11	36	4
Camden	4	2	5	4	19	19	60	237	3	6	63	4	12
Cape May	0	0	0	0	0	24	0	1	316	6	1	0	0
Cumberland	0	0	0	0	0	16	1	1	12	300	8	0	25
Gloucester	2	1	5	1	7	9	12	40	4	21	249	1	42
Mercer	5	0	0	1	1	1	6	1	0	0	0	268	0
Salem	0	0	1	0	0	1	1	1	1	16	15	0	276
Survey Area	370	370	370	370	370	370	370	370	370	370	370	370	370

Thus, the "true" value for any given county or sub-area for any given question in this survey has a 95% chance to fall within a range of ±5 percentage points of the observed value (provided there are 370 surveys for that county or sub-area). For example, in Table 5, the "true" value of persons who drive alone to work in Bucks County has a 95% chance to fall within a range of ±5 percentage points of the reported 82.7% (i.e., 77.7%-87.7%).

Sampling error for proportions (i.e., those presented in the tables in Chapter 3) is derived from the following formula:

$$\text{Sampling Error} = 1.96 \sqrt{\frac{P(1-P)}{N}}$$

Survey Procedures

This survey sampled 13 different counties of residence. For the purposes of random telephone number generation, each county of residence was considered to define a separate sample frame. That is, the random generation of telephone numbers was carried out independently for each county of residence. Telephone numbers used for this survey were provided by a commercial vendor, and were generated randomly from blocks of numbers (i.e., groups of 100 four-digit numbers sharing the first two digits) known to have a high percentage of working, residential telephone numbers.

The method that was used to generate the telephone numbers is as follows. First, all exchanges used within the survey area, and all working blocks within each exchange, were identified. Second, all combinations of an exchange plus the first two digits of a known working block within that exchange were listed in numerical order; each combination was listed once for each time that a telephone number with that combination appeared in a published directory (e.g., if 50 listed telephone numbers were in the block "555-1100 to 555-1199," the combination "555-11" was listed 50 times). Third, a "sampling interval" was calculated by dividing the number of listed telephone households in the county by the quota of telephone numbers required for that county. Fourth, starting at a random point within the first sampling interval, the list of exchange plus block combinations was sampled such that one combination was chosen at each sampling interval. Steps two, three, and four ensured that each exchange would have a probability of selection equal to its share of listed telephone households. Fifth, for each combination selected, a number from 00 to 99 was randomly generated and appended to the combination. Sixth, the resulting telephone number was compared against a database of known business telephone numbers. If the telephone number was a business number, a new two-digit number was generated and appended to the exchange plus block combination. This sixth step was repeated until the resulting number did not match a known business number.

Bias can be introduced into survey results if any segment or segments of the population are systematically excluded from the sample. For example, persons with unlisted telephone numbers are on the average younger, better educated, and more affluent than persons with listed telephone numbers. Therefore, surveys that do not include unlisted telephone numbers may be biased in the direction of greater age, less education, and lower economic status.

In order to reduce the risk of bias in the sample, the survey was conducted using telephone numbers randomly generated using exchanges serving the survey area. This ensured that unlisted telephone numbers were called in proportion to their incidence in the population. In addition, the survey was conducted during evenings and weekends, when eligible respondents were most likely to be at home. Each telephone number was attempted at least five times before being discarded, at different times of the day and on different days of the week. When contact was made with an answering machine, a brief message was left asking the resident to call the DVRPC at a toll-free number staffed by a supervisor at the survey center at Biospherics, who then attempted to complete an interview.

Once contact was made with a potential respondent, every effort was made to complete the interview. Procedures included a brief introduction that provided the topic of the survey and emphasized the brevity of the interview. If the respondent was resistant, the interviewer emphasized the brevity of the interview and the confidentiality of the results, as well as the importance of participation. If the respondent continued to decline, the interviewer asked whether there would be a more convenient time to call and attempted to schedule a callback. If the respondent refused to participate, the interviewer asked whether anyone else in the household might be interested in participating in the survey. The interviewer terminated the call only if the respondent refused all requests to participate and indicated that there was no one else in the household who might participate.

The interviewers received training in general interviewing procedures and skills, in use of the script for this survey, and in the operation of the computer-assisted telephone interview (CATI) hardware and software. Interviewers were trained to complete the interviews in standardized ways and to elicit and record the answers in the same way from each respondent. The interviewer supervisor was trained prior to the interviewers and assisted in the interviewer training. The training period included an interactive oral presentation, practice using the CATI system, and mock interviewing with other interviewers, the interviewer supervisor, and the project manager. The interviewers were carefully supervised during all aspects of training, and feedback was given during the CATI training and mock interviewing.

Survey Materials

The telephone survey was conducted using a CATI program developed specifically for this survey. The CATI program was operated on a Compaq 386 microcomputer configured for a multi-user environment. The program displayed the scripted questions and interviewer directions on individual user terminals, along with the telephone number to be dialed. The program allowed the interviewer to record responses to survey questions while the interview was being conducted. In addition, the program automatically followed scripted skip patterns, reducing the risk that the interviewer would ask an inappropriate question or record a response in an incorrect location.

The survey instrument and script were developed by DVRPC and was later modified after pilot testing (Appendix B.). The script was designed to afford accurate results, maximize the response rate, and ensure that the most critical information (i.e., the travel-to-work mode and the job location) was collected at the earliest possible point in the interview.

The script began with a brief introduction that identified the organization conducting the survey (DVRPC), the topic of the survey (transportation), and the initial eligibility criterion (that the respondent work on weekdays). The eligibility of the respondent was established with the first two survey questions. Question 1 asked whether the respondent started work between 6:00 a.m. and 10:00 a.m. on a weekday. Question 2 asked whether the respondent's job was located within the survey area. In Phase I of the survey, this was done by determining the county in which the job was located. In Phase II of the survey, in which additional surveys were sought for persons working in Philadelphia or Atlantic County, question 2 asked whether the respondent's job was located in Philadelphia or Atlantic County.

The remainder of the survey was divided into groups of questions to establish characteristics of the respondent's job, characteristics of the respondent's commuting pattern, the respondent's employment and home address, and demographic characteristics of the respondent and the respondent's household. With the exception of questions to establish the respondent's eligibility, the survey script was identical for Phases I and II of the survey.

Training materials for interviewers included handouts covering basic interviewing rules and interviewing skills. In addition, interviewers were provided with the survey script and examples of appropriate probes and clarifying questions, and guidelines for responding to respondents' concerns and requests for clarification.

Pretest of Survey Instrument and Procedures

A pretest of the survey instrument and procedures was conducted as a joint effort by DVRPC and the northern New Jersey study effort. Random calls were made to residents in both the DVRPC study area and northern New Jersey. Twenty-five interviews were conducted in the pretest. The results of the pretest confirmed the expected duration of the interview (i.e., five to seven minutes). The following modifications were made to the survey script as a result of the pretest:

- Question 2. Instructions were added to terminate the interview if the respondent did not know in what county or municipality he/she works, since it would be impossible to determine by address or street intersection alone where the employee works.

- Question 7. Instructions were added to ask respondents to include all modes of transportation taken from their home to their workplace.

- Question 8. Instructions were added to ask for an average travel-to-work distance if the respondent stated that the distance traveled to work differs from the distance traveled home.

- Question 11. Instructions were added to ask the municipality and nearest intersection of each respondent regarding their place of employment if any part of the address was not known.

- Question 15. The question regarding the age and gender of other eligible workers in the household was altered to "starts work between 6:00 a.m. and 10:00 a.m.".

Response Rates

Response rates were consistent with those commonly obtained in telephone surveys. Between Phase I and Phase II of the survey, 27,231 households were contacted. Of these, 15,113 (55.5%) resulted in contact with an eligible respondent. Of the 15,113 contacts with eligible respondents, 6,282 (41.6%) resulted in completed interviews.

Steps to Maintain Target Distribution

As noted above, it was important that the distribution of completed interviews for each county of employment across the counties of residence closely approximate the distribution of the work force for each county of employment across the counties of residence. The following steps were taken to maintain this distribution. Lists of randomly generated residential telephone numbers were obtained for each county in the survey area. The number of telephone numbers generated for each county varied according to the requirements of the sample design, with counties expected to contribute fewer completed interviews to the final sample having fewer telephone numbers and counties expected to contribute more completed interviews to the final sample having more telephone numbers.

Each list was randomized and partitioned into three equal sized segments. The first segments of the various lists were combined and randomized again. This combined list of telephone numbers from all counties constituted the first wave of telephone numbers used in the survey. Using this procedure, it was possible to compare the distribution of the surveyed households to the expected distribution before releasing all of the telephone numbers to the interviewers. Had the distribution departed significantly from the expected distribution, adjustments would have been made to subsequent waves of telephone numbers to increase the number of telephone numbers from some counties and decrease the number from other counties to maintain the expected distribution. Approximately halfway into the data collection period, the AVO Survey Steering Committee determined that the distribution of county-of-employment interviews over the counties of residence did not significantly depart from the expected distribution. Therefore, no adjustments were needed to maintain the target distribution.

Maintenance of Quality Control

Quality controls were implemented at several points in the survey process. First, the survey instrument was scrutinized for wording that was ambiguous, misleading, or liable to result in non-response. Second, the instrument was tested using randomly selected telephone numbers and interviewers that were trained for this survey. Third, a CATI system was developed to ensure that the proper sequence of questions was followed, that all skip patterns were properly executed, and that illegal or out-of-range values were not accidentally entered into the data base. Fourth, interviewers were rigorously trained using interactive oral presentations, written handouts, hands-on instruction in and practice with the CATI system, and mock interviewing. Fifth, interviewers were closely supervised and provided with feedback throughout the survey. Sixth, at the midpoint of the survey, data were downloaded and presented in tabular form to the AVO Survey Steering Committee to be examined for evidence of bias or significant deviation from expected results.

In addition to the above, quality control was maintained by ensuring that all completed interviews were correctly classified by county of employment. Although interviewer training and survey

procedures were designed to minimize error in data collection and recording, some errors did occur in the reporting of information by the respondent. Discrepancies among the reported employment town, employment county, and employment ZIP code occurred in approximately seven percent of the completed interviews. To resolve these discrepancies, all employment ZIP codes and all employment cities/towns were listed, by employment county. After printing out the complete address data, published ZIP code directories, state maps, and a published directory of counties and towns in the United States were utilized to resolve the discrepancies. In some cases, the discrepancy was due to an incorrect ZIP code or a misspelled city/town name; however, in some cases, the ZIP code and/or the city/town name were correct, but the county was incorrect. The county of employment was changed only when the address data clearly indicated a different county than was originally recorded. □

3. SURVEY RESULTS

This section contains the results of the random phone survey to determine 1992 AVO rates for the Pennsylvania and New Jersey counties in the study area. Survey results including work trip origins, travel mode, and other work trip characteristics are presented. The data are presented for each of the counties and sub-county areas and also for the two nonattainment areas. Results for the nonattainment areas are aggregated from the county and sub-area responses and are "weighted" by relative amounts of employment.

Work Trip Origins

In the study area, the most likely work trip origin is the county or sub-area of employment (Table 4). Adjacent counties are the next greatest source of employees. In general, persons work in the same state as they reside.

Work Trip Mode

In the study area, "drive alone" is the most preferred commute option (Table 5). According to the survey, single occupant drivers account for 71% of the trips in the Philadelphia Nonattainment Area portion of the study area and 73% in the Atlantic City Nonattainment Area. In general, carpools account for the second largest amount of commuters, and combined forms of public transit the third largest amount.

At the county and sub-area level, the modal split in the Philadelphia Central Business District deviates the most from the patterns found elsewhere. There, public transit is the arrival mode of more than half the workers (55%). Just 30% of the trips are drive alone trips.

Drive Trip Characteristics

The driving distance of those who drive to work in the study area (drive alone or car or van pool) is evenly distributed (Table 6).

Travel times in the nonattainment areas reflect the spread of driving distances. The majority of trips are under 20 minutes in duration. This is true in every county or sub-area except for Philadelphia CBD and the remainder of Philadelphia County.

Additional Survey Results

Among other characteristics regarding the survey respondents and the job which they described were the following (reported only for the Philadelphia Nonattainment Portion of the Study Area):

- almost half work at larger sites ($\geq$ 100 employees) (46%)
- almost all work at their job year-round (98%)
- one of ten drivers drop off a family member within half a mile of their job (12%)
- less than one quarter require a car for business purposes (24%)
- the majority reside in households with 1-2 cars (71%)
- slightly under half are 30 years old or less (42%)
- male employees slightly outnumber female employees (53% vs. 47%)
- roughly half have household incomes between $15,000-$60,000 (56%) □

Table 4: Work Trip Origins by Employment Location

FROM: Residence County	TO: Employment County														
	Bucks County	Chester County	Delaware County	Montg. County	Phila. CBD	Phila. Non-CBD	Burl. County	Camden County	Cumb. County	Glouc. County	Mercer County	Salem County	Atlantic City	Atlan. Co. Excl. A.C.	Cape May County
Total Responses	292	285	253	353	383	368	287	309	299	275	271	259	293	198	275
Bucks	79.5%	2.1%	2.0%	12.2%	3.9%	5.2%	1.0%	2.6%	0.3%	0.4%	13.7%	1.5%	0.3%	0.5%	0.4%
Chester	0.3%	78.2%	15.8%	13.3%	2.6%	1.4%	0.7%	0.0%	0.0%	0.7%	0.0%	0.0%	0.0%	0.5%	0.4%
Delaware	1.4%	10.2%	67.6%	6.8%	13.6%	8.2%	0.7%	1.3%	0.0%	0.7%	0.4%	0.8%	0.3%	0.0%	0.7%
Montgomery	10.3%	5.6%	4.3%	60.9%	7.0%	3.3%	0.7%	0.6%	0.0%	0.0%	0.0%	0.4%	0.0%	0.0%	0.0%
Philadelphia	2.4%	1.1%	2.8%	4.0%	55.1%	64.9%	0.7%	0.3%	0.0%	0.4%	0.4%	0.0%	0.7%	0.0%	0.0%
Burlington	2.4%	1.4%	0.8%	1.1%	3.4%	3.5%	67.9%	18.1%	0.3%	0.7%	12.5%	0.4%	0.7%	1.0%	0.4%
Camden	0.7%	0.0%	1.2%	0.8%	6.3%	4.1%	14.6%	50.8%	0.3%	6.2%	1.5%	1.2%	1.0%	3.0%	1.1%
Cumberland	0.3%	0.0%	0.4%	0.0%	0.3%	0.3%	0.3%	1.0%	81.9%	2.5%	1.1%	2.7%	0.3%	9.1%	2.5%
Gloucester	0.7%	1.4%	2.4%	0.3%	4.7%	5.4%	9.1%	18.8%	2.3%	69.5%	0.7%	2.3%	2.4%	4.0%	0.4%
Mercer	1.0%	0.0%	0.0%	0.3%	0.0%	0.0%	0.3%	0.0%	0.0%	0.0%	69.4%	0.0%	0.0%	0.0%	0.0%
Salem	0.3%	0.0%	2.0%	0.3%	0.5%	1.6%	1.4%	3.2%	9.4%	16.4%	0.0%	89.6%	0.3%	1.0%	0.0%
Atlantic	0.0%	0.0%	0.8%	0.0%	2.6%	1.6%	1.0%	1.3%	2.3%	1.8%	0.4%	0.4%	88.7%	65.2%	3.3%
Cape May	0.7%	0.0%	0.0%	0.0%	0.0%	0.5%	1.4%	1.9%	3.0%	0.7%	0.0%	0.8%	5.1%	15.7%	90.9%

Table 5: Travel Mode to Work by Employment Location

Employment Location	Total Responses	Drive Alone	Carpool	Vanpool	Bus	Train	Subway	Dropped Off	Taxi	Motorcycle	Bicycle	Walk	Work at Home	Jitney	Other
Bucks	362	82.7%	12.8%	1.6%	1.0%	0.3%	0.0%	0.3%	0.0%	0.3%	0.3%	0.6%	0.2%	0.0%	0.0%
Chester	361	76.8%	18.1%	2.1%	1.3%	0.3%	0.1%	0.5%	0.0%	0.0%	0.0%	0.5%	0.3%	0.0%	0.0%
Delaware	338	73.7%	17.6%	2.2%	1.6%	0.3%	0.5%	1.8%	0.0%	0.3%	0.9%	0.8%	0.2%	0.0%	0.0%
Montg.	414	76.5%	18.9%	1.5%	0.7%	0.6%	0.0%	0.3%	0.0%	0.3%	0.3%	0.9%	0.1%	0.0%	0.2%
Phila. CBD	421	29.8%	9.0%	0.9%	19.5%	22.9%	12.6%	0.8%	0.3%	0.0%	0.6%	3.0%	0.1%	0.0%	0.5%
Phila. Non-CBD	402	64.4%	16.4%	1.3%	10.7%	2.8%	2.2%	0.0%	0.0%	0.0%	0.5%	1.4%	0.1%	0.0%	0.2%
Burlington	367	85.6%	10.5%	1.2%	0.8%	0.0%	0.1%	0.0%	0.1%	0.3%	0.3%	0.6%	0.1%	0.0%	0.6%
Camden	391	79.8%	13.2%	1.5%	0.8%	1.16	0.5%	0.3%	0.0%	0.3%	1.1%	0.4%	0.3%	0.0%	0.3%
Cumberland	374	81.0%	14.8%	2.0%	0.3%	0.3%	0.0%	0.3%	0.0%	0.0%	0.5%	0.6%	0.0%	0.0%	0.3%
Gloucester	371	83.6%	11.1%	1.5%	1.0%	0.3%	0.0%	0.3%	0.0%	0.6%	0.6%	0.4%	0.2%	0.0%	0.6%
Mercer	349	79.0%	14.7%	2.6%	1.3%	0.1%	0.0%	0.2%	0.1%	0.3%	0.6%	0.9%	0.1%	0.0%	0.1%
Salem	366	80.6%	13.6%	3.0%	1.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.5%	0.2%	0.0%	0.0%
Phil.NAA Portion		**70.5%**	**14.8%**	**1.6%**	**5.0%**	**3.6%**	**2.0%**	**0.4%**	**0.0%**	**0.2%**	**0.5%**	**1.1%**	**0.1%**	**0.0%**	**0.2%**
Atlan. City CBD	348	58.7%	19.6%	4.0%	5.7%	3.2%	0.3%	0.3%	0.3%	0.0%	1.6%	2.3%	0.1%	3.9%	0.0%
Atlantic	216	80.7%	14.1%	2.5%	0.6%	0.0%	0.0%	0.5%	0.0%	0.0%	0.6%	0.6%	0.0%	0.0%	0.5%
Cape May	372	75.4%	13.6%	4.0%	0.7%	0.3%	0.0%	0.0%	0.0%	0.3%	2.8%	2.2%	0.3%	0.2%	0.1%
Atl. City NAA		**73.4%**	**15.5%**	**3.2%**	**2.1%**	**0.9%**	**0.1%**	**0.3%**	**0.1%**	**0.1%**	**1.3%**	**1.4%**	**0.1%**	**1.1%**	**0.3%**

Table 6: Driving Distance Traveled To Work by Employment Location

Employment Location	Total Responses	5 Miles or Less	6-10 Miles	11-20 Miles	Over 20 miles
Bucks County	318	39.0%	28.3%	24.5%	8.2%
Chester County	306	28.8%	28.8%	26.5%	16.0%
Delaware County	286	46.2%	19.9%	21.3%	12.6%
Montgomery County	359	33.1%	27.3%	24.2%	15.3%
Philadelphia CBD	176	25.6%	27.3%	23.9%	23.3%
Philadelphia Non CBD	288	34.7%	27.8%	26.7%	10.8%
Burlington County	311	35.0%	29.3%	24.8%	10.9%
Camden County	319	34.5%	28.5%	24.5%	12.5%
Cumberland County	311	46.3%	27.3%	21.9%	4.5%
Gloucester County	301	39.5%	26.9%	23.3%	10.3%
Mercer County	298	32.2%	29.9%	25.2%	12.8%
Salem County	296	43.6%	27.7%	19.9%	8.8%
Philadelphia NAA Portion*		**34.6%**	**27.4%**	**24.6%**	**13.4%**
Atlantic City	236	30.1%	33.9%	22.9%	13.1%
Atlantic County (Exc.Atl. City.)	179	34.6%	22.3%	23.5%	19.6%
Cape May County	296	47.6%	25.7%	19.3%	7.4%
Atlantic City NAA*		**36.1%**	**26.3%**	**22.4%**	**15.2%**

*Note: percentages for nonattainment areas are derived from county-level data weighted by employment.

Prepared by the Delaware Valley Regional Planning Commission **July, 1993**

Table 7: Driving Time to Work by Employment Location

Employment Location	Total Responses	Under 10 Minutes	11-20 Minutes	21-40 Minutes	Over 40 Minutes
Bucks County	318	31.8%	36.5%	22.0%	9.7%
Chester County	306	24.5%	37.6%	27.8%	10.1%
Delaware County	286	31.5%	36.4%	22.4%	9.8%
Montgomery County	359	24.5%	32.3%	31.5%	11.7%
Philadelphia CBD	176	9.7%	18.2%	38.6%	33.5%
Philadelphia Non CBD	288	18.1%	31.3%	37.8%	12.8%
Burlington County	311	29.9%	35.4%	25.1%	9.6%
Camden County	319	27.3%	32.6%	29.2%	11.0%
Cumberland County	311	42.8%	39.2%	15.1%	2.9%
Gloucester County	301	37.5%	35.2%	21.3%	6.0%
Mercer County	298	28.9%	33.2%	25.2%	12.8%
Salem County	296	44.3%	34.1%	15.9%	5.7%
Philadelphia NAA Portion*		**24.8%**	**32.1%**	**29.6%**	**13.5%**
Atlantic City	236	19.9%	44.5%	23.7%	11.9%
Atlantic County (Exc. Atl. City.)	179	34.1%	26.3%	28.5%	11.2%
Cape May County	296	44.3%	32.1%	18.6%	5.1%
Atlantic City NAA*		**32.2%**	**32.6%**	**25.1%**	**10.1%**

*Note: aggregated percentages for nonattainment areas are derived from county-level data weighted by employment.

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Table 8: Number of Employees at the Work Site by Employment Location

Employment Location	Total Responses	1-49 Employees	50-99 Employees	100-999 Employees	≥ 1000 Employees	Don't Know
Bucks County	359	47.1%	12.3%	25.1%	11.7%	3.9%
Chester County	359	46.8%	10.3%	26.5%	13.4%	3.1%
Delaware County	335	45.7%	12.5%	22.1%	15.8%	3.9%
Montgomery County	409	43.0%	11.0%	26.7%	17.6%	1.7%
Philadelphia CBD	419	24.6%	7.4%	32.9%	32.0%	3.1%
Philadelphia Non CBD	394	37.8%	10.9%	26.9%	21.8%	2.5%
Burlington County	367	42.2%	13.6%	28.9%	10.6%	4.6%
Camden County	382	41.6%	14.4%	29.6%	11.8%	2.6%
Cumberland County	371	40.7%	11.9%	32.6%	11.9%	3.0%
Gloucester County	372	49.2%	13.2%	27.7%	6.7%	3.2%
Mercer County	348	33.6%	10.6%	26.4%	24.7%	4.6%
Salem County	366	47.5%	9.0%	19.9%	19.4%	4.1%
Philadelphia NAA Portion*		**40.0%**	**11.2%**	**27.4%**	**18.3%**	**3.1%**
Atlantic City	348	24.7%	6.6%	17.8%	47.4%	3.4%
Atlantic County (Exc. Atlantic City)	217	48.8%	13.4%	26.7%	9.7%	1.4%
Cape May County	372	56.7%	13.7%	15.6%	8.6%	5.4%
Atlantic City NAA*		**43.7%**	**11.5%**	**21.9%**	**20.0%**	**2.8%**

* Note: percentages for nonattainment areas are derived from county-level data weighted by employment.

Prepared by the Delaware Valley Regional Planning Commission **July, 1993**

Table 9: Year Round or Summer Job by Employment Location

Employment Location	Total Responses	All Year Job	Summer Job
Bucks County	362	97.0%	3.0%
Chester County	360	98.3%	1.7%
Delaware County	336	98.5%	1.5%
Montgomery County	414	98.1%	1.9%
Philadelphia CBD	421	99.3%	0.7%
Philadelphia Non CBD	401	98.3%	1.7%
Burlington County	363	97.5%	2.5%
Camden County	386	98.4%	1.6%
Cumberland County	370	96.8%	3.2%
Gloucester County	370	96.8%	3.2%
Mercer County	347	96.8%	3.2%
Salem County	365	97.3%	2.7%
Philadelphia NAA Portion*		**98.0%**	**2.0%**
Atlantic City	348	98.3%	1.7%
Atlantic County (Exc. Atlantic City)	215	96.7%	3.3%
Cape May County	370	89.7%	10.3%
Atlantic City NAA*		**95.7%**	**4.3%**

*Note: percentages for nonattainment areas are dervived from county-level data weighted by employment.

Prepared by the Delaware Valley Regional Planning Commission **July, 1993**

Table 10: Drop Off Family Members Within a Half Mile of the Driver's Job on the Way To Work by Employment Location

Employment Location	Total Responses	Yes	No
Bucks County	342	8.2%	91.8%
Chester County	339	14.2%	85.8%
Delaware County	300	13.0%	87.0%
Montgomery County	389	13.9%	86.1%
Philadelphia CBD	190	11.1%	88.9%
Philadelphia Non CBD	317	13.2%	86.8%
Burlington County	350	7.1%	92.9%
Camden County	362	9.9%	90.1%
Cumberland County	350	11.1%	88.9%
Gloucester County	345	6.4%	93.6%
Mercer County	320	10.6%	89.4%
Salem County	338	6.8%	93.2%
Philadelphia NAA Portion*		**11.5%**	**88.5%**
Atlantic City	261	9.6%	90.4%
Atlantic County (Exc. Atlantic City)	201	10.4%	89.6%
Cape May County	327	9.2%	90.8%
Atlantic City NAA*		**9.9%**	**90.1%**

*Note: percentages for nonattainment areas are derived from county-level data weighted by employment.

Prepared by the Delaware Valley Regional Planning Commission **July, 1993**

Table 11: Number of People Requiring a Car for Work by Employment Location

Employment Location	Total Responses	Yes	No
Bucks County	338	21.9%	78.1%
Chester County	333	27.0%	73.0%
Delaware County	298	21.1%	78.9%
Montgomery County	381	24.9%	75.1%
Philadelphia CBD	188	24.5%	75.5%
Philadelphia Non CBD	316	25.0%	75.0%
Burlington County	348	25.0%	75.0%
Camden County	360	26.1%	73.9%
Cumberland County	349	20.1%	79.9%
Gloucester County	345	17.4%	82.6%
Mercer County	321	17.8%	82.2%
Salem County	337	17.2%	82.8%
Philadelphia NAA Portion*		**23.6%**	**76.4%**
Atlantic City	262	18.3%	81.7%
Atlantic County (Exc. Atlantic City)	202	27.2%	72.8%
Cape May County	324	24.1%	75.9%
Atlantic City NAA*		**24.1%**	**75.9%**

*Note: percentages for nonattainment areas are derived from county-level data weighted by employment.

Prepared by the Delaware Valley Regional Planning Commission **July, 1993**

Table 12: Household Car Ownership by Employment Location

Employment Location	Total Responses	0 Cars	1 Car	2 Cars	3 Cars	4 Cars	Refused
Bucks County	296	1.4%	24.0%	44.3%	15.9%	11.8%	2.7%
Chester County	291	0.7%	22.0%	48.8%	16.5%	9.6%	2.4%
Delaware County	262	5.7%	26.0%	43.1%	16.8%	5.7%	2.7%
Montgomery County	362	0.6%	22.4%	52.2%	14.6%	8.3%	1.9%
Philadelphia CBD	389	10.0%	38.8%	36.8%	9.0%	2.6%	2.8%
Philadelphia Non CBD	374	8.3%	34.5%	36.6%	11.5%	4.5%	4.5%
Burlington County	291	0.7%	27.8%	47.1%	15.1%	7.2%	2.1%
Camden County	323	2.8%	22.0%	47.7%	13.3%	8.7%	5.6%
Cumberland County	307	2.3%	23.5%	47.2%	17.9%	7.2%	2.0%
Gloucester County	288	0.7%	18.1%	46.9%	20.1%	9.7%	4.5%
Mercer County	282	1.1%	20.9%	48.2%	16.3%	9.9%	3.5%
Salem County	269	2.2%	23.4%	43.9%	15.6%	9.3%	5.6%
Philadelphia NAA Portion*		**3.9%**	**26.9%**	**44.4%**	**14.3%**	**7.2%**	**3.3%**
Atlantic City	296	9.5%	31.4%	36.5%	11.5%	6.8%	4.4%
Atlantic (Exc. Atlantic City)	203	1.5%	23.2%	52.7%	9.4%	9.4%	3.9%
Cape May County	283	3.2%	29.0%	40.3%	14.1%	10.6%	2.8%
Atlantic City NAA*		**4.1%**	**26.7%**	**45.6%**	**11.0%**	**8.9%**	**3.8%**

*Note: percentages for nonattainment areas are derived from county-level data weighted by employment.

Prepared by the Delaware Valley Regional Planning Commission **July, 1993**

Table 13: Age of Employees by Employment Location

Employment Location	Total Responses	30 Years Old or less	31-40 Years Old	41-50 Years Old	51-62 Years Old	Over 62 Years Old
Bucks County	363	41.0%	23.7%	19.8%	12.7%	2.8%
Chester County	361	47.4%	24.4%	16.6%	9.7%	1.9%
Delaware County	340	45.9%	22.6%	16.5%	12.6%	2.4%
Montgomery County	416	38.0%	28.4%	18.3%	12.7%	2.6%
Philadelphia CBD	424	36.6%	29.2%	19.6%	11.6%	3.1%
Philadelphia Non CBD	402	39.8%	26.6%	21.1%	10.0%	2.5%
Burlington County	367	46.6%	21.8%	16.6%	10.6%	4.4%
Camden County	392	48.0%	19.6%	18.9%	11.5%	2.0%
Cumberland County	374	42.0%	21.9%	20.3%	12.6%	3.2%
Gloucester County	372	47.6%	22.8%	15.6%	11.6%	2.4%
Mercer County	350	42.0%	25.4%	20.6%	10.0%	2.0%
Salem County	367	49.6%	16.9%	18.0%	13.1%	2.5%
Philadelphia NAA Portion*		**42.0%**	**25.1%**	**18.9%**	**11.4%**	**2.6%**
Atlantic City	348	47.4%	21.6%	17.8%	9.5%	3.7%
Atlantic (Exc. Atlantic City)	217	41.0%	25.8%	21.2%	6.9%	5.1%
Cape May County	372	48.9%	19.1%	16.7%	11.6%	3.8%
Atlantic City NAA*		**44.5%**	**23.2%**	**19.3%**	**8.6%**	**4.4%**

*Note: percentages for nonattainment areas are derived from county-level data weighted by employment.

Table 14: Gender of Employees by Employment Location

Employment Location	Total Responses	Female	Male
Bucks County	276	46.0%	54.0%
Chester County	269	42.8%	57.2%
Delaware County	241	43.6%	56.4%
Montgomery County	337	46.0%	54.0%
Philadelphia CBD	367	55.3%	44.7%
Philadelphia Non CBD	354	45.5%	54.5%
Burlington County	271	43.5%	56.5%
Camden County	297	43.8%	56.2%
Cumberland County	283	55.8%	44.2%
Gloucester County	269	51.3%	48.7%
Mercer County	262	51.9%	48.1%
Salem County	243	49.0%	51.0%
Philadelphia NAA Portion*		**47.1%**	**52.9%**
Atlantic City	273	47.6%	52.4%
Atlantic County (Exc. Atlantic City)	190	46.3%	53.7%
Cape May County	267	52.1%	47.9%
Atlantic City NAA*		**47.9%**	**52.1%**

*Note: percentages for nonattainment areas are derived from county-level data weighted by employment.

Prepared by the Delaware Valley Regional Planning Commission **July, 1993**

Table 15: Household Income by Employment Location

Employment Location	Total Responses	Under $15,000	$15,000-$60,000	Over $60,000	Don't Know	Refused
Bucks County	291	3.8%	55.3%	19.9%	2.7%	18.2%
Chester County	286	3.5%	53.1%	21.0%	1.7%	20.6%
Delaware County	257	5.4%	55.3%	21.4%	2.3%	15.6%
Montgomery County	358	2.2%	54.2%	26.0%	3.6%	14.0%
Philadelphia CBD	382	3.7%	56.8%	24.6%	1.6%	13.4%
Philadelphia Non CBD	363	6.3%	62.5%	19.6%	1.4%	10.2%
Burlington County	282	3.5%	55.3%	23.8%	2.5%	14.9%
Camden County	311	6.8%	51.8%	25.4%	3.5%	12.5%
Cumberland County	301	7.3%	57.5%	19.9%	1.7%	13.6%
Gloucester County	275	8.4%	55.3%	20.7%	4.7%	10.9%
Mercer County	272	1.5%	56.6%	27.6%	2.2%	12.1%
Salem County	255	5.5%	56.5%	16.9%	2.7%	18.4%
Philadelphia NAA Portion*		**4.4%**	**56.3%**	**22.9%**	**2.4%**	**13.9%**
Atlantic City	287	5.6%	57.5%	20.9%	3.1%	12.9%
Atlantic County (Exc. Atlantic City)	195	5.6%	57.9%	24.6%	2.6%	9.2%
Cape May County	274	8.0%	56.2%	17.2%	4.7%	13.9%
Atlantic City NAA*		**6.1%**	**57.5%**	**22.0%**	**3.2%**	**11.2%**

*Note: percentages for nonattainment areas are derived from county-level data weighted by employment.

Prepared by the Delaware Valley Regional Planning Commission **July, 1993**

4. Average Vehicle Occupancy Rates

The major purpose of this study is to determine 1992 AVO rates for AM peak period work trips for portions of the Philadelphia and Atlantic City regions. AVO rates are area-wide measures of vehicle usage for work trip purposes. They are derived by dividing the total number of employees in a given area by the number of vehicles used to arrive at the worksite. In developing worker and trip profiles, data is often collected for an entire week, Monday to Friday, (as was the case with this study) so as to produce an AVO which is averaged over the course of one week. For this study, only trips to a worksite between 6 and 10 AM on a weekday are considered.

The number of vehicles attributed to an individual's work trip may be expressed as a fraction because car and van pools are counted as partial vehicles. Drive-alone commuters are attributed one full vehicle per work trip, whereas persons who walk, bicycle, or work at home are attributed no vehicles per trip.

1992 AVO Rates

Based on data from the random phone survey, 1992 AVO rates were derived for each county and sub-county area in the study area (Table 16). The Philadelphia CBD, including University City, possesses the region's highest AVO at 2.85. The next highest AVO rates are also urbanized areas: Atlantic City (1.55) and the remainder of Philadelphia (1.45). Suburban county rates are somewhat lower. They range from 1.10 (Burlington County) to 1.24 (Cape May County).

The aggregated AVO rate for the portion of the Philadelphia Nonattainment Area in the study area 1.30. The AVO rate for the Atlantic City Nonattainment Area is 1.27. This rate is derived from aggregating county and sub-county AVO rates "weighted" by employment. To derive an aggregate AVO rate the following equation was used:

$$\text{Aggregated AVO} = \frac{E_1+E_2+\ldots+E_n}{\frac{E_1}{A_1}+\frac{E_2}{A_2}+\ldots+\frac{E_n}{A_n}}$$

where E_1 = employment in County One; and A_1 = AVO rate in County One.

Modified 1992 AVO Rates for New Jersey

The proposed rule for the Employer Trip Reduction Program in New Jersey does not permit family members who are dropped off on the way to work (a child at a day-care center, for example) to be counted as carpool occupants. This exclusion causes a change in the calculation of average vehicle occupancy. AVO rates for portion of New Jersey surveyed in this study range from 1.10 (in Burlington County) to 1.55 (in Atlantic City) where such family members are counted, but range from 1.06 to 1.46 where they are not. Appendix D lists New Jersey AVO rates modified to exclude family members dropped off on the way to work.

Conclusions

AVO rates are reflective of many variables including land use patterns, the density of development, and transit availability. In the study area, a variation of rates is evident. In general, more urbanized areas, such as the Philadelphia CBD and Atlantic City, have higher AVO rates. At the county level, suburban rates are generally closely clustered.

The AVO rates specified herein are based on factual 1992 data and adhere to available guidance in determining AVO. As a result, the rates and associated data should be useful to the states of New Jersey and Pennsylvania in making provisions to establish ETR Programs and comply with the requirements of the CAAA. AVO rates are key prerequisites for ETR programs.

Ultimately, it may be desirable to create AVO zones which do not correspond to the county or sub-county areas contained in this report. The AVO rates presented herein admit to such aggregations, provided the aggregations draw from a sufficient number of household phone surveys. In performing such aggregations, the equation for estimating aggregated AVO rates presented in this study should be employed. □

Table 16: 1992 AVO Rates for Work Trips in the Delaware Valley

Employment Location	Total Responses	Work Trips[1]	Vehicles Used[2]	Total Employment	AVO Estimate[3]
Bucks County	362	1,744	1544.83	245,345	1.13
Chester County	361	1,729	1474.96	197,752	1.17
Delaware County	338	1,634	1327.44	230,459	1.23
Montgomery County	414	2,002	1695.40	457,500	1.18
Phil. CBD and Univ. City	421	2,042	716.75	332,877	2.85
Phil. Non-CBD (Exc. Univ. City)	402	1,958	1354.55	503,997	1.45
Burlington County	367	1,790	1623.13	191,345	1.10
Camden County	391	1,883	1614.60	227,933	1.17
Cumberland County	374	1,783	1549.58	67,360	1.15
Gloucester County	371	1,778	1579.52	86,079	1.13
Mercer County	349	1,692	1442.32	220,592	1.17
Salem County	366	1,744	1475.72	29,221	1.18
Phil. NAA Portion	**4,516**	**NA**	**NA**	**2,790,460**	**1.30**
Atlantic City	348	1,565	1012.83	66,035	1.55
Atlantic (Exc. Atlantic City)	216	1,026	883.23	120,247	1.16
Cape May County	372	1,760	1419.00	49,265	1.24
Atlantic City NAA	**936**	**NA**	**NA**	**235,547**	**1.27**

NOTATIONS:

[1] Work Trips: the total number of trips to work by the survey respondents for the applicable job for the profiled week (Monday to Friday only). Each respondent could account for a maximum of 5 work trips.

[2] Vehicles Used: the total number of vehicles used by the survey respondents for the profiled week (Monday to Friday only). On a daily basis, the guidlines for determining the number of vehicles used is as follows: for transit users, the number is 0. For auto drivers (including motorcyclists) who drive alone, the number is 1. For car and vanpoolers, the number is the reciprocal of the number of people in the pool. If the number of people in the vanpool is greater than or equal to 9, the number is also 0. For people who walk or work at home or use bicycles, the number is 0. For people who are dropped off by a non-working member of the family or use a taxi or any other unspecified means to go to work, the number is 1. If the auto drivers drop off family member(s) on their way to work, the case is treated as a carpool.

[3] AVO Estimate: Calculated by dividing the number of work trips by the number of vehicles used. AVO represents a region-wide average irrespective of employer size.

SOURCES:

Employment: 1990 US Census, Bureau of Economic Analysis, 1990. For Philadelphia and Atlantic counties: Philadelphia City Planning Commission and New Jersey Transit, respectively.

APPENDICES

Appendix A: Guidelines for Estimating Average Vehicle Occupancy

The paragraphs below, which describe the methodology for estimating average passenger occupancy, also apply to the estimation of average vehicle occupancy:

Measured APO is calculated by dividing the number of employees who report to a worksite or another related activity center between 6 a.m. and 10 a.m. inclusive Monday through Friday by the number of vehicles in which these employees report to work over that 5-day period.

$$\text{Measured APO} = \frac{\text{Number of Employees}}{\text{Number of Vehicles}}$$

In determining the APO and the measured APO, all vehicles driven by the only occupant and all vehicles with eight or fewer adult seating positions should be counted proportionately. For example, an employee who drives to work alone is counted as an employee reporting to work that day in one vehicle. Another employee who shares a ride with two other employees would be counted as having reported to work that day in 1/3 of a vehicle. A third employee who arrives via bus would be counted as having reported to work in zero vehicles for that day.

Vehicles carrying employees of different companies are also allocated in the vehicle counts of those companies proportionately. If, for example, a vehicle carries one employee from employer A and three employees from employer B, each employee would arrive in 1/4 of a vehicle. Children that are dropped off at a daycare facility at, or within one half mile of the worksite are to be counted as occupants in the vehicle. Therefore, a parent who drops off two children at such a close-by childcare facility en route to the worksite will be counted as having reported to work in 1/3 of a vehicle.

If an employee is dropped off at the worksite by a vehicle that is not continuing to another worksite, then that employee is counted as having driven alone in a single vehicle. Employees who telecommute and spend their entire workday at home are included in the employee count for that day and assigned a zero vehicle count for that day. Full-time employees on a compressed work week schedule are to be included in the employee count for their compressed weekdays off and assigned a zero vehicle count on those days. An employee who walks or rides a bicycle for his or her entire trip to the worksite is assigned a zero count for that day.

A vehicle is included in the employer's vehicle count if it parks or drops the employee off at the worksite or if there is no mode of travel other than walking between parking the vehicle and the employee arriving at the worksite. Vehicles left at transit terminals, bus stops, or carpool formation points more than 2 miles from the worksite (or another State-selected distance adequate to discourage the artificial use of end-of-trip pooling as a compliance tactic, given the local geography and other conditions which might encourage or discourage such use) need not be counted. The examples in this paragraph should be applied in calculating the area AVO as well.

Appendix B: Telephone Survey and Interviewer Script

INTERVIEWER: _____ TIME: _____

SURVEY NO.: _____ DATE: _____

Philadelphia/Atlantic City Region
Average Vehicle Occupancy Survey

Introduction

Hello. This is (**FIRST NAME**) calling for the **DELAWARE VALLEY REGIONAL PLANNING COMMISSION**. We are conducting a brief five minute survey about transportation in your area. I need to speak with a person in your household who works on weekdays. Would that be you? Can you spare five minutes to answer some questions about how you commute to work? (Is he/she in? When is the best time to reach him/her?)

IF THERE IS A QUALIFIED PERSON AT THIS RESIDENCE, BUT THAT PERSON IS NOT AVAILABLE (INCLUDING ON VACATION), ARRANGE FOR A CALLBACK AND TERMINATE CALL. IF THERE IS NO QUALIFIED PERSON AT THIS RESIDENCE, THANK RESPONDENT AND TERMINATE CALL.

Eligibility status:

Respondent eligible 1
Other in household eligible 2
No one in household eligible 3

Questions

First, I would like to ask some questions about when you work.

1. Do you work at a job in which you start between 6 AM and 10 AM on a weekday, Monday through Friday?
   Yes 1
   No 2

IF NO: I'm sorry, we are looking for people who start work between 6 AM and 10 AM on a weekday. Is there anyone else in your household who might be eligible? (Is he/she in? When is the best time to reach him/her?). IF NO ONE ELIGIBLE: I would like to thank you for your time.

IF RESPONDENT WORKS MORE THAN ONE JOB, ALL QUESTIONS ABOUT THE JOB WILL REFER TO THE **FIRST** JOB AT WHICH THE RESPONDENT WORKED ON A WEEKDAY LAST WEEK (OR THE LAST WEEK WORKED).

2. In what county is your job located?

IF RESPONDENT DOES NOT KNOW COUNTY: In what state is your job located?

Pennsylvania counties:	Bucks	01
	Chester	02
	Delaware	03
	Montgomery	04
	Philadelphia	05
New Jersey counties:	Atlantic	06
	Bergen	07
	Burlington	08
	Camden	09
	Cape May	10
	Cumberland	11
	Essex	12
	Gloucester	13
	Hudson	14
	Hunterdon	15
	Mercer	16
	Middlesex	17
	Monmouth	18
	Morris	19
	Ocean	20
	Passaic	21
	Salem	22
	Somerset	23
	Sussex	24
	Union	25
	Warren	26
Delaware counties:	Kent	27
	New Castle	28
Doesn't know county:	New Jersey	29
	Pennsylvania	30
	Delaware	31
	New York	32
	Other	33

please specify if other: _____

IF RESPONDENT NAMES A COUNTY THAT IS NOT ON THE ABOVE LIST, OR WORKS IN NEW YORK: I'm sorry, that is outside of our survey area. Is there anyone else in your household who might be eligible? (Is he/she in? When is the best time to reach him/her?). IF NO ONE ELIGIBLE: I would like to thank you for your time. (TERMINATE CALL)

3. About how many people are employed by your company at your **particular** work location?
   - 1-49 1
   - 50-99 2
   - 100-999 3
   - 1,000 or more 4
   - Don't know 5

4. What days of the week do you normally work at this job?
   - Monday 1
   - Tuesday 2
   - Wednesday 3
   - Thursday 4
   - Friday 5
   - Saturday 6
   - Sunday 7

IF RESPONDENT DOES NOT WORK ON A WEEKDAY (MONDAY TO FRIDAY): I'm sorry, we are looking for people who work on a weekday. Is there anyone else in your household who might be eligible? (Is he/she in? When is the best time to reach him/her?).

IF NO ONE ELIGIBLE: I would like to thank you for your time. (TERMINATE CALL).

5. How many hours do you work each week at this job? ____

6. Is this a year-round job or a summer job?
   - Year-round 1
   - Summer 2

Now I would like to ask some questions about how you travel to work on weekdays, Monday through Friday.

7. Last week (or the last week you worked), how did you commute to work on **(NAME OF FIRST WEEKDAY CITED IN QUESTION 4)**? Please include all modes of transportation from your home to your workplace.
   - Carpooled (go to A, B, and C) 1
   - Vanpooled (go to A and B) 2
   - Drove alone (go to A and C) 3
   - Rode a bus or trolley bus (go to D) 4
   - Rode a train (go to D) 5

Rode a streetcar, subway/elevated (go to D) 6
Was dropped off by another who was not going to work 7
Took a taxi 8
Rode a motorcycle/moped 9
Rode a bicycle 10
Walked 11
Worked at home 12
Jitney 13
Other (specify) 14

_____

A. On your way to work on a weekday, do you stop to leave another family member at a school or day care center that is within a half mile of your job?
Yes 1
No 2

IF YES: How many people do you drop off? . . . . . ___

B. Including the driver (and any such family members), how many people are normally in your carpool/vanpool? ___

C. Does your employer or job require you to have your car at work for business purposes?
Yes 1
No 2

D. If you drive to get to public transit, is the distance you travel by public transit more than two miles?
Yes 1
No 2
Don't drive to public transit 3

QUESTIONS 8 AND 9 PERTAIN TO TRAVEL DISTANCE AND TIME

8. If you drive a car for all or part of your commute, what is the approximate one-way distance you drive in miles? ___

9. In minutes, what is the approximate total travel time for a <u>one-way</u> trip from your home to work? ___

10. Did you commute in the same way on the other weekdays last week?
Yes 1
No 2

IF YES, SKIP TO QUESTION 11. IF NO, REPEAT THE FOLLOWING QUESTION FOR EACH OF THE OTHER WEEKDAYS CITED IN QUESTION 4; FOR EACH DAY OF THE WEEK, CIRCLE ALL APPROPRIATE NUMBERS IN THE CORRESPONDING COLUMN OF THE FOLLOWING TABLE.

Last week (or the last week you worked), how did you commute to work on (Tuesday/Wednesday/Thursday/Friday)?

	T	W	Th	F
	--	--	--	--
Carpooled	1	1	1	1
Vanpooled	2	2	2	2
Drove alone	3	3	3	3
Rode a bus or trolley bus	4	4	4	4
Rode a train	5	5	5	5
Rode a streetcar, subway/elevated	6	6	6	6
Was dropped off by another who was not going to work	7	7	7	7
Took a taxi	8	8	8	8
Rode a motorcycle/moped	9	9	9	9
Rode a bicycle	10	10	10	10
Walked	11	11	11	11
Worked at home	12	12	12	12
Jitney	13	13	13	13
Other (specify)	14	14	14	14

_____

11. A. What is the complete street address of your place of employment? (SPECIFY WHETHER IT IS ROAD, STREET, AVENUE, BOULEVARD, ETC.)

_____

_____

B. What is the city or town?_____

C. What is the state?_____

D. And what is the ZIP Code?_____

IF ANY PART OF THE ADDRESS IS NOT KNOWN:

E. What is the municipality (city, township or borough) in which your place of employment is located?

_____

F. What are the names of the streets of the nearest intersection?

_____

Now I would like to ask you some questions about where you live. (IF RESPONDENT IS HESITANT, REMIND HIM/HER THAT THE INFORMATION IS CONFIDENTIAL, AND THAT IT IS NEEDED IN ORDER TO DETERMINE COMMUTING PATTERNS).

_____

12. A. What is the complete street address of your residence? (SPECIFY WHETHER IT IS ROAD, STREET, AVENUE, BOULEVARD, ETC.)

_____

_____

B. What is the city or town?_____

C. What is the state?_____

D. And what is the ZIP Code?_____

IF ANY PART OF THE ADDRESS IS NOT KNOWN:

E. What is the municipality (city, township or borough) in which your residence is located?

_____

F. What are the names of the streets of the nearest intersection?

_____

13. In what county is your residence located?

Pennsylvania counties:	Bucks	1
	Chester	2
	Delaware	3
	Montgomery	4
	Philadelphia	5
New Jersey counties:	Atlantic	6
	Bergen	7
	Burlington	8
	Camden	9
	Cape May	10
	Cumberland	11
	Essex	12
	Gloucester	13
	Hudson	14
	Hunterdon	15
	Mercer	16
	Middlesex	17
	Monmouth	18
	Morris	19
	Ocean	20
	Passaic	21
	Salem	22
	Somerset	23
	Sussex	24
	Union	25
	Warren	26

Doesn't know county 27
Other 28
please specify if other: _____

Now, I would like to conclude this interview by asking you three questions about your household.

14. How many cars are owned by your household?
0 0
1 1
2 2
3 3
4 or more 4

15. Can you list the age and sex of everyone in your household who starts work between 6:00 a.m. and 10:00 a.m. on a weekday, beginning with yourself?

Respondent:	Age:_____	Sex: M F
1st household member:	Age:_____	Sex: M F
2nd household member:	Age:_____	Sex: M F
3rd household member:	Age:_____	Sex: M F
4th household member:	Age:_____	Sex: M F
5th household member:	Age:_____	Sex: M F
6th household member:	Age:_____	Sex: M F
7th household member:	Age:_____	Sex: M F
8th household member:	Age:_____	Sex: M F

16. Finally, which of the following broad categories include your annual household income:
One, less than $15,000 1
Two, between $15,000 and $60,000 2
Three, greater than $60,000 3
Don't know 4
Refused 5

END That is all of the questions I have. Thank you for your time and cooperation.

Appendix C: Expected Proportion of Completed Interviews in Each County of Employment by County of Residence

County of Residence	County of Employment												
	Bucks	Chester	Del.	Mont.	Phila.	Atlantic	Burl.	Camden	Cape May	Cumb.	Glouc.	Mercer	Salem
Bucks	.722	.013	.010	.109	.041	.001	.024	.014	.001	.001	.008	.140	.003
Chester	.005	.738	.092	.066	.016	.000	.004	.005	.001	.000	.003	.001	.005
Delaware	.009	.091	.727	.062	.080	.002	.008	.013	.004	.001	.013	.002	.012
Montgomery	.100	.112	.055	.598	.075	.001	.009	.014	.001	.000	.006	.006	.001
Philadelphia	.113	.033	.076	.141	.690	.008	.029	.049	.009	.001	.018	.011	.004
Atlantic	.001	.000	.001	.001	.002	.783	.005	.009	.074	.044	.013	.002	.004
Burlington	.020	.003	.008	.008	.023	.017	.707	.137	.003	.005	.029	.097	.010
Camden	.011	.005	.014	.010	.051	.052	.162	.641	.008	.017	.171	.011	.031
Cape May	.000	.000	.001	.000	.001	.064	.001	.002	.853	.016	.002	.000	.001
Cumberland	.000	.000	.000	.000	.000	.043	.002	.003	.032	.812	.023	.001	.068
Gloucester	.004	.003	.012	.004	.018	.025	.031	.106	.011	.058	.672	.004	.114
Mercer	.014	.001	.001	.001	.002	.001	.017	.003	.001	.000	.001	.724	.001
Salem	.000	.000	.002	.000	.001	.002	.002	.004	.002	.044	.040	.000	.745
TOTAL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Source: 1990 US Census

Appendix D: Modified 1992 AVO Rates for Work Trips in New Jersey*

***Passengers who are family members who are dropped off on the way to work are not counted as carpoolers.**

Employment Location	Total Responses	Work Trips[1]	Vehicles Used[2]	Total Employment	AVO Estimate[3]
Burlington County	367	1,790	1683.46	191,345	1.06
Camden County	391	1,883	1693.07	227,933	1.11
Cumberland County	374	1,783	1645.75	67,360	1.08
Gloucester County	371	1,778	1626.03	86,079	1.09
Mercer County	349	1,692	1519.32	220,592	1.11
Salem County	366	1,744	1533.13	29,221	1.14
Atlantic City	348	1,565	1068.33	66,035	1.46
Atlantic (Exc. Atlantic City)	216	1,026	928.00	120,247	1.11
Cape May County	372	1,760	1496.42	49,265	1.18

NOTATIONS:

[1] Work Trips: the total number of trips to work by the survey respondents for the applicable job for the profiled week (Monday to Friday only). Each respondent could account for a maximum of 5 work trips.

[2] Vehicles Used: the total number of vehicles used by the survey respondents for the profiled week (Monday to Friday only). On a daily basis, the guidelines for determining the number of vehicles used is as follows: for transit users, the number of vehicles is 0. For auto drivers (including motorcyclists) who drive alone, the number of vehicles is 1. For car and vanpoolers, the number of vehicles is the reciprocal of the number of people in the pool. If the number of people in the vanpool is greater than or equal to 9, the number of vehicles is also 0. For people who walk or work at home or use bicycles, the number is 0. For people who are dropped off by a non-working member of the family or use a taxi or any other unspecified means to go to work, the number is 1. *If the auto drivers drop off family member(s) on their way to work, the case is treated as a single-occupant vehicle.*

[3] AVO Estimate: Calculated by dividing the number of work trips by the number of vehicles used. AVO represents all employees regardless of employer size.

SOURCES:

Employment: 1990 US Census, Bureau of Economic Analysis, 1990. For Atlantic County: New Jersey Transit.

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