

A HANDBOOK FOR A DUAL FRAME METHODOLOGY
TO CONDUCT
TRANSIT MARKET RESEARCH

prepared by

ROBERT HITLIN RESEARCH ASSOCIATES, INC.
705 HILLWOOD AVENUE
FALLS CHURCH, VIRGINIA 22042
(703) 533-9150

and

SG ASSOCIATES, INC.
4200 DANIELS AVENUE
ANNANDALE, VIRGINIA 22003
(703) 750-3363

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I. INTRODUCTION

This handbook is a summary of a transit market research and analysis technique developed and conducted under contract with the Northern Virginia Transportation Commission in cooperation with the Falls Church Department of Planning and Development and the Fairfax County Office of Transportation.

This approach uses survey data to develop ridership estimates for public transit services. A "dual frame" methodology is used for collection of the survey data. The ridership is estimated by a screening process. The technique includes both self-administered surveys delivered to every housing unit in the target area and a followup telephone survey of non-respondents in each area. The resulting data is analyzed using a discriminant model-building approach that screens out unlikely transit users.

The estimates that result from this process are likely to be much more realistic than those derived from standard survey approaches. Transit research has clearly demonstrated the likelihood of overestimation of potential patronage if expressions of interest are accepted without further scrutiny. In one of the two instances where the technique has been applied the resulting estimate has been closely confirmed by the actual ridership of the new service. In the other location (where

service has not yet begun) the results have been accepted by local transit officials for planning purposes and are in line with the experience of similar systems in other cities.

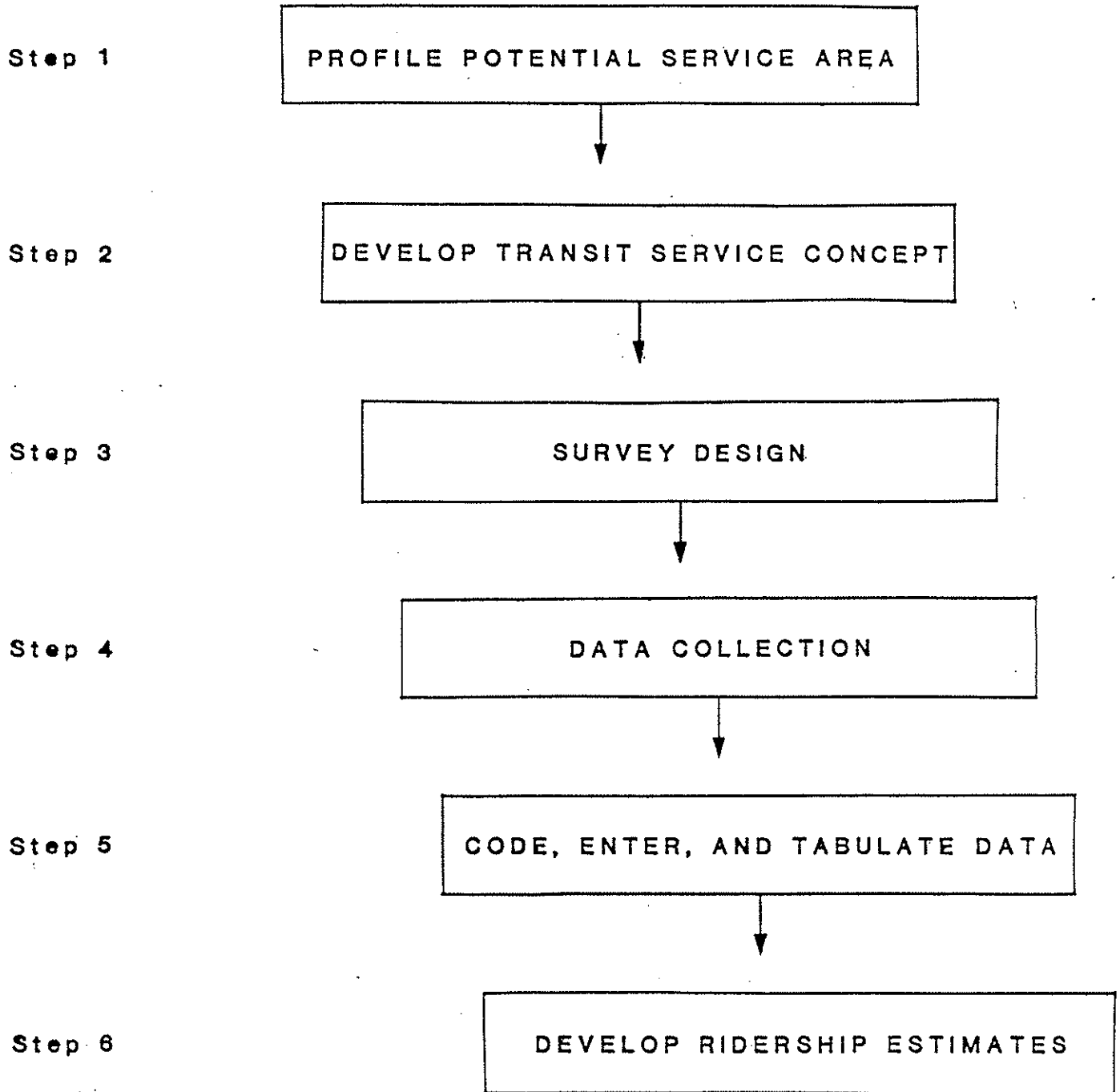
This technique for assessing demand for public transportation is adaptable for use in other areas. It is a cost-effective method for collecting data from potential transit users who are, statistically speaking, a "rare population," and for deriving reliable estimates of potential transit users. It also provides the ability to gather additional information to draw a profile of residents and their travel patterns that can be of use in general transportation planning unrelated to the immediate project.

This handbook describes the techniques involved. The appendices provide some details about their application in two Northern Virginia locations. The communities where the approach has been utilized have approximately 4000-4500 housing units each. These techniques could easily be applied to smaller areas. Larger areas can be studied if the resources, supervisory personnel, and labor are available. Readers interested in more details should refer to the final reports for the projects in Falls Church and Centreville, available from the Northern Virginia Transportation Commission (2009 N. 14th St., Suite 300, Arlington, Virginia 22201, (703) 524-3322).

The steps in this handbook are keyed to the steps in the flowchart presented in Figure 1. The techniques will need to be adapted to specific projects in specific locations, but the information presented in this handbook should be adequate to serve as an overall blueprint for the research design and planning process.

FIGURE 1

DUAL FRAME
FLOWCHART OF STEPS



II. RESEARCH PROCEDURES

Each section of this handbook is keyed to the steps in the flowchart presented in Figure 1 (page 6). Sample questionnaires are included in the Appendices.

Step 1. Profile the Service Area

The first step in designing the research project is to become familiar with the characteristics of the area under investigation. The service area profile serves at least three purposes:

1. To define the geographic limits of the household and telephone surveys;
2. To provide basic demographic data that are used to check the validity of survey results and to develop survey expansion factors; and
3. To help in designing the survey questionnaire, developing specific "screens" to be used in the transit patronage analysis, and in understanding the needs of the community in developing alternative transit service concepts to test in the research.

Data to be included in the area profile are:

1. Base maps showing all streets with a scale of about 1"=200'
2. The definition of the potential service area

3. Number of households by type (e.g., single family, apartment, etc.)
4. Current estimate of transit use
5. Labor force information
6. Housing density in each part of the area
7. Parts of the area that are commercial (and therefore not surveyed).

For some of these items current accurate data may not be available. The most recent U.S. Census is the best starting point, but in rapidly growing areas these data may be out of date. Estimates of current transit use can be developed using records of the transit operator currently serving the area. Census data may also provide an estimate of transit work trips. However, these data may not agree with other sources due to quirks in the Census phrasing of the question on "mode of travel to work."

From the profile several measures should be developed to check against the characteristics of the survey samples. There may in fact be some differences between the two sets of numbers due to rapid growth in an area, so it cannot be assumed that any differences from Census data indicate errors in data collection. As the 1980 Census data becomes more and more obsolete its utility as a benchmark obviously lessens. Some of the characteristics of the sample to check are:

1. Number of households
2. Persons per household
3. Workers per household
4. Current transit use (number of trips).

Step 2. Develop Transit Service Concept

Before developing a questionnaire or a sampling design it is essential to clearly specify the type of transit service that the project is designed to test. After frequency, hours of service, potential routes, and fare alternatives have been determined, the questionnaire can be designed to test public reaction to a clearly defined concept.

One of the questions in the screening process is "Would you use (or consider using) the transit service described?" In order to obtain valid responses to this question the proposed service must be described in sufficient detail to permit the respondent to make a considered evaluation. The elements of the system that affect rider choice - distance from residence, service frequency, travel time, fare - must be presented either as specifications or as options.

To avoid raising expectations the description should avoid detail unless a commitment to a specific service plan has already been made. Stated service parameters, such as travel

time, should be reasonable in order to elicit the most accurate responses possible.

Hours of service may or may not be presented. For a planning study it is best to avoid specifying the hours of service so that the widest potential market is identified. The screening process can be used to determine the effect of various hours of operation on expected patronage.

Some desired levels of service may simply be too costly to operate. Before settling on the concepts to be tested in the surveys it is advisable to investigate the general cost of purchasing, maintaining, and operating the vehicles for the desired level of service. Such measures as revenue vehicle-miles, total vehicle-hours, revenue vehicle-hours, etc., should be estimated to determine the realistic costs of such service before raising public expectations by including unrealistic options in the questionnaire.

Step 3. Survey Design

a. Questionnaire

The questionnaires should be printed on two sides of high quality paper (about 40 pound stock) in four page booklet form. The questionnaires should be designed by graphic artists to give

them the appearance of official public documents and to make them interesting looking and attractive as well.

The questionnaires utilized in the two Northern Virginia locations are included in the Appendices. They can be utilized in other locations after suitable modifications are made to adapt them to specific localities. The first page is a cover letter signed by local officials. The questions on pages 2 and 3 are designed to collect the screening information that will be used to screen out respondents, who, although they might respond that they would consider using the new transit service, would be unlikely to do so. These screening questions may need little or no modification before use in other locations. The questions on page 4 of each questionnaire are designed to test the alternative service concepts and must be completely customized in each instance.

Printing in this manner permits use of standard materials for pages 2 and 3 while pages 1 and 4 can be customized to a particular area. Each page of the questionnaire is 8 1/2 x 11" so that standard paper sizes can be used. Use of a smaller form is not recommended. The larger form is easy to fill out and can be "spotted" by crews picking up forms.

The questionnaire is designed to be closed-ended (self-coding) in order to make it as easy to fill out as possible and

to make certain that all responses are usable. The final question asks for additional comments. The comments will likely provide some interesting ideas for transportation planners to consider. Comments may also help the researchers understand some of the thinking behind the responses, and provides a deeper understanding of the results which otherwise would be based solely on percentages.

The variables included in the final questionnaire that are used to profile the transit service areas, to compare the results to Census data, and to build the discriminant patronage estimation models are the following:

Household Demographics

- o number in household
- o number of adults in household
- o number employed outside household
- o number of vehicles available for commuting
- o housing type

Individual Worker and Trip Characteristics

- o work location (zip code)
- o sex
- o is a vehicle available for commuting
- o current mode of travel
- o work start time
- o work end time
- o total commuting time
- o is workplace served by public transit
- o ever commuted by transit before
- o willingness to use mass transit in the future
- o is personal car needed at work
- o are children dropped off/picked up by car when going to/from work
- o parking cost, if applicable
- o if carpool or vanpool member, monthly charge and number in vehicle

Transit Service Concept

- o use of service at various times
- o use of service at several fare levels
- o interest in earlier or later service
- o which public transit station/stop will be used

Some modification of the questionnaire will be required in most instances to conform to the nature of the area being surveyed. In other instances, identical questions may be asked but it will only become clear after the fact that certain questions will not prove to be effective screens. For example, the question on auto availability was designed to identify transit captives. In both areas studied in Northern Virginia there was almost universal auto availability and so this question did not prove to be a useful screen. In other areas having lower auto ownership rates it might be more useful as a screening measure.

b. Focus Group

Prior to finalizing the questionnaires and research procedures a focus group session should be held involving residents from the research site. Participants can be invited by letter and then by telephone, and paid \$25 to attend the two-hour session. Citizens can be recruited from a variety of sources, including people who have contacted the local governments about

related issues and names drawn at random from the telephone book.

The purpose of the focus group session is to solicit comments from average citizens on the length, clarity, and format of the proposed questionnaires. Sponsoring agency officials should attend and participate in the discussion of the questions, instructions, and distribution and collection procedures.

c. Sampling Procedures

The dual frame methodology calls for two independent surveys to be conducted in each research site. The first survey is a self-administered questionnaire delivered to each housing unit, and the second is a random sample telephone survey of non-respondents to the door-to-door survey.

i. Household Survey

A questionnaire is placed on the door of every housing unit in the research area. Questionnaires can be attached to each¹ doorknob or screen door in clear plastic "hanger bags." Respondents should be instructed to complete the questionnaire (with

¹ Mail boxes cannot be used since it is illegal to use them for anything besides U.S. mail.

space provided for several workers per household) and leave it on the doorknob in the plastic bags to be picked up after 10:00 A.M. two days later.

Problems can arise in deriving estimates from surveys in which respondents are a self-selected sample. If propensity to respond is related to the major question under study (i.e., transit usage), and the respondents are therefore not typical or representative of the universe from which they come, a very inaccurate estimate will be made. As a check on this potential problem a telephone survey must be conducted of non-respondents to confirm that the self-selected respondents to this door-to-door survey gave responses that were similar on almost all questions to the telephone respondents.

The door-to-door survey gathers information at low cost from a large number of households and results in a comparatively small confidence interval around the final results. The "dual frame methodology", therefore, controls costs as well as sampling error

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While it is possible to pre-code the questionnaires to the housing unit level this approach is not recommended. To do so raises confidentiality and privacy questions. Such problems can be avoided while useful information is collected if questionnaires are coded at the block level while being picked up, and if addresses are crossed off on maps or master lists.

in the final estimate, while at the same time confirming the
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validity of the door-to-door survey results.

ii. Telephone Survey

A random sample of 200 households from each research site should be selected from among the housing units that do not respond to the door-to-door survey. Telephone numbers for the selected addresses can be obtained from a reverse ("criss-cross") directory. A sample size of 200 households yields an overall confidence interval of between +/- 4.2% and +/- 7.1% for each research site (see pages 30-31 for further explanation).

In the design of complex surveys when low response rates lead to suspicion of self-selection bias the most effective strategy is to conduct a supplementary random survey of the non-respondents. The purpose of such a supplementary survey is to determine whether non-respondents are similar to respondents. The resulting information either establishes that the respondents are indeed representative of the universe from which they were drawn,

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If the telephone survey results indicate that the door-to-door respondents are "untypical" on some major characteristic or on transit usage, weights derived from the telephone survey can be applied. This was not necessary in the two instances where the technique has been used so far. The Appendix contains tables comparing the survey results in Northern Virginia. The results of the door-to-door and telephone surveys in each location were clearly within each other's overlapping confidence intervals. In other words, self-selection bias was not a problem.

or provides some correction factors. For reasons of time and cost, however, supplementary surveys of initial non-respondents are rarely conducted in contemporary survey research.

This "dual frame" methodology uses an adapted version of this procedure. Non-respondents to the household survey are treated as a totally separate population in each location. A follow-up telephone survey of these non-respondents is conducted to derive independent estimates from these segments of the population. If the results of the two surveys are similar it is not necessary to apply any correction factors.

Step 4. Data Collection

a. Household Survey

A survey booklet must be delivered to each housing unit in each survey area. Labor can be provided by workers hired through

There is another potential use for the telephone survey. It can provide a patronage estimate for non-respondents to the household survey which can be added to the actual results of the household survey to arrive at a total estimate. The advantage of such an approach is that if the household results are considered as a universe (and not a sample) no sampling error need be included in interpreting that part of the totals. However, this means that the telephone survey sample needs to be very large in order to keep the confidence intervals associated with it small enough to be considered useful (since only a small proportion of people contacted will actually be transit users). This additional cost may negate the savings that are an important advantage of this dual frame approach.

a temporary employment agency. Other potential sources of labor are the Boy Scouts and Girl Scouts, and high school or college students. Questionnaires in clear plastic bags should be attached to each doorknob or screen door. The instructions on the questionnaire are that the booklets will be picked up two days later on a specified day after 10:00 A.M.

Distribution in each Northern Virginia location took place over a four day period. From 15 to 40 people can be involved in the distribution/collection process, depending on the size of the area and number of days allowed for the process. The density of an area (and the presence of high rise apartment buildings which are faster to distribute to than single family homes) will affect the time needed. For planning purposes it is safe to assume that each member of the survey crew can distribute about 30 forms per hour, and pick up about 40 per hour. Distributors were given maps and clipboards and instructed to note the address of each house when leaving a questionnaire. The distribution process will go smoothly if routes are worked out in advance and each member of the crew is given a map showing his or her route.

When the questionnaires are picked up the collectors should be instructed to cross off the number of each house or dwelling

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With a likely response rate of about 25% the workers will have many fewer questionnaires to pick up than to distribute. Only surveys which have been placed outside the residence are to be picked up. They still have to cover the entire route, however.

unit from which a response is obtained. If possible, the crew members should pick up forms along the same route to which they distributed forms. In some areas with high density housing, lists of addresses can be made rather than using the maps themselves. Census block numbers can also be recorded on each questionnaire for use in subsequent analysis.

Other specific guidelines for this type of survey are as follows;

1. This type of door-to-door activity should not be conducted during the winter. The danger of cold weather, snow and ice make the work difficult, and potentially dangerous.

2. This activity can be conducted by high school or college students, but there is always difficulty in recruiting and relying on adequate numbers of them.

3. Even when dealing with adults hired through a temporary agency, many (20%) of the people who promise to show up will not. Hire more people than are needed to do the job.

4. The most efficient approach is to have a supervisor work directly with three or four people. The supervisor needs copies of maps on which to outline specific walking routes, and can do some of the work himself. A supervisor who has to work with more than 4 people may not be able to move people to new areas as soon as they complete their sections, resulting in some loss of time. Whatever the supervisory patterns that are employed, constant supervision is a must.

5. The temporary distribution/collection employees have little incentive to record address and block data thoroughly and carefully. Supervisors must pay careful attention to insure the accuracy of the records kept by collection/ distribution personnel. Close supervision, especially at the beginning, is essential.

6. If they are not readily available, maps of the areas to be surveyed must be developed prior to field work. They should be as clear as possible, at an appropriate scale and must include legible street names. If geographic analysis of the results is desired the block numbers must be clearly marked on maps given to survey workers. Prior to the survey the field supervisor should visit the area to check the housing density and accuracy of the maps in order to estimate the amount of time and labor needed to complete the task.

7. Distribution routes should be predetermined along with personnel drop off/pick up points.

8. Schedule distribution routes to provide for supervisor contact at least every 30 minutes. At each contact the supervisor should review the records being kept.

10. Forms should be prepared if the scale of the maps is not large enough to permit direct recording of addresses (see Figure 2).

11. To the extent feasible, use the same worker for pick up and drop off in a given area. Familiarity with the area speeds the process.

12. Specific block numbers should be assigned to each block in the survey area. Crew members should note the block number on the returned forms at the time of pick up.

b. Telephone Survey

A telephone survey of workers from a sample of non-responding housing units must be conducted for each research site. The samples can be drawn from a reverse ("criss-cross") directory that lists all streets and addresses alphabetically. The records kept during the door-to-door survey are the basis for determining the eligibility of a household for inclusion in the telephone survey.

A problem that may arise during the sample selection is that the directory may not list apartment numbers within garden apartment or high rise developments. Instead there may be only alphabetical listings of residents. In such cases, random samples should be drawn from these buildings. Consequently, some people called on the phone will indicate that they have already returned the questionnaires. This may result in some inefficiency in the survey, but should not be a major problem. These people can be replaced in the sample by other names from the same developments.

The per completion price of the telephone survey is likely to be three to four times the per completion price for the

household survey. It is not possible to give precise dollar figures because so many variables are involved in a given area. Telephone surveys will vary because of the length of the questionnaire and the type of sampling done within each household. The cost of the household surveys will vary according to housing density, weather, the existence of high rise and low rise buildings, local labor rates, etc. What is certain, however, is that the household approach will yield many more completions and more data than the telephone approach will for the same amount of money. It does, however, require a much greater organizational effort.

Step 5. Code, Enter and Tabulate Data

All questionnaires must be thoroughly edited before data entry takes place. The largest problems are likely to involve the workplace zip codes supplied by the respondents if the area being studied is a complicated metropolitan area. Approximately 40% of the respondents in Northern Virginia could not supply their

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The comparative costs on the two Northern Virginia projects were approximately \$7 per respondent for the household survey and \$25 per respondent for the telephone surveys. These figures include all project costs - questionnaire development, sampling, editing, data entry, extensive computer analysis, and written reports. These per unit prices can be slightly reduced by adapting the questionnaires in the Appendices and by building on the experience contained in this Handbook. As a comparison, the Federal Highway Administration Office of Planning estimates total project costs for random door-to-door (in person) interviews at \$100 per completion, and \$50 if the housing units are highly clustered. Telephone costs can also run up to \$50 per completion.

workplace zip code. In these cases they were asked to supply either workplace addresses or the nearest intersection. Maps and zip code books can be consulted using this information to derive the zip codes. This is a very time consuming process at the editing stage.

Each questionnaire should receive a unique identification number (using an automatic numbering machine) that will allow it to be retrieved when machine processing identifies errors either in the coding or in the punching. All questionnaires should be subjected to range and logic checks to identify errors before the screening and estimation process begins.

The data processing can be done on a personal computer with sizable hard disk capability and commercially available statistical packages that have the ability to remove records from the data set in steps according to specified criteria. These are sometimes one variable criteria, and in other cases multiple variable criteria. While the basic logic of the screening process is not difficult to explain, it is complicated to translate it into computer language. The processing will require some sophisticated programming, data cleaning, and problem

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All of the statistical analysis in the Northern Virginia projects was done on an IBM XT with 10 megabyte hard disk using the SPSSPC+ statistical package. An 8087 Coprocessor is recommended to reduce processing time considerably.

solving abilities. It is advisable that only an experienced programmer/analyst undertake it.

Data can be entered directly onto floppy disks. Once keyed the data can be transferred directly to hard disk for editing and cleaning processes. Be certain to keep backup copies of the data at every stage to guard against machine or operator failure. The data sets will become sizable and may exceed the capacity of some editing programs. It is advisable to test all editing and screening programs with dummy data whose errors and results are designed in advance to be certain that all programs are in fact operating correctly.

Step 6. Develop Ridership Estimates

a. Screen Out Non-Riders

There is a well documented understanding among transit researchers that more people will generally indicate that they intend to use a proposed service than will in fact use it when it opens. The philosophy underlining the screening process is that by asking questions regarding current activity patterns, attitudes, and capabilities of the respondents it is possible to separate those who have a high probability of using the transit

service from those who "have an interest" or would "like the service" but are unlikely to use the service on a regular basis.

The ideal analytical situation in estimating potential patronage for proposed services would be to survey both users and non-users of similar services in other locations and to apply a formal "discriminant analysis" in order to classify the population into "transit user" and "non-user" segments. Since this is an expensive and unrealistic possibility in most research situations the questionnaire and discrimination questions were developed subjectively based on experience with other transit services and the screening was "all-or-nothing," i.e., a respondent was rated as either a probable transit user or as a probable non-user. Probabilities were either zero or one with no intermediate probabilities used.

The estimate that emerges from the screening and analysis stage is designed to be a "mature estimate" of patronage. It is really an estimate of the potential market for transit in a given area, excluding persons who are very unlikely to use transit. The estimate is actually the largest number of people that the transit service can hope to attract through effective marketing and reliable service. Patronage on new transit routes generally grows in the early stages until a plateau is reached. The methodology described in this handbook is designed to forecast

the approximate level of that plateau, excluding any population
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growth in the service area.

The screening questions are of 5 types:

Type 1. Propensity to use transit

- a. Will you consider using public transit on a regular basis to commute to work?
- b. Have you ever used public transit on a regular basis to commute to work?
- c. How do you generally travel to work?

Those who responded "no" to question 1a are excluded from the potential rider group. Question 1b has not yet been used in the screening process but could prove to be useful in the future.

Type 2. Work Place Location

- a. Is workplace served by public transit (within walking distance of a station/stop)?
- b. Workplace zip code
- c. Report to primary work location most of the time?

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One problem with this geographically based estimation technique is that some people from nearby areas not included in either survey may park/ride.

Type 3. Factors Related to Auto Use

- a. Vehicle available to drive to work
- b. Do you usually need your car at work?
- c. Do you need your car to drop off or pick up children at day care on your way to or from work?

Type 4. Time and Cost of Current Trip to Work

- a. How long does it take to get to work?
- b. Parking cost
- c. Carpool or vanpool charge per person (per month)

Type 5. Ability to Use Transit Service Offered

- a. Work start time from 6:30 A.M. to 9:30 A.M.
- b. Work end time from 3:30 P.M. to 6:30 P.M.

These are a stringent set of screens. Many people who indicate that they will use the transit option in fact fail these screens. Table 1 illustrates the effectiveness of the screening process in the two Northern Virginia locations.

As Table 1 indicates, the screening process reduced the number of respondents who contributed to the final estimates significantly. Through this discriminant-type filter procedure many of the kinds of respondents who traditionally account for

the overestimates in surveys of potential riders of new services
 9
 have been removed from the estimate.

TABLE 1
 IMPACT OF THE SCREENING PROCESS

	FALLS CHURCH	CENTREVILLE
Total Workers Responding	1162	1733
Workers Expressing Interest in Public Transit	546	563
Workers Passing All Screens	248	10 66

b. Calculation of Expansion Factors

The number of workers who pass all of the screens are a known fraction of the workers in a given area. The trips that will be made by these workers must be extrapolated to the universe from which they were drawn using the following formula to calculate expansion factors:

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See Appendices 3 and 4 for flow charts illustrating the detailed results of the screening process in Falls Church and in Centreville. Note that the number of respondents screened out at each stage is affected by the order in which the screens are applied.

10

These numbers will not match the figures found in the Centreville final report. Final estimates for Centreville were based on only those respondents who live in pre-selected areas scheduled to be served by new bus routes.

all_workers = (expansion factor)
workers responding to survey

c. Adjustments for "Frequency of Usage"

The questionnaire can contain a question asking potential riders how often they would use the new service. In one of the Northern Virginia projects the categories provided were 4-5 days/week, 1-3 days/week, and "less often," but other formulations of this question are possible. It is important to ask this question because research has demonstrated that as many as 15-20% of workers do not report to their regular place of work each day because of vacations, illness, or travel. These results can be applied as a correction factor to the patronage estimates.

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d. Calculation of Sampling Error

The calculation of all potential sampling errors and confidence intervals was done at the 95% level of confidence (+/- 1.96 standard errors) using the formula:

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The factor applied in Falls Church, for example, was .59. Additional adjustments may be made to remove potential commuters from the estimate who live in areas deemed impractical to serve when the final routes for the new service are established.

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See Earl Babbie, Survey Research Methods (Belmont, CA: Wadsworth), Chapter 5.

$$\text{Standard Error} = \frac{\sqrt{PQ}}{\sqrt{N}}$$

where:

P= proportion of riders estimated out of the total workers in the universe

Q= (1-P) 13

N= sample size

Since transit ridership is a statistical "rare event" the large sample sizes provided by the household survey are needed to avoid having very large confidence intervals that seriously reduce the utility of the eventual estimates.

For the 200 household sample size used in the telephone survey the confidence interval ranges from approximately +/- 4.2% when 10% are transit riders (P=.10, Q=.90) to approximately +/- 7.1% when 50% are transit riders (P=.50, Q=.50).¹⁴

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The potential sampling error calculations for Falls Church (free fare, 10 minute frequency) were as follows:

percent of workers estimated to use the service = 12.6%
sample size= 1162

$$\sqrt{\frac{(.126)(.874)}{1162}} (1.96) = .0097313 (1.96) = +/- 1.91\%$$

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Using the formula above a confidence interval can be calculated for results under 10% or over 90%.

III. CONCLUSION

This manual is designed as a step by step guide to a research procedure that can provide significant amounts of information for a modest investment of resources. It is a cost effective technique that gathers large amounts of data efficiently, including data that can be of use for planning purposes beyond the scope of the immediate project.

Estimates derived for locations where the techniques described in this manual have been applied have been found to be very reasonable by professional transportation planners. In addition, if the data is stored in the appropriate manner (i.e., if block numbers are coded for each survey form) they can also be used to plan routes for the service being studied.

IV. APPENDICES

DESCRIPTION OF PROJECT IN FALLS CHURCH

The Falls Church project was designed to estimate potential ridership for a proposed neighborhood minibus service serving the two new nearby Metrorail stations scheduled to open several months after the completion of the survey. Since Falls Church is an incorporated city the delineation of the service area posed no difficulty. The only complication was whether or not to include housing units on property that is partly in Falls Church and partly outside of it. The decision was made to include these properties since they do pay some taxes to the City.

Information about population and housing characteristics was available through the Falls Church Department of Planning and Development, as were detailed maps showing Census Block numbers and groupings. Falls Church is a city of approximately 4500 households and over 9000 people. Other sources of demographic information were the U.S. Census, and travel pattern analyses based on Census data compiled by Falls Church staff and by NRTC staff using data supplied by the Washington Metropolitan Council of Governments. Since Falls Church is an older suburban area with a comparatively stable population the demographic information and maps available were reliable and accurate.

Several proposed routes and frequencies were analyzed for overall cost, revenue vehicle-miles, total vehicle-hours, revenue vehicle-hours, etc., in order to estimate the realistic costs of such service. After studying the results of this analysis Falls Church staff decided to test the free, \$.25, .50 and .75 fare levels, and 10 and 20 minute frequencies in the survey.

CITY OF FALLS CHURCH TRANSPORTATION SURVEY



CITY OF FALLS CHURCH

Harry E. Wells Building • 300 Park Avenue • Falls Church, Virginia 22046

Mayor Carol W. DeLong
Vice Mayor Robert L. Hubbell

Elizabeth A. Blystone
W. John Cameron

Gary D. Knight
Edward B. Strat

J. Roger Wollenberg
(703) 241-6014

February, 1986

Dear Resident,

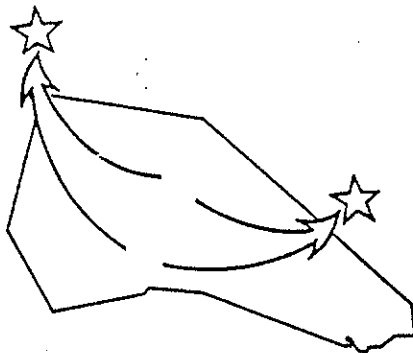
The City of Falls Church in cooperation with the Northern Virginia Transportation Commission is conducting a travel survey of households within the City. The main purpose of this survey is to determine residents' transportation needs. The information you provide will be used to shape future transportation policies within Falls Church. For example, the City is considering a mini-bus system that would link neighborhoods to the soon to be opened Metrorail stations.

Please take a few minutes to complete this survey and leave it on your doorknob in the plastic bag provided. The information you provide will be kept completely confidential and will not be used for any other purpose.

With kindest regards,

Carol W. DeLong

Carol W. DeLong, Mayor
Falls Church



John G. Milliken

John G. Milliken
Chairman, NVTC

INSTRUCTIONS:

- a. All persons in the household who are employed outside of the home should respond on this one questionnaire.
- b. Please leave the completed survey in the plastic bag and attach to your front door by 10 a.m., Saturday, February 22.

QUESTIONS ABOUT YOUR HOUSEHOLD

- 1. How many people live in your household? _____ (1)
- 2. How many are 18 years old or older? _____ (2)
- 3. How many are employed outside the home, either full-time or part-time? _____ (3)
- 4. How many vehicles are available for commuting to work (autos, pickups, vans, motorcycles, etc.)? _____ (4)
- 5. Housing Type? Single Family Detached 1. (5)
Town House 2.
Apartment or Apartment/Condominium 3.

IF NO ONE IS EMPLOYED OUTSIDE THE HOUSEHOLD, GO TO THE "ADDITIONAL COMMENTS" QUESTION ON THE BACK PAGE.

QUESTIONS ABOUT INDIVIDUAL WORKERS EMPLOYED OUTSIDE OF THE HOME

(NOTE: Three workers can use this same questionnaire. If there are more than three in the household, additional workers can respond in the margins.)

WORKER #1

- 6. Where do you work (address or nearest street intersection)?
street address _____ (6-10)
city/town _____ state _____ zip code _____
Do you report to this location most of the time? Yes 1. (11)
No 2.

ANSWER QUESTIONS IN COLUMN 1, NEXT PAGE.

WORKER #2

- 6. Where do you work (address or nearest street intersection)?
street address _____ (6-10)
city/town _____ state _____ zip code _____
Do you report to this location most of the time? Yes 1. (11)
No 2.

ANSWER QUESTIONS IN COLUMN 2, NEXT PAGE.

WORKER #3

- 6. Where do you work (address or nearest street intersection)?
street address _____ (6-10)
city/town _____ state _____ zip code _____
Do you report to this location most of the time? Yes 1. (11)
No 2.

ANSWER QUESTIONS IN COLUMN 3, NEXT PAGE.

	Worker #1	Worker #2	Worker #3		
20. When the Falls Church Metrorail stations are opened, which station do you expect to use most?	East Falls Church	1. <input type="checkbox"/>	1. <input type="checkbox"/>	1. <input type="checkbox"/>	(43)
	West Falls Church	2. <input type="checkbox"/>	2. <input type="checkbox"/>	2. <input type="checkbox"/>	
	Another Station	3. <input type="checkbox"/>	3. <input type="checkbox"/>	3. <input type="checkbox"/>	
	Do not plan to use Metrorail	4. <input type="checkbox"/>	4. <input type="checkbox"/>	4. <input type="checkbox"/>	

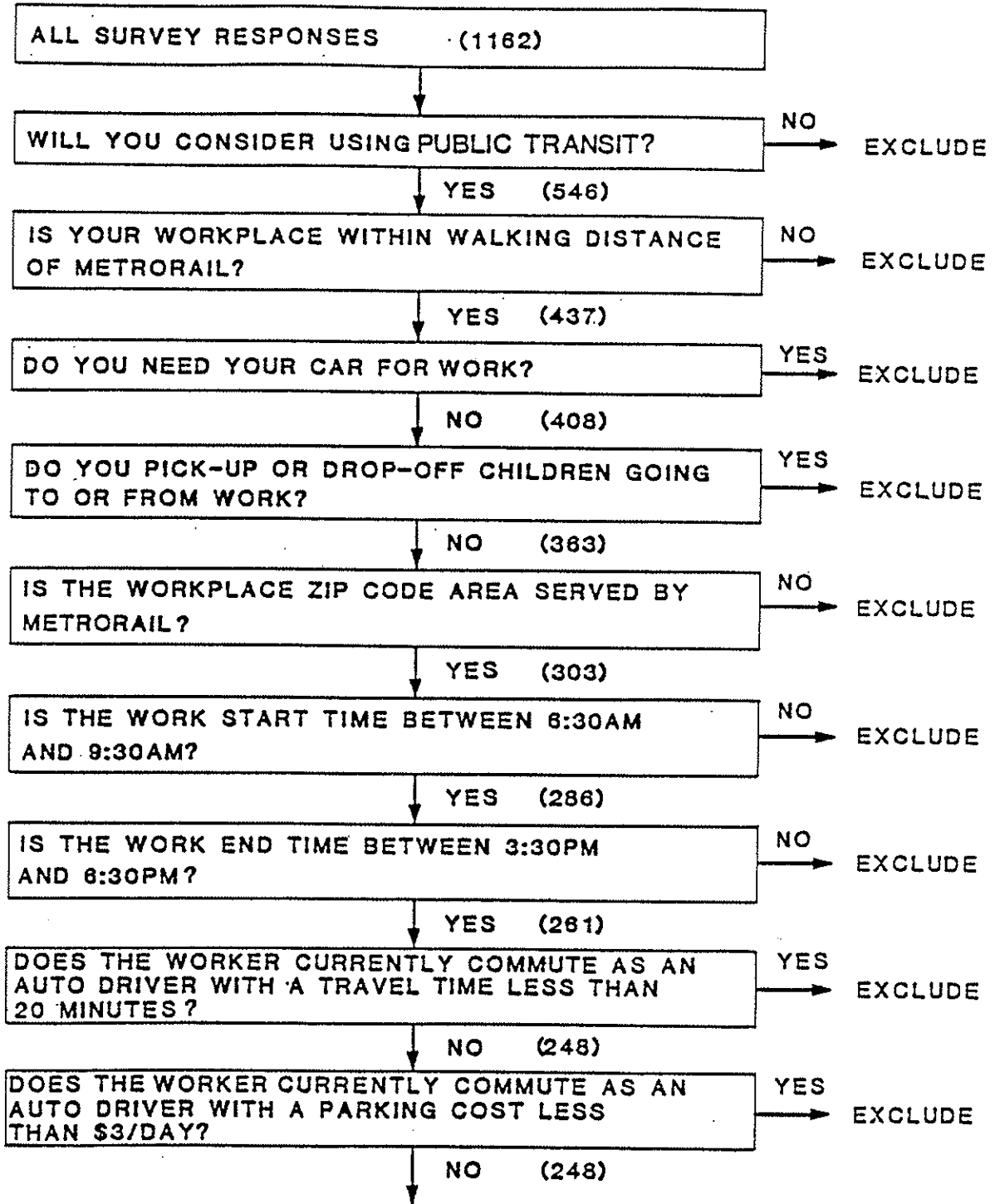
The City of Falls Church is considering a neighborhood connector bus service operating on residential streets and serving nearby Metrorail stations using minibuses. This service would run *only* in morning and evening peak commuting hours. The anticipated average travel time to the station will be about 10 minutes. The one way Metrorail fare from West Falls Church to downtown Washington, D.C., will be \$1.70.

	Worker #1	Worker #2	Worker #3		
21. Would you use this service if the minibus came every 10 minutes ?	Yes	1. <input type="checkbox"/>	1. <input type="checkbox"/>	1. <input type="checkbox"/>	(44)
	No	2. <input type="checkbox"/>	2. <input type="checkbox"/>	2. <input type="checkbox"/>	
22. Would you use this service if the minibus came every 20 minutes ?	Yes	1. <input type="checkbox"/>	1. <input type="checkbox"/>	1. <input type="checkbox"/>	(45)
	No	2. <input type="checkbox"/>	2. <input type="checkbox"/>	2. <input type="checkbox"/>	
23. Would you use it if the minibus fare were: (Please answer all questions.)					
a. free?	Yes	1. <input type="checkbox"/>	1. <input type="checkbox"/>	1. <input type="checkbox"/>	(46)
	No	2. <input type="checkbox"/>	2. <input type="checkbox"/>	2. <input type="checkbox"/>	
b. 25 cents?	Yes	1. <input type="checkbox"/>	1. <input type="checkbox"/>	1. <input type="checkbox"/>	(47)
	No	2. <input type="checkbox"/>	2. <input type="checkbox"/>	2. <input type="checkbox"/>	
c. 50 cents?	Yes	1. <input type="checkbox"/>	1. <input type="checkbox"/>	1. <input type="checkbox"/>	(48)
	No	2. <input type="checkbox"/>	2. <input type="checkbox"/>	2. <input type="checkbox"/>	
d. 75 cents?	Yes	1. <input type="checkbox"/>	1. <input type="checkbox"/>	1. <input type="checkbox"/>	(49)
	No	2. <input type="checkbox"/>	2. <input type="checkbox"/>	2. <input type="checkbox"/>	
24. If you are interested in the minibus service, how often would you use it?	4-5 Days/Week	1. <input type="checkbox"/>	1. <input type="checkbox"/>	1. <input type="checkbox"/>	(50)
	1-3 Days/Week	2. <input type="checkbox"/>	2. <input type="checkbox"/>	2. <input type="checkbox"/>	
	Less Often	3. <input type="checkbox"/>	3. <input type="checkbox"/>	3. <input type="checkbox"/>	

25. **Additional comments** on local transportation issues:

PLEASE PLACE THE COMPLETED SURVEY IN THE PLASTIC BAG AND ATTACH IT TO YOUR FRONT DOOR
BY 10:00 A.M., SATURDAY, FEBRUARY 22.

TECHNIQUE FOR SCREENING SURVEY RESPONSES



POTENTIAL USER OF MINIBUS SERVICE

NOTE: THE ORDER IN WHICH THE SCREENS WERE APPLIED AFFECTS THE NUMBER REMOVED AT EACH STAGE. THE ORDER DOES NOT AFFECT THE RESULT.

COMPARISON OF HOUSEHOLD AND TELEPHONE SURVEYS
FALLS CHURCH

NUMBERS ARE MEANS OR YES=1 AND NO=2	HOUSEHOLD OR TELEPHONE SURVEY?	
	HOUSEHOLD	TELEPHONE
PEOPLE IN HOUSEHOLD.....	2.7	2.8
ADULTS IN HOUSEHOLD.....	2.1	2.1
EMPLOYED OUTSIDE THE HOME.....	1.9	1.8
VEHICLES AVAILABLE FOR COMMUTING.....	1.9	2.0
REPORT TO WORKPLACE MOST OF THE TIME?.....	1.0	1.0
SEX.....	1.5	1.5
WORK WITHIN WALKING DISTANCE OF SUBWAY?..	1.5	1.5
EVER REGULAR TRANSIT USER?.....	1.5	1.5
WILL YOU USE NEW METRORAIL TO COMMUTE?	1.5	1.5
NEED CAR AT WORK?.....	1.8	1.7
DO YOU DROP OFF KIDS WHEN COMMUTING?.....	1.9	1.9
USE MINIBUS WITH 10 MINUTE FREQUENCY?.....	1.4	1.4
USE MINIBUS WITH 20 MINUTE FREQUENCY?.....	1.6	1.5
USE MINIBUS IF FREE?.....	1.4	1.4
USE MINIBUS IF 25 CENT FARE?.....	1.4	1.4
USE MINIBUS IF 50 CENT FARE?.....	1.7	1.6
USE MINIBUS IF 75 CENT FARE?.....	1.9	1.8

DESCRIPTION OF PROJECT IN CENTREVILLE

The Centreville area is a rapidly growing suburban area of approximately 4000 households for which up-to-date maps and population data do not exist. The purpose of the study in this area was to estimate potential ridership and optimal departure times for a planned feeder bus service to a soon to be opened Metrorail station.

Fairfax County property maps supplied by Fairfax County Office of Transportation staff were utilized along with commercially available maps, but these were incomplete due to the recent rapid growth of the area. Population data from the 1980 U.S. Census proved to be very outdated. The lack of adequate demographic data led to difficulties in estimating the number of households in the area, and therefore the amount of time, number of data collectors, and number of forms required.

The new Metrobus route from Centreville to the Metrorail station was approved before this survey was begun. Since Metrobus fares are fixed areawide the major questions to be answered by the survey were the expected level of demand for the proposed route, whether an extension of the route to other nearby areas would be justified, and the optimum departure times for the trips.

These questions were addressed by providing the currently proposed schedule to respondents and asking about interest in the service. Respondents were also asked if they would use the service if there were an earlier or later morning, or earlier or later evening trip in the schedule. Residents from areas not currently included in the proposed route were also included in the sample to obtain information on reaction to extending the proposed route.

CENTREVILLE TRANSPORTATION SURVEY



Northern Virginia Transportation Commission

Arlington Executive Building • 2009 North 14th Street • Suite 300 • Arlington, Virginia 22201 • (703) 524-3322

February, 1986

Chairman
John G. Milliken

Vice Chairman
George T. Snyder, Jr.

Secretary/Treasurer
Bernard S. Cohen

Commissioners:
City of Alexandria
James P. Moran, Jr.
Robert L. Calhoun

Arlington County
Ellen M. Bozman
Michael E. Brunner
John G. Milliken

Fairfax County
Joseph Alexander
Elaine McConnell
T. Farrell Egge
Nancy K. Falck
James M. Scott

City of Fairfax
George T. Snyder, Jr.

City of Falls Church
Carol W. DeLong

Virginia Department
of Highways & Transportation
Sally H. Cooper

Virginia General Assembly
Senator Joseph V. Gartlan, Jr.
Senator Edward M. Holland
Delegate Bernard S. Cohen
Delegate Robert E. Harris
Delegate Warren G. Stambaugh

Staff:
Executive Director
Richard K. Tauba

Dear Resident,

Fairfax County in cooperation with the Northern Virginia Transportation Commission is conducting a travel survey of households in the Centreville area. The main purpose of this survey is to determine residents' commuting needs. The information you provide will be used to shape future transportation policies in your community. For example, the survey results will help shape plans for bus service that will connect Centreville with the soon to be opened Vienna Metrorail station.

Please take a few minutes to complete this survey and leave it on your doorknob in the plastic bag provided. The information you provide will be kept completely confidential and will not be used for any other purpose.

With kindest regards,

Elaine McConnell
Fairfax County Supervisor,
Springfield District

John G. Milliken
Chairman, NVTC

INSTRUCTIONS:

- a. All persons in the household who are employed outside of the home should respond on this one questionnaire.
- b. Please leave the completed survey in the plastic bag and attach to your front door by 10 a.m., Saturday, February 22.

QUESTIONS ABOUT YOUR HOUSEHOLD

- 1. How many people live in your household? _____ (1)
- 2. How many are 18 years old or older? _____ (2)
- 3. How many are employed outside the home, either full-time or part-time? _____ (3)
- 4. How many vehicles are available for commuting to work (autos, pickups, vans, motorcycles, etc.)? _____ (4)
- 5. Housing Type?
 - Single-Family Detached 1. (5)
 - Town House 2.
 - Apartment or Apartment/Condominium 3.

IF NO ONE IS EMPLOYED OUTSIDE THE HOUSEHOLD, GO TO THE "ADDITIONAL COMMENTS" QUESTION ON THE BACK PAGE.

QUESTIONS ABOUT INDIVIDUAL WORKERS EMPLOYED OUTSIDE OF THE HOME

(NOTE: Three workers can use this same questionnaire. If there are more than three in the household, additional workers can respond in the margins.)

WORKER #1

6. Where do you work (address or nearest street intersection)?
- street address _____ (6-10)
- city/town _____ state _____ zip code _____
- Do you report to this location most of the time? Yes 1. (11)
- No 2.

ANSWER QUESTIONS IN COLUMN 1, NEXT PAGE.

WORKER #2

6. Where do you work (address or nearest street intersection)?
- street address _____ (6-10)
- city/town _____ state _____ zip code _____
- Do you report to this location most of the time? Yes 1. (11)
- No 2.

ANSWER QUESTIONS IN COLUMN 2, NEXT PAGE.

WORKER #3

6. Where do you work (address or nearest street intersection)?
- street address _____ (6-10)
- city/town _____ state _____ zip code _____
- Do you report to this location most of the time? Yes 1. (11)
- No 2.

ANSWER QUESTIONS IN COLUMN 3, NEXT PAGE.

		Worker #1	Worker #2	Worker #3	
7. Sex	Male	1. <input type="checkbox"/>	1. <input type="checkbox"/>	1. <input type="checkbox"/>	(12)
	Female	2. <input type="checkbox"/>	2. <input type="checkbox"/>	2. <input type="checkbox"/>	
8. Whether you use it or not, do you have a vehicle available to drive to work?	Yes	1. <input type="checkbox"/>	1. <input type="checkbox"/>	1. <input type="checkbox"/>	(13)
	No	2. <input type="checkbox"/>	2. <input type="checkbox"/>	2. <input type="checkbox"/>	
9. How do you generally travel to work? (Check all that apply.)	Drive Alone	1. <input type="checkbox"/>	1. <input type="checkbox"/>	1. <input type="checkbox"/>	(14)
	Carpool/Vanpool	2. <input type="checkbox"/>	2. <input type="checkbox"/>	2. <input type="checkbox"/>	(15)
	Bus	3. <input type="checkbox"/>	3. <input type="checkbox"/>	3. <input type="checkbox"/>	(16)
	Metrorail	4. <input type="checkbox"/>	4. <input type="checkbox"/>	4. <input type="checkbox"/>	(17)
	Other	5. <input type="checkbox"/>	5. <input type="checkbox"/>	5. <input type="checkbox"/>	(18)
10. What time do you start work?	A.M.	_____	_____	_____	(19-22)
	P.M.	_____	_____	_____	
11. What time do you leave work?	A.M.	_____	_____	_____	(23-26)
	P.M.	_____	_____	_____	
12. How long does it take you to get to work?	Minutes	_____	_____	_____	(27-29)
13. Is your workplace served by Metrorail (within walking distance of a station)?	Yes	1. <input type="checkbox"/>	1. <input type="checkbox"/>	1. <input type="checkbox"/>	(30)
	No	2. <input type="checkbox"/>	2. <input type="checkbox"/>	2. <input type="checkbox"/>	
14. Have you ever used public transit on a regular basis to commute to work (in this area or elsewhere)?	Yes	1. <input type="checkbox"/>	1. <input type="checkbox"/>	1. <input type="checkbox"/>	(31)
	No	2. <input type="checkbox"/>	2. <input type="checkbox"/>	2. <input type="checkbox"/>	
15. Will you consider using public transit to commute to work when Metrorail is opened to Falls Church and Vienna?	Yes	1. <input type="checkbox"/>	1. <input type="checkbox"/>	1. <input type="checkbox"/>	(32)
	No	2. <input type="checkbox"/>	2. <input type="checkbox"/>	2. <input type="checkbox"/>	
16. Do you usually need your car at work?	Yes	1. <input type="checkbox"/>	1. <input type="checkbox"/>	1. <input type="checkbox"/>	(33)
	No	2. <input type="checkbox"/>	2. <input type="checkbox"/>	2. <input type="checkbox"/>	
17. Do you drop off or pick up children at school or day care on your way to or from work?	Yes	1. <input type="checkbox"/>	1. <input type="checkbox"/>	1. <input type="checkbox"/>	(34)
	No	2. <input type="checkbox"/>	2. <input type="checkbox"/>	2. <input type="checkbox"/>	
18. What does it cost you to park?	Per Day	\$ _____	\$ _____	\$ _____	(35-38)
19. If you currently commute in a carpool or vanpool, what is the charge per person?	Per Month	\$ _____	\$ _____	\$ _____	(39-42)

Metrobus will establish a bus service from the Centreville area (via I-66) to the new Vienna Metro station when it opens this summer. The round trip bus fare from Centreville to the Vienna Station will be \$1.25. The one way Metrorail fare to Metro Center in downtown Washington, D.C., will be \$2.30 and to The Pentagon will be \$2.15.

A possible schedule for the bus service is:

MORNING			EVENING		
Leave Centreville	Arrive Vienna Metrorail Station	Arrive Metro Center or Pentagon	Leave Metro Center or Pentagon	Leave Vienna Metrorail Station	Arrive Centreville
6:00 A.M.	6:20 A.M.	6:55 A.M.	4:55 P.M.	5:30 P.M.	5:50 P.M.
6:30 A.M.	6:50 A.M.	7:25 A.M.	5:25 P.M.	6:00 P.M.	6:20 P.M.
7:00 A.M.	7:20 A.M.	7:55 A.M.	5:55 P.M.	6:30 P.M.	6:50 P.M.

20. If the bus operates on the major streets in your subdivision, and is within a 5 minute walk from your home will you use this service?
- | | Worker #1 | Worker #2 | Worker #3 | |
|-----|-----------------------------|-----------------------------|-----------------------------|------|
| Yes | 1. <input type="checkbox"/> | 1. <input type="checkbox"/> | 1. <input type="checkbox"/> | (43) |
| No | 2. <input type="checkbox"/> | 2. <input type="checkbox"/> | 2. <input type="checkbox"/> | |

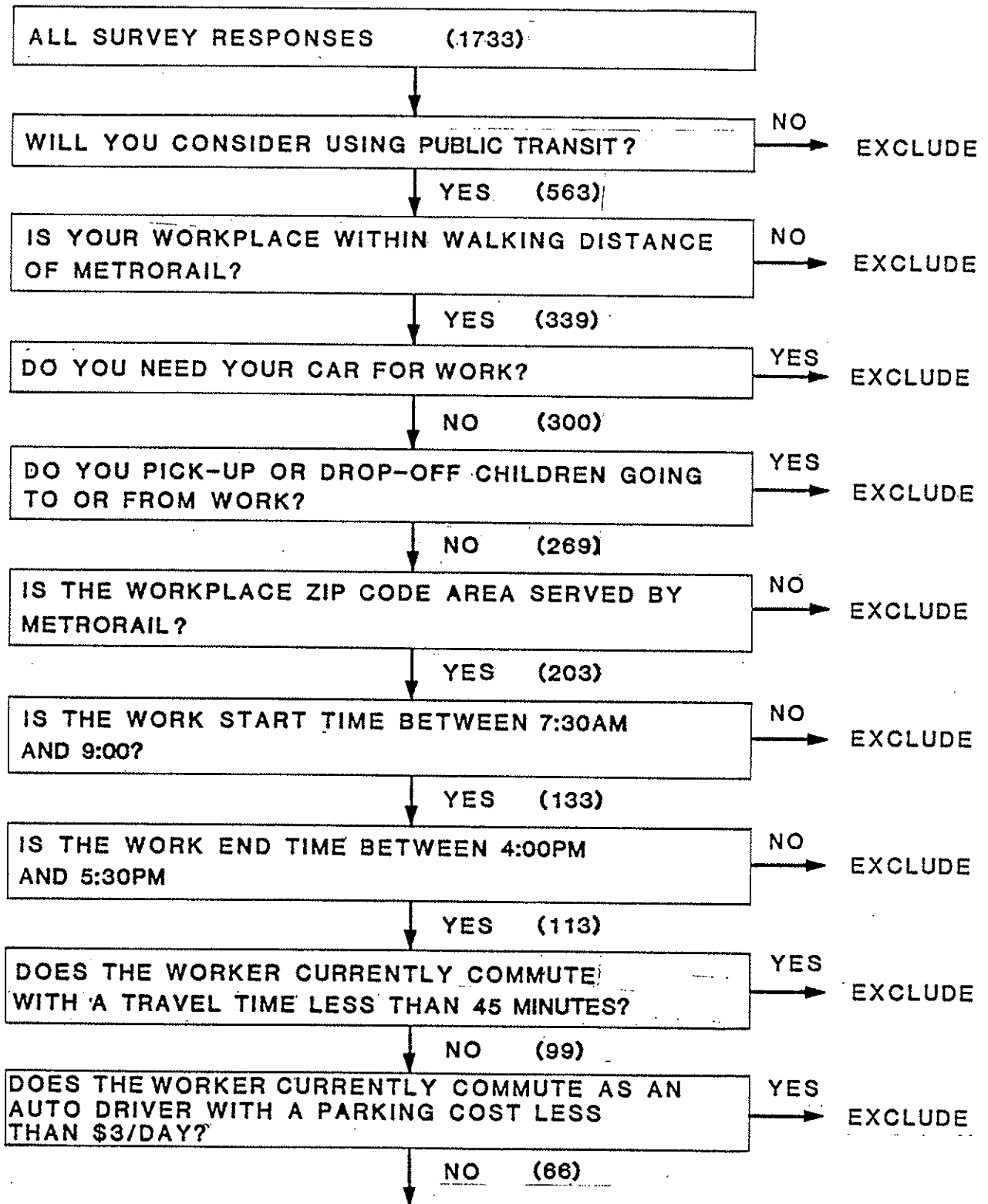
IF YOU ANSWERED "NO" TO QUESTION 20:

21. Please indicate if the addition of any of the following trips would result in your use of this service. (Please answer all questions.)
- a. An earlier morning bus?
- | | | | | |
|-----|-----------------------------|-----------------------------|-----------------------------|------|
| Yes | 1. <input type="checkbox"/> | 1. <input type="checkbox"/> | 1. <input type="checkbox"/> | (44) |
| No | 2. <input type="checkbox"/> | 2. <input type="checkbox"/> | 2. <input type="checkbox"/> | |
- b. A later morning bus?
- | | | | | |
|-----|-----------------------------|-----------------------------|-----------------------------|------|
| Yes | 1. <input type="checkbox"/> | 1. <input type="checkbox"/> | 1. <input type="checkbox"/> | (45) |
| No | 2. <input type="checkbox"/> | 2. <input type="checkbox"/> | 2. <input type="checkbox"/> | |
- c. An earlier evening bus?
- | | | | | |
|-----|-----------------------------|-----------------------------|-----------------------------|------|
| Yes | 1. <input type="checkbox"/> | 1. <input type="checkbox"/> | 1. <input type="checkbox"/> | (46) |
| No | 2. <input type="checkbox"/> | 2. <input type="checkbox"/> | 2. <input type="checkbox"/> | |
- d. A later evening bus?
- | | | | | |
|-----|-----------------------------|-----------------------------|-----------------------------|------|
| Yes | 1. <input type="checkbox"/> | 1. <input type="checkbox"/> | 1. <input type="checkbox"/> | (47) |
| No | 2. <input type="checkbox"/> | 2. <input type="checkbox"/> | 2. <input type="checkbox"/> | |

22. **Additional comments** on local transportation issues:

PLEASE PLACE THE COMPLETED SURVEY IN THE PLASTIC BAG AND ATTACH IT TO YOUR FRONT DOOR BY 10:00 A.M., SATURDAY, FEBRUARY 22.

TECHNIQUE FOR SCREENING SURVEY RESPONSES



POTENTIAL USER OF METROBUS SERVICE

NOTE: THE ORDER IN WHICH THE SCREENS WERE APPLIED AFFECTS THE NUMBER REMOVED AT EACH STAGE. THE ORDER DOES NOT AFFECT THE RESULT.

COMPARISON OF HOUSEHOLD AND TELEPHONE SURVEYS
CENTREVILLE

NUMBERS ARE MEANS OR YES=1 AND NO=2	HOUSEHOLD OR TELEPHONE SURVEY?	
	HOUSEHOLD	TELEPHONE
PEOPLE IN HOUSEHOLD.....	3.0	3.2
ADULTS IN HOUSEHOLD.....	2.1	2.1
EMPLOYED OUTSIDE THE HOME.....	2.0	1.9
VEHICLES AVAILABLE FOR COMMUTING.....	2.1	2.1
REPORT TO WORKPLACE MOST OF THE TIME?.....	1.0	1.0
SEX.....	1.5	1.5
WORK WITHIN WALKING DISTANCE OF SUBWAY?..	1.7	1.8
EVER REGULAR TRANSIT USER?.....	1.7	1.7
WILL YOU USE NEW METRORAIL TO COMMUTE?	1.7	1.7
NEED CAR AT WORK?.....	1.7	1.5
DO YOU DROP OFF KIDS WHEN COMMUTING?.....	1.9	1.8
WILL YOU USE THE NEW BUS SERVICE?.....	1.7	1.7
WANT AN EARLIER MORNING BUS?.....	1.9	2.0
WANT A LATER MORNING BUS?.....	1.8	1.9
WANT AN EARLIER EVENING BUS?.....	1.8	1.9
WANT A LATER EVENING BUS?.....	1.9	2.0