TABLE 35 Original Commuting Mode (information obtained from first survey)

Mode	Not Contacted		Nonparticipant		Still Carpooling		Not Still Carpooling	
	No.	%	No.	%	No.	%	No.	%
Bus	0	0.0	0	0.0	0	0.0	1	2.8
Motorcycle	0	0.0	0	0.0	0	0.0	1	2.8
Bicycle	0	0.0	1	2.0	0	0.0	0	0.0
Commuter van	0	0.0	0	0.0	0	0.0	0	0.0
Truck	0	0.0	0	0.0	0	0.0	0	0.0
Automobile	6	100.0	49	98.0	8	100.0	34	94.4
Total	6	100.0	50	100.0	8	100.0	36	100.0

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Survey and Analysis of Vanpooling in Metropolitan Washington, D.C.

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ABSTRACT

It is difficult to use traffic-counting programs in Washington, D.C., to accurately monitor vanpool occupancies because of the high speeds, high occupancies, and vision-restricting "privacy windows" of vans. A survey of vanpool operators was conducted to develop occupancy factors for traffic monitoring and also to collect other data of general interest. Because many of the vanpools in the Washington area are owner operated, a comprehensive survey of the entire population was not feasible through employers or third-party providers. Thus a license-plate survey technique was developed; it led to a mail-back survey that had a 57 percent response. A sample of the nonrespondents was contacted by telephone to correct for bias. Survey findings cover the following topics: number of vanpools, origins and destinations, occupancy rates, travel times and trip lengths, traffic assignment, collection-distribution characteristics, vehicle ownership, preferential treatment and parking, assistance from ridesharing agencies, and operators' concerns.

In the Spring of 1982 the Metropolitan Washington Council of Governments (COG) undertook a mail-back and telephone survey of operators of vanpools that had been spotted on major arterials in the morning peak period. The survey was conducted to develop average vanpool occupancy factors to be used in traffic volume and occupancy studies that are conducted by COG. Accurate monitoring of vanpools and their occupants is an important concern in the Washington, D.C., area because public agencies have implemented policies to encourage high-occupancy vehicle use in commuting, including restriction of certain highway lanes to carpools, vanpools, and buses. The immediate reason for the survey was the apparent rapid growth in vanpooling, coupled with difficulties in monitoring that result from high speeds, high occupancies, and dark passenger "privacy windows" of vans.

To perform such a survey and produce representative occupancy data, it was necessary to develop a method of sampling the total vanpool population. Many of the Washington, D.C., region's vanpools are known to be privately owned and operated, and these could not be located through employers or third-party vanpool providers. Thus the survey technique selected was license-plate monitoring in traffic, which led to a mail-back survey of vanpool operators. Because mail-back surveys are sometimes associated with nonrespondent bias, a telephone survey of a sample of the mail-back nonrespondents was also planned.

Although vehicle occupancies and traffic-count factors were the first concern of the study, it was

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recognized that the survey presented an exceptional opportunity to collect other data on vanpooling in Washington. Vanpool operators were therefore asked questions that explored such travel characteristics as route, trip distance, origin and destination, and parking cost. Inquiry was also made about some related topics: vehicle ownership, preferential treatment, assistance received from ridesharing agencies, and operators' concerns.

The occupancy factors developed from this survey have been previously documented in the 1983 Metro Core Cordon Count of Vehicle and Passenger Volumes (1). The purpose of this subsequent paper is to document the method and present and analyze the complete findings of the 1982 Washington vanpool survey.

SURVEY METHOD

The method was designed to survey a sample of the population of all vanpools in metropolitan Washington, D.C. The basic components of the method were

1. Identifying those links of the arterial highway system carrying the greatest concentration of vanpools;
2. Designing questionnaires for two surveys, the main mail-back and the follow-up nonrespondent;
3. Sending survey teams to selected highway links to record the license-plate numbers of vanpool-style vans, including vans with privacy windows that prohibited visual determination of occupancy;
4. Identifying addresses of van owners, using records of the Department of Motor Vehicles (Virginia), the Motor Vehicle Administration (Maryland), and mailing questionnaires to van owners;
5. Calling a sample of the mail-back survey nonrespondents to check and correct for nonrespondent bias; and
6. Reducing and analyzing data.

This process is detailed in the following subsections.

Site Selection

Highway links were selected for survey by a desk-top traffic assignment process that took into account vanpools for which origins and destinations were known. These vanpools and their trip ends were identified with assistance from third-party providers, van-leasing firms, and employers. The assignment technique was especially needed in Maryland because, in 1982, the vast majority of vanpools in Northern Virginia were known to be operating on the Shirley Highway high-occupancy vehicle lanes.

The technique was to identify the origin and destination for each known vanpool and, using professional judgment, to select the series of highway links most probably traveled by that van. An accounting system was devised to keep track of the links. When the process was completed, most of the known vanpool traffic was found to be concentrated on a small number of highway links, for part of their travel. Nine links in Maryland and three in Virginia (Table 1) were selected for survey.

A preliminary visit was made to each highway link, and survey station locations were identified. The criteria for locating stations were

1. Surveyor safety: there had to be a substantial barrier between the traffic and the surveyor and
2. Visibility: because much of the traffic to be monitored was traveling at high speeds, the surveyors needed to be as close as possible to the traffic to accurately read license plates.

Except for two sites, it was possible to locate surveyors close to the traffic flow without compromising safety. The exceptions were Stations M7 and M8 (Baltimore-Washington Parkway and US-50 in Maryland); monitoring of these was done with field glasses from an overpass.

Questionnaires

Mail-Back Survey

The questionnaire for the main (mail-back) survey was designed to address the original principal concern of the survey--development of factors for use in the COG's traffic-counting programs. Thus the first questions determined the surveyed van's occupancy and whether it had privacy windows. Following, in order, are the topics explored by the questionnaire:

- Occupancy,
- Privacy windows,
- Van ownership,
- Trip purpose,
- Parking fee,
- Preferential treatment at employment,
- Home origin,
- Assembly method,
- Work destination,
- Major highway links used,
- Total trip length (time and distance),
- Home-end circuity (time and distance),
- Assistance received from ridesharing agencies, and
- Issues of concern to vanpool operators.

The survey questionnaire was designed to reflect the date and highway link associated with the field

TABLE 1 Vanpool Survey Stations

State	Station No.	Facility	Location	Direction	Date Surveyed
Virginia	V1	George Washington Parkway	Abingdon Lane	Northbound	5/19/82
	V2	I-395 HOV lanes	Ridge Road	Northbound	5/18/82
	V3	George Washington Parkway	Spout Run Parkway	Southbound	5/18/82
Maryland	M1	I-270	North of MD-124	Southbound	5/21/82
	M2	I-270	Montrose Road	Northbound	5/21/82
	M3	I-270	Montrose Road	Southbound	5/21/82
	M4	I-495 (Beltway)	Connecticut Ave.	Westbound	5/20/82
	M5	16th Street	D.C. line	Southbound	5/18/82
	M6	Georgia Avenue	Thayer Street	Southbound	5/20/82
	M7	Baltimore-Washington Parkway	South of I-95	Southbound	5/20/82
	M8	US-50	East of I-95	Westbound	5/19/82
	M9	MD-5	MD-337	Northbound	5/19/82

work that identified the van. Using word-processing, questionnaires were custom-tailored for each survey site. The purpose of this was to determine actual van usage and occupancy on the survey date at the survey site. It was thought that more generalized survey approaches (i.e., "How many people are in your vanpool?" or "On a typical day, how many people ride in your vanpool?") might result in overestimation. Thus this questionnaire asked for van occupancy on a specific day at a specific place.

Nonrespondent Survey

This was a telephone survey; its concern was whether the van was operating as a vanpool and what its occupancy was. The occupancy question did not refer to the date on which the van was monitored because, by the time the nonrespondent survey was conducted, that would have been too far in the past for accurate memory. Instead, the respondent was asked for occupancy "The last time your van made this same trip in the morning."

Implementing the Mail-Back Survey

License-Plate Monitoring

Three teams of surveyors received training in reading license plates, using a typical high-speed road. Each team consisted of two persons, a spotter and a recorder. The spotter's job was to read and call out the license-plate number of any vanpool-style van that either had seven or more passengers or had privacy windows restricting determination of occupancy. The recorder's job was to accurately write down the license-plate number. Teams were also responsible for keeping tallies of vans the license plates of which could not be monitored. All monitoring work was completed in 4 days, May 18-21, 1982, for the 12 sites given in Table 1.

Mail-Out

Identification of van owners and distribution of questionnaires were handled differently for stations in Maryland and Virginia.

In Maryland, the Motor Vehicle Administration (MVA) agreed to allow COG staff on-line access to its registration records. License-plate data were therefore carried directly from the field to an MVA field office. There, van owners' names and addresses were manually transcribed and carried back to the COG offices where they were typed onto envelopes, and the questionnaires were mailed out, usually on the same day that monitoring took place.

In Virginia, the Department of Motor Vehicles (DMV) in Richmond required key-punching of the license-plate data to produce vehicle owner addresses. However, the DMV was also able to produce address labels for the mail-out. Thanks to excellent cooperation from DMV, and good courier work between Washington and Richmond, the turn-around time was minimal and all questionnaires were mailed within less than a week from the time of monitoring.

Implementing the Nonrespondent Survey

Any mail-back survey has the potential for nonrespondent bias (i.e., the survey respondents may have significantly different values than the nonrespondents for parameters that are being measured). A sample survey of nonrespondents was designed to check and correct for this possible bias. When the COG stopped receiving mail-back questionnaires, it was possible to compile a list of nonrespondents (199 in all). From this list a sample was randomly selected and stratified by each of the two home-origin states, Maryland and Virginia. Sample sizes were 37 for Maryland and 37 for Virginia, or 74 in all. The sample was roughly scaled to predict the percentage of the main survey nonrespondents who were owners of vans used as pools with an absolute error of estimate of ±0.07 at the 90 percent confidence interval.

Telephone numbers were obtained for the 74 nonrespondents from phone books and from listings of vanpoolers obtained from third-party leasing agencies. Two surveyors worked in both the daytime and evenings to contact as many of this second sample as possible. The surveyors succeeded in interviewing 67 of the 74. Six of these reported that they did not own vans, and were thus relegated to a "data error" category because they evidently represented an incorrectly read license plate in the field survey. Thus the final response was 61 out of 68, or a 90 percent response rate.

It was discovered that the percentage of vans in the vanpooling mode was significantly different for respondents to the mail-back survey.

Data Reduction

The procedures for data reduction for this survey were somewhat complex. This was, in part, because it could not be known until after the survey which portion of the sample was actually vanpools and, in part, because of the necessity of factoring in the results of the nonrespondent survey. Until a number of data reduction procedures were performed, there could be no estimate of the volume or occupancy of vanpools and no means of factoring the survey data by strata. These procedures are documented here in a general way.

A total of 463 questionnaires were mailed out, and 264 were returned--a response rate of 57 percent, which is high for a mail-back survey and considered adequate for analysis purposes. The surveyors were asked to note vanpool-style vans the license plates of which they could not read. These are lumped with vans carrying out-of-state tags, vans the questionnaires about which were returned by the post office as undeliverable, and respondents who claimed that they did not own a van (this was assumed to be license-plate reading error). There are 382 of these "other vans." Counting the 463 surveyed vans and the 382 "other vans," the survey population was 845 vans. It should be remembered that these were not all vanpools; they were a collection of vans that could be seen to have seven and more passengers along with a number of vanpool-style vans with privacy windows that restricted visibility into the passenger area of the van.

To calculate total vanpools and develop weights for the survey data, the following steps were necessary:

- Estimate how many nonrespondent vans were vanpools and
- Estimate how many unsurveyed vans were vanpools.

When this had been done, Table 2 was produced.

In Table 2, Row J, Total vanpools, is calculated by adding together E (Surveyed nonresponding owners of vanpool vans), H (Unsurveyed owners of vanpool vans), and I (Surveyed respondent owners of vanpool vans). The result yields an estimate for total vanpools at each site and for the region (667). This

TABLE 2 Calculation of Total Vanpools

	Item	Virginia Subtotal	Maryland Subtotal	Total
A	Mailed questionnaires	262	201	463
B	Returned questionnaires	155	109	264
C	Nonresponding van owners (A – B)	107	92	199
D	Nonresponse factor (from survey of nonrespondents)	0.77	0.60	
E	Nonresponding owners of vanpool vans (C x D)	82	55	137
F	Unsurveyed vans	258	124	382
G	Vans to vanpools factor	0.83	0.72	
H	Unsurveyed owners of vanpool vans (F x G)	214	90	304
I	Respondent owners of vanpool vans	136	90	226
J	Total vanpools (E + H + I)	432	235	667

estimate is discussed further in the section on findings.

All data in the section on findings have been weighted. The method for developing the weights was to divide vanpool population by respondents for each station. The purpose of the weighting procedure is to factor the sample data back to a proportionate estimate of the total vanpool population.

Discussion of Sampling Methods and Confidence Levels

Sampling Methods

For the main, mail-back survey, the vans to be surveyed were not selected by a purely random or systematic procedure. The surveyors were instructed to read all the appropriate van license plates, which they could see and record, at each of the 12 survey stations. Technically, this approach should be described as "haphazard" and could be associated with bias. Because the sample selected (463 vans) was more than 50 percent of the population (845 vans), this potential problem is thought to be minimal, with one exception. On busy facilities, the rate at which vans were sampled is known to be lower during the peak hour of travel than during the balance of the peak period. Thus vans traveling during the peak hour are somewhat underrepresented by the sample.

For the nonrespondent survey, the sample was selected by an automated random sampling procedure.

Confidence Limits

Considering the "vanpool occupancy" parameter, at the 90 percent confidence interval, the mail-back survey has a 0.19 bound on the error of the estimate. For the nonrespondent survey, the bound for vanpool occupancy is 0.55, also at the 90 percent confidence interval. Combining results for both surveys, the bound for occupancy is 0.24. Thus, 90 percent of the time, the estimate of occupancy, 11.7, will fall into a range of from 11.46 to 11.94.

FINDINGS

This section contains the findings of the survey. The following topics are explored:

- Number of pools,
- Origins and destinations,
- Occupancy rates,
- Travel times and trip lengths,
- Traffic assignment,
- Collection and distribution characteristics,
- Ownership,
- Preferential treatment and parking,
- Assistance from ridesharing agencies, and
- Pool operators' concerns.

All data have been weighted to the total estimated population.

Number of Vanpools

A basic output of this survey is an estimate of the number of vanpools operating in metropolitan Washington, D.C., in spring of 1982. This figure is 667 vanpools. As explained previously, this estimate is a sum of the unsurveyed vanpools, nonrespondent vanpools, and surveyed vanpools.

This total may be checked against another data source, the 1980 Census. In 1980 a 16 percent sample of the census questionnaires included questions on work travel (2). These questions included information on mode and vehicle occupancy. The total number of persons living in the Washington, D.C., standard metropolitan statistical area (SMSA) and traveling to work in a vehicle with seven or more occupants in 1980 was 6,828 (Census Tape STF4A). Assuming that these are vanpool occupants, and that the average vanpool membership is 13.8 persons (to be discussed later), an estimate of vanpools originating in the SMSA would be 6,828/13.8 = 495. This census-derived number is probably understated because the STF4A tape does not include person-trips that originate outside the Washington region and travel into the region for work. Moreover, the census was taken 2 years before the vanpool survey. On the basis of professional experience, it is judged that vanpooling in the Washington area increased substantially between 1980 and 1982. It would thus appear that the 1980 Census estimate, 495 vanpools, serves as a rough, order-of-magnitude verification of the survey estimate, 667 vanpools.

Origins and Destinations

The survey questionnaire asked for the vanpool's community of origin and employment area destination. Using these data, it is possible to geographically distribute vanpools by origin and destination. Destinations are compressed into two major categories: core (downtown) and noncore (elsewhere). Core destinations include downtown Washington and the Virginia employment areas, Rosslyn, Crystal City, and the Pentagon. Van origins are summarized by home state.

Table 3 gives vanpools cross-tabulated by home state and core or noncore destination. It can be seen that 64 percent (429) of all vanpools originate in Virginia. Moreover, the Virginia-originated vanpools are almost entirely oriented toward the core, whereas the Maryland pools are destined for both core and noncore locations.

Figure 1 shows all core-destined vanpools distributed by major travel corridor. Most of the core-

TABLE 3 Vanpools by State of Origin and Core or Noncore Destination

	Destination		
Origin	Core	Noncore	Total
Maryland	122	113	235
Virginia	425	4	429
West Virginia	—	3	3
Total	547	120	667

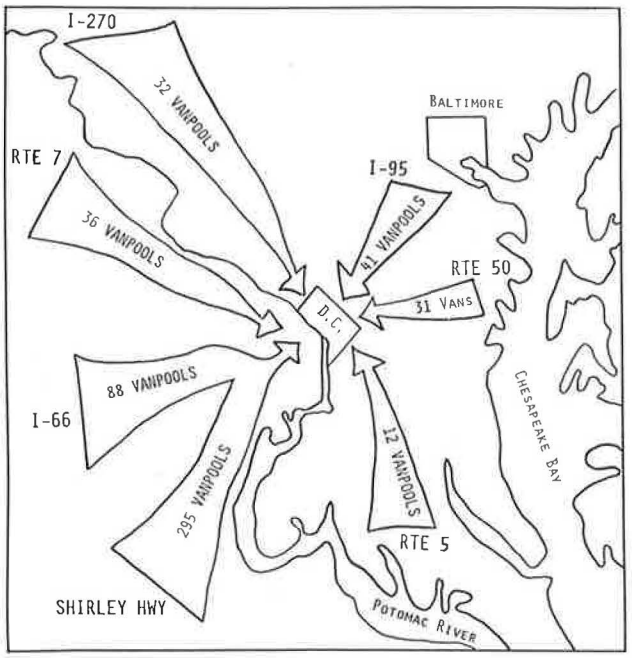

FIGURE 1 Vanpools destined for downtown employment area by travel corridor, Washington, D.C., 1982.

oriented vanpools travel in these seven corridors. The role played by the I-95 and I-395 Shirley Highway high-occupancy vehicle (HOV) lanes in promoting vanpooling is obvious, with 295 vanpools in that corridor. Considering home community, the highest concentrations of vanpool origins in the region are in Woodbridge and Lake Ridge (92 vanpools) and the contiguous Dale City (54 vanpools); both of these sites are in close geographic association with Shirley Highway. Many other vanpools benefit from the HOV lanes--the exact number will be investigated in the section on traffic assignment.

Core-destined vanpool passengers were disaggregated by destination employment district or area. Passengers, instead of vanpools, were selected for this procedure because it was discovered that a number of vanpools discharged in two or more different areas, a phenomenon that is discussed further in the section on collection and distribution characteristics. A total of 6,400 vanpool passengers were found to be destined for 14 distinct employment areas. Of the 14 areas, Southwest, Federal Triangle, and Farragut Square had the most disembarking passengers. Approximately 4,400 vanpoolers were traveling to these three employment areas, or almost 70 percent of the total destined for the core.

Occupancy Rates

An original aim of the vanpool survey was the production of occupancy factors to be used in converting raw field data. An important consideration in calculating these factors or rates was the hypothesis that survey nonrespondents would have different occupancy characteristics than respondents. It was for this reason that the sample survey of nonrespondents was conducted. This survey showed that

1. A lower percentage of nonrespondent than respondent van owners had vanpools and
2. The nonrespondent vanpools had a lower occupancy rate than did the respondent vanpools.

A weight-averaging technique was used to compute the average vanpool occupancies for vanpools monitored in Maryland, Virginia, and the region. The technique blends results from the main survey with those from the nonrespondent survey. Resulting occupancies are

- Maryland average vanpool occupancy = 12.2,
- Virginia average vanpool occupancy = 11.4, and
- Regional average vanpool occupancy = 11.7.

These occupancies reflect travel on an average day--the day vanpools were monitored in the field. It is important to distinguish between vanpool average occupancy and membership, which would include all persons who have that vanpool as their principal means of transport to work. Most prior surveys apparently have produced data on average membership. Average occupancy would differ from this by excluding people who did not travel on the survey date. However, the two measures can be made roughly equal. The 1968 Home Interview Survey conducted in the Washington area showed that, on the average workday, 85 percent of employed persons travel to work (3). The following calculations convert vanpool average occupancies to membership:

	Avg Occupancy		Avg Membership
Maryland	12.2/0.85	=	14.4
Virginia	11.4/0.85	=	13.4
Region	11.7/0.85	=	13.8

It is interesting that, after this adjustment, the average Maryland pool membership, 14.4, is close to the 14.2 figure reported in the 1980 Maryland vanpool survey (4).

An attempt was made to associate occupancies with trip length, and travel time, and parking cost. This was done for both core and total destinations, using appropriate measures of association. No strong correlation was discovered between occupancy and these variables.

Travel Times and Trip Lengths

Data provided by the survey respondents were used for travel times and trip lengths. No independent verification was attempted.

Figure 2 shows a frequency distribution of travel distances for all vanpools. The histogr shows that most of the pools fall in the 20- to 50-mi one-way travel distance range.

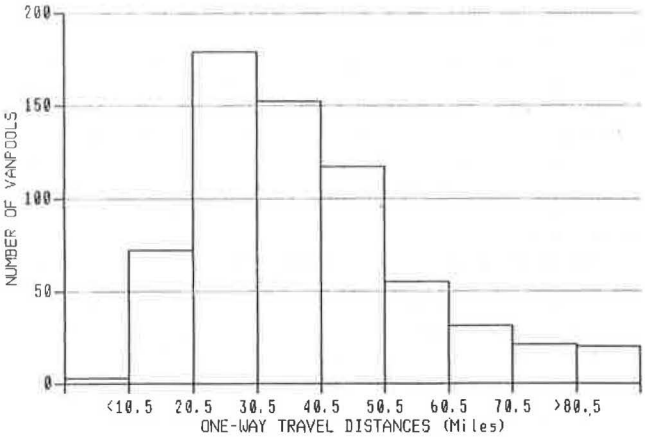

FIGURE 2 Frequency distribution of vanpool travel distances.

The average reported one-way vanpool travel distance was 36.3 mi. This may be compared with the reported distance of 33.8 mi from the 1980 Maryland survey of vanpool markets (5). The average reported one-way travel time was 58.8 min (0.98 hr). This is almost identical to the travel time reported in the 1980 Maryland survey, 59 min (4). It is possible to compute an average speed, using travel time and distance. The formula is

Rate = Distance/Time

and, substituting values,

Rate = 36.3/0.98 = 37.0 mph

It is useful to compare these travel time, distance, and speed values with the average for all commuters in the Washington area. Table 4 gives a comparison of the values from the 1982 vanpool survey with those for all persons commuting in automobiles or trucks in 1977. From Table 4, it can be seen that, compared with the general population of automobile-commuters, vanpoolers have longer travel distances, greater travel times, and higher average speeds. The higher speed may be due either to a greater proportion of the vanpool trip being on uncongested roads or to a greater proportion of the vanpool trip being on high-speed arterials.

TABLE 4 Comparison of Commuting Travel Characteristics, Vanpoolers Versus All Commuters Using Automobiles or Trucks in Metropolitan Washington

	Vanpoolers	All Commuters in Automobiles or Trucks[a]
One-way travel distance	36.3 mi	9.3 mi
One-way travel time	58.8 min	24.2 min
Speed	37.0 mph	23.1 mph

[a]Median values taken from Salopek (6).

The consideration of travel times, distances, and speeds offers another interesting comparison. This is between core-destined vanpools using the Shirley Highway HOV lanes and all other core-destined vanpools. It would be expected that Shirley Highway vans would have a significantly higher rate of speed because the HOV lanes offer free-flow travel from the Capital Beltway to the Potomac River. However, the Shirley Highway vans had an average speed of 36.3 mph (average distance = 34.6 mi, average time = 0.95 hr), and other core-destined vans had an average speed of 35.5 mph (average distance = 37.3 mi, average time = 1.05 hr). Thus the difference is less than 1 mph. This represents an approximate travel time savings of a little over a minute, assuming an average trip of 35 mi. Yet, it is known that vehicles using the Shirley HOV lanes save >15 min in travel time, compared with vehicles using parallel radial arterials.

To check whether the speeds were being skewed by some very long trips, the estimate for each trip type was refigured by computing the speed for each individual vanpool and averaging these values. The results were little different: Shirley Highway vanpools = 35.5 mph; other vanpools = 35.3 mph.

This counterintuitive finding is based on reported travel times and distances. It is possible, but unlikely, that these data are systematically overstated in the Shirley corridor or understated in the other travel corridors. A more likely explanation is that radial arterials in the non-Shirley Highway travel corridors operate at a higher level of service than radial arterials in the Shirley Highway corridor. Thus the Shirley Highway HOV lanes do offer significantly higher speeds and lower travel times, but only in relation to contiguous facilities in the same travel corridor.

Traffic Assignment

Surveyed owners of vanpool vans were asked, "What major routes are used to make your trip to work?" Responses were coded according to highway and tabulated to determine which links carried the highest volumes of vanpool traffic. Respondents listed a total of 36 major highways used. Because of the somewhat general nature of the question, it was not possible to differentiate short links. Highways that carried more than 20 vanpools are given in Table 5, in order of volume.

TABLE 5 Highways with Highest Vanpool Volumes

Rank	Highway	Vanpool Volume
1	I-395 (Shirley Highway)	372
2	I-270	115
3	Virginia beltway	109
4	Maryland beltway	100
5	I-66 (outside beltway)	71[a]
6	US-50 (John Hanson Highway)	57
7	George Washington Parkway, Virginia	48
8	Baltimore-Washington Parkway	48
9	George Washington Parkway, Canal Road	33
10	Old Keene Mill Road	32
12	Dulles Access Road	24
13	US-1 (Jefferson Davis Highway)	23
14	Kenilworth Avenue	21

[a]I-66 inside the Beltway was not open in 1982.

Collection and Distribution Characteristics

The method by which vanpools assemble provides valuable information for further work on demand estimation. Early researchers believed that, predominantly, vanpools assembled by pickup at the door. This entailed a circuitous route and a stop at each passenger's house in both the morning and the evening. If at-home pickup were the principal assembly method for vanpools, vanpooling would have little success in low-density residential areas because the aggravation of assembly would incline most potential drivers and passengers toward other modes.

Respondents were asked how their vanpool assembled in the morning. Three possibilities were provided (passengers picked up at home, at a central meeting place, or at more than one meeting place), but multiple answers were permitted to describe combinations. Table 6 gives the results. The data in Table 6 indicate that exclusive pickup at home is a minor assembly method (6.8 percent). Although another 6.6 percent of vanpools mix home and meeting place pickup, the typical method of assembly is at one or more meeting places. It is assumed that most passengers arrive at these meeting places as automobile drivers or passengers.

There are two implications to this finding. First, vanpools can be formed in areas with a low density of trip home origins in relation to a particular work destination. Second, adequate commuter parking fa-

TABLE 6 Vanpool Methods of Assembly (home end)

Method	No. of Vanpools	Percentage
All picked up at home	45	6.8
All picked up at central meeting place	193	29.1
All picked up at several meeting places	381	57.5
Picked up at home and central meeting place	6	.9
Picked up at home and several meeting places	38	5.7
Total	663	100.0

cilities at the residential trip end are a necessity for the successful operation of this mode.

The survey also explored operational characteristics of pools at the work end. Respondents were asked to name employment areas where vanpools dropped off passengers. Many operators indicated that passengers came from multiple buildings in one general area. Some also specified that their vans distributed passengers in several different areas. The data in Table 7 indicate how many vans dropped off passengers in one, two, three, or four downtown districts.

TABLE 7 Core-Destined Vanpools by Number of Distribution Areas (work end)

No. of Distribution Areas	Vanpools	Percentage
1	389	71
2	136	25
3	20	4
4	3	1
Total	547	100

Ownership

Respondents were asked how the van was owned. The question also provides insight into the basic organization of the vanpool: employer sponsored, third party, or owner operated. Table 8 gives a summary of responses by state of origin.

From the table, it can be seen that ownership patterns are quite different in Maryland and Virginia. The predominant owner in Virginia is the van operator (82 percent). Here the Shirley Highway HOV lanes have evidently provided a powerful incentive for private individuals to form vanpools. In Maryland, more vans are owned by a leasing agency (52 percent) than by any other means. This may be because of the success of the various government-sponsored third-party programs that have aided the growth of vanpooling in Maryland. Overall, employers account for little vanpool van ownership (8 percent). This is in contrast to the national scene, where employer-sponsored programs are quite significant.

From comments written in the "Other" category, the survey discovered another method of ownership and operation: this is partnership, which accounts for 4 percent of vans in Virginia and none in Maryland.

Preferential Treatment and Parking

Van operators were asked whether they received preferential treatment at work because of vanpooling. Thirty-five percent of respondents reported that they received no preferential treatment; 37 percent reported one benefit; 22 percent reported two benefits; and 5 percent reported three benefits. Table 9 gives the number and percentage of respondents who reported receiving each type of preferential treatment. The table shows that receiving a reserved parking space or free or discounted parking were the benefits most frequently reported. Parking costs ranged from $0 to $120 a month. For respondents reporting a parking cost, the mean was $38.10 a month. Table 10 gives the frequency distribution of parking costs for all vanpools. It is interesting that, of the vanpools traveling to noncore destinations, 89 percent had no parking cost compared with 57 percent of those traveling to core destinations.

Assistance from Ridesharing Agencies

There are a number of agencies in the Washington area that offer assistance to vanpoolers. The survey asked which of these had been helpful in forming the vanpool. Table 11 is a listing that tallies the number of times agencies were cited; one vanpool may have cited more than one agency. The two agencies most cited were Virginia Vanpool Association (VVPA) and the COG Commuter Club. VVPA is a Virginia-based association of owner-operators. It has wide experience in vanpooling and provides extensive advice to would-be operators. It also directs potential riders to members with vacancies in their vans. The COG Commuter Club operates a regional computer-based pool-matching system. Applicants with similar origin-destination and work-time characteristics are advised of their compatibility via "matchletters." At the time of the survey, no special outreach for vanpoolers was taking place, but vanpoolers were clearly using the COG system to find riders.

It should be remembered that the survey was taken in the spring of 1982. Several of these listed agencies had, in 1982, been in business for only a short time.

Concerns of Vanpool Operators

The survey listed eight issues of concern to vanpoolers. Respondents were asked to score each issue,

TABLE 8 Means of Vanpool Vehicle Ownership by Home State

Owner	Maryland		Virginia		Total	
	Vans	Percentage	Vans	Percentage	Vans	Percentage
Myself or family member	55	23.4	355	82.1	409	61.3
Partnership			16	3.7	16	2.4
Leasing company	123	52.4	32	7.5	156	23.3
Employer	48	20.5	3	0.7	51	7.7
Private party outside my family	4	1.6	23	5.3	26	4.0
Other	5	2.1	3	0.7	8	1.2
Total	235	100.0	432	100.0	667	100.0

TABLE 9 Preferential Treatment of Vanpools at the Employment Site

Benefit	Yes		No	
	No.	Percentage	No.	Percentage
Reserved parking space	230	34	437	66
Closer parking space	97	15	570	85
Discounted or free parking	253	38	414	62
Subsidy of other vanpool costs	9	1	658	99
More convenient working hours	60	9	607	91

Table 10 Reported Monthly Parking Costs for All Vanpools

Cost ($)	No. of Vanpools	Percentage
0	416	62
1-20	101	15
21-40	57	9
41-60	24	4
61-80	33	5
More than 80	37	6
Total	667	100

TABLE 11 Assistance from Ridesharing Agencies in Forming Vanpool

Agency	No. of Vanpools Assisted
Virginia Vanpool Association	152
COG Commuter Club	131
VANGO	82
Prince William County Ridesharing Office	79
Montgomery County Ridesharing Office	45
Maryland Ridesharing Office	16
Fairfax County Ridesources	3
Silver Spring Share-a-Ride	2

using a scale of 1 to 5, where 1 = no concern and 5 = great concern. Table 12 gives the eight issues, along with the average score for each, and the total number of respondents who checked 5. It can be seen that the two issues of greatest concern to vanpool operators were increased HOV lanes and van insurance.

TABLE 12 Concerns of Vanpool Operators

Issue	Avg Score	No. of 5 Scores
More highway priority lanes for vanpools	3.58	103
Insurance	3.45	102
Priority parking at work	3.23	88
Van servicing	3.11	76
Finding new riders	3.05	62
Government regulation	2.59	49
Finding a backup van	2.58	42
Access to commercial parking garages	1.96	34

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