GUIDELINES FOR SELECTING MATCHING TECHNIQUES FOR RIDE SHARING

by

B. H. Cottrell, Jr.
Research Scientist

(The opinions, findings, and conclusions expressed in this report are those of the author and not necessarily those of the sponsoring agencies.)

Virginia Highway & Transportation Research Council
(A Cooperative Organization Sponsored Jointly by the Virginia Department of Highways & Transportation and the University of Virginia)

In Cooperation with the U. S. Department of Transportation
Federal Highway Administration

Charlottesville, Virginia

November 1982
VHTRC 83-R18

PLANNING RESEARCH ADVISORY COMMITTEE

MR. R. C. LOCKWOOD, Chairman, Transportation Planning Engineer, VDH&T

MR. E. D. ARNOLD, JR., Research Scientist, VH&TRC

MR. D. W. BERG, Assistant Public Transportation Engineer, VDH&T

MR. G. W. BROWN, Assistant City Manager, City of Martinsville, City Hall

MR. G. R. CONNER, Assistant Rail Div. Admin., VDH&T

MR. JAMES C. ECHOLS, Executive Director, Tidewater Transp. Commission

MR. TOM FAULKNER, JR., Civil Engineering Department, V.M.I.

MR. D. R. GEHR, Northern Virginia Division Administrator, VDH&T

MR. J. N. HUMMEL, Chief, Planning & Engineering Division, Arlington Department of Public Works

MR. D. E. KEITH, Northern Virginia Division Administrator, VDH&T

MR. J. D. PAULUS, Planner I, Transportation Peninsula Planning District Comm.

MR. J. K. SKEENS, Urban Engineer, VDH&T

MR. A. J. SOLURY, Division Planning & Research Engineer, FHWA

ABSTRACT

Several matching techniques for ride sharing are available to serve a wide range of operating conditions. There is a need for guidelines to aid ride-sharing agencies in Virginia in selecting the most appropriate matching technique. The objective of this research was to develop such guidelines. Information on the state of the art of ride-share matching techniques was obtained through a literature review and telephone requests of ride-sharing agencies and selected state departments of transportation. Interviews were conducted with personnel of the eleven ride-sharing agencies operating in Virginia to obtain information for an analysis of their ride-share matching techniques.

Factors that identify the threshold point at which a computerized matching technique should be considered in lieu of a manual technique were defined. Guidelines that provide a procedure for selecting a matching technique by comparing the ride-sharing agency's matching needs with the capabilities of a selected group of matching techniques were developed.

SUMMARY AND CONCLUSIONS

The following conclusions are drawn from this report.

Guidelines for Selecting Matching Techniques

Manual matching techniques tailor-made for the service area can be developed. The use of manual matching is oriented toward rural and small urban areas. The use of community names and employers is recommended for the locational system when possible. A ride-sharing kit is available for use in urban areas. The guidelines for selecting computerized matching techniques employ a systematic procedure for comparing needs with techniques.

Manual Matching Techniques

There are basically two groups of manual matching techniques: self-service and central. Self-service methods are oriented toward employers and central matching serves both employers and area-wide ride-sharing efforts. Manual matching systems usually are tailor-made for the service area.

Computerized Matching Techniques

Several computerized matching techniques are available. As expected, most programs specially developed for ride sharing are designed for urban areas. Two matching techniques have used available computer programs to satisfy the matching needs of rural and small urban areas.

Threshold from a Manual to a Computerized Matching Technique

There is no single point, on the basis of the size of the file, at which the conversion from a manual to a computerized matching technique is suggested. Other factors considered in identifying the threshold point are the processing capacity, demand for processing, cost, and additional capabilities. The probable need for expansion of the ride-sharing program is also an important consideration.

Matching Techniques Used in Virginia

The analysis of the data collected through interviews with personnel of ride-sharing agencies provided an overview of ride-share matching in Virginia. Elements of the matching systems used in 11 agencies were reviewed and summarized. The matching techniques

vary widely, and there is a large variation for almost every element considered. All of the urban areas used a computer, whereas only half of the rural and small urban areas did so.

The use of 2 surveys or a transportation survey of commuting patterns and transportation needs is not recommended for a ride-sharing survey. A one-page survey form is recommended.

The effectiveness of the follow-up procedures used by the agencies could not be determined because of a lack of data. Rural and small urban programs utilize follow-up activities more than do urban programs.

Problems in Matching Techniques

Operating cost data on matching techniques generally are not available because of the manner in which expenditures are allocated in the budget for ride-sharing programs. Although several follow-up procedures have been employed, a lack of data precludes conclusions on their cost-effectiveness. The follow-up is an important aspect of the matching technique and ride-sharing agencies would benefit from information on follow-up procedures. The follow-up procedure is an excellent point in the ride-share matching process at which to incorporate a personalized service.

Locational Systems

Grid maps are the basis for the locational system most used in urban areas. When already available and adequately maintained, geographic base files or automatic geocoding systems are generally used by ride-sharing agencies. Community names have been used successfully in rural and small urban areas.

Personalized Ride-Sharing Services

Two ride-sharing programs, the Minneapolis Ride-Sharing Commuter Service and Share-A-Ride of Silver Spring, Maryland, have personalized services of a type that should be considered by ride-sharing programs.

Microcomputers

The technology for using microcomputers in ride-share programs is available, but current applications are limited. For this reason, caution should be exercised in planning the use of a microcomputer. It is anticipated that such use will increase significantly in the near future. Low cost microcomputers can provide advantages in flexibility and processing speed.

RECOMMENDATIONS

It is recommended that the guidelines developed in this study be adopted by the Public Transportation Division to aid operators of ride-sharing programs in selecting matching techniques.

Further, it is recommended that the Public Transportation Division request that all ride-sharing agencies in Virginia using a follow-up procedure document the cost-effectiveness of their procedures. The information so developed could be analyzed by the Division or, possibly, by the Research Council.

A comparison of the use of the COMSIS ride-sharing kit by the Southside Planning District Commission and a microcomputer system by the Lord Fairfax Planning District Commission is recommended. Since this study did not review the COMSIS Kit in use by a ride-sharing program, it is recommended that the COMSIS Kit be evaluated to assess its effectiveness.

Finally, it is suggested that the Public Transportation Division consider updating this report periodically to reflect changes in the state of the art of matching techniques.

GUIDELINES FOR SELECTING MATCHING TECHNIQUES FOR RIDE SHARING

by

B. H. Cottrell, Jr.
Research Scientist

INTRODUCTION AND PROBLEM

In recent years, numerous ride-sharing programs, such as carpooling and vanpooling, have been initiated throughout the nation in response to the need to conserve energy, reduce traffic congestion, and decrease parking demands. An instrumental part of these programs is a matching technique for identifying commuters having similar commuting patterns and needs. The appropriate technique for a specific program depends on (1) the number of people and type of area served, (2) the staff and funds available to administer the program, and (3) the special needs of the program.

Some ride-sharing programs use manual matching techniques and others use computerized techniques that consider different matching strategies, program options, and programming capabilities. At present, however, the conditions under which a matching system should be computerized cannot be precisely defined. Most ride-sharing matching systems are designed for use in urban areas, but ride-sharing is being implemented in rural areas, and there is a need to design systems oriented toward these areas.

There are 11 ride-sharing programs in the Commonwealth of Virginia serving areas ranging from heavily urbanized to rural. The Public Transportation Division of the Virginia Department of Highways and Transportation, which has been designated as the lead ride-sharing agency in the Commonwealth, is not able to provide guidance on matching techniques for ride sharing because it does not have guidelines for selecting and implementing appropriate techniques. Consequently, some ride-sharing agencies are experiencing difficulties in obtaining techniques appropriate for their programs.

For example, ride-sharing agencies using the computerized matching system administered by the Metropolitan Washington Council of Governments are experiencing a slow turn-around time that reduces their effectiveness. Other programs are planning to change or have changed from one matching system to a system more responsive to their needs. Some agencies are uncertain of when to switch from manual to computerized matching and of the type of computerized matching system to use. Agencies that use computerized systems have often

found it necessary to modify them. The costs of implementing matching techniques are important, and in this regard it is noted that minicomputers or microcomputers having the capability for use in matching programs may be more economical than mainframe computers under certain conditions.

OBJECTIVE AND SCOPE

The objective of the research reported here was to develop guidelines that would enable a ride-sharing program to select the matching technique most appropriate for its operation. The Public Transportation Division (PTD) of the Virginia Department of Highways and Transportation requested the research.

The scope of the project, as outlined by the ride-sharing advisory committee of the PTD, addressed the following.

1. A review of the state of the art of ride-sharing matching programs for urban and rural areas, with emphasis on the locational systems employed.

2. An analysis of the matching techniques used by ride-sharing programs in Virginia.

3. Recommendations with respect to (a) the threshold for going from manual to computerized matching, (b) manual matching options, and (c) computer hardware-software options.

In light of the above, the following tasks were conducted.

A. A literature search and telephone requests to obtain information on the state of the art of manual and computerized matching techniques and the supporting locational systems.

B. Interviews with ride-sharing coordinators of the 11 ride-sharing programs in Virginia to obtain information for use in the analysis of the matching techniques.

C. The development of guidelines for selecting ride-sharing matching techniques, with consideration being given to the threshold at which a ride-sharing program should switch from a manual to a computerized matching technique.

It is important to note that while a matching system may be used as a marketing tool, it is a means, not an end for increasing ride-sharing activity.

FORMAT FOR PRESENTING THE GUIDELINES

Since the users of the guidelines presented in this report will vary greatly in their familiarity with ride-sharing and computers, the format of the remainder of the report is presented here with some suggestions on how it should be read.

The remainder of the body of this report consists of two sections, "The Threshold from A Manual to a Computerized Matching System" and "Guidelines for Selecting Matching Techniques." The first section is provided to assist readers (1) who do not have a preference for either a manual or a computerized system or (2) who are considering converting from a manual to a computerized matching system. The second section presents guidelines for the development of manual matching techniques and the selection of computerized matching techniques.

There are five appendices to supplement the guidelines:

Appendix A — Locational Systems

Appendix B — Manual Matching Techniques

Appendix C — Computerized Matching Techniques

Appendix D — Personalized Ride-sharing Services

Appendix E — Matching Techniques Used by Virginia's Ride-sharing Agencies

Appendices A, B, and C provide descriptions of locational systems and matching techniques mentioned in the guidelines. Consequently, these can aid the person seeking an understanding of matching techniques. Personalized ride-sharing services, which have the potential to enhance the effectiveness of ride-sharing programs and are now receiving much attention, are discussed in Appendix D. Information on the matching techniques used by the 11 ride-sharing agencies in the Commonwealth of Virginia is presented in Appendix E.

Persons who are unfamiliar with ride-sharing matching are encouraged to review all of the appendices and gain an understanding of the general concepts presented and the computer terminology used. Persons who have difficulty understanding a computer matching technique of great interest to them should consult someone knowledgeable of computers. Where interest is limited to manual matching techniques, the review of Appendix D can be omitted, and if interest is limited to computerized techniques, a review of Appendix C is unnecessary. The appendices should be read before the body of the report. For general information on ride-sharing such as the goals of ridesharing; community conditions that promote successful ride-sharing; the design of ride-share programs, and planning, implementing, and operating a ride-share program refer to "Guidelines for Using Vanpools and Carpools as a TSM Technique."(1)

Persons who have experience with ride sharing should consult the appendices as needed. Appendices D and E should be of interest, and the references cited in this report can provide additional details.

THE THRESHOLD FROM A MANUAL TO A COMPUTERIZED MATCHING SYSTEM

An alternate heading for this section could be, "When should a manual matching technique be used and when should a computerized matching technique be used? This issue confronts ride-sharing agencies that must select a matching technique and have no preference between the manual and computerized systems, or that are using a manual technique and are considering converting to a computerized technique. The advantages of manual matching techniques are (1) quick implementation, (2) low initial cost, and (3) more personalized service. The advantages of a computerized technique are that it is possible to (1) process more applications in a shorter period of time, (2) reduce the cost per processed application, and (3) improve the overall efficiency of the ride-sharing program. Since most high density urban areas initially use computerized matching systems, this subject is primarily of interest to persons concerned with services for rural and small urban areas.

Several reports that have suggested threshold values for this transition based on the number of employees at a single employer site are given in Table 1. Since ride-sharing agencies that serve several employers or the general public operate quite differently than a single employer ride-sharing program, these values are presented for information only. The threshold for going from manual to computerized systems should take into account not only the number of applicants, but also, and more importantly, the processing capacity of the ride-sharing matching system. Processing capacity is based on the processing of applications that request a match list (or transit information). This is an important clarification since some agencies process applications that do not request match lists (or transit information). The processing capacity is a function of the locational system; match criteria and procedure, especially sorting and filing; match list format; staffing; the amount of time spent on other activities, such as marketing and administrative duties; and, in some cases, follow-up. Consequently, processing capacity varies significantly from program to program.

Table 1

Threshold Values for Transition from Manual to Computerized Matching

Number of Employees	Reference
300	2
500	3
750	4
1,000	5

For the Minneapolis Ride-sharing Commuter Service, it was estimated that total processing time per application was 30 minutes with follow-up phone calls and 20 minutes without the follow-up.(6) Total processing involves sorting and filing applications, manual matching, and preparing match letters. It was estimated that a staff of two, a coordinator and a secretary, could process 500 applications a month with follow-up calls and 800 applications a month without follow-up. This employer-based program has processed 16,530 applications from 11 employers over a 2-year period. This manual matching system was converted to the CIS computer program when the manual matching system began operating near capacity and any expansion of the ride-sharing program required a system with the capacity to match quickly and type match letters for large numbers of applicants.

The three manual matching programs in Virginia vary greatly in their match processing capacity. New River Valley Ride-sharing has an average time required per match of 1 week and a file size of 675. One full-time coordinator and a part-time secretary comprise the staff. Commuter Express, an employer-based vanpooling program, averages 15 minutes per match, with 500 applicants on file and an estimated file capacity of 800. The staff consists of one person. RADCO Commuter Service, which serves the general public with a staff of two persons working part-time, averages 15 minutes per match, with a range of 5 minutes to 30 minutes. The file size is 334 and is becoming cumbersome.

As the file size increases, the processing time per application is likely to increase by a small amount. Since files are generally organized by origin (or destination) or employer and then grouped by destination (or origin), only a subset of applications are reviewed for each potential match. The type of locational system, matching criteria, and spatial distribution of applicants influence the threshold level. The rate at which applications are received is important for employer-based surveys. The information on processing of matches cited above indicates the wide range of

manual matching capacities and needs. Capacity is estimated by dividing the average number of person-hours/week allocated for match processing by the average processing time required for each application. If the average turn-around time is greater than 1 week, then person-hours per average turn-around time should be used in place of a week. The average number of applications received per week (or per employer for employer-based programs) can be estimated from experience or forecasts. If the average number of applications received per week is greater than the average processing capacity per week, then five options should be considered.

1. Do nothing (accept a longer turn-around time)
2. Shift more person-hours to processing
3. Increase the staff temporarily
4. Increase the staff permanently
5. Use a computer to aid in the processing

Options 1, 2, and 3 may be implemented quickly for a short-term solution; options 4 and 5 will require some administrative planning and provide a long-term solution.

The match processing factors, costs, and additional capabilities listed below should be considered.

1. Match Processing Factors
   a. processing capacity (applications/week)
   b. average processing cost/application or processing cost/week
   c. average processing time/application
   d. changes in processing capacity, cost, and time
2. Cost (and Revenue)
   a. initial cost
   b. operating costs
   c. changes in operating costs from the present
   d. cost of transferring the data base to a new matching system
   e. sources of funding

3. Additional Capabilities
   a. expanded ride-sharing program
   b. improved matching system
   c. improved elements in the matching process such as the follow-up procedure
   d. evaluation
   e. ability to serve new markets
   f. bookkeeping and accounting

The match processing factors, costs and additional capabilities must satisfy the needs and goals of the agency. It is expected that the need for additional processing capacity and the expansion of the ride-sharing program are the most common reasons for converting from manual matching to computerized matching. The low cost of microcomputers makes the hardware relatively easy to obtain, but as in all computer applications the software matching programs are the key.

From the above discussion, it is concluded that, based on the number of applicants, there is no single threshold value at which an agency should convert from a manual to a computerized matching system. Match processing factors, costs, and the need for additional capabilities should be considered.

GUIDELINES FOR SELECTING MATCHING TECHNIQUES

The objective of the guidelines is to define a procedure whereby the matching needs of a ride-sharing program are compared with the capabilities of matching techniques to identify the techniques most appropriate for the program.

The guidelines are in two parts: the development of manual matching techniques and the selection of computerized matching techniques.

Development of Manual Matching Techniques

From the information developed in this study, it appears that in most cases where manual matching techniques are needed they are developed to suit the service area rather than being selected from ones already available. Generally, the agency establishing a ride-share program finds out what other ride-sharing agencies have done and modifies one of their systems to suit its needs. Otherwise, the

agency develops a system from scratch based on its perception of its needs. Consequently, most matching techniques are tailor-made for the ride-sharing program, services offered, area served, and the abilities of the staff.

The COMSIS ride-sharing kit is an already prepared matching technique. It is designed for employer-based ride-sharing programs in urban areas. However, it is suitable for rural and small urban areas if an appropriate locational system is substituted for the grid system. Conditions for the use of self-service methods and descriptions of manual matching techniques are given in Appendix B.

To develop a manual matching technique it is first necessary to identify the ride-share matching needs. Preparatory to accomplishing this, it is helpful to make copies of Tables 2 and 3 for use as a worksheet and to gain familiarity with the terminology in Appendix B.

A general description of the mission of the ride-sharing program is given in Table 2, Part I, where the area served, program orientation, and services offered are defined. It is assumed that the program's mission has been defined prior to consideration of the needed matching techniques. Table 2, Part II provides a checklist of requirements for the locational system, matching system factors, and other components. Operational objectives are listed in Table 2, Part III. The objectives are for operations in one year; however, the time period may vary to suit the needs of the program.

Complete Table 2 by placing an "x" in the space provided for selected options or a numerical value where appropriate.

Table 3 is provided to assist in identifying matching requirements. In Table 3, the locational systems are grouped by program orientation and area served. Additionally, self-service matching techniques are listed in Table 3 for consideration in employer-based programs.

After Table 2 has been completed, a ride-sharing matching system can be developed. The following example explains how this is done. Table 4 shows a completed Table 2. The framework for the matching system is defined in Table 4, Part II, Requirements for Matching Systems. The locational system, matching factors, sorting techniques, match list, and filing are defined.

It had been decided that a locational system based on community names would be employed from the four locational systems and matching techniques listed in Table 3 for employer-based programs for rural and small urban areas. An operational manual matching system can be implemented from these data. For the example, it had previously been decided that self-service methods were not desired.

Table 2

Manual Ride-Sharing Matching Needs

Instructions: Place an "x" next to the appropriate choice(s).

Part I. The Mission of the Ride-Sharing Program

A. Area Served

____urban ____ rural or small urban ____ other (specify)_____

B. Program Orientation

____employer-based ____general public ____both

C. Services Offered

____carpool matching ____vanpool matching ____transit information

Part II. Requirements for Matching Systems

A. Location (or Geocoding) System

1. Geographic Unit

____grid cells ____zip code and neighborhood
____community names ____other (specify)_____
____map plotting

2. Identifier of Applicant's Geographic Unit (or Geocoder)

____ride-sharing staff ____applicant ____other (specify)_____

B. Matching System Factors

1. Locational Search Expansion (around applicant's home and work location)

____adjacent units ____no expansion
____route-to-work ____other (specify)_____

2. Time Search Expansion (around applicant's work hours)

____+/- 15 minutes ____no expansion
____+/- 30 minutes ____other (specify)_____
____work hour groupings (shifts)

3. Ride-Sharing Preferences (i.e., driver, rider, both)

____match with respect to preference
____list preferences only
____do not consider preference
____other (specify)

C. Sorting (or Search) Technique (number in the order of desired sorting approach)

____origin ____time
____destination ____time search expansion
____locational expansion ____ride-sharing preferences

D. Match List

1. Letter

____form letter separate from list ____no letter
____letter on the list

2. List Format

____individual list for each applicant
____one list for all applicants on the list
____recent applicants listed first
____best matches listed first
____other (specify)_____

Table 2 continued

3. Contents of the Match List

____name	____employer
____home address	____ride-sharing preference
____work phone no.	____current travel mode
____work hours	____other (specify)_____

E. Filing

____employer/home end	____log book
____home end/work end	____other (specify)_____

Part III. Estimated Operational Objectives of the Matching Technique (Refer to the section on the Threshold from a Manual to a Computerized Matching System for assistance.)

A. Processing Capacity ____ average number of applications processed per week or per employer (underline week or employer)

B. File Size ____

C. Average Turn-Around Time ____

D. Other ____

Table 3

Identification of Potential Locational Systems
and Manual Matching Techniques

Instructions: Place an "x" in the space provided to denote all preferred locational systems and matching techniques.

I. Urban Areas
   A. Employer-Based Programs
      1. ____grid cells
      2. ____community names and employers
      3. ____map plotting
      4. ____zip code and neighborhood
      5. ____self-service methods
   B. General Public (or General Public and Employer-Based Programs)
      1. ____grid cells
      2. ____community names and employers
      3. ____map plotting
      4. ____zip code and neighborhood

II. Rural and Small Urban Areas
   A. Employer-Based Programs
      1. ____community names and employers
      2. ____map plotting
      3. ____zip code and neighborhood
      4. ____self-service methods
   B. General Public for General Public and Employer-Based Programs
      1. ____community names and employers
      2. ____map plotting
      3. ____zip code and neighborhood

Table 4

Example Manual Ride-Sharing Matching Needs

Instructions: Place an "x" next to the appropriate choice(s).

Part I. The Mission of the Ride-Sharing Program
   A. Area Served
      ____urban __x__small urban or rural ____other (specify)_____
   B. Program Orientation
      __x__employer-based ____general public ____both
   C. Services Offered
      __x__carpool matching ____vanpool matching ____transit information

Part II. Requirements for Matching Systems
   A. Location (or Geocoding) System
      1. Geographic Unit
         ____grid cells
         __x__community names
         ____map plotting
         ____zip code and neighborhood
         ____other (specify)_____
      2. Identifier of Applicant's Geographic Unit (or Geocoder)
         __x__ride-sharing staff ____applicant ____other (specify)_____

Table 4 continued

B. Matching System Factors

1. Locational Search Expansion

____adjacent units
__x__route-to-work
____no expansion
____other (specify)_____

2. Time Search Expansion

__x__+/- 15 minutes
____+/- 30 minutes
____work hour groupings (shifts)
____no expansion
__x__other (specify) THIS MAY VARY FOR DIFFERENT EMPLOYER

3. Ride-Sharing Preferences (i.e., driver, rider, both)

____match with respect to preference
____list preferences only
__x__do not consider preference
____other (specify)_____

C. Sorting (or Search) Technique (number in the order of your desired sorting approach).

__1__origin home end
____destination work end
__3__locational expansion
__2__time
__4__time search expansion
____ride-sharing preferences

D. Match List

1. Letter

____form letter separate from the list
__x__letter on the list
____no letter

2. List Format

____individual list for each applicant
__x__one list for all applicants on the list
____recent applicants listed first
____best matches listed first
__x__maximum of 15 (number of) persons per list
____other (specify)_____

3. Contents of the Match List

__x__name
__x__home address
__x__work phone no.
__x__work hours
____employer
____ride-sharing preference
____current travel mode
____other (specify)_____

E. Filing

__x__employer/home end
____home end/work end
____subfiled by work hours
____subfiled by ride-sharing preferences

Part III. Estimated Operational Objectives of the Matching Technique (Refer to the section on the Threshold from a Manual to a Computerized Matching System for assistance.)

A. Processing capacity 100 average number of applicants processed per week or per employer
B. File Size (number of applicants) 600
C. Average Turn-Around Time 5-8 work days
D. Other_____

The procedures described above can be used to develop a manual matching technique. The use of manual matching is oriented toward rural and small urban areas or small segments of an urban area. Manual matching is also appropriate for one-time ride-sharing efforts that operate for 1 year or less.

Selection of Computerized Ride-Sharing Matching Techniques

The computerized matching techniques listed below were selected for consideration.

1. FHWA Carpool Matching Program
2. FHWA Commuter Information Service (CIS)
3. Ride-Sharing System (RSS)
4. RideFinder of Colorado Springs
5. Data Base Management Systems (DBMS)
6. Statistical Program Packages (STATS)
7. Mail List for Word Processor Software Program (WP)

The first four techniques were developed by or for government agencies and are therefore nonproprietary. The remaining three are software packages that have proven to be applicable for ride-share matching. All seven techniques are described in Appendix C to allow a prospective user to gain familiarity with the techniques and terminology involved.

Although there are many differences in the numerous proprietary and nonproprietary matching techniques available, the seven techniques selected for examination in this study are representative of the range of matching techniques.

A four-step procedure is used to select the computerized matching technique.

Step 1. Identify ride-sharing matching needs for the program in question.

Step 2. Identify potential matching techniques.

Step 3. Complete the check list indicating how well the potential matching techniques satisfy the matching needs.

Step 4. Select the matching technique.

To facilitate use of the procedure, it is suggested that Tables 5-9 be copied and placed so they can be readily viewed as it is necessary to refer back to preceding tables frequently.

Step 1. Identify Computerized Ride-sharing Matching Needs

Table 5 displays a form used to identify the needs for ride-share matching. A general description of the mission of the ride-sharing program is given in Table 5, Part I. The program orientation, services offered, and area served are defined. It is assumed that the program's mission has been well defined prior to the consideration of techniques. Table 5, Part II provides a checklist of requirements for the locational system, matching strategy, match list, and other functions. Table 5, Part II is especially important because the more specific the requirements, the more likely it is that the optimal technique will be selected. Table 5, Part III lists the resources available to the ride-sharing program in staffing, computer services, and funding sources. It is important to note the availability of a computer programmer either in-house or reasonably accessible at an affordable cost. Software and programming costs often exceed the cost of hardware in any computer application.

Step 2. Identify Potential Matching Techniques

This step considers the ride-sharing program as described in Part I of Table 5. The matching techniques are screened by area served, program orientation, and services offered. Computer matching techniques are grouped in Table 6. Enter Table 6 for the appropriate area served and program orientation. The services offered are identified in parentheses. Place an "x" in the space provided to denote the computer matching techniques that meet or exceed the needs relative to services offered. The techniques denoted by the "x" are the potential matching techniques.

Step 3. Complete the Checklist of Requirements for Matching Systems

The matching techniques selected from the screening in step 2 are compared with the requirements for matching techniques specified in Part II of Table 5. The corresponding features for the matching systems are given in Table 7. Note that sections A-E in Table 7 correspond to the same sections in the ride-sharing matching needs, Part II, Table 5. Additional comments on the computer matching techniques are given in Table 8. The checklist in Table 9 is used to indicate how well the desired requirements for matching techniques (Table 5) are incorporated into the potential matching techniques (Table 7). The potential techniques are listed in the columns and an "x" is placed in the spaces where the desired feature is included in a potential matching technique. If the user is limited to a specific type of computer, then only the techniques that employ that type of computer or operating system are considered. If more than four techniques are being considered, use two copies of Table 9. After all of the potential matching techniques are checked, the number of checks are summed for each matching technique and the total number of checks is written in the "Total" space at the bottom of the checklist. All of the requirements are weighted equally.

Table 5

Computer Ride-Sharing Matching Needs

Instructions: Place an "x" next to the appropriate choice(s).

Part I. The Ride-Sharing Program

A. Area Served

____urban ____rural or small urban ____other (specify)_____

B. Program Orientation

____employer-based ____general public ____both

C. Services Offered

____carpooling matching ____transit information ____vanpool matching

Part II. Requirements for Matching Systems

A. Location System

____grid map
____automatic geocoding
____network
____community names
____map plotting
____other (specify)_____

B. Matching Strategy

1. Locational Search Expansion (around applicant's home end or work end)

____adjacent units
____rings of adjacent locations (specify no. rings)
____no expansion
____radial search
____route-to-work
____other (specify)_____

2. Time Search Expansion (around applicant's work hours)

____+/- 15 minutes
____+/- 30 minutes
____work hour groupings (shifts)
____variable
____no expansion
____other (specify)_____

3. Ride-Sharing Preferences (i.e., rider, driver, both)

____match with respect to preference
____list preferences only
____do not consider preference
____other (specify)_____

C. Match List

1. Letter

____predetermined message prepared in software
____letter content determined by the ride-share program
____no letter

2. Match List Ranking

____most recent applications listed first
____best matches listed first (the criteria are generally distance and time)
____other (specify)_____

3. Contents of the Match List

____name
____home address
____home phone no.
____work address
____work phone no.
____work hours
____employer
____requested ride-sharing mode (i.e.,carpool,vanpool, or transit)
____pooling preference
____current travel mode
____other (specify)_____

Table 5 continued

D. Options
   1. ____automatic deletions (delete records that have been active for n months)
   2. ____mailing labels
   3. ____additional letters (generate letters other than match lists)
   4. ____evaluation tools (measure the effectiveness of the ride-sharing program)
   5. ____office bookkeeping
   6. ____vanpool monitoring (monitor van maintenance, ridership, costs, etc.)
   7. ____density plots for vanpool planning
   8. ____other (specify)_____

E. Type of Computer (for minicomputer and microcomputer, specify the model and operating system)

____mainframe ____minicomputer
____microcomputer ____no preference

Part III. Resources

A. Staff Size and Job Titles/Functions_____
_____

B. Availability of Computer or Computer Services
____in-house
____access via a remote terminal (source)
____another agency or organization (specify)_____

C. Funding Sources
   1. Initial cost (specify)_____
   2. Operating cost support sources
      ____in-kind (donated)
      ____budgeted
      ____other (specify)_____

Table 6

Identification of Potential Computer Matching Techniques

Instructions: Place an "x" in the space provided to denote all matching techniques that meet or exceed the matching needs.

Part I. Urban Areas

A. Employer-Based Programs
1. ____FHWA Carpool (CP,VPP)
2. ____CIS (CP,VPP)
3. ____STATS (CP)
4. ____RSS (CP,VP,TR)
5. ____RideFinder (CP)
6. ____DBMS (CP,VP)
7. ____WP (CP,VP)

B. General Public (or General Public and Employer-Based) Programs
1. ____CIS (on-line) (CP,VPP)
2. ____RSS (CP,VP,TR)
3. ____RideFinder (CP)
4. ____DBMS (CP,VP)
5. ____WP (CP,VP)

Part II. Rural and Small Urban Areas

A. Employer-Based Programs
1. ____STATS (CP)
2. ____DBMS (CP,VP)
3. ____WP (CP,VP)

B. General Public (or General Public and Employer-Based) Programs
1. ____DBMS (CP,VP)
2. ____WP (CP,VP)

Legend: CP — Carpooling
VP — Vanpooling
VPP — Vanpool Planning
TR — Transit Information

Table 7

Capabilities of the Commuter Ride-Sharing Matching Technique

	A. Locational System	B.1 Location Home End		B.2 Time Expansion	B.3 Pref.	C.1 Match Letter	C.2 List Ranking	C.3 List Contents	D. Options	E. Computer
FHWA Carpool	Grid 1 or 2 density manual code	1 ring if 8 app.	Single or multiple employer grid #	Variable (15 min.)	Not considered	None	Best matches first of 8; otherwise none	Name address work phone no. and room no. work hours	Update; density plots	IBM 360/ 65 (OS) mainframe
CIS	Grid 1 or 2 density manual code	Max. 5 rings route-to-work option	Max. 3 rings	Variable	List preferences only	Message on the list	Best matches first	Variable	Mailing labels letters; density plots	IBM 360 mainframe TI-990 minicomputer
RSS	Grid	1 $mi.^2$ grid 1 ring search pass-thru for VP	1 $mi.^2$ grid 1 ring search	+/- 15 min.	List preferences only	Separate letter	Best matches first	All contents	None; however, can add other software packages such as word processing, accounting, DBMS	Radio Shack TRS-80 Model II microcomputer
RideFinder	Dual density grid	Any 4 grids may be entered	Any 4 grids may be entered	+/- 15 min.	Not considered	List is in text of letter	None	Name work phone no.	Data management program with bookkeeping and some evaluation tools	Digital PDP 1144 minicomputer
DBMS (SIR HPImage, etc.)	Community names (variable)	Variable	Variable	Variable	Optional	Variable	Optional	Variable	Evaluation tools; bookkeeping tools; can add word processing package	Mainframe minicomputer microcomputer (limited)
Statistical Program Packages — SPSS SAS	Community names (variable)	Variable	Variable	Variable	Optional	Variable	Optional	Variable	Evaluation tools	Mainframe
Mail list of WP (Superior/Douglas Co-Ride Share Base File)	Ride-share sectors highway corridors	None	None	None	Optional	Variable	Optional	Variable	Mailing labels	Memorite III word processing system on Vector graphic 3 microcomputer

1 $mi.^2$ - 1.6 Km

Table 8

Additional Comments on the Computer Matching Techniques

FHWA Carpool

a. Extensively used before CIS
b. Still used by some ride-sharing programs that prefer its simplicity
c. Many users have modified the match list printout

CIS

a. Designed for regional ride-sharing
b. Is being used extensively
c. Highly modular with separate programs
d. Unavoidably complex due to the numerous options and flexibility and therefore requires extensive debugging
e. Good software maintenance support
f. Duplicated but not well documented on a microcomputer by Metro Plan, Little Rock, Arkansas

RSS

a. Currently installed on 8-bit microcomputer whereas 16-bit microcomputers are commonplace
b. Can be expanded to provide a more powerful microcomputer, remote terminals, more memory, and additional software packages
c. User-friendly language, quick response

DBMS

a. On-line, interactive system, not many are available on microcomputers to date
b. User-friendly language, quick response
c. Software packages are readily available but must be tailor-made for a ride-share matching program
d. Can provide a good matching system, evaluation and office bookkeeping (see Appendix C)

Statistical Programs

a. Provide statistical measures for evaluation
b. Flexible in selecting the locational system and matching criteria
c. Community names are the only locational systems that have been used (see Appendix E, JAUNT Rideshare and Rooftop CAP)

Mail List Feature of a Word Processor

a. Word processors may cost as much as a microcomputer that can perform word processing and many other computer functions
b. User-friendly
c. Matching is a minor use of a word processor

Table 9

Checklist for Evaluating Matching Technique Alternatives

Instructions: The matching needs are taken from Table 5 and compared with the capabilities of the matching techniques (Table 7).

An "x" should be placed in the position where the alternative satisfies the needs.

	Alternatives			
	A	B	C	D
(Name of Alternative)	_____	_____	_____	_____
II. Matching Needs				
A . Locational system	_____	_____	_____	_____
B1. Locational search expansion	_____	_____	_____	_____
B2. Time search expansion	_____	_____	_____	_____
B3. Ride-sharing preferences	_____	_____	_____	_____
C1. Match letter	_____	_____	_____	_____
C2. Match list ranking	_____	_____	_____	_____
C3. Contents of the match list	_____	_____	_____	_____
D . Options (list below)				
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
E . Type of computer	_____	_____	_____	_____
TOTAL	_____	_____	_____	_____

Step 4. Select the Matching Technique for Implementation

The alternative that has the highest "total" sum (calculated in step 3) on the checklist (Table 9) is selected as the matching technique with the highest potential for implementation. If there is a tie for the highest total, then the tied techniques are selected and are reviewed in further detail as discussed in the pre-implementation activities.

Example of How to Use the Procedure

Tom Christoffel of the Lord Fairfax Planning District Commission (LFPDC),Front Royal, Virginia, employed these guidelines to identify an appropriate computer matching technique for future implementation in the LFPDC Ride-sharing Project. The completed Tables 5, 6, and 9 are displayed in Tables 10, 11, and 12, respectively. The LFPDC was interested in acquiring a microcomputer for ride-share matching. The mission of the ride-sharing program and the estimated requirements for the matching system were well defined. Three potential matching techniques were identified. The three techniques were entered into the checklist and the DBMS alternative obtained the highest total. The LFPDC is considering use of a microcomputer and data base management software program when the threshold value for transition to a computer matching technique is reached. The guidelines proved to be helpful by setting up criteria and identifying appropriate matching techniques.

Cost of Implementation

Although the selection of a matching technique focuses on the operational features of the techniques, the decisive factor will be the cost of implementation. The goal is to obtain an appropriate system that is also affordable. Since the cost of implementation depends on detailed cost items that vary from case to case, only general comments will be made here. The low cost microcomputer makes it possible to have in-house processing that has satisfied the needs of many ride-sharing programs. Many ride-sharing programs can now afford a computer. Based on the experiences of ride-sharing programs, in-house control of the computer is highly desirable. The minicomputer provides more computing power for comprehensive ride-sharing processing and uses not related to ride sharing. Obtaining remote access to a mainframe computer may offer economic advantages, depending on the situation.

The selected matching technique may not be implementable because it is too costly. If this is the case, then the technique with the next highest total is considered.

Table 10

Computer Ride-Sharing Matching Needs

Instructions: Place an "x" next to the appropriate choice(s).

Part I. The Ride-Sharing Program

A. Area Served

___urban __x__rural or small urban ___other (specify)_____

B. Program Orientation

__x__employer-based ___general public ___both

C. Services Offered

__x__carpooling matching ___transit information __x__vanpool matching

Part II. Requirements for Matching Systems

A. Location System

___grid map
___automatic geocoding
___network
__x__community names
___map plotting
___other (specify)_____

B. Matching Strategy

1. Locational Search Expansion (around applicant's home end or work

___adjacent units
___rings of adjacent locations (specify no. rings)
__x__no expansion
___radial search
__x__route-to-work
___other (specify)_____

2. Time Search Expansion (around applicant's work hours)

__x__+/- 15 minutes
___+/- 30 minutes
___work hour groupings (shifts)
___variable
___no expansion
___other (specify)_____

3. Ride-Sharing Preferences (i.e., rider, driver, both)

__x__match with respect to preference
___list preferences only
___do not consider preference
___other (specify)_____

C. Match List

1. Letter

___predetermined message prepared in software
___no letter
__x__letter content determined by the ride-share program

2. Match List Ranking

___most recent applications listed first
__x__best matches listed first (the criteria are generally distanc and time)
___other (specify)_____

3. Contents of the Match List

__x__name
___home address
___home phone no.
___work address
__x__work phone no.
___work hours
___employer
___requested ride-sharing mode (i.e.,carpool,vanpool, or transit)
___pooling preference
___current travel mode
___other (specify)_____

Table 10 continued

D. Options
1. ____automatic deletions (delete records that have been active for n months)
2. _x_ mailing labels
3. ____additional letters (generate letters other than match lists)
4. _x_ evaluation tools (measure the effectiveness of the ride-sharing program)
5. _x_ office bookkeeping
6. ____vanpool monitoring (monitor van maintenance, ridership, costs, etc.)
7. ____density plots for vanpool planning
8. ____other (specify)_____

E. Type of Computer (for minicomputer and microcomputer, specify the model and operating system)

____mainframe ____minicomputer
_x_ microcomputer ____no preference

Part III. Resources

A. Staff Size and Job Titles/Functions_____
_____

B. Availability of Computer or Computer Services
_x_ in-house (PROPOSED)
____access via a remote terminal (source)
____another agency or organization (specify)_____

C. Funding Sources
1. Initial cost (specify)_____
2. Operating cost support sources
____in-kind (donated)
____budgeted
____other (specify)_____

Table 11

Identification of Potential Computer Matching Techniques

Instructions: Place an "x" in the space provided to denote all matching techniques that meet or exceed the matching needs.

Part I. Urban Areas

A. Employer-Based Programs
1. ____FHWA Carpool (CP,VPP)
2. ____CIS (CP,VPP)
3. ____STATS (CP)
4. ____RSS (CP,VP,TR)
5. ____RideFinder (CP)
6. ____DBMS (CP,VP)
7. ____WP (CP,VP)

B. General Public (or General Public and Employer-Based) Programs
1. ____CIS (on-line) (CP,VPP)
2. ____RSS (CP,VP,TR)
3. ____RideFinder (CP)
4. ____DBMS (CP,VP)
5. ____WP (CP,VP)

Part II. Rural and Small Urban Areas

A. Employer-Based Programs
1. x STATS (CP)
2. x DBMS (CP,VP)
3. x WP (CP,VP)

B. General Public (or General Public and Employer-Based) Programs
1. ____DBMS (CP,VP)
2. ____WP (CP,VP)

Legend: CP — Carpooling
VP — Vanpooling
VPP — Vanpool Planning
TR — Transit Information

Table 12

Checklist for Evaluating Matching Technique Alternatives

Instructions: The matching needs are taken from Table 5 and compared with the capabilities of the matching techniques (Table 6).
An "x" should be placed in the position where the alternative satisfies the needs.

	Alternatives			
	A	B	C	D
(Name of Alternative)	STATS	DBMS	WP	
II. Matching Needs				
A . Locational system	x	x	x	
B1. Locational search expansion	x	x		
B2. Time search expansion	x	x		
B3. Ride-sharing preferences			x	
C1. Match letter		x		
C2. Match list ranking	x	x	x	
C3. Contents of the match list				
D . Options (list below)				
Mailing labels				
Evaluation	x	x		
Office bookkeeping		x		
E . Type of computer		x	x	
TOTAL	5	8	4	

Pre-implementation Activities

Several activities should be conducted prior to the implementation of the selected matching technique.

1. Examine the compatibility between the selected computer matching program and the computer hardware that will be used. A computer programmer or specialist is needed to do this.

2. If the computer hardware and software are being purchased, a computer specialist should assist in developing requirements for bidding. A list of factors that should be considered is given in Table 13.

3. Additional information on the hardware and software used by the matching technique may be obtained from the developers or sponsor of the matching technique, users of the technique, or hardware and software vendors.

4. Estimate the approximate cost of implementing the potential matching techniques, then compare cost and performance to confirm or revise the selected matching technique.

5. Develop a schedule for the planning, installation, and training of the matching technique.

6. For new programs, consider the possibility of employing a manual matching technique temporarily while the computer matching system is being installed.

Table 13

Considerations for Computer Matching Techniques

Hardware

1. Type of computer
2. Number of bits (number of binary digits that can be processed at one time, or word size) — determines processing power and speed
3. Memory (internal and external) — may limit file size
4. Operating system
5. Disk type (data storage devices)
6. Printer type and speed
7. Number of users
8. Remote access option
9. Multiple job submission
10. Future expansion
11. Maintenance availability

Software

1. Programming language
2. Availability of other software packages (such as word processor)
3. File contents and size
4. System command (menu driven is common on minicomputers and microcomputers)
5. Training staff
6. References from current users of the softwares
7. Availability of other software packages (such as word processor)
8. Availability of support for updating software and troubleshooting

Source: 1. Notes from the COMPOOL, Inc. Computer Review Committee, Richmond, Virginia, 1982.

Summary

The guidelines presented in this section provide a systematic procedure for selecting matching techniques. Other matching techniques that are of interest can be included in the alternatives. A description of the matching techniques is given in Appendix C. All of the matching techniques have their advantages and disadvantages. Nevertheless, the author suggests that the following computer matching techniques be considered.

For urban areas,

1. CIS on a minicomputer because of its comprehensive and flexible features (documentation of CIS on a microcomputer will soon be available — see Appendix C).
2. RSS because of its low cost and services offered.

For rural and small urban areas,

1. **DBMS** because it has worked successfully with comunity names as a locational system and it has evaluation and bookkeeping capabilities.

Additional Uses and Extension of the Guidelines

There are several ways in which the use of the guidelines may be expanded.

For planned ride-sharing programs, it may be desirable to use the guidelines with different matching needs to generate additional alternatives. This is especially helpful where the matching needs have not been well defined.

Other matching techniques can be added to the guidelines. Other locational systems and manual matching techniques should be added to Table 3 for consideration. Computer matching techniques should be added to Tables 6, 7, and 8 in the same format. In particular, proprietary matching techniques can be easily added.

The evaluation of the ride-share matching system may be reviewed within the guidelines. A ride-sharing program may investigate the conversion from a manual to a computerized matching system with respect to changes in matching needs and operations. Also, the conversion from one computerized matching technique to another technique may be evaluated. For example, it may be feasible to evolve from a technique using a word processing package to a data base management system. The word processing may be significantly easier and less expensive to implement.

ACKNOWLEDGEMENTS

The author expresses appreciation to Kenneth W. Wester and David W. Berg of the Public Transportation Division of the Virginia Department of Highways and Transportation; R. Allen Lassiter, Jr. and Lori Hobson of the Virginia Office of Emergency and Energy Services; and E. D. Arnold, Jr. of the Research Council for providing assistance and reviewing the first draft report. Appreciation is due Rebecca Langfitt of the Central Shenandoah Planning District Commission and Philip Winters of COMPOOL for reviewing the revised draft.

Special thanks are extended to Tom Christoffel of the Lord Fairfax Planning District Commission for providing an example of the use of the guidelines to select a computer matching technique and for reviewing the first draft and the revised draft report.

Appreciation is due the following persons for providing information on ride-sharing programs through interviews.

Philip Winters — Program Manager of COMPOOL, Inc.

Viktoria W. Fox — Director of Easyride

Simela Triandos — Project Manager of Commuter Club

Marsha B. Spears — Ride-sharing Coordinator of Alexandria Ridesharing Service

Lee Yolton — Ride-Share Coordinator of the Prince William County Ride-Sharing Program

William Potapchuk — Assistant Director of JAUNT, Inc.

L. W. Douglas, Jr. — Ride-sharing Coordinator of Rooftop of Virginia CAP (and Teresa Blevins of Rooftop)

John Ferguson — Virginia Center for Coal and Energy Research

Marian J. Craighill — Ride-sharing Coordinator of the Commuter Express

Harry Surratt — Ride-sharing Coordinator of the New River Valley Ride-sharing Program

Thomas M. Spratt — RADCO Commuter Service

A. Jeff Becker — Service Development Manager of Tidewater Regional Transportation Ride-Sharing Program

Jerry Meggett — Representative of Share-A-Ride, Silver Spring, Maryland

The services provided by the staff of the Virginia Highway and Transportation Research Council are acknowledged. Special acknowledgement is made of Susan Kane and Jan Kennedy for typing the final report draft, Jean Vanderberry for typing the report manuscript, and Harry Craft for editing the final report.

The research was financed from highway planning and research funds administered through the Federal Highway Administration.

REFERENCES

1. Misch, M. R., J. B. Margolin, et al.,"Guidelines for Using Vanpool and Carpools As a TSM Technique," National Cooperative Highway Research Program Report 241, Transportation Research Board, Washington, D. C., December 1981.

2. Miller, Gerald K., and Melinda Green, A Guideline for the Organization of Commuter Van Programs, prepared for the Urban Mass Transportation Administration, Washington, D. C., February 1976.

3. Goodwin, G. S. III, and R. N. Robertson, "Methods of Identifying Potential Vanpool Riders," Virginia Highway and Transportation Research Council, Charlottesville, Virginia, February 1977.

4. U. S. Department of Transportation and Highway Users Federation, How to Pool It, Washington, D. C., May 1975.

5. Alan M. Voorhees and Associates, Inc., Manual Carpool Matching Methods, prepared for the U. S. Department of Transportation, Washington, D. C., January 1974.

6. Weisbrod, Glen E., and Ellyn S. Eder, Evaluation of the Minneapolis Ridesharing Commuter Services Demonstration: Final Report, prepared for the Urban Mass Transit Administration, Washington, D. C., June 1980.

APPENDIX A

LOCATIONAL SYSTEMS

A locational system provides the geographic unit that identifies the origin and destination of a commuter. Applicants are matched with commuters who have similar origins and destinations as defined through the locational system. Six locational systems — grid map, geographic base file, transportation network, community names or landmarks, map plotting, and zip codes — are discussed below.

Grid Map System

A gridded map or a grid system overlaid on a map is the most popular locational coding system currently used.(1) The grid cells or squares typically range from 1/4 mile (0.4km) to 2 miles (3.2km) on a side. Each grid cell is identified by an x-y coordinate in most cases. However, a single number is sometimes used to uniquely identify a grid cell. Addresses can be geocoded using grid maps in three ways: by the applicant who is provided with a map, by trained ride-sharing staff persons (employee transportation coordinators, ETCs included), or by automatic geocoding using a geographic base file. Although geocoding by the applicant is least expensive, the following problems are associated with using it: (a) many people have difficulty reading maps and misgeocoding has resulted on 5% to 15% of the applications, (b) the distribution of grid maps with applications can be cumbersome, (c) some employers may object to the use of the grid maps, and (d) certain marketing alternatives (e.g., newspaper ads) would be eliminated. Manual geocoding by the ride-sharing staff may result in delays when large batches of applications are processed. The geocoding error rate should be lower for staff geocoding than for applicant geocoding.

Geographic Base File

A geographic base file (GBF) is a computer file that contains geographic information systematically organized. A GBF system permits geocoding by using the computer. The Bureau of Census has developed a GBF/Dual Independent Map Encoding (DIME) System, a computerized version of a map.(2) While the GBF/DIME system was developed to file Standard Metropolitan Statistical Areas (SMSA's), it has become an important tool for city, county, and regional organizations of SMSA's. The addresses are defined by x-y coordinates and then the coordinates are related to geographic units. The most common application is address matching or geocoding by units such as school districts, census tracts, transportation zones, and

neighborhoods. Other geographic base file systems have been developed for specific transportation purposes such as the Washington Metropolitan Area Transit Authority's AIDS Geographic Data Base System for use as a transit information system. A geographic base file is the primary method for automatic geocoding of grid cells. Automatic geocoding has (1) a high initial cost to make the system operational, (2) a lower cost for large batches of applicants, and (3) a need to be adequately maintained and updated. Note that most ride-sharing agencies that employ automatic geocoding already had the capability available.

Transportation Network

Transportation networks provide zone-to-zone information by identifying the minimum time path from origin to destination. A network is the only locational system that considers zone-to-zone minimum time paths. This addition makes it necessary to have a complete simulation of the travel network.

Several ride-sharing agencies use networks. Transportation networks require an extensive effort in maintenance and updating to be most effective. Networks have a high initial cost and high maintenance costs; therefore it is beneficial to have a network already available and adequately maintained.

Community Names or Landmarks

In this locational system, locations are identified by familiar names of towns, neighborhoods, shopping centers, roads, or intersections. The locations may be defined by area size, geographic or physical boundaries, population, ease of travel or matching within, etc.[3] Large towns are divided into several locations and small towns are one location. This system is especially useful for service areas where grid systems are not appropriate because of the distribution and density of the population, physical barriers, and accessibility to travel corridors. It may be appropriate for the size of the locations to increase as the population density decreases and the distance from the major employment centers increases. On the work-end, locations may be defined by major employers or business districts. In some cases, the community names are selected by the applicant from a list on the application. This approach requires a long application form and very familiar names. However, the potential for error increases where the location of a mailing address differs from the town or location of residence and where neighborhoods are not well defined in large cities or towns. The possibility of coding errors is reduced when the geocoding is performed by ride-sharing staff members.

Map Plotting

Map plotting consists of identifying the home location of the applicant on a large base map by means of a flag or label. The flag or label contains information on the applicant's identification number, destination, and, possibly, work hours and pooling preferences. A search for matches is executed by looking for potential matches in the vicinity or along-the-route of an applicant's home and then checking for similar destinations and other commuting habits. A system of color-coded flags or labels and alphanumeric codes assist in displaying important information in a convenient manner. Map plotting can be somewhat tedious. However, it provides one of the most precise locational systems since the exact home location is considered in lieu of a broader geographic area. Map plotting is used for manual matching only.

Zip Codes

U. S. Postal Service zip code areas have been used as a locational system of ride sharing. The effectiveness of zip codes depends on the size of the zip code area. Since zip code areas are generally large, zip codes are used as an initial screening, and then geographic matches are made based on a smaller area such as a neighborhood. The zip codes are more effective in urban areas where the zip code areas are smaller.

APPENDIX A REFERENCES

1. Glazer, Lawrence, et al., Commuter Information System User's Guide (draft), prepared for the Federal Highway Administration, Washington, D. C., May 1977.

2. Geography Division, Bureau of the Census, "GBF/DIME SYSTEM Description and Uses," U. S. Department of Commerce, Washington, D. C., February 1978.

3. Rides for Bay Area Commuters, Inc., "The San Francisco Interactive Ride Matching System," October 18, 1980.

APPENDIX B

MANUAL MATCHING TECHNIQUES

Manual matching techniques are divided into two categories: central matching and self-service. Central matching techniques are suitable for an area-wide ride-sharing program or an employer-based program. Self-service techniques require a central location that is frequented by the potential applicants, such as a lobby at the main entrance to an employer's building, or a lounge or cafeteria; therefore, it is most suitable for employer-based programs.

Since this report is oriented to area-wide ride-sharing programs, self-service techniques are considered supplemental techniques or alternatives for employers who are not willing to allow the ride-sharing agency to survey their organization.

Central Matching Technique

A single person or group is responsible for managing and operating the ride-share matching program. More specifically, distributing the survey form, processing (i.e., editing, geocoding, and sorting) returned forms, matching potential riders, distributing the match results, and monitoring the program are the primary duties.(1) This technique may be used by a local or regional ride-share agency, an employer that strongly supports ride-sharing, or a community-based group. The variations in sorting methods depend on the locational system and consideration of work schedules, participation in pooling, and other factors.

The locational systems include map plotting, location by map grid, community name, zip code, and route-to-work. The locational system may consist of a two-step process, first defining a broad area such as zip code and then a smaller area such as a neighborhood. The survey forms may be sorted by any combination of the following: origin, destination, work hours, participation in pooling, and personal preferences. The forms are filed by employer or origin and destination.

Each individual may receive a unique match list or the same match list may be provided to all applicants on the match list. Some methods have been developed to facilitate central matching. For example, the Hallmark Card Company was able to reduce typing needs by mounting up to 10 survey forms on a paperboard sheet so that names and telephone numbers were visible. A photocopy of the filled board became the match list. The keysort system is discussed below.

Keysort

COMSIS, Inc. has developed a manual ride-sharing kit that uses a keysort system.(2) The system employs notches or punched holes on the edges of a keysort card above prepunched holes to code information provided on the application form. With the deck of cards neatly stacked, a needle or thin rod is inserted through a prepunched hole that represents a specific commuting characteristic. By raising the rod, all cards with a hole punched on the edge above the prepunched hole will drop from the deck. The dropped cards share one commuting characteristic and are further sorted by other characteristics until compatible commuters are found. The matching search can be expanded or changed to satisfy a given match criterion. The kit is designed for employer-based matching services. In summary, the following 8 steps describe the match procedure.

1. Transfer the data from the survey form to the keysort cards
2. Select a keysort record
3. Search for work hour matches
4. Search for x-position matches
5. Search for y-position matches
6. Punch record in processed position
7. Punch record in matched position, if appropriate
8. Repeat procedures 2-7 for the next record.

Note that (1) the applicant identifies his home address by grid numbers using the ride-share locator board, and (2) the order of the search steps may be changed.

The ride-share kit contains display posters, information brochures, materials to organize a ride-share locator board, work sheets, survey forms, keysort cards, hole puncher, and metal skewer or rod.

Location Board and Pigeon Hole Technique

This technique is a self-service system where a large grid map and a cabinet with compartments (or pigeon holes) corresponding to the grid cells on the map is conspicuously centrally located in the employment complex.(1) An interested employee completes a questionnaire card and places it in the pigeon hole corresponding to his home grid cell. The employee reviews the questionnaire cards in his

home grid cell to identify potential matches. Two different colored cards should be used; one color to indicate a vacancy to be filled in an existing pool and a second color to indicate persons wishing to join a pool. Adjacent grid cells may also be searched to satisfy pooling needs. Minimal supervision is needed to keep the area properly maintained and to monitor the correct use of the system by employees. This supervision is very important. This method can handle over 1,500 employees.

Roster Technique

A self-service technique for smaller groups (under 100) of employees uses a roster or numbered list of names, addresses, and telephone numbers accompanied by matching, numbered pins, and a large area map.(3) Interested poolers place the numbered pin at the place of residence on the map. The employee checks the map to determine other employees in his area who are interested in pooling by matching the pin number with the roster number. Employees are asked to remove the pin and cross out their names after forming a pool. Little or no maintenance or monitoring is required.

Pin and Number Technique

The pin and number technique, which can handle 500 to 1,000 employees, is basically similar to the roster.(4) An employee places a numbered pin on the map at his place of residence and writes his name, address, and telephone number on the corresponding numbered space on the roster. This technique differs from the roster technique in that the names of uninterested persons are eliminated.

Do-It-Yourself Method

In cases where the matching techniques are not successful in providing a match, an individual may post a sign or flyer in a car window, park 'n ride lots, or bulletin board at work. A sample sign is given below.

CARPOOL WANTED

From :_____

To :_____

Time :_____

Phone:_____

If this sign is mailed in lieu of an empty match list, then the ride-sharing agency's logo, phone number, and offer for assistance should be included at the bottom of the sign. This method can be used independently to supplement a ride-sharing matching program or for transportation emergencies.

Summary

The four techniques described above (excluding the do-it-yourself method) have been modified or combined to develop other techniques. The matching technique should be tailored to satisfy the needs of the employer. The self-service techniques are limited to situations where a single employer or community is the target group for ride sharing.

APPENDIX B REFERENCES

1. Alan M. Voorhees and Associates, Inc., Manual Carpool Matching Methods, prepared for the U. S. Department of Transportation, Washington, D. C., January 1974.

2. COMSIS, Inc., "Rideshare...The Better Way — Reference Manual," (for use with the COMSIS Rideshare Kit).

3. Goodwin, G. S. III, and R. N. Robertson, "Methods of Identifying Potential Vanpool Riders," Virginia Highway and Transportation Research Council, Charlottesville, Virginia, February 1977.

4. U. S. Department of Transportation and Highway Users Federation, How To Pool It, Washington, D. C., May 1975.

APPENDIX C

COMPUTERIZED MATCHING TECHNIQUES

Several computerized ride-sharing programs have been developed to serve the matching needs for urban areas. Since ride sharing has begun serving low density areas such as rural and small urban locations, a couple of readily available software programs have been successfully used for ride-share matching. A variety of hardware and software systems have been used for ride-share matching. These include computerized matching techniques developed by or for the Federal Highway Administration (FHWA) and the Urban Mass Transportation Administration (UMTA), or for individual ride-sharing programs, and the use of available software packages for ride-share matching. An overview of several computerized matching techniques is presented in this section. For further details, consult the appropriate references.

FHWA Carpool Matching Program

This is a computerized carpool/buspool matching program written in ANS COBOL, developed on an IBM 360/65 (OS) and transferable to other computers.(1) A one or two density grid system of X and Y coordinates with a maximum number of 99 each may be used.

There are four segments to the program package:(1)

1. UPDATE builds or updates a basic sequential file of participants, and edits and prints separate lists of rejected and accepted data cards.

2. PROCESS processes the basic sequential file into files indexed for operations in the next two segments.

3. LISTS produces the following three matched output options:

   a. "Master" — a master matched listing of all participants.

   b. "Mail" — individual match listings for all participants for mail outs.

   c. "Request" — individual match listings for selected participants as requested by the user. This is used for new applicants and for along-the-route matching by specifying desired grid cells.

4. DENSITY produces graphical home grid printouts for a given work schedule and work grid showing the total number of participants in each grid cell. This indicates trip distribution and is useful in examining vanpools, buspools, and transit routing and scheduling.

The matching logic identifies all participants who live in the same home cell and work in the same work cell and have the same work hours within a specified time range. If there are fewer than 8 matched participants in a home cell, all participants in the 8 adjacent home cells who work at the same work cell and have the same work hours are added. Multiple work grids are recognized and matched separately. A sample match list is shown in Figure C-1.

FHWA Commuter Information System (CIS)

CIS was developed by Crain & Associates for the FHWA as a successor of the Carpool Matching Program to produce a carpool and transit information system.(2) It was designed principally for regional ride-sharing efforts where the ride-sharing coordinator does not serve as the computer staff. CIS is written in ANS COBOL. It was developed on an IBM 360; therefore, it must be recompiled for operations on non-IBM computers. It was designed for operation on most medium-scale computers by a moderately experienced data processor. Since it is highly modular, it may be customized to local objectives and resources.

The geocoding system employs grids with a maximum of 999 grid squares on each axis. A fine grid system with sides from 1/4 to 1/2 mile (0.4 to 0.8 km) long is recommended. However, the FHWA Carpool Matching Program grids may be used. Brief descriptions of the 8 programs are given below.(2)

1. UPDATE edits all incoming data, and performs additions, changes, and deletions to the master file.

2. CARPOOL performs the matching search and produces the match list. The four searches are home-end search (a maximum of 4 cells because each addition of 4 cells increases processing time by 100%); extended time search, which is user specified with default of +/-30 minutes; and route-to-work search by means of a straight-line vector to work-end or a specified vector such as a feeder to a major route (very expensive). User-controlled options exist in all searches. The match list (see Figure C-2) is easier to read than the FHWA Carpool Match List, and the lists may be sorted by employer or zip code. The cost/match is independent of the number of applications processed.

3. SELECT is used to extract records based on a wide range of parameters from the master file for use in the DENSITY and PRINT programs.

SEND TO:

D-51
751
MCEVOY JOHANNA
743 ARLINGTON BLVD FAIRFAX VA 22399

FROM GRID X13Y23 TO GRID X24Y20 WORKING HOURS: 0830-1700

NAME			HOME ADDRESS			OFFICE PHONE	ROOM NO.	ROUTING SYM.
0800-1630								
SCHUMACHER	DEBBIE	88	MAIN ST	FAIRFAX	VA 22399	753-3301	428	C-4
ROLLS	JAMES	521	FIRST ST	FAIRFAX	VA 22399	412-7433	123	E-12
FROM GRID X14Y23								
0815-1645								
UNDERWOOD	GARY	112	GALLOWS RD	FAIRFAX	VA 22399	124-0072	225	A-4
FROM GRID X14Y24								
0815-1645								
JONES	BERTHA	99	WARREN RD	FAIRFAX	VA 22399	357-7516	529	A-43
FROM GRID X13Y24								
0800-1630								
CAPONE	DAVID	695	ARLINGTON BLVD	FAIRFAX	VA 22399	336-4273	352	C-54
0830-1700								
WOOD	CLARENCE	61	WHITE ST	FAIRFAX	VA 22399	237-4112	521	E-99
FROM GRID X11Y23								
0815-1645								
INSKO	CAROL	10	MAIN ST	FAIRFAX	VA 22399	427-8586	123	E-52

>>>>>>>>>>>>>>>>>>>>>>>> SPECIAL INSTRUCTIONS <<<<<<<<<<<<<<<<<<<<<<<<

1. IF THERE ARE FEWER THAN 8 PERSONS IN YOUR HOME GRID CELL WHO SHARE YOUR CARPOOLING NEEDS, THE PERSONS IN THE ADJACENT HOME GRID CELLS ARE ALSO LISTED.
2. THE ABOVE LISTED PERSONS HAVE THE SAME WORK GRID CELL AS YOU AND A REPORTING AND DEPARTING TIME WITHIN PLUS OR MINUS 15 MINUTES OF YOUR OWN TIMES.
3. ALL REPORTING AND DEPARTING TIMES ARE PRINTED IN MILITARY (24-HOUR CLOCK) TIME. SIMPLY SUBTRACT 1200 FROM ANY TIMES THAT ARE GREATER THAN 1200 TO CONVERT INTO P.M. TIMES.

Figure C-1. Carpool locator individual list. (Reference 1)

000000399,YYY,00
004,011/007,011
RUN DATE: 11/ 2/77

COMMUTER INFORMATION SYSTEM
CARPOOL MATCH LIST

EMPLOYER: 00000
LOCATION: AAF-560

ERV PORTER
3805 SOUTH AVENUE
FAIRFAX VA 22030

WORK HOURS	PHONE NUMBER	MAJOR HWY. INTERSECTION	BLDG	ROOM
8:30AM- 5:00PM	555-8937 WORK	VA 236 & ESTEL RD	A-12	428

- CUT HERE -

THE FOLLOWING PEOPLE LIVE AND WORK NEAR YOU. THE BETTER MATCHES ARE LISTED FIRST.

NAME		HOME ADDRESS	WORK HOURS	PHONE NUMBER	MAJOR HWY. INTERSECTION	BLDG	ROOM
KEVIN	HALL	5112 2ND AVENUE ANNANDALE VA	8:30- 5:00	555-9350 WORK	VA495 @ BRADDOCK RD	C-45	723
BARBARA	ROGERS	3113 C STREET FAIRFAX VA	8:30- 5:00	555-8034 WORK	US-50 @ US 29/211	B-3	426
BOB	REED	3134 KING STREET FAIRFAX VA	8:30- 5:00	555-2053 WORK	VA 50 ELLENWOOD DR	A-12	300
DOREEN	ZEEL	9017 FAIRFAX COURT FAIRFAX VA	8:30- 5:00	555-3394 WORK	VA 236 @ GLENBROOK RD	A-12	536
DON	MEYER	3819 HIGH STREET FAIRFAX VA	7:45- 4:15	555-0317 WORK	VA 236 AND PRINCE WM DRIVE	A-12	124
RAY	BELL	3042 VIRGINIA COURT VIENNA VA	7:45- 4:15	555-2775 WORK	I 66 @ VA 123	A-12	123
SANDI	BROOKS	3229 WASHINGTON PLACE FAIRFAX VA	7:45- 4:15	555-2180 WORK	US 50 @ STAFFORD	B-3	319
STEVE	BENNETT	8312 E STREET ANNANDALE VA	7:45- 4:15	555-4917 WORK	I-495 @ GALLOWS RD	C-45	613
PERRY	DEAN	9001 PEACH STREET FAIRFAX VA	7:45- 4:15	555-2171 WORK	VA 29/211 @ HIDEAWAY RD	C-45	411
GARY	MILLER	2731 DUKE LANE VIENNA VA	7:30- 4:00	555-2430 WORK	VA 243 & I-66	B-3	330
PETER	MESS	9659 MAIN STREET FAIRFAX VA	7:30- 4:00	555-9372 WORK	FAIRFAX CIRCLE 29-211 / 50	A-12	422
WAYNE	BAKER	8901 NORTH AVENUE VIENNA VA	7:30- 4:00	555-1256 WORK	VA 123 & COURTHOUSE ROAD	A-12	102

IF YOU HAVE ANY QUESTIONS ABOUT THIS DOT CARPOOL MATCH LIST OR WOULD LIKE ADDITIONAL INFORMATION, PLEASE CALL MR. BOB JONES AT 555-4286.

Figure C-2. Sample carpool match list.
(Reference 2)

4. DENSITY prints density matrices for specified work grids displaying the distribution of the origins for all commuters to a given work grid. Shaded and numeric density matrices can be produced. DENSITY is used for vanpool and buspool planning.

5. PRINT generates the master file listing, personalized letters, mail labels, etc.

6. CONVERT automatically converts existing FHWA Carpool Matching Program files into the CIS format.

7. LOADTRAN builds or updates the files for the transit network.

8. TRANSIT is not available at this time. It is designed to inform applicants of those transit routes that serve their commuting needs.

CIS is unavoidably complex because of the many decisions that must be made on the range of options available.

CIS has been duplicated but not documented on a TI 99/4A microcomputer by MetroPlan of Little Rock, Arkansas. MetroPlan hopes to thoroughly document the program so that it may be adopted for use by other ride-sharing programs. Also, Crain & Associates are installing CIS under the name of POOLMATCH on a microcomputer.

Ride-Sharing System

Ride-Sharing System (RSS) provides an information service on carpool, vanpool and transit opportunities available to the commuters of a metropolitan area.(3) It was developed under contract for UMTA by the Knoxville Commuter Pool to provide a low cost, easy-to-use, quick response, in-house, easy-to-expand and update, continuing computer matching system. It was developed on a microcomputer, Radio Shack TRS-80-Model II, and is written in Microsoft BASIC. RSS is menu driven; therefore, it can be easily used by anyone.

There are 4 functions that support the matching capability:(3)

1. ENQUIRY. Subscriber and service enquiry provides for rapid response to telephone enquiries on ride-sharing opportunities. Subscriber and Service Density aids in monitoring the number of trips between one origin and one destination. Subscriber and Service Coverage aids in monitoring the number of trips between all origins and one destination for given time parameters.

2. ADDITION. Subscribers, van services, bus services, and company data can be added to the system as soon as the

information is available. The information is entered interactively, verified for correctness, and written into the data base. Subscribers may be added by batch processing where there is a large volume of data to be entered. The entries may be entered during the day and added to the file overnight without operator intervention.

3. CHANGE. The data on subscribers, van service, bus service, and company data can be updated or changed as needed. All changes are made in real time.

4. CANCELLATION. Subscriber, van service, bus service, and company data can be cancelled or deleted from the data base.

A grid system with 1 square mile (2.6 km^2) cells was used in the demonstration operations with the Knoxville Commuter Pool. In the matching algorithm, primary and secondary matches are considered. Primary matches have the same origin and destination cells. Secondary matches consist of a search of the contiguous cells surrounding the origin (home-end) cell for matches and then a search of the cells surrounding the work-end cell. Also, a pass-thru match, where vans are willing to pick up or discharge passengers along the route of travel, is a secondary match. For subscribers and vans, a +/- 15 minute time tolerance is specified. A sample match letter and list are shown in Figures C-3 and C-4. Figure C-5 lists the components and price of installing the RSS system.

RideFinders of Colorado Springs

RideFinders operates an on-line, interactive matching program for the general public.(4) RideFinders has a data base of 3,000 applicants. Over 9,000 applications have been processed, with 63% of those receiving match lists.

A PDP 1144 minicomputer by Digital, 13 terminals, and 3 printers, will constitute the hardware for RideFinders at the central office and 5 remote locations by September 1982. RideFinders is currently sharing computer space on a mainframe PDP 11/70 by Digital. The program was written in BASIC +2 under contract between the Pikes Peak Library District and the Colorado Department of Highways.

KNOXVILLE COMMUTER POOL
Transportation Center
The University of Tennessee
Knoxville, Tennessee 37916
Tel. 615/637-RIDE
7433

John Smith
Rt #4 Box 45
Seymour TN 37865

2/8/82

Dear John Smith,

The Knoxville Commuter Pool has identified a total of 15 ways for you to commute to work besides driving alone.

We have found 12 neighbors in your community who have made an inquiry or completed a survey form just as you have. These people have been matched as closely as possible to best accomodate your commuting schedule. The list of preferred Subscriber Schedules are your best possible match to form a carpool. While Backup Subscriber Schedules will be your second choice. Information on each person is listed on two lines. The first line contains the person's name, address, and home phone number; while the second line lists their working hours, commuting preference in a pooling arrangement (Ride, Drive, or Share Drive), name of the company they work for, and work, extension phone number. Along with this list we included a brochure with a few helpful suggestions about forming or joining carpool.

In certain instances, it is possible that some of the people listed cannot actively participate in a ridesharing program at this time. For example, change of address, different shift hours, a new job or other extenuating circumstances could make ridesharing an unacceptable commuting alternative. If this is the case John, then please let us know so that we can make the appropriate changes or deletions on our file.

There is one van passing through your neighborhood. Simply give the driver listed on the next page a call to see if there is currently a space available. You may want to be maintained on the driver's waiting list if there are presently no vacant seats.

We have also included information on 2 bus routes which could meet your commuting needs. The buses that are most convenient both happen to be express rush-hour buses.

We here at Knoxville Commuter Pool thank you for your interest, and hope that you may soon begin to enjoy the benefits of ridesharing.

Cordially,

Anthony Todd

Anthony Todd
Operations Coordinator

Figure C-3. RSS sample match letter.
(Reference 3)

****** PREFERRED SUBSCRIBER SCHEDULE ******

Virginia * Fitzwater			Rt 6 Box 461, Seymour 37865	Home No.	573-5043
815A	500P	SHARE	Park National Bank	Work #: 521-5344 Ext: 05344	
Kenneth Pierce			Rt 5 Howard Dr, Seymour 37865	Home No.	577-8333
800A	500P	SHARE	South Central Bell	Work #: 522-0620 Ext: 00000	
Lou Ann Garrett			Rt 5 Howard Dr, Seymour , 37865	Home No.	573-0327
800A	500P	RIDE	Valley Fidelity Bank	Work #: 521-3033 Ext: 00000	
Debbie Harvey			Rt 6 Box 335 Shenandoah, Seymour .. 37865		577-6290
800A	500P	DRIVE	Knox Federal S & L	Work #: 637-4711 Ext: 00000	
Kenneth Burnett			P O Box 5, Seymour 37865	Home No.	632-3900
800A	445P	SHARE	Tn Valley Auth	Work #: 000-0000 Ext: 00000	
Sherry Dutts			Rt 4 Box 369 County Lin, Seymour 37		573-0009
800A	445P	RIDE	Tn Valley Auth	Work #: 632-2739 Ext: 00000	
Steve Wiser			Rt 3 Box 165, Seymour 37865		573-4247
800A	445P	SHARE	Tn Valley Auth	Work #: 632-4003 Ext: 00000	
Rose Smith			Rt 4 Box 98 Oliver Rd, Seymour 37865		577-7858
800A	500P	RIDE	K U B	Work #: 524-2911 Ext: 00000	
Kenny Loveday			Rt 2 Dupont Rd, Seymour 37865		453-2186
800A	500P	RIDE	K U B	Work #: 524-2911 Ext: 00261	
Lois Thomas			Rt 3 Box 424, Seymour 37865	Home No.	577-4619
800A	500P	SHARE	Knox News Sentinel	Work #: 523-3131 Ext: 00000	
Margaret Schly			Rt 5 Murphy Rd, Seymour 37865	Home No.	573-4486
800A	500P	SHARE	K U B	Work #: 524-2911 Ext: 00000	
Darris Hawkins			Rt 6 Box 92, Seymour 37865	Home No.	577-7624
800A	500P	RIDE	K U B	Work #: 524-2911 Ext: 00000	

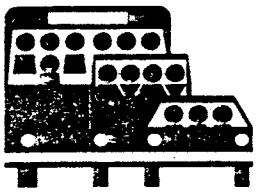
****** PREFERRED BUS SERVICE SCHEDULE ******

DIRECTION	TYPE	ID	ROUTE NAME	FARE	FIRST RUN	LAST RUN
Inbound	Exp	S2	SEYMOUR	$1.40	800A	815A
Outbound	Exp	S2	SEYMOUR	$1.40	500P	515P

****** PREFERRED VAN SERVICE SCHEDULE ******

LEAVE	RETURN	DRIVER'S NAME	HOME #	WORK #	EXT	CHARGE
800A	500P	ANTHONY TODD	5770089	6377433		XX.XX

Figure C-4. Sample RSS match list. (Reference 3)



Knoxville Commuter Pool

Transportation Center
The University of Tennessee
Knoxville, Tennessee 37916
(615) 637-7433

February 10, 1982

The Knoxville Commuter Pool/Transportation Center will make its micro computer system available to all organizations interested in installing a low cost real time micro computer ridesharing matching service. These three packages will allow an organization to be operation. Costs of the Knoxville Commuter Pool providing the hardware, installing the system and training personnel are as follows:

HARDWARE PACKAGE	COST
° Radio Shack TRS-80 Model 11 64K Memory	
° Power line conditioner	
° Corvis 5 meg.	
° Centronics printer model 352	
° Softwear CPM Pickel & Trout	
° Printer Stand	
Total Hardware Package	$9,664.00
INSTALLATION PACKAGE	
° Use CPM to generate system	
° Bring up RSS on hardware; RSS software package (free)	
° Put in grid system*	
° Make system operational	
Total Installation Package	4,999.00
TRAINING PACKAGE	
° Train personnel in RSS system operation (up to five days)	
° Provide telephone follow-up for operational personnel for six months	
° Provide a system operational package documentation manual	
The training package cost does not include travel to site if required. If training is requested outside Knoxville, this cost will be added to training cost.	5,337.00
Total Training Package	$20,000.00

TOTAL OPERATIONAL PACKAGE

To those organizations that currently have a sizeable employee data base file, ways can usually be worked out to transfer this data base to new micro computer.

*Above costs are based upon being able to put present grid system in new system.

Figure C-5. Costs of RSS.

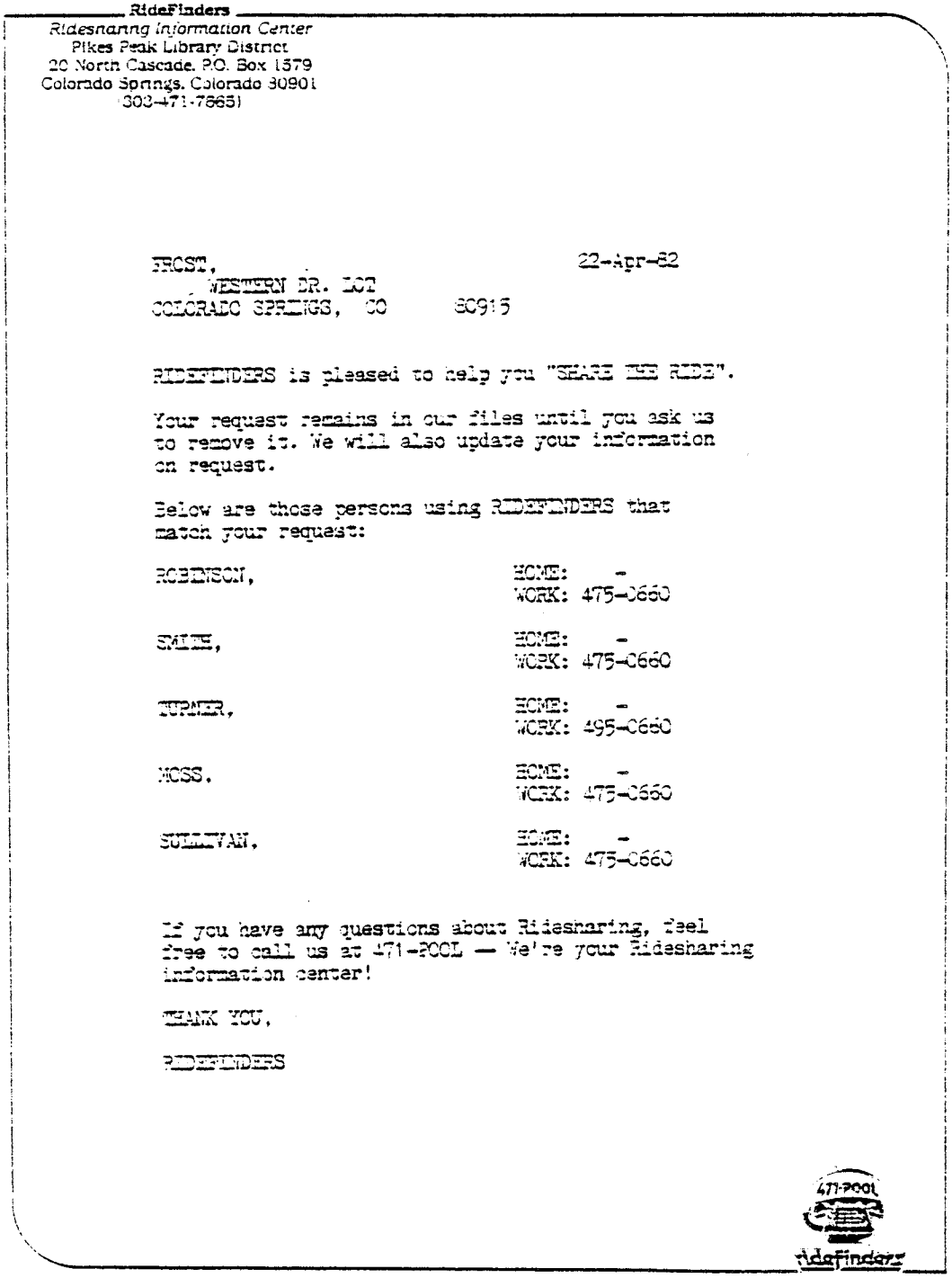
Four origin and destination grids from a dual-density grid map may be entered with only the first grid for each being retained in memory. As a result, route matching and expanded matching can be performed. Arrival and departure times must be within +/- 15 minutes for a match to occur, and weekdays are matched by the operator. A data management program performs queries, counts, updates, and deletions.

For phone-in requests, the average response time is within 3-5 minutes. Applicants are usually called back within 30 minutes of the initial call and given match information. For employer-based surveys, 1 week or less is the turn-around time depending on the number of applications. A sample match list is shown in Figure C-6.

The software, including a magnetic tape, program listings, and complete documentation, is available to public agencies for $45 (to offset duplicating, packaging, and shipping expenses).

Data Base Management Systems

A data base management system is a collection of related programs for loading, accessing, and controlling a data base.(5) It provides a data structure such as a filing system within which data can be stored and accessed in such a way that they can be used for many applications. The basic procedures for a data base management system are "to select the required information using applicable selection criteria, sort it, perform the calculations, and pass the data to a report-formatting program for output to the printer. The final step is to update the data base with current information."(5) Data base management systems are interactive and written in user-friendly language. True data bases are structured as trees or plex structures that provide a heirarchy of levels in the data base. Associated data bases and indexed filed data bases share some of the characteristics and functions of a true data base. Data base management systems have been successfully used for ride sharing in a single-company system, Lawrence Livermore National Laboratory, and for 2 regional systems, Share-A-Ride and JAUNT. The system at LLNL satisfied the objectives of on-line data entry and maintenance, immediate report access, ability to produce match lists and mailing labels, batch processing, limited required training, and quick set up and operations.(6) The Share-A-Ride system is described in Appendix D and JAUNT in Appendix E.



RideFinders
Ridesharing Information Center
Pikes Peak Library District
20 North Cascade, P.O. Box 1579
Colorado Springs, Colorado 80901
(303-471-7665)

FROST, 22-Apr-82
WESTERN DR. LOT
COLORADO SPRINGS, CO 80915

RIDEFINDERS is pleased to help you "SHARE THE RIDE".

Your request remains in our files until you ask us to remove it. We will also update your information on request.

Below are those persons using RIDEFINDERS that match your request:

ROBINSON,	HOME: - WORK: 475-0660
SMITH,	HOME: - WORK: 475-0660
TURNER,	HOME: - WORK: 495-0660
MOSS,	HOME: - WORK: 475-0660
SULLIVAN,	HOME: - WORK: 475-0660

If you have any questions about Ridesharing, feel free to call us at 471-POOL — We're your Ridesharing information center!

THANK YOU,

RIDEFINDERS

471-POOL
RideFinders

Figure C-6. Sample RideFinders match letter.

Statistical Program Packages

Statistical program packages such as Statistical Package for the Social Sciences (SPSS)[7] provide a system of computer programs that consist of a wide variety of data management facilities and statistical procedures to simplify data analysis. Statistical program packages have been employed to sort employer-based ride-sharing matching files, to establish match lists, and to provide useful statistical summaries on every item on the application or survey form. Community names and employers were used for the locational system. An example of how this was done for JAUNT Ride-Share is given below. For a given employer all applicants are sorted by their community. The list of persons from a given community and pertinent information such as home address, telephone number and work hours, etc. form the match list. Frequency tables, graphs and other statistics were obtained for each survey question.

Ride-Share Matching Utilizing the Mailing List Feature of a Word Processor

The Superior/Douglas County Ride-Share Basefile was developed using the mailing list feature of a word processor.[8] A Vector Graphic 3 video display terminal equipped with disc drive, 5 vinyl floppy disks for data storage, and the mailing list feature of the Memorite III word processing system were employed. The basefile utilizes 13 fields of information and the qualifier field. An example is given below.

```
Jonathon Upright
1234 Hammond Avenue
Superior        WI 54880
H 392-4321      w 394-5678(222)
Amalgamated Stuffed Shirts
16½ Short Sleeve Street, Superior
08:00 to 16:30   0035 810924
SA SC ZZZ BM DO G E D BE G ONO
```

The next to the last line includes work hours, identification number, and date. The qualifier field, the bottom line, is the key field for matching and includes the following.

1. Origin
2. Destination
3. Park 7 pool lot
4. Start work
5. Quit work
6. Preferred ride-share mode

7. Ride-share role
8. Number of days currently driving
9. One-way distance to work (miles)
10. Mpg of applicant's vehicle
11. Employer

The first letter indicates highway corridor or city sector and the second indicates the subdivision code for the origin and destination. Ten additional columns are available (31-40). Members of the qualifier field are specified by letter codes for selection as the sort field. For example, by specifying the codes for the origin, destination, start work, quit work, and number of days currently driving, a sub-list, that is a match list, is created by sorting the qualifier fields. It is also possible to sort by any of the 13 information fields.

Other functions that are performed are the creation, deletion, and edition of file entries and printing of the match lists.

This program demonstrates a case study on the use of word processors for ride-share matching. The Minnesota Department of Transportation has published a manual of instructions that explains how to use any type of word processor for ride-share matching.(9)

Microcomputers

Microcomputers are now commonplace in many businesses, schools, and homes. Although a microcomputer is smaller, slower, and generally less powerful than a minicomputer, it has the capability to handle the computing needs of many ride-sharing programs. The low cost of a microcomputer system hardware makes it possible for many ride-sharing agencies to acquire computing services.

Of the computerized matching techniques presented above, only RSS and the word processing technique employ microcomputers. For this reason, caution should be exercised in pursuing the use of a microcomputer. The technology is available for use in ride-share matching but current applications are limited. The application of microcomputers for ride-share matching is increasing rapidly.

The Microcomputers in Planning Association Newsletter, which reports on applications of microcomputers in public agencies, has contained articles on ride-sharing programs in several recent issues. For 1982, the membership fee was $12.50. For further information contact: Robert L. Stockman, P. E., PCP
10748 100th St.
Alto, Michigan 49302

APPENDIX C REFERENCES

1. Federal Highway Administration, User Documentation for the FHWA Carpool Matching Program, Washington, D. C., 2nd ed., June 1975.

2. Glazer, Lawrence, et al., Commuter Information System User's Guide (draft), prepared for the Federal Highway Administration, Washington, D. C., May 1977.

3. RSS, A Computerized Ride Sharing System — Management Document (draft), prepared for the Urban Mass Transportation Administration, February 1982.

4. RideFinders, Correspondence — Information on RideFinder's Matching System, Colorado Springs, Col., April 1982.

5. Veit, Stanley S., Using Microprocessor in Business: A Guide for the Perplexed, Hayden Book Company, Rochelle Park, N. J., 1981.

6. Taasevigen, Diane, "Ridesharing and the Data Base Management System," Lawrence Livermore National Laboratory, Livermore, Cal., August 1981.

7. Nie, Norman, et al., Statistical Package for the Social Sciences, McGraw-Hill Book Company, New York, New York, 1975.

8. Dalager, Doug, "Instruction Manual for Rideshare Matching Utilizing Nector Microcomputer," Metropolitan Interstate Committee, Duluth, Minn., September 1981.

9. Minnesota Department of Transportation, "Using Word Processing for Matching Rideshare Program Participants," St. Paul, Minn., August 1982.

APPENDIX D

PERSONALIZED RIDE-SHARING SERVICES

Research by Margolin and Misch[1] and Levin[2] has shown the importance of personalization in increasing the effectiveness of ride-sharing services. Personalized ride sharing attempts to overcome behavioral barriers — such as a hesitancy to contact strangers and uncertainties about the social interaction and rules of the pool — that prevent persons from pursuing ride sharing on their own initiative.

Personalization ideally fits into ride sharing in three ways: (1) tailoring the service to the needs of commuter market groups, (2) having the service mediated by people rather than impersonal match lists, and (3) providing personal outreach in the formation of ride-sharing arrangements and follow-up to determine if the applicant's needs have been met and to provide further assistance if necessary.[3] The first way to personalize ride sharing should be addressed in marketing and promotional campaigns. The second way implies that potential ride sharers should communicate through channels with personal interactions, such as meetings and conference calls, that do not exist through the match lists alone. The third way indicates the need for the ride-sharing staff to provide assistance in forming pools and to continue assistance beyond the distribution of match lists. Several ride-sharing services have experimented with follow-up activities such as phone calls, post cards, and letters with varying degrees of success. Telephone calls are the most effective and the most time consuming.

On the other hand, many ride-sharing matching processes are based on a computer-driven system that focuses on improved computerized procedures to process large volumes of data with short turn-around times instead of a computer-assisted system with personalized placement to increase the program's effectiveness.[4] Manual matching is in keeping with the concept of personalized placement.

The potential for effective personalization of matching service depends on the size of the market being served, the number of applicants on file, staff size, and ride-sharing budget. Currently, it is not possible to determine the most cost-effective level of personalization due to insufficient data.

Two ride-sharing programs, the Minneapolis Ride-Sharing Commuter Services and Share-A-Ride of Silver Spring, Maryland, that have incorporated personalized activities in their matching systems are described below.

Minneapolis Ride-Sharing Commuter Services (MRCS)

This employer-based ride-sharing program has experienced an evolution in matching techniques from manual map plotting to manual zip code matching with limited map plotting to the CIS computerized program.(5)

Recognizing the need for a more personalized service, MRCS initially held carpool formation meetings for potential pools. Because of low attendance at these meetings, they were replaced by telephone brokerage. Telephone calls were used to remarket the program, to encourage applicants to contact persons on the match list, and to determine if new matches were needed. About one-third of the processing time was spent in telephone brokerage. Although telephone brokerage is time consuming, it increases the number of persons placed in pools, provides personal service that is responsive to the needs of the applicants, acts as an automatic data updating, and confirms the number of persons placed in pools.

Share-A-Ride of Silver Spring, Md.

Share-A-Ride operates a hybrid processing system for personalized ride sharing in a market area of 18,000 employees.(6) Carpool and vanpool matching and transit information are provided. The hybrid processing system uses Hewlett-Packard's (HP) 3000 minicomputer and HP IMAGE data base management system to perform the following functions: (1) data entry, verification, and updating, (2) computer generation of cards and letters, (3) storage of information from follow-up telephone calls, and (4) data retrieval and report generation.

Manual matching is performed by scanning the map (i.e., map plotting) to identify good matches based on home proximity, work arrival and departure times, flexibility of work hours, and work location.

Follow-up calls are made to new applicants 2 to 3 weeks after being matched and several more times thereafter to determine what action the applicant has taken and to offer personal assistance if necessary. Often, subtle parameters are considered to improve the quality of a second match. A historical account of the applicant's activities and various pools are also on the applicant's record (apprec).

Under a mature program, one experienced representative and one secretary can effectively serve up to about 18,000 employees in a suburban business district (where the representative's time would consist of 20% on matching, 40% on follow-ups, and 40% on

marketing and other administrative tasks) or up to 75 large employers and 22,500 employees in outlying office parks and government complexes (where the representative's time would consist of 25% on matching, 50% on follow-ups, and 25% on marketing and other administrative tasks).(7)

APPENDIX D — REFERENCES

1. Margolin, Joseph B., and Marion R. Misch, "Incentives and Disincentives for Ridesharing: A Behavioral Study," prepared for the Federal Highway Administration, Washington, D. C., August 1978.

2. Levin, Irwin P., "Interpersonal Factors in Carpooling," Institute of Urban and Regional Research, University of Iowa, Iowa City, Iowa, November 1979.

3. Ribner, Richard, "Ridesharing Operations," Ridesharing Needs and Requirements: The Role of the Private and Public Sectors, Transportation Research Board Special Report 193, Washington, D. C., 1981.

4. Jones, David W., Jr., "Two Ways of Thinking About Productivity and Ridesharing," Ridesharing Needs and Requirements: The Role of the Private and Public Sectors, Transportation Research Board Special Report 193, Washington, D. C., 1981.

5. Weisbrod, Glen E., and Ellyn S. Eder, Evaluation of the Minneapolis Ridesharing Commuter Services Demonstration: Final Report, prepared for the Urban Mass Transit Administration, Washington, D. C., June 1980.

6. Hershey, William R., and Alexander J. Hekimian, "Hybrid Processing System for Personalized Ridesharing Programs in Moderate Size Employment Centers," a paper presented at the 61st Annual Meeting of the Transportation Research Board, Washington, D. C., January 1982.

7. Hekimian, Alexander J., Correspondence on Share-A-Ride, Silver Spring, Md., May 5, 1982.

APPENDIX E

MATCHING TECHNIQUES USED BY VIRGINIA'S RIDE-SHARING AGENCIES

Interviews were conducted with personnel from the 11 ride-sharing agencies operating in Virginia to obtain general information on the agencies and detailed descriptions of the matching techniques they employed. In this section the interview results are presented by agency and are summarized and analyzed for all agencies. The interview results are outlined to provide the following data for each ride-sharing agency.

1. Sponsor
2. Service area
3. Services offered and program orientation
4. Matching technique
5. Update and filing
6. Special practices
7. Statistics
8. Reason for using this system
9. Problems and proposed changes
10. Transferability

The interview results by agency are arranged by the type of matching technique used as listed below.

Commuter Information Service (CIS)

1. COMPOOL, Inc.
2. Easyride

Computer Matching System of the Metropolitan Washington Council of Governments

3. Commuter Club
4. Alexandria Ridesharing Service
5. Prince William County's Vanpool/Ridesharing Program

Data Base Management System (Scientific Informational Retrieval, S.I.R.)/Statistical Package (Statistical Package for the Social Sciences, SPSS)

6. JAUNT Ride Share Program

Statistical Package (Statistical Analysis Systems, SAS)

7. Local Individual and Factory Transportation System (LIFTS)

Manual Matching

8. New River Valley Ridesharing Program
9. Commuter Express
10. RADCO Commuter Service

Matching Assistance

11. Tidewater Regional Transit Ridesharing

Ridesharing programs 1-5 and 11 serve urban areas and ride-sharing programs 6-10 serve rural and small urban areas. Table E-1 presents a summary of the survey data with emphasis on the operational characteristics of each ride-sharing program grouped by urban areas and rural and small urban areas. It is noted that Prince William County's Vanpool/Ridesharing Program could be placed in the rural and small urban group, but since the program uses an urban area matching technique, it is placed with the urban areas.

Analysis

The 11 ride-share matching techniques are summarized and analyzed in this section by the types of data available. There are large variations between some of the systems. Statistics on ride-sharing programs in Virginia are also given in reference 1. To avoid duplication of the statistics in reference 1, the statistics are arranged by categories without considering the particular ride-sharing agency. Urban and rural (small urban included) are used to designate the service areas.

Sponsor

The following types of organizations sponsored the ride-sharing programs.

Type of Sponsor Organization	Urban	Rural	Total	Percent
Transportation district or transit service	2	1	3	27
Public nonprofit corporation	1	1	2	18
Planning District	0	2	2	18
City or county government	2	0	2	18
Council of governments	1	0	1	9
Community action agency	0	1	1	9

Service Area

The service areas ranged from a total population of 50,000 to an employee force of over 1.5 million. Only two programs, Alexandria and Prince William County, were limited to one locality. Both of these programs cooperate with a regional ride-sharing program.

Table E-1

Summary of the Matching Techniques of Ride-Sharing Programs in Virginia

a) Urban Areas

	Program Orientation	Services Offered	Staff Size	Matching Program (file size)	Turnaround Time	Follow-up by RSA	Update & Filing	Transferability	Comments
COMPOOL	EB	CP	1F,2P	CIS on Mainframe (7200)	2-5 wks.	None. Left up to ETC	No formal update	Metropolitan areas where computer is economical	Under contract for a microcomputer system
EASYRIDE	EB/GP	CP,VP	2F,1P	TI990 CIS on Minicomputer (65000)	GP 24 hrs.	Depends on applicant to call back. Carpool registration is planned	Employers are resurveyed every 6 months	All systems, especially high density areas	
COMMUTER CLUB	EB/GP	CP,VP	2F,1P	WCOG program with automatic geocoding on mainframe (42000)	1-3 wks.	None	Delete persons that have been inactive for at least 10 months	densely populated areas	Under contract for a new system with flexible radial search, on-line and interactive
ALEXANDRIA RIDESHARING SERVICE	EB	CP,VP	1F	See Commuter Club, manual matching of phone requests by zip code and corridor pick-ups (1089)	1-3 wks.	Telephone follow-up calls are being done on a trial basis	See Commuter Club	A suburban area with a high density residential area with numerous medium size employers	Will soon be marketed in high density residential areas
PRINCE WILLIAM COUNTY'S VANPOOL/RIDE-SHARING PROGRAM	GP	CP,VP, TR	1F	See Commuter Club, VP requests are matched with a roster of VPs; CP requests are sent to Commuter Club; telephone requests are answered in minutes on the phone (3250)	1-3 wks. or minutes	None	VVPA roster of VPs are updated by VVPA every 2 months. Files consist of a ride-share information request log and a car/vanpool formation log	Any area with access to a computer matching system for a metropolitan area and average commuting distances that justify vanpools (35 mi. [56 km])	
TRT RIDE-SHARING	EB	CP,VP, BP,TR	5F,1P	Provide assistance in developing matching techniques; an ETC operates the program for each employer	—	None	Files are updated annually by the ETCs. Files are generally organized by home grids	Anywhere employers are willing to actively participate in ride-sharing	TRT leases 143 vans and 6 buspools

Table E-1 continued

Summary of the Matching Techniques of Ride-Sharing Programs in Virginia

b) Small Urban and Rural Areas

	Program Orientation	Services Offered	Staff Size	Matching Program (file size)	Turnaround Time	Follow-up by RSA	Update & Filing	Transferability	Comments
JAUNT RIDESHARE	EB/ GP	CP,VP	1F,1F	DBMS for GP and old statistical package for EB; Both on a main-frame on-line and interactive (1252)	GP 24 hrs.	None	Delete inactive records after 12 months on file	An area with one major urban center	
LIFTS	EB	CP	1F,1P	Statistical Package by staff at Va. Tech (4909)	3 mos.	Follow-up survey conducted 5-6 months later; low response	None. A one-time effort	Rural or suburban locations with distinct communities	Now operates 2 vp
NEW RIVER VALLEY RIDE-SHARING PROGRAM	EB	CP	1F,1P	Manual matching based on community names (675)	1 wk.	Telephone call 3-4 weeks later	None. Files are arranged by employer	1 or 2 county areas with a large employer base and commuters from low density areas	
COMMUTER EXPRESS	EB	VP	1F	Manual matching by work hours, zip codes, home location (500)	variable	Potential drivers, back-up drivers, and riders are telephoned and a meeting is arranged for the vanpool group	Employers are resurveyed annually; resurveys are conducted when a potential pool has 8 riders	Urban areas with a population under 100,000 and its surrounding counties	May acquire a microcomputer for vp monitoring and matching
RADCO COMMUTER SERVICE	GP	CP,VP	2P	Manual matching by destination grid map, an origin access ramp to I-95 and work hours (334)	24 hrs.	Mailing a letter to all persons on file (possibly every 6 months)	None. Done only as requested; the files are continuous, no periodic deletions; files are arranged by access ramp with forms, individual requests, and existing pools; information is color coded	Any area along an interstate corridor to a major metropolitan area	

Key: RSA — ride-sharing agency
EB — employer based
GP — general public
CP — carpool
VP — vanpool
BP — buspool
VVPA — Virginia Van Pool Association
ETC — Employee Transportation Coordinator

Service Offered and Program Orientation

The listings below indicate the types of services offered and program orientation for the 11 ride-sharing programs.

Service Offered	Urban	Rural	Total	Percent
Carpool matching	5	4	9	82
Vanpool matching	4	3	7	64
Transit information	3	0	3	27
Vanpool leasing	2	1	3	27
Vanpool load program assistance	2	0	2	18
Buspool matching and leasing	1	0	1	9
Carpool and vanpool assistance	1	0	1	9

In general, the urban programs offer more services.

Program Orientation	Urban	Rural	Total	Percent
Employer-based (EB)	3	3	6	55
General public (GP)	1	1	2	18
Employer-based and general public (EB/GP)	2	1	3	27

There is no significant difference between urban and rural programs with respect to program orientation.

Survey Form

The survey forms vary in format and content as shown below.

Survey Form Format	Urban	Rural	Total	Percent
Boxes or spaces for data entry	4	2	6	55
Lines for data entry	2	3	5	45
Letter included	2	3	5	45
Promotional message included	2	1	3	27
2 Surveys are conducted	0	1	1	9
Transportation survey	0	1	1	9

The use of 2 surveys or a transportation survey which examines commuters and commuting patterns in general is not recommended for a ride-sharing survey. With 2 surveys, there was a significant reduction in the number of survey forms returned (4,485 for survey #1, and 675 for survey #2). This implies that 85% of the respondents to survey #1 did not return survey #2. A transportation survey form is exceptionally lengthy and discourages potential ride-sharing applicants.

Additional survey content aside from name, home and work address and telephone number, and work hours is given below.

Survey Content	Urban	Rural	Total	Percent
Usual work trip mode	4	4	8	73
Ride-share interest request	4	4	8	73
Transit information request	4	1	5	45
Adjustable hours	3	2	5	45
Nearest crossroad to your home	2	1	3	27
Pooling preferences (ride, drive, share)	2	1	3	27
Distance traveled to work	0	3	3	27

Only elements with a total of 3 or more responses were considered. Urban areas offer transit information requests and rural areas request information on the distance traveled to work.

Locational System

The following locational systems are used.

Locational System	Urban	Rural	Total	Percent
Grid maps	3	0	3	27
Community names and employer	0	3	3	27
Automatic geocoding Supplemented by grid map, or community name, or zip code and route-to-work	3	0	3	27
Zip code and home location	0	1	1	9
Access ramps at the home-end and grid map at the work-end	0	1	1	9

As indicated above, three locational systems are used equally. Grid maps and automatic geocoding are used in urban areas. Community names and employers are used in rural and small urban areas along with zip codes and access ramps that are used for manual matching.

Matching System

Five types of matching techniques are used.

Matching System	Urban	Rural	Total	Percent
Commuter information service (CIS)	2	0	2	20
Commuter club (WCOG)	3	0	3	30
Data base management system (SIR) for general public and SPSS for employer-based	0	1	1	10
Statistical package (SAS)	0	1	1	10
Manual	0	3	3	30
Matching assistance	1	0	1	10

Primarily, seven types of matching techniques are employed by ride-sharing programs in Virginia; 4 computerized techniques and 3 manual techniques. Two of the manual matching systems focus on vanpooling. Manual matching is used to supplement computerized matching in several cases.

Match List

Match list information is summarized below.

Match List Format	Urban	Rural	Total	Percent
Computer generated letter and list	3	2	5	50
Computer generated list (CIS)	2	0	2	20
Form letter and separate list	0	2	2	20
Form letter with list at the bottom	0	1	1	10

Match List Content	Urban	Rural	Total	Percent
Name	5	5	10	100
Work hours	5	3	8	80
Employer	4	3	7	70
Work telephone number only	4	1	5	50
Home address	2	2	4	40
Emergency ride sharers noted	3	0	3	30

The first four items listed are the basic information provided on match lists. A better profile of the potential pooling partner is obtained by providing information on the home address and pooling preferences and interests. On the other hand, there is a concern for confidentiality, especially in large urban areas. Match list content items that received less than 3 responses are not considered.

Follow-Up Procedure

Five ride-sharing programs have experimented with strategies for follow-up.

Follow-up Procedure	Urban	Rural	Total	Percent
None	4	1	5	50
Telephone calls (1 on a trial basis)	1	1	2	20
Survey	0	1	1	10
Vanpool formation meetings and telephone calls	0	1	1	10
Letters mailed around every 6 months with form to be returned (also updates)	0	1	1	10

The effectiveness of the follow-up procedures is not measurable because of a lack of data. It is noted that follow-up activities are instrumental in providing further encouragement to carpool and additional assistance if necessary. Rural programs are more involved in follow-up activities than are urban programs.

Update and Filing

Three programs conduct employer-based resurveys, one every 6 months, and two annually (1 rural program). Four programs delete records, 3 after 10 months, and 1 after 12 months (rural program). As mentioned in the section on follow-up procedure above, one program updates based on the return of follow-up information. Three programs do not have a formal updating procedure.

For computer programs, filing is incorporated into the system. Manual matching systems generally arrange files by employer or origin and destination.

Special Practices

Special practices are activities or strategies that a ride-sharing agency performs that are specific to the local needs or ride-sharing goals. A list of 11 special practices is given below, along with the number of programs that have this special practice in parentheses if there are more than one.

1. Emphasis is on benefits of one regional data base (2)
2. Placement of applicants into existing pools is done when possible (2)

3. Match lists are independent of work hours in order to accommodate shift changes (2)

4. Vanpools are coordinated with the Virginia Van Pool Association (VVPA) (2)

5. The ride-sharing system is designed to meet employers' transportation needs

6. No home addresses or telephone numbers are provided on match lists in order to provide a degree of confidentiality

7. For employer-based surveys, all employees are encouraged to complete and return a survey form

8. Applicants identify community names since they are more familiar with the area than the persons processing the survey forms

9. A do-it-yourself flyer is provided to solicit carpoolers when no matches are available

10. Plans are being made to market in high-density residential areas

11. The employer is the sponsor with the ride-sharing agency serving as an umbrella group.

Statistics

Table E-2 displays the statistics that were readily available from the ride-sharing programs. Many useful statistics were not readily available, especially cost data. Most recordkeeping systems consider some of the statistical measures but not all of the measures needed to assess the effectiveness of the matching system. Most of this information is based on general ride-sharing program activities. Only data on the percentage of applicants pooled and cost per pooler require follow-up data or an evaluation. The data range is quite large for statistics presented for 4 or more agencies. Averages were not calculated because the data were incomplete.

Ideally, a turn-around time of 1 day is desired for the general public and less than 1 week for employer-based campaigns. Generally speaking, turn-around time is longer when processing is done using batch entries and there is no access to the computer in-house.

Table E-2

Statistics on Ride-Sharing Programs in Virginia

	COMPOOL	EASYRIDE	COMMUTER CLUB	ALEXANDRIA RIDE-SHARING SERVICE	PRINCE WILLIAM COUNTY VANPOOL/ RIDESHARING PROGRAM	JAUNT RIDE-SHARE PROGRAM	LIFTS	NEW RIVER VALLEY RIDE-SHARING	COMMUTER EXPRESS	RADCO COMMUTER SERVICE
applicants on file	7200	65,000	42,000	1089	3250	1252	4909 (1075 with car-pool in-terest)	675	500	334
% applicants receiving match lists	80	90		over 50	very high	85	100			70
% of applicants pooled	8.5			31			2			9
max. number of surveys processed	1277 per employer					700 per week			100 per employer	
average number of applicants processed per week			200-300 during campaigns		120 per month					
average time required per match			1 week	1 week	15-20 minutes in-house; 1 week (Com-muter Club)	4 minutes for S.I.R.		1 week	15 miuntes	
turn-around time	2-5 weeks	24 hours	1-3 weeks	1-3 weeks	within 1 day for in-house matches; 1-3 weeks for Commuter Club	1 day—general public; 3 days employer based	3 months	2-3 months	variable	
estimated cost per match	$.75 computer time only		$1.00 computer and keypunching	$30/pooler	$5.00-$6.00	$.005-employer based; $1.00-general public; computer time only	$4.07			$42.37/ pooler
number of vans leased		43 vans leased			215 vanpools on file		2 vans		3 vans leased	

Summary

This section presented descriptions of each ride-sharing matching technique and a summary and analysis of all of the ride-sharing matching techniques employed by ride-sharing programs in Virginia. The types of matching techniques vary just as the types of areas served. The ride-sharing programs in major urban areas employ computerized matching techniques such as Commuter Club and CIS. The rural and small urban area ride-sharing programs use computer programs that are general in purpose but can be applied for ride-sharing matching such as statistical packages for employer-based programs and data base management systems for the general public. Ride-sharing programs that focus on vanpooling or that have data files under 700 applicants use manual matching techniques that are tailored for the service area.

APPENDIX E REFERENCES

1. Virginia Department of Highways and Transportation and the Virginia Office of Emergency and Energy Services, "Ridesharing Programs in Virginia: Services, Operations, and Costs for Fiscal Year 1981," Richmond, Va., January 1982.