February 1984

DOE/IR/05106--T63

DE89 013828

MEMPHIS AREA RIDESHARE

ON-LINE INFORMATION SYSTEM

A Project Report

Memphis Area Rideshare
Memphis and Shelby County
Office of Planning and Development
City of Memphis

Memphis, Tennessee

RICHARD C. HACKETT, Mayor
City of Memphis

Conducted by the
Memphis-Shelby County
Office of Planning and Development

PREFACE

The Urban Consortium for Technology Initiatives was formed to pursue technological solutions to pressing urban problems. The Urban Consortium conducts its work program under the guidance of Task Forces structured according to the functions and concerns of local governments. The Energy Task Force, with a membership of municipal managers and technical professionals from eighteen Consortium jurisdictions, has sponsored sixty-eight energy management and technology projects in 30 Consortium member cities and counties since 1978.

To develop in-house energy expertise, individual projects sponsored by the Task Force are managed and conducted by the staff of participating city and county governments. Projects with similar subjects are organized into "Units" of four to six projects each, with each Unit managed by a selected Task Force member. A description of the Units and Projects included in the Fourth Year (1982-1983) Energy Task Force Program follows:

UNIT -- MUNICIPAL FINANCIAL MECHANISMS

Designed to develop and apply innovative local financial management systems for municipal energy programs, projects focused on both capital and noncapital expenditures for energy management and the inclusion of these procedures into the normal budgeting practices of local governments. The Unit consisted of six projects:

- Cleveland, Ohio - "The Energy Savings Payback Fund (ESPF): A Municipally Financed Shared Savings Program"
- Dade County, Florida - "Energy Financing For Local Governments: Metropolitan Dade County's Energy Investment Fund"
- Houston, Texas - "Alternative Sources and Techniques for Financing Local Government Energy Conservation Projects"
- New Orleans, Louisiana - "An Innovative Financing and Incentive Package to Reduce Municipal Energy Consumption"
- Pittsburgh, Pennsylvania - "Improving Energy Management and Accountability in Municipal Operations: A Model Budget for Local Governments"
- Public Technology, Inc. - "Financing Energy Efficiency: Options and Decisions in Five Local Governments"

UNIT -- PUBLIC/PRIVATE COORDINATION

Designed to define effective strategies to increase private sector participation and financial investment for energy management and energy related business development in urban areas, projects focused on means to improve private/public collaboration in energy efficient land development, for industrial and business expansion and for participation with energy utilities. The Unit consisted of five projects:

- Detroit, Michigan - "Rehabilitation of Older Housing to Superinsulated Standards: Energy and Air Quality Impacts"
- Indianapolis, Indiana - "Financial Options for the Construction of Fluidized Bed Combustion Systems"
- Kansas City, Missouri - "Development of an Energy Park in Kansas City: Issues and Implementation Options"

- Memphis, Tennessee - "Memphis Area Rideshare On-Line Information System"

- Washington, DC - "Service and Conservation Alternatives to Increased Electricity Generation"

UNIT -- INNOVATIVE ENERGY TECHNOLOGIES

Designed to develop and apply new energy technologies not previously proven for use in local governments, projects covered a variety of topics ranging from the use of municipal wastes as alternate energy resources to innovative applications of telecommunications technology for energy management. The Unit consisted of five projects:

- Baltimore, Maryland - "A Hydrate Process for Dewatering Sewage Sludge: Feasibility and Energy Resource Potential"

- Columbus, Ohio - "Planning for Telecommunications in a Local Government: Issues, Strategies and Energy Management Aspects"

- Denver, Colorado - "Alternative Uses for Digester Methane Gas: An Analysis of Technical and Economic Feasibility"

- Phoenix, Arizona - "Energy Conservation through Computerized Automation of a Wastewater Treatment Plant"

- San Antonio, Texas - "Landfill Gas Recovery: A Methodology for Site Planning"

UNIT -- INTEGRATED ENERGY SYSTEMS

Designed to identify procedures to resolve difficulties inherent in the implementation of integrated energy systems, projects addressed initial feasibility studies, technology assessments and analyses of institutional or financial barriers. The Unit consisted of four projects:

- Chicago, Illinois - "An Initial Assessment of District Heating and Cooling: A General Methodology Applied in Chicago"

- Hennepin County, Minnesota - "Multi-jurisdictional Planning for District Heating: A Concept Plan for Bloomington and Hennepin County, Minnesota"

- New York, New York - "Financial Planning for District Heating: The Brooklyn Navy Yard Project"

- San Francisco, California - "Renovation Opportunities for a Steam District Heating System: A Decision Process in San Francisco"

Reports from each of these projects are specifically designed to aid the transfer of proven experience to other local governments. Readers interested in obtaining any of these reports or further information about the Energy Task Force and the Urban Consortium should contact:

Energy Program
Public Technology, Inc.
1301 Pennsylvania Avenue, NW
Washington, DC 20004

Acknowledgements

Mr. Phillip L. Whittenberg, Director of the Memphis-Shelby County Office of Planning and Development, served as the project director for this project. Mr. Alan D. Gray, Manager of the Memphis Area Rideshare program administered by the Office of Planning and Development, served as the project manager for this project and is the principal author of this report. Mr. Gray received writing and editorial assistance from Mr. Lawrence Jesse Glazer at Crain and Associates Systems Development Company and Mr. David G. Adams, Deputy Director of Comprehensive Planning in the Office of Planning and Development.

Many others assisted in project implementation, and it is a pleasure to acknowledge and thank them for their efforts. Staff members at Memphis Area Rideshare involved in the project included Mr. Michael Grant, Ms. Yvonne Key, Mr. James Blankenship, Ms. Nancy McDonald, Ms. Shirley Greer, and Mr. Ted J. Newsom of Van Pool Services, Inc. Other staff members within the Office of Planning and Development which performed key project roles included Mr. Michael Walls, Mr. James Milford and Ms. Linda Robinson.

The project also benefited greatly from assistance and guidance provided by individuals outside the Office of Planning and Development, including Mr. David L. Cook at the Tennessee Department of Transportation: Michael Hufnagel, Kerry Roby, and Lew May at the Memphis Area Transit Authority; and Mr. Don Morris at the City of Memphis Data Center.

Special thanks are also given to the Urban Consortium Energy Task Force staff at the City of Chicago, Unit Manager Mr. John K. Burge with the City of Kansas City, Missouri, members of the Fourth Year Energy Task Force Private/Public Cooperation Unit, and Mr. Richard Zelinski of Public Technology, Inc. for providing management and technical assistance.

Various elements of this project were funded and supported by the U.S. Department of Energy, the Tennessee Energy Authority, the Tennessee Department of Transportation, the Federal Highway Administration, the Urban Mass Transportation Administration, the Environmental Protection Agency, Shelby County Government, the Memphis Area Transit Authority, and the City of Memphis.

Abstract

CITY OF MEMPHIS

MEMPHIS AREA RIDESHARE ON-LINE INFORMATION SYSTEM

Since the mid 1970s, there has been an evolution in data processing needs at regional ridesharing agencies. Initially, ridesharing programs were basically "areawide carpooling efforts" which stressed pre-planned commuter surveys and large-scale computerized carpool matching using batch mode procedures. However, experience gained in efforts to influence urban travel behavior has led to the adoption of comprehensive marketing strategies and personalized transportation brokerage techniques which are more responsive to commuter needs. With this changing emphasis, new data processing tools are needed which will support new ridesharing marketing strategies, not dictate them.

As described in this report, the method taken at Memphis Area Rideshare to acquire data processing capabilities needed to support new marketing approaches involved development of an in-house, on-line multi-user system using POOLMATCH ridesharing software. The applied research performed during the project consisted of the following major work tasks:

- Analysis and acquisition of software, microcomputer hardware, and peripheral equipment;
- System installation and activation;

- Staff training and development of system user's documentation;
- Application of the on-line system to daily rideshare program operations; and
- Incremental addition of new data processing functions, including automatic geocoding, transit information, word processing and spread sheet programs, and data base management capabilities.

The project has resulted in an advanced technology information system which effectively supports rideshare marketing strategies. The information system also provides for increased autonomy and efficiency, improves service to program clientele, and contributes to energy savings and other ridesharing program benefits.

TABLE OF CONTENTS

APPENDICES

FIGURES

Chapter 1: Overview

INTRODUCTION

This report describes the design, development and implementation of an in-house microcomputer-based information system for Memphis Area Rideshare, a regional multimodal ridesharing program sponsored by the City of Memphis. The report is intended as an information source and guide for other cities committed to the ridesharing concept as a transportation system management measure and which sponsor or promote carpool, vanpool, transit or paratransit programs.

The report describes the evolving relationship between rideshare marketing, promotional strategies and the role of computers in ridesharing programs, and provides information on some of the latest developments in microcomputer technology which have now made it feasible and affordable for many ridesharing agencies to consider purchasing and operating their own in-house data processing systems. As documented in this report, the implementation of the Memphis Area Rideshare on-line information system project should provide useful guidance for other agencies contemplating the acquisition of in-house computer systems to provide data processing support for ridesharing programs.

PROJECT CONCEPT

In cooperation with local governments in the Memphis metropolitan area and State and Federal transportation/energy/air quality agencies, the City of Memphis has sponsored a successful regional ridesharing program since 1979. The program, which is referred to as Memphis Area Rideshare, is administered by the Memphis-Shelby County Office of Planning and Development, an agency of the City of Memphis and Shelby County Government. According to estimates prepared for the Tennessee Department of Transportation and the Tennessee Energy Authority, Memphis Area Rideshare activities were responsible for placing over 6,400 commuters in regular carpool, vanpool, buspool and public transit arrangements as of July 1983. Current estimated annual direct benefits include 21 million miles of vehicle travel reduced, 1.7 million gallons of gasoline conserved, 1,512 tons of carbon monoxide air pollution removed, and nearly $6.3 million in commuting costs saved.

Originally, Memphis Area Rideshare was initiated as an "areawide carpooling effort" in response to rapidly escalating energy prices and spot gasoline shortages. The early procedure to match riders with their origin/destination points was through batch mode processing of survey information gathered through large scale, pre-planned promotional campaigns at major area work-sites. Commuters were matched for carpool opportunities utilizing a centralized data processing approach which relied heavily on outside agencies for data entry and computer support.

However, as the program matured and Memphis Area Rideshare moved to develop more sophisticated marketing strategies and a more comprehensive package of "transportation brokerage" services, program activites were severely constrained by inflexible and time-consuming batch-mode data processing procedures. New data processing capabilities

were needed which would support marketing and service delivery functions, not dictate them.

In order to overcome data processing constraints, an applied research project was initiated with assistance from the Urban Consortium Energy Task Force and led to the implementation of an in-house microcomputer-based information system for Memphis Area Rideshare. The system uses new POOLMATCH ridesharing applications software developed by Crain and Associates Systems Development and advanced microcomputer technology in an on-line, multi-user environment. environment.

The new system has:

- eliminated delays previously experienced with batch-mode processing;
- provided Memphis Area Rideshare with complete control over data processing operations;
- improved service delivery to program clientele;
- eliminated costs previously incurred for outside data entry and processing; and
- provided flexibility to accommodate future growth and innovation in rideshare program operations.

REPORT ORGANIZATION

The Memphis Area Rideshare on-line information system project experience should assist others who may be considering the development and implementation of similar in-house computer systems. To facilitate transfer of the project experience to other agencies and jurisdictions, the remainder of this report has been organized into the following major sections:

Chapter 2

General Background and Initial Project Planning. Provides background information on the evolution of ridesharing marketing philosophies and resulting changes in data processing requirements in ridesharing programs; documents the Memphis Area Rideshare experience; and explains some of the key factors which were considered during planning for the new Memphis Area Rideshare information system.

Chapter 3

Project Development and Implementation Phases. Dicusses the project work program development, the consultant selection and procurement arrangements for computer software and hardware, and the major activities undertaken during the course of project implementation.

Chapter 4

The POOLMATCH Software System. Describes the major features and capabilities of the ridesharing software acquired for the Memphis Area Rideshare information system, with some information as to how different capabilities are used in daily rideshare program applications.

Chapter 5

The Computer Hardware Configuration. Provides hardware selection criteria and descriptions of the computer hardware components chosen for the Memphis system, including information on major features and use of the equipment at Memphis Area Rideshare; also includes guidance for selecting major hardware and peripheral equipment for ridesharing programs or other microcomputer-based business information systems.

Chapter 6

Summary and Lessons Learned. Provides a summary of major project accomplishments and lessons learned, and includes guidance for the transfer of similar systems to other jurisdictions.

Appendix A

Request for Proposals. Contains the Request for Proposals (RFP) used to solicit contractor proposals for computer software and hardware for the Memphis Area Rideshare on-line information system.

Appendix B

Samples of System Output. Gives some samples of POOLMATCH output, including a rideshare match list and an applicant list printout.

Report and Information Sources

Sources for additional copies of this report, further information on the Memphis Area Rideshare on-line information system project, and additional information on the system are listed on the final page of this report.

PROJECT SUPPORT

The Memphis Area Rideshare on-line information system project was implemented with grant financing from the U.S.

Department of Energy through the Urban Consortium Energy Task Force and the Tennessee Energy Authority. Additional project financing was also provided by the Tennessee Department of Transportation, the Memphis Area Transit Authority, the Federal Highway Administration, the Urban Mass Transportation Administration, Shelby County Government, and the City of Memphis. Technical and project management support was provided by Public Technology, Inc., the City of Chicago (which manages the Urban Consortium Energy Task Force), members of the Private/Public Sector Cooperation Unit of the Energy Task Force Fourth Year Program, and Crain and Associates System Development Company. The City of Memphis very much appreciates the generous assistance provided by these agencies and organizations. In addition, considerable staff support was provided by the Tennessee Energy Authority, the Tennessee Department of Transportation, and the Memphis Area Transit Authority.

Chapter 2: General Background and Initial Project Planning

INTRODUCTION

Preliminary planning for the Memphis Area Rideshare on-line information system project involved both identification of current data processing problems and anticipation of the evolution of ridesharing marketing strategies and data processing support needs. In addition, initial project planning was accomplished with a firm understanding of the current status and future directions of ridesharing program activities nationwide. Through the development of a solid conceptual framework for the project, Memphis Area Rideshare was able to define a strategic and comprehensive solution to address current data processing limitations as well as provide flexible data processing capabilities to meet future requirements.

This chapter provides background information on the changes that have occurred in marketing philosophies and data processing requirements at regional ridesharing agencies since formal "areawide carpool programs" were first established in the mid-1970s. The evolution in marketing approaches and data processing requirements experienced at Memphis Area Rideshare is also documented. These discussions demonstrate that the new relationship between marketing strategies and the supportive role of the computer desired at Memphis Area Rideshare reflects changes that have been occurring in marketing philosophies and data processing

requirements at regional ridesharing agencies on a nationwide basis. Later sections in this chapter review some of the major issues investigated during preliminary project planning and outline the decision to implement a new in-house microcomputer-based information system for the Memphis program.

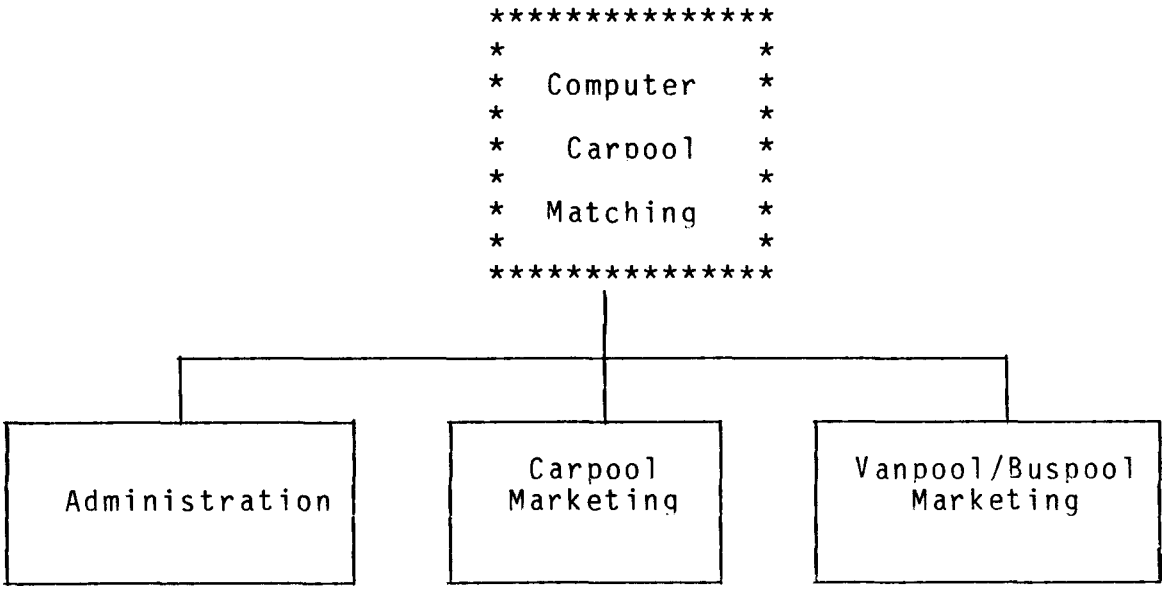
HISTORY OF COMPUTERS IN RIDESHARING

Early Emphasis -- Large-Scale "Batch" Matching

The role of computers in ridesharing has changed a great deal since the first formal "areawide carpool programs" were begun in response to the energy problems of the 1970s. Figure 1 presents a symbolic representation of the structural organization of a typical urban ridesharing (carpooling) program in 1974. The major focus of activity in those days was the computer program that produced match lists, and the capability to efficiently process large numbers of carpool candidates was the basic "product" offered to the commuting public. The prevailing notion was that the major impediment to increased carpooling was a lack of information about potential carpool partners. (Note that the term "ridesharing" was not in common use then.)

In those early days of organized ridesharing, responsible agencies usually selected a batch computer program, organized their efforts around the capabilities of the computer system, and reponded to potential carpool candidates with information that the computer was programmed to provide. Most agencies used one of the available large scale programs such as the Federal Highway Administration (FHWA) "Carpool" or CIS (Commuter Information System) packages, the Bureau of Census "Carpool" program with the ADMATCH/UNIMATCH/DIME package, or the Comsis Corporation CRIS

Figure 1: STRUCTURAL ORGANIZATION OF TYPICAL URBAN RIDESHARING PROGRAM, CIRCA 1974



(Comsis Rideshare Information System) programs. These programs were typically developed to operate in batch mode on an IBM 360 mainframe computer.[1]

Although early carpooling advocates were correct in assuming a widespread need for matching information, it was only after gaining more substantial operating experience that rideshare practitioners began to recognize the existence of other fundamental impediments to increased ridesharing. Most noteable of these are the psychological, social, and institutional barriers which influence commuting behavior and which cannot be eliminated through "technical fixes" (such as a clever new computer-matching algorithm) that will quickly bring about great increases in vehicle occupancy levels. Major increases in ridesharing participation will require effective and comprehensive marketing programs which utilize personalization techniques applied over a period of several years before significant changes in commuting behavior will be evident.

New Approach -- Marketing and Brokerage Support

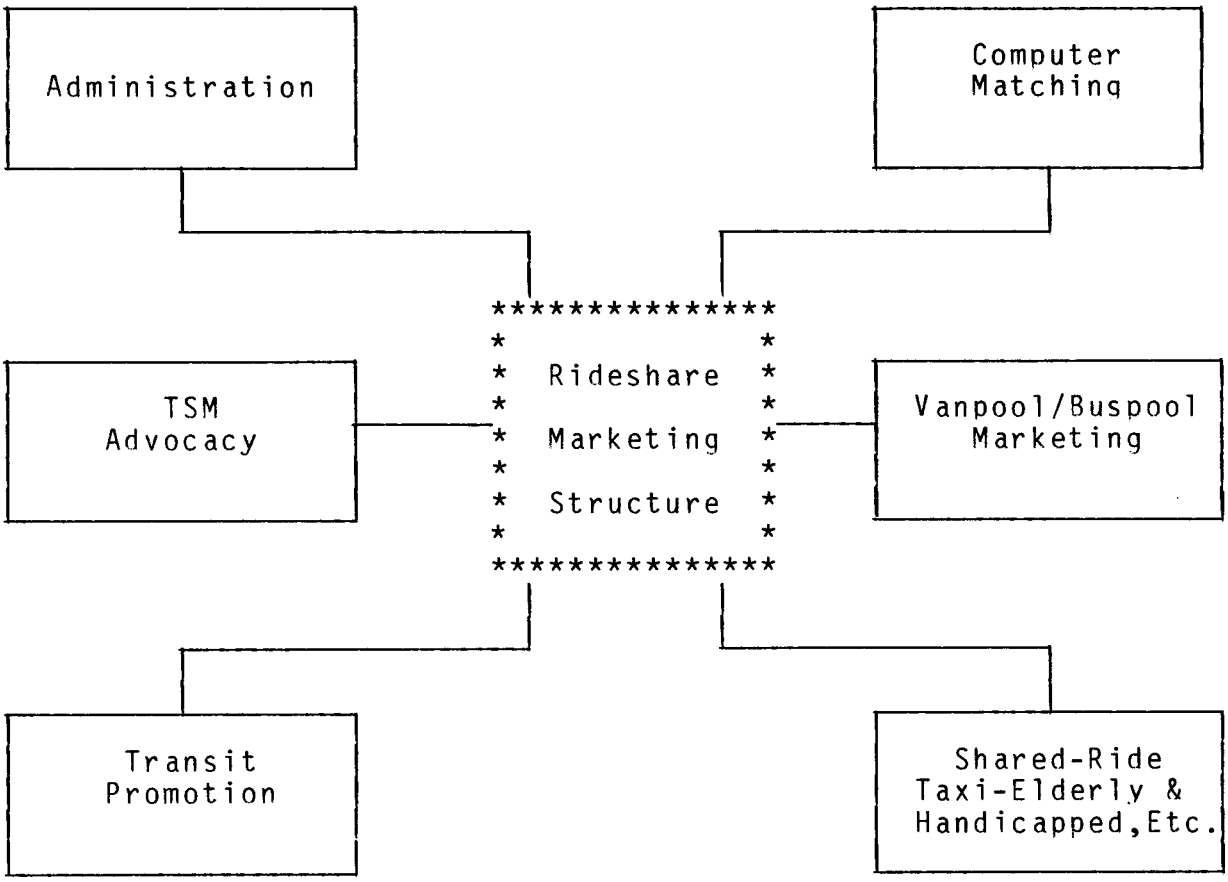
A natural evolutionary process has led practitioners to accept the now current view that ridesharing programs should emphasize marketing activities that are oriented toward identifying and addressing a broad range of commuter needs and concerns to offer a variety of user-sensitive products and services. This more realistic viewpoint sees the "ridesharing market" as highly segmented, demanding that ridesharing agencies serve as arrangers, brokers and coordinators of diversified transportation alternatives that will offer choices to different users and that are responsive to changing urban travel demands.

Recognizing the importance of effective marketing to emphasize choice and responsiveness, many ridesharing practitioners are changing their programs to the type of

organizational structure symbolically portrayed in Figure 2. With such a structure, the role of the computer in ridesharing is no longer a central one. Instead of conforming rideshare marketing activities to the capability of an existing computer program, this new structure requires responsive and flexible data processing capabilities to support personalized marketing techniques used by ridesharing agency professionals to help guide clients to commuting alternatives. Under this structure, the computer is no longer a driving factor in the forefront of program administration. Its new role as a supportive tool, however, can be much more pervasive and essential for new administrative programs. The computer should be seen as supporting a number of new activities which go well beyond basic carpool matching, such as transit information, vanpool and paratransit planning, fleet maintenance and monitoring, financial accounting, and other administrative and planning tasks.

Despite the evolution of this new approach to ridesharing management, most agencies have been locked into the capabilities of available mainframe computer programs. Even with the best versions, ridesharing agencies have been frustrated by lack of response, unacceptable turnaround times, cost, and restrictions on a "canned" system. The only alternative has been to develop an interactive minicomputer based system, specifically for local use. Unfortunately, the hardware, software and overall development costs of these types of systems ($150,000 to $300,000 or more) have placed them beyond the reach of all but a handful of the largest, most sophisticated ridesharing agencies.

Figure 2: DESIRED STRUCTURAL ORGANIZATION FOR A COMPREHENSIVE URBAN RIDESHARING PROGRAM



The Promise of Microcomputer Technology

In the late 70s, rideshare practitioners became interested in the possible application of emerging microcomputer technology to ridesharing program operations. Microcomputers contain powerful microprocessors on a small chip or board, thus allowing these devices to range in size from that of a portable television to a hand-held calculator. More importantly, it was believed that the low cost of acquiring microcomputer based systems could allow computers to be used in-house by many ridesharing agencies for a broad range of data processing applications. Microprocessor-based computers were first available in 1975 and began to proliferate in the late 70s. The original first-generation and second-generation machines were all "8-bit" single-user systems with an internal memory limit of 64K and floppy disk drives.

One of the first projects to apply the new microcomputer technology in ridesharing was development of the Knoxville RSS System for use at Knoxville Commuter Pool. With funding support from the Urban Mass Transportation Administration (UMTA), the system was originally programmed on a large time-shared IBM system in Boston and eventually converted to operate on a Radio Shack TRS-80 Model II (single-user system). This pioneering work enabled carpool, transit, and vanpool/buspool information to be processed on-line as well as in batch mode, allowed for customized matching such as route-to-work searches, and provided other useful tools for Knoxville Commuter Pool to move into rideshare marketing and transportation brokerage.

However, the introduction in 1982 of the new "16-bit" microprocessor-based computers, the continued development of technology to produce inexpensive, high-speed, high-capacity hard disks, and the introduction of multi-user operating systems such as OASIS, MPM-86, and UNIX, made it possible to configure a multi-user information system with sufficient

main memory and hard disk capacity for under $25,000. Although many of the microcomputers being sold today are still 8-bit machines -- APPLE II and III, Radio Shack TRS-80, Xerox 820, Vector Graphics, etc. -- virtually all computer manufacturers are rapidly moving toward improved capabilities with the use of new 16-bit processors, increased memory, new input/output devices, and more sophisticated operating systems. The 16-bit microprocessor, which has more than twice the power of an 8-bit processor, is clearly the industry thrust and will rapidly render the 8-bit hardware obsolete. Most manufacturers, including IBM, Altos, Texas Instruments, DEC, Radio Shack, and many others, are now delivering working 16-bit machines.

The significance of all this is that ridesharing agencies can now acquire inexpensive, multi-user information systems that have the capabilities of most small and medium-scale minicomputers, and which may exceed the capabilities some of the older mainframes that the original large-scale batch mode rideshare programs such as CIS ran on. A number of agencies, such as COMPOOL in Richmond, Virginia, the MAG Ridesharing Program in Phoenix, Arizona, Seattle-King County Commuter Pool in Seattle, Washington, the PAG Rideshare Program in Tucson, Arizona, and Memphis Area Rideshare in Memphis, Tennessee, have very recently installed microcomputer-based information systems, and many agencies in other cities are now making plans to do so.

THE MEMPHIS AREA RIDESHARE EXPERIENCE

The development of Memphis Area Rideshare, with its changing data processing requirements, closely parallels the national evolution of ridesharing programs. Memphis Area Rideshare was initiated in 1979 during a time of escalating

energy prices and spot gasoline shortages. The program, which is now administered by the Memphis-Shelby County Office of Planning and Development, was originally set up with State Energy Conservation Planning (SECP) funds from the U.S. Department of Energy (DOE) and assistance from the Tennessee Energy Authority (TEA). During 1979-80, the program took the form of an employer-based "areawide carpooling effort". Thousands of employees at work sites throughout the Memphis metropolitan area were surveyed and computer-matched using the large-scale batch mode Comsis Rideshare Information System (CRIS) program. Computer processing was accomplished in Pittsburgh by Comsis Corporation under contract to TEA.

During 1981, the CRIS computer package was acquired by TEA from Comsis Corporation and installed on State of Tennessee computer facilities in Nashville and procedures were developed to provide continuing data processing support for Memphis Area Rideshare and the MTA Ridesharing Program in Nashville. In the case of Memphis Area Rideshare, employer ridesharing survey returns were manually edited and coded by Memphis Area Rideshare staff. Coded surveys were then forwarded to NLT Computer Services Corporation in Nashville, which provided data entry services under contract to Memphis Area Rideshare. After accomplishing data entry and verification, NLT delivered a tape of the survey data to TEA for processing at the State computer facilities. After computer-matching was completed, carpool lists and related ridesharing products were shipped to Memphis Area Rideshare for subsequent distribution to survey respondents through a network of on-site company ridesharing coordinators or through the mail.

Although these arrangements worked reasonably well for processing large sets of rideshare applications generated through pre-planned work-site survey campaigns, the lack of data processing autonomy at Memphis Area Rideshare inevitably created problems. Delays due to coding or data entry

errors, misunderstood communications, time consumed in shipping survey data and computer results between Memphis and Nashville, and competing priorities for State computer resources frequently caused response times for processing employer survey data to run four or more weeks. In addition, as the ridesharing program continued to mature, purging, updating and deleting client data on the rideshare applicant master file, which contained over 26,000 names, became an increasingly unwieldly process. Responses to individual requests for ridesharing assistance had to be handled manually using hardcopy print-outs of the master file because, with the batch mode procedures and reliance on outside data processing support, it took almost as long to run one rideshare applicant as it did to run a thousand. Marketing efforts were dictated and constrained by the inflexible data processing capabilities. The effectiveness of the staff at Memphis Area Rideshare was not determined by the commuter's needs and willingness to rideshare, or by the staff's desire to help the commuter, but by the structure of the computer matching software and the lack of data processing autonomy. To make matters more difficult, there was also growing concern that changing directions in Federal and State energy policies would result in reduction or termination of grant funds used to finance outside data entry and processing. Without stable computer support, rideshare program continuity could not be assured.

PLANNING FOR A NEW DATA PROCESSING SYSTEM

In early 1982, Memphis Area Rideshare and TEA decided to investigate and develop improved data processing arrangements. With a successful track record and the necessary institutional support in the Memphis area, Memphis Area Rideshare appeared to have an important continuing role in

the community. Thus, the development of a new data processing system was properly viewed as a strategic decision which would have considerable long-term effects.

Goals For The New System

A number of goals for the development of a new data processing system were outlined. First, it was realized that the young ridesharing field would continue to be characterized by rapid innovation and that any new data processing system would need to be able to provide for this growth and meet future program needs. Furthermore, it was deemed imperative that any new data processing system be designed to support desired marketing strategies, not dictate them. Although a major marketing emphasis would continue to be employer- based with pre-planned promotional and survey compaigns, Memphis Area Rideshare was moving more and more into the area of maintaining current candidate rideshare information for already-marketed employers. In order to prevent Memphis Area Rideshare staff from becoming buried in a flurry of paper applications and update requests, and to provide rapid turnaround times, these types of program maintenance activities would require on-line data processing capabilities. In addition, on-line capabilities would be needed to support new promotional activities targeted to generate dial-in requests from the general public and to support marketing for the new Memphis Area Commuter Vans "third-party" vanpooling service which was launched by the City of Memphis through Memphis Area Rideshare with contractual assistance from Van Pool Services, Inc. in late 1982.[2]

Data System Options

Part of the preliminary assessment included determining a preferred environmental design for processing Memphis Area Rideshare data. Three designs were considered as available. In the jargon of data processing/management consultants, these designs included: 1) centralized; 2) distributed; and 3) centralized/distributed.

A distributed system is depicted in Figure 3. Some type of distributed system is usually the most desirable data processing environment because information is entered into the computer and returned from the computer by the people most familiar with the data (in-house rideshare staff). Corrections or changes are also handled by the same people without passing information through other hands. Distributed data processing can usually minimize staff resources required at the end user level as well as at the data processing level, but this approach also requires a larger investment in hardware since each end user needs a CRT video display screen and possibly access to a printer.

A centralized data processing system is depicted in Figure 4. This approach does not require as much computer hardware as the distributed approach, but it does require a larger staff at the location where data entry and input to the central computer is accomplished and the same level of end user staff resources. In centralized processing, all data must pass from persons most familiar with it (the rideshare staff) to data entry staff who are less familiar with it. Data then enters the computer via the data entry staff. All corrections and changes must travel along the same path to the computer as the original information, and final products travel in reverse along the same path. Original documents (such as rideshare assistance applications) are rarely used for input to the computer. Instead information is transcribed to input forms and then submitted to data entry for keying into the computer.

Figure 3: EXAMPLE OF DISTRIBUTED DATA PROCESSING INFORMATION FLOW REPRESENTING ONE INPUT ERROR, ONE CHANGE, AND ONE FUNCTION

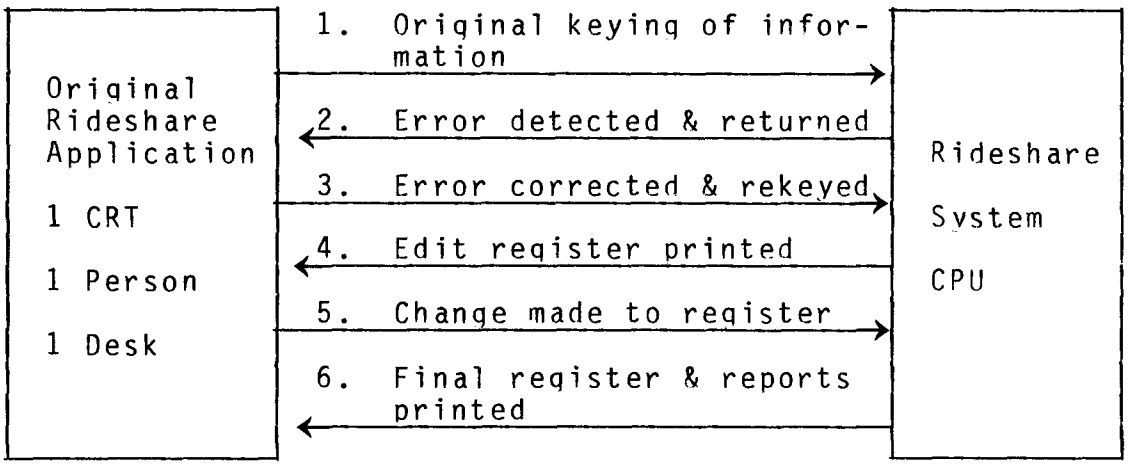
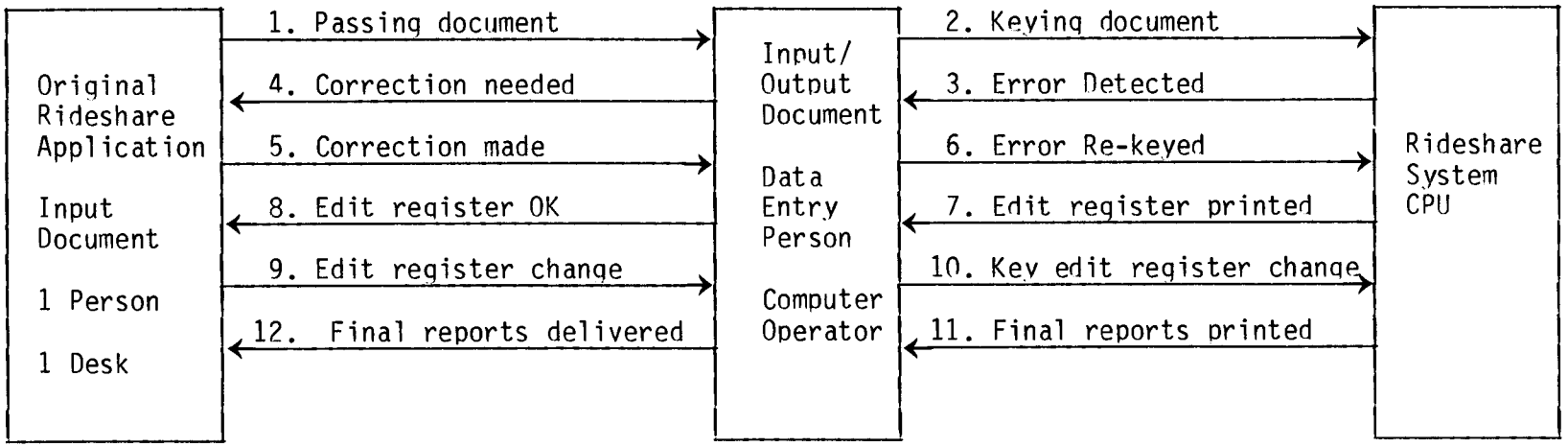


Figure 4: EXAMPLE OF CENTRALIZED DATA PROCESSING INFORMATION FLOW REPRESENTING ONE INPUT ERROR, ONE CHANGE, AND ONE FUNCTION



The centralized/distributed design is a combination of the two designs previously described. In practice, this approach is usally biased toward centralization. Usually, the basic distributed feature involved is the use of multiple CRTs for partial data entry and inquiry. Since part of the data entry and all of the processing control is placed with the central data processing staff, almost all of the liabilities and few of the advantages of distributed data processing is the typical result.

Data System Selection

After reviewing possible arrangements for processing Memphis Area Rideshare data, it became evident that attempting to link-up with existing data processing centers operated by the City of Memphis and Shelby County Government would require either a centralized or centralized/distributed approach. This was deemed undesirable because it would place extra requirements on existing City and County data center staff while still requiring the same level of ridesharing staff resources as a pure distributed approach. In addition, such a centralized or centralized/distributed approach would perpetuate the expensive reliance of Memphis Area Rideshare on outside data processing support, and all parties agreed that ridesharing needs could suffer from time to time due to competing priorities if handled through the local City or County computer centers.

Because of the above considerations, it was agreed that a distributed approach using an in-house, multi-user data processing system would be the best solution for addressing the data processing requirements at Memphis Area Rideshare. Some desired features of such a system included: increased flexibility in matching capabilities: on-line data entry, matching and updating to facilitate rapid response to rideshare assistance requests; a capability to process large

jobs such as major work-site surveys in batch mode; more flexibility and aesthetics in match lists, direct mail pieces and other computer products; automatic geocoding; vanpool/buspool planning and support capabilities; transit information and marketing support capabilities; word processing, spread sheet and related capabilities; and, enough capacity and flexibility to provide for future growth and evolution in data processing requirements.

With the recommended approach, it was realized that Memphis Area Rideshare would be required to take on a new set of responsibilities. Development of an in-house information system would necessitate the training and maintenance of in-house staff with appropriate data processing skills, arranging for hardware and software maintenance on a continuing basis, dealing with break-downs, power failures, or other emergencies, providing for data security, arranging and paying for data processing supplies, and inevitably having to deal with technical obsolescence. However, the risks involved in acquiring and maintaining an in-house, "stand alone" information system were outweighed by the ability of such a system to increase rideshare agency autonomy, to lessen the dependence on outside agencies or grant funds for data processing support, and, most importanly, to provide the kind of data processing support tools that would allow Memphis Area Rideshare staff to undertake their marketing activities with full confidence that ridesharing services and assistance could be delivered in a timely fashion and as promised.

Chapter Three of this report provides more information on the development and implementation of the Memphis Area Rideshare on-line information system project, including preparation of the work program and procurement of computer software and hardware.

Chapter 3: Project Development and Implementation Phases

INTRODUCTION

This chapter discusses the major developmental and implementation phases of the Memphis Area Rideshare on-line information system project. Various chapter sections describe the development of the project work program and project funding, the consultant selection process and subsequent contractual arrangements for procurement of computer software and hardware, and the major steps taken in project implementation.

WORK PROGRAM DEVELOPMENT

Based on the system design requirements and overall objectives discussed in Chapter 2 of this report, as well as a review of the latest innovations in data processing support systems in use in other cities, a developmental plan for the Memphis Area Rideshare on-line information system project was prepared by the Memphis Area Rideshare staff in consultation with TEA, the City of Memphis Data Center, and representatives from the Memphis Area Transit Authority (MATA). The development plan included the following major work tasks:

- identification and development of necessary computer software;

- acquisition of appropriate computer hardware;
- system installation and activation;
- staff training and preparation of system documentation;
- system operation;
- system adjustments and refinements;
- final project report preparation.

On behalf of Memphis Area Rideshare, the work program for the on-line information system was submitted by the City of Memphis for funding through the Urban Consortium Energy Task Force. The project was subsequently included in the Energy Task Force Fourth Year program and $80,000 was awarded to the City to finance project implementation. Shortly thereafter, the Urban Consortium grant funds were used to leverage almost $40,000 in additional funding for various project components from TEA, the Tennessee Department of Transportation, FHWA, UMTA, the Environmental Protection Agency (EPA), MATA, and local government.

CONSULTANT SELECTION PROCESS AND CONTRACTURAL ARRANGEMENTS

Because the necessary technical expertise was not immediately available within local government, a Request for Proposals (RFP) was prepared in late 1982 and a competitive process was initiated to acquire the services of a consultant/contractor to provide computer software and hardware for the Memphis Area Rideshare information system. The RFP, which is included as Appendix A of this report, was issued to a list of candidate providers in mid-December, 1982.

A selection committee was organized to review the proposals received. This committee, which was chaired by the City of Memphis Chief Administrative Officer, included representatives from Memphis Area Rideshare, the Memphis

Shelby County Office of Planning and Development (the agency which administers Memphis Area Rideshare), MATA, the City Data Center, and the City Purchasing Department.

On April 13, 1983, the firm of Crain and Associates Systems Development Company (Los Angeles), the developer of the original FHWA CIS package of batch mode rideshare matching software, was selected to assist in the implementation of the rideshare information system. Work on the project was begun immediately after a contract was executed between the City of Memphis and Crain and Associates Systems Development on June 9, 1983.

The rideshare software provided to Memphis Area Rideshare by Crain and Associates Systems Development was a system of computer programs called POOLMATCH. The POOLMATCH system, which consists of an on-line, enhanced version of basic CIS modules plus transit information, automatic geocoding, employer data management, and other innovative capabilities, is described in detail in Chapter 4 of this report. The POOLMATCH software was offered under a Non-exclusive Perpetual License Agreement. This form of agreement, which is standard in the computer software industry, allowed Crain & Associates Systems Development to retain sole ownership of all POOLMATCH programs and the sole right to market them elsewhere, while Memphis Area Rideshare received the right to their perpetual use. Auxiliary software (which included word processing and spread sheet packages, a data base management software package, and a BASIC language compiler software package) was provided under similar licensing agreements with the manufacturers of each selected package.

The software provider for the Memphis Area Rideshare information system was also required to provide all system hardware. This was done to simplify the procurement process and contract administration (it is easier to deal with one provider than many diverse vendors) and to prevent the possibility of controversy over warranty coverage and

responsibilities which might arise if more than one provider were accountable. Most importantly, using one firm for software and hardware helped to insure that all components selected for the rideshare information system would be fully compatible. Computer hardware for the Memphis Area Rideshare system and considerations which entered into hardware selection are discussed in detail in Chapter 5 of this report.

SUMMARY OF PROJECT IMPLEMENTATION PHASES

Design and Implementation

Actual design and implementation of the Memphis Area Rideshare on-line information system was accomplished during the last half of 1983 and early 1984. Major steps in implementing the system included: system analysis and design; system development; system testing and installation; user training and documentation; and incremental implementation of additional system capabilities.

System analysis and design was conducted during June, 1983 and involved developing a detailed technical review of what outputs the rideshare information system should produce and what inputs would be required. Based on this review, modifications to the POOLMATCH system to facilitate its use at Memphis Area Rideshare were identified and documented.

System development, which began in early July 1983 and stretched through December 1983, involved identification, procurement, and testing of appropriate computer hardware and testing modifications to the POOLMATCH software programs to achieve identified system design objectives. System development tasks also included the development of an X-Y coordinate grid system for geocoding and converting existing Memphis Area Rideshare applicant files over from the batch mode CRIS system.

Basic system testing and installation was accomplished during October 1983. Acceptance testing was performed by the project consultant in California and then repeated by Memphis Area Rideshare staff after installation and activation of the system in Memphis. Computer hardware service/maintenance policies were purchased for all hardware components, and a telecommunications link using computer modems and a dedicated phone line was established between Memphis Area Rideshare and Crain and Associates Systems Development offices in California to permit remote diagnosis and correction of any software problems on a continuing basis.

User training on the POOLMATCH programs and system documentation tasks were accomplished during October 1983 through January 1984. The bulk of training for system administrators, data entry staff, and other user levels coincided with installation and activation of the basic system in October 1983. After initial training, Memphis Area Rideshare staff and computer support staff from the Memphis Shelby County Office of Planning and Development planning services section spent several weeks testing and becoming familiar with the system before attempting to apply it to daily rideshare program operations. A system user's guide was finalized only after gaining considerable experience with the system.

Incremental implementation of additional system capabilities began in November 1983, shortly after the basic carpool and vanpool capabilities in POOLMATCH had begun to be used in daily rideshare program operations. These additional capabilities included on-line geocoding (a labor-saving program which automatically translates rideshare applicant home and work street addresses into a grid cell in a geographic X-Y coordinate system), a "level 2" transit information capability, word processing (Altos Horizon) and spread sheet packages (Multiplan), and data base management software (Informix).

Organizational and Logistical Requirements

During the course of acquiring, installing, and activating the various Memphis Area Rideshare on-line information system project components, considerable experience and a number of general insights were gained by in-house staff. Experiences and observations which specifically relate to the system software and hardware are discussed in Chapters Four and Five. Other experiences and insights, which relate to the process of adapting to a new in-house data processing system with distributed information flow, are discussed in Chapter 6.

Aside from the purely technical software/hardware selection and application, there were a number of problems and challenges with respect to human-computer relationships and the data processing operating environment which had to be addressed during project development and implementation. At the outset, acquisition of a new in-house computer system for Memphis Area Rideshare created rapid change and imposed new procedures on existing staff. New procedures for allocating staff resources, designating and training appropriate agency staff at various user levels, purchasing and stocking necessary data processing supplies, providing for system security and confidentiality of data, and managing information flow and computer resources had to be outlined.

Establishing the in-house computer system also required that logistical measures be taken to fit the new system into the office and operational environment. Some changes in the existing office space configuration had to be made to position the computer, printers, and various video terminal work stations in locations which would provide a safe operating environment for the equipment and maximize staff productivity. Other concerns included locating phone lines, providing for an appropriate and reliable power supply, locating and measuring channels for cable runs, and providing adequate temperature and ventilation for the "computer room" where

the central processing unit was to be located. The incremental approach adopted for the project helped to keep the logistical problems manageable.

Chapter Four provides an overview of the capabilities and features of the POOLMATCH ridesharing applications software selected for the Memphis Area Rideshare system. Computer hardware for the system is discussed in Chapter Five.

Chapter 4:
The Poolmatch Software System

INTRODUCTION

The Memphis Area Rideshare on-line information system uses the latest version of the POOLMATCH ridesharing software package. POOLMATCH, which is a proprietary product of Crain and Associates Systems Development Company, provides a comprehensive set of data processing tools and support functions for all the planning, marketing, and data management and reporting activities commonly performed at regional ridesharing agencies. The sections of Chapter Four describe the major features and capabilities of POOLMATCH, in terms of the benefits to the system user. The description assumes that the reader had some familiarity with ridesharing concepts and terminology.

OVERVIEW OF POOLMATCH

The POOLMATCH software is an on-line, greatly enhanced version of the widely-used FHWA CIS package. In very brief terms, POOLMATCH provides the following major capabilities: on-line entry and updating of all data files; on-line and batch mode carpool, vanpool and transit information; vanpool planning and support; automatic geocoding for conversion of street addresses into map grid coordinates; an employer data maintenance system; and, housekeeping programs to produce

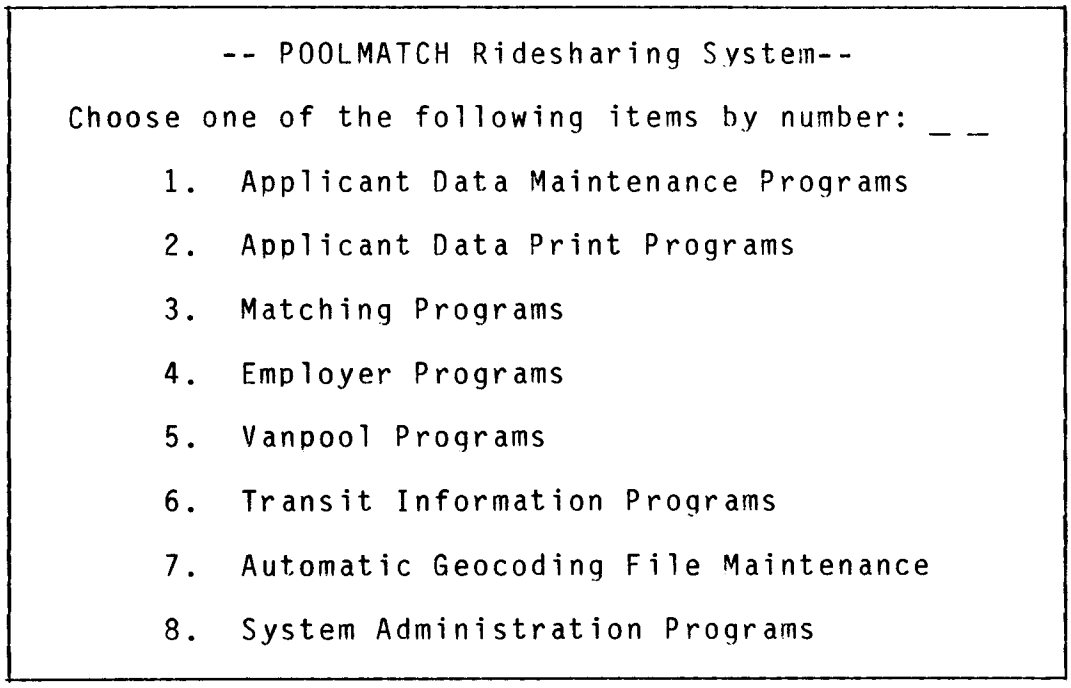
master and alphabetical lists, print mailing labels, assemble employer data, and so on.

In terms of its developmental history, the earliest version of POOLMATCH (Version 1.0) was first available in 1981 and was installed on minicomputers at ridesharing agencies in Tulsa, Oklahoma and Hampton, Virginia. An enhanced Version 2.0 was subsequently developed in early 1983 for use with the UNIX operating system on microcomputers in a multi-user environment.[3] This version, which was adopted for the Memphis Area Rideshare on-line information system, has also recently been acquired for use at regional ridesharing agencies in Richmond, Virginia; Phoenix, Arizona; Tuscon, Arizona; Seattle, Washington; and Melbourne, Florida.

THE POOLMATCH MENU STRUCTURE

The POOLMATCH system is completely "menu-driven" for ease of use. Programs are requested by selecting the desired program from a main menu and eight sub-menus of programs displayed on a video terminal. In virtually all situations where a choice or decision must be made by the user, the system will supply a list of the options available. These features make the system very "user-friendly" and eliminate the need to memorize program names and routines. (There are over 50 programs in the POOLMATCH system.)

When the computer is turned on, the video screen displays the following POOLMATCH menu.



As indicated on the main menu, the various POOLMATCH ridesharing programs are organized into eight broad groupings. The applicant data maintenance group includes all of the programs needed to enter, update, and count applicants or groups of applicants on the rideshare applicant master file. The applicant data print programs include all of the programs that produce printed reports, mailing labels, alphabetical listings, and other print utilities. The matching programs category includes all programs used to produce applicant match lists. Programs such as BATCH and ONLINE, plus programs related to producing match list cover letters, and programs to set matching parameters, are included in this category. The employer programs group includes all programs used to maintain an employer file, as well as programs for creating and printing reports from the data on that file. The vanpool programs group consists of the programs to enter and update vanpool listings, assign riders to vanpool groups, produce vanpool reports, and display vacancies for assignment of new riders. In

addition, this group also includes programs to print density matrices commonly used in planning new vanpool routes. The transit information group contains all the programs used to enter data describing available public transit services. The automatic geocoding file maintenance group is used to enter data regarding the street and address system to permit the computer to automatically assign grid squares to new ride-share applicants. Finally, the system administration group includes programs used to set up and maintain the POOLMATCH system. Access to this last set of programs is limited to system administrators or "superusers".

The programs included under the major groups displayed on the POOLMATCH main menu are themselves displayed on one of eight sub-menus which correspond to the eight groups on the main menu. The operator chooses the desired functional area from the main menu by entering the number corresponding to that area. For example, if the operator enters "3", the terminal will then display a sub-menu showing the two matching programs available (BATCH and ONLINE) and other programs which related to match list cover letters and matching parameters.

In the POOLMATCH system, functions that are suitable for interactive processing are performed on-line, while other functions (such as printed reports or applicant master lists) are executed in batch mode. While a batch program is executing, the display terminal is available for interactive processing (e.g., while a large print job is running, new applicant data can be entered on-line).

ON-LINE UPDATING OF APPLICANT AND EMPLOYER DATA

The package named "APPL" on the applicant data maintenance sub-menu allows the rideshare staff to add, change or

delete applicants on the rideshare applicant master file immediately, by entering the applicant's information into the video terminal.

The computer asks for only one item at a time, and immediately checks the correctness of each item of information entered, making data entry a simple task. It is also easy to retrieve the information on file for any applicant, so that it can be examined on the video screen immediately. If the operator then wishes to change the information on file, he/she need only enter the item to be changed.

Once the data for an applicant has been entered, the operator can either produce a match list immediately (for dial-ins, for example) or can hold that application until enough co-workers have been entered so as to process them all in a batch to produce the best matches for all.

This on-line update program also allows the operator to delete records, either individually or in groups. Single records can be deleted by any user, but "mass deletes" (an entire company, for example) are only permited by authorized users. The program named "DELETE" on the applicant data maintenance menu performs mass deletes. Similarly, the CHANGE program will perform a mass change to any data field in the rideshare applicant master file (e.g. when a company changes the main telephone number).

Another important on-line file is the employer file. This file contains data for each rideshare program client employer and employer prospects, including commuter-related data (work address, work grid, start/stop time, telephone, etc.), plus marketing-related data (name of ridesharing coordinator, date of last contact, etc.). Data in the employer file can also be accessed immediately, and a variety of printouts are available.

CARPOOL/VANPOOL MATCHING PROGRAMS

Rideshare matching programs in POOLMATCH will produce match-lists containing the names of potential carpool partners, and separate match-lists showing information for each vanpool which serves an applicant's commute trip. With the Transit Information System module in POOLMATCH, the match list can also include information about available public transportation services.

Matching can be done in "batch" or "on-line" modes. Batch matching (the "BATCH" program on the matching programs sub-menu) allows the operator to enter a batch of applicants from a company, for example, and then to produce printed match lists for each of them after the entire group has been entered. On-line matching (the "ONLINE" program on the matching programs sub-menu) enables the operator to enter an applicant and produce a match list immediately, either on the video screen or the printer (or both). It is possible to quickly change the searching and matching parameters, so the operator can customize the matching for any employer or for any individual.

The match lists are printed in a letter-style format, consisting of a cover letter followed by a carpool match list, a vanpool match list, and (optionally) transit information (See Appendix B for a sample). All match lists are letter-quality, and appear to have been individually typed. The format of the match lists can be customized to fit any desired letterhead and layout requirements.

The carpool-matching program used in the POOLMATCH system has extensive search capability -- 121 grid cells on the home end, 25 cells on the work end, alternate origins along the route-to-work, and any "time window" up to 24 hours (including flextime, irregular schedules and shift work). The user can control the extent of these searches. Up to 49

names can be printed for each potential rider match, and the best matches are printed at the top of the list. The "best" carpool matches are selected using a sophisticated technique to measure the "quality of match" for each name on the list. Quality of match considers factors such as location, work schedules, and age of the applicant record. The user can limit the match list to a specified number of names (typically seven), and these will be the best available matches. For those applicants who receive poor-quality lists, the program can be set up to generate a new match list if better matches become available at a later date. This option is user-controllable. The rideshare staff can also include any desired information in a remarks field (such as "non-smokers preferred", etc.), to be printed out on the carpool lists.

VANPOOL PLANNING AND SUPPORT

There are two different techniques available in POOLMATCH for vanpool planning, corresponding to the two different ways for establishing vanpools now used by ridesharing practitioners.

The first technique is to produce a "Vanpool Driver's List", using the carpool-matching programs. The prospective vanpool driver is entered as a vanpool applicant, and the carpool-matching program is used. This program is used to execute a wide search pattern, with heavy emphasis on the route to work, to produce a list of names of people who have expressed an interest in vanpooling and who live near the prospective vanpool route. At Memphis Area Rideshare, this Vanpool Driver's List is given to the prospective driver, who is then responsible for contacting the people on the list. Alternatively, the rideshare staff may use the list themselves to make contacts.

A second and very different technique for vanpool planning is to use two types of density matrices -- the "numeric" and "shaded" density matrices. The "shaded matrix" is used first to quickly scan the entire city to identify clusters of grid cells that appear to have enough potential riders for a prospective vanpool. After identifying one or more clusters, the "numeric matrix" is printed for each cluster to examine the exact number of potential riders for each home cell, and to establish a tentative vanpool routing. The SELECT program in POOLMATCH can then be used to select all vanpool applicants in the home cells served by that routing, and then print form letters to mail to these applicants, or alphabetical lists (with phone numbers) to be used in calling them.

Once a vanpool has been established, Memphis Area Rideshare then monitors that vanpool's operation and endeavors to keep the seats filled. POOLMATCH has two different ways to do this.

First, the vanpool pickup points are entered into the Van Stops data base in the POOLMATCH system. The entries contain a description of pickup points in each grid square as appropriate; for example: "Sears Parking Lot". This information then appears automatically on the vanpool match lists of all applicants who are best-served by that pickup point.

Second, Memphis Area Rideshare staff also monitors operating vanpools in order to be able to respond to a prospective vanpool rider who is inquiring about available vanpool opportunities. The VAN program in POOLMATCH allows the rideshare staff to perform this monitoring function by maintaining complete information about each vanpool (number of seats, fares, etc.), and about the driver (name, home address and phone, work schedule, etc.). The driver information for any particular vanpool can be called up instantly on a video screen, and changes can be made, or the information for all vanpools can be printed out.

In addition, the VANRDR program maintains records of the names of all riders in each vanpool. The rider information for any van can be displayed on a video screen, and changes can be made immediately. The rider information includes a "wait list" of up to ten people. Vehicles with up to 60 seats can be handled by the VANRDR program, so that buspools can be served as well as vanpools, taxipools and "sedan-pools".

The VANLIST program will create a printout listing all vans, sorted by van number, and showing the names of all riders.

The VANVAC program will produce a descriptive listing of all vans with vacant seats.

TRANSIT INFORMATION SYSTEM

The Transit Information System in POOLMATCH will produce for each applicant a "Level 2" description of the transit service that serves his/her commute trip. In most cases, this includes:

- the route number,
- the name of the operator,
- the headboard route description,
- the street along which to board or alight,
- the frequency of operation (headways),
- transfer information (if applicable),
- other descriptive text.

A typical "trip" on the printout might appear as follows:

Take MATA bus number 56, which runs along Union Avenue approximately every 30 minutes from 6:00 a.m. to 9:00 a.m. Get off along the Mid-America Mall near where you work.

The transit routing information is printed only if an applicant's work hours fall within the service hours of the route shown. Separate routings are shown to/from work, because they can differ. Two different routings can be shown for each direction, if appropriate. In most cases, the "descriptive text" on the match list can include information such as fares, express services, boarding restrictions, etc.

The Transit Information System does not print out exact boarding locations or arrival times, as most ridesharing applications do not require this level of detail. Such detail, known as "level 3" transit information, would require the entry of a tremendous amount of data, which would then have to be updated whenever any schedule or route change was made. Those data entry costs are far beyond the budget of Memphis Area Rideshare or most other ridesharing agencies. The POOLMATCH Transit Information System requires a relatively small amount of initial data entry, and updating is required only in the case of major route or schedule changes.

The POOLMATCH Transit Information System provides a level of information that is appropriate for a commuter, who is usually familiar with the origin and destination of the trip being described. This system will not, however, replace the transit information systems used by transit operators to respond to telephone inquiries from travelers who are unfamiliar with the area. These telephone information services will continue to be necessary and useful. In the case of Memphis, the MATA continues to operate a Transit Information Center, while the Memphis Area Rideshare Information System is used to direct market existing and new public transportation services to commuters who have applied for ridesharing assistance.

SPECIAL LISTINGS

The POOLMATCH system also provides programs to produce rideshare applicant master lists, alphabetical lists, cross-reference lists, form letters, mailing labels, applicant record printouts and others. In most cases, the operator can obtain a listing in less than an hour after requesting it.

The rideshare applicant master list (produced by the "PMAST" program on the print applicant data sub-menu) contains most of the information for each applicant, and applicants can be printed in order of work grids and home grids within each work grid. In the past, such a master list was used for manual matching. With the sophisticated, on-line matching capabilities of POOLMATCH, the master list is only for backup.

The cross-reference list (produced by the "PXREF" program) is printed in alphabetical order, and shows each applicant's name and identification number in a three-column format similar to a telephone directory. An alpha list that contains name, ID number, home address, telephone, work hours, and home/work grid squares can also be produced. This is a convenient way to check for duplicate records on file, a common problem at Memphis Area Rideshare and most other ride-sharing organizations.

An applicant record print (produced by the "PRECS" program) is simply a printout of all data in the file for any applicant. This includes data which is not on the printed rideshare applicant master list (for example, date of last change, quality of list, etc.).

Form letters (produced by "PLETR" program) can also be created to send special mailings to applicants. The applicant's name appears at the top of the page, and the body of the letter can contain any message that the operator wishes. Mail labels (produced by the "PLABL" program) can be created

for the entire rideshare applicant master file or any selected subset of applicants. These capabilities have saved considerable staff time and been very useful in Memphis Area Rideshare direct mail marketing activities.

The "SELECT" function in the POOLMATCH system makes special listings even more useful. It allows the operator to select any group of records from the rideshare applicant master file. For example, the operator can SELECT all records from a certain employer and then print an alphabetical list. This enables Memphis Area Rideshare to give an employee transportation coordinator at a company an alphabetical listing of all employees that have registered for ridesharing services. The operator could also SELECT all applicants whose date of last contact is more than one year ago, and send each of them a form letter asking if their matching data is still correct. (This is one form of "purge" procedure, to keep data up-to-date). Another use would be to SELECT all applicants who live in a neighborhood served by a new express bus, and then print mail labels to affix to a flyer announcing the new service. The SELECT program employs the logic of Boolean algebra and mathematical set theory. Retrievals by the SELECT program can be done on the basis of most of the data fields in the rideshare applicant master file, in virtually any logical ("and/or") combination.

AUTOMATIC GEOCODING

The automatic geocoding program in POOLMATCH translates the applicant's address into a grid cell, eliminating the manual map-reading effort for most applicants. It can use a Geographic Base File (GBF) such as the Census Bureau's DIME file (this was the approach taken at Memphis Area Rideshare) or any similar GBF to perform this translation.

The geocoding is performed on-line and immediately. When an applicant's data is being entered to update the rideshare applicant file, the address is automatically geocoded within seconds after it is entered. The computer promptly notifies the operator if there are any errors in the address field or if the automatic geocoding operation was not successful.

Since most DIME files are incomplete, a "reject" occurs for an address which is not on the geocoding file. The operator then looks up the grid cell on a map and enters that information into the computer, which places that grid cell into the applicant's record. At Memphis Area Rideshare, this data is used to update the geocoding file (using the STREETS and GRIDS programs in the geocoding system maintenance submenu), so that addresses nearby will be geocoded automatically in the future. Thus, the "holes" in the geocoding file are gradually filled in with very little effort.

Chapter Five discusses the computer hardware configuration chosen for the Memphis Area Rideshare on-line information system and the major considerations that effect the selection of hardware for ridesharing applications.

Chapter 5:
The Computer Hardware Configuration

INTRODUCTION

This chapter includes a discussion of the current status of the microcomputer industry and other considerations that enter into the selection of hardware for an in-house, microcomputer-based data processing system. Also included is a description of the hardware configuration selected for the Memphis Area Rideshare on-line information system and some information on the major features and uses for the various system components. Hardware recommendations, some basic guidance, and estimated costs are also given for regional ridesharing agencies which may consider adopting similar in-house data processing systems using the POOLMATCH rideshare software package.

HARDWARE SELECTION CRITERIA

Selection of computer hardware for Memphis Area Rideshare was an important decision, since the ramifications of the selection will significantly effect the capabilities and flexibility of the ridesharing effort for the next 5 years or more. The hardware decision was further complicated by the seemingly bewildering array of equipment available. The current small computer market is flooded with a variety of equipment which ranges in price from under $1,000 to over

$100,000, and the capabilities, features, and power of the hardware varies as much as the price.

A critical consideration in hardware selection is the pattern of technological evolution likely to occur over the next few years. Many computer configurations which are currently popular in the market will quickly be made obsolete by newer developments. Although the majority of the microcomputers now being sold are 8-bit machines, the latest technological developments include 16-bit and 32-bit microprocessors. During 1982-83, virtually all major computer manufacturers announced new product offerings with 16-bit architecture, and 32-bit machines are expected to proliferate in the near future. The trend is quite clear. Systems based on more powerful microprocessors, increased memory, new input/output devices, and more sophisticated operating systems, will essentially render the 8-bit hardware obsolete for business applications. Prices of 16-bit microcomputers are somewhat higher than the 8-bit machines, but the computational speed, power and flexibility of the 16-bit hardware is three to ten times greater. As a consequence, the 16-bit hardware with the ability to use appropriate operating system logic can support multiple users much more effectively. Thus, a major criterion for selection of a regional ridesharing program microcomputer is to consider only the more powerful machines and operating systems that allow multiple terminals, and avoid 8-bit microcomputers entirely.

Another area of concern in selecting hardware is the volatility of the microcomputer industry. New manufacturers appear and disappear almost daily, and new product announcements are routinely made many months before deliveries actually begin. In some cases, companies have even announced a product and then taken orders to finance the development of that product. New products are also frequently rushed into production before they have been thoroughly de-bugged, and technical support and maintenance for products in service is not always up to the professional standards set by the main-

frame and minicomputer manufacturers. In this precarious environment, an important criterion is to select only equipment from well-established manufacturers, even if their prices are not the lowest available.

Another prominent consideration which must enter into hardware selection is the need to plan for future data processing needs. Many first-time computer users have made the mistake of purchasing systems that are too small to accommodate expansion of their data processing needs. Firsttime computer users tend to "grow into" an increasing dependency upon computers, and, after gaining experience, begin to discover the many roles that computers can perform in their organizations. Many of these roles are unanticipated at the time of original hardware acquisition. Thus, it is important to choose a computer configuration with substantial reserve capacity and expansion capabilities to accommodate future growth.

MEMPHIS HARDWARE CONFIGURATION

Computer hardware for the Memphis Area Rideshare on-line information system was selected to be compatible with the POOLMATCH package of ridesharing software and to satisfy hardware selection criteria discussed above. The system hardware configuration effectively supports three to four work stations in a multi-user environment, provides on-line storage capacity for the POOLMATCH and other system files, and provides sufficient room for future growth.

System Configuration

The Memphis system configuration is currently based on an Altos 586-14 microcomputer with fixed-disk storage of 40

megabyte (MB) capacity and floppy disk storage of 1MB capacity.[4] The manufacturer of this computer is well-established and specializes in providing business machines designed to operate in a multi-user environment. The 586-14, which is a 16-bit microcomputer with 512K main memory, is a newly announced model which offers some minor improvements (including a largercapacity floppy disk and a real-time clock) over the earlier Altos 8600, but at a much lower price. The Memphis configuration also includes: three Hazeltine Esprit III video terminals; one NEC 3510 letter-quality printer with adjustable tractor and friction feed; one Okidata ML-83 high-speed dot matrix printer with adjustable tractor and friction feed; two U.S Robotics 1200 baud, originate/answer modems; and UNIX operating system software. The hardware configuration for the Memphis Area Rideshare information system cost approximately $25,000. It should be noted that the prices for computer hardware have been lowered since the procurement of components for the Memphis system, and current trends indicate that hardware costs will continue to show steady and significant declines, as was the case with earlier 8-bit machines.

Data Storage Requirements

The following calculations which are based on a "typical" urban ridesharing program serving an area of roughly one million residents, were used to estimate the hard-disk storage requirements for the Memphis system:

File Name	Maximum Number of Records	Est. Bytes per Record	Est. Total Storage
Applicant Master File	20,000 est.	600	12 MB
Vanpool File	200 est.	1000	.2 MB
Transit Information Files	10,000 est.	200	2 MB
Employer File	1,000 est.	1000	1 MB
Geographic Base File	20,000 est.	100	2 MB
Word Processing Files	--	-- est.	1 MB
Operating System & Application Programs	--	--	4 MB
			22 MB

For a "typical" urban ridesharing program, about 22 MB (million characters) of on-line storage is required if all POOLMATCH and supporting programs are installed and if files increase to their estimated maximum size. Therefore, the requirements for a "typical" system could be satisfied by a 30 MB hard disk, which has about 27 MB of actual capacity. (The "30 MB" is the unformatted capacity; approximately 10 percent of this space is lost when data is stored in reasonably-sized blocks.) However, in this "typical" case, it is strongly recommended to use a 40 MB drive in order to accommodate future growth. Additional hard disks can be added at a later date, but usually at a cost of more than twice that if purchased with the initial computer. If the computer will be used for tasks such as word processing, then a larger disk capacity is definitely needed. Because of these considerations, the Memphis Area Rideshare system was ordered with 40 MB hard-disk capacity. (Note that up to 80 MB of hard-disk capacity can be purchased with the Altos computer, which would theoretically accommodate over 150,000 ridesharing applicants on-line.)

Other Major Features

Some additional major features in the Memphis Area Rideshare information system hardware should be noted. First, the 512 KB of main memory with the Altos computer is considered sufficient to support up to four users. If the system in the future needs to accommodate more than this, an additional 512 KB of memory can be added. Also, it should be noted that there is very little advantage in terms of cost savings to be realized by adding the extra increment of memory at the time of purchase. Because of this, and the fact that the additional memory may never be needed, Memphis Area Rideshare staff decided to hold off on such an expenditure.

Second, the 1MB floppy disk is used mainly for system "backups" (copying the on-line files on a regular basis as a safeguard in case of hard-disk failure in the main computer). Consideration is currently being given to the acquisition of a 17 MB magnetic tape storage device as a more convenient means of file backup. The 17 MB (unformatted) capacity would probably be sufficient to contain on one cartridge all of the volatile files, excluding the application programs, the operating system, the transit information database, and the geocoding files. These later files do not change very much, so frequent backup is not necessary for them.

Third, the letter-quality printer (the NEC 3510) is used to produce all of the client-oriented computer rideshare products, such as match lists, that need to have the appearance of being hand-typed. The dot-matrix printer (the Okidata ML-83), which offers higher speed but lower quality print, is used to print large, internal documents (such as rideshare applicant master lists) where appearance is not as important. Also, the dot-matrix printer serves as a backup in case the letter-quality printer should need repairs.

Fourth, the UNIX operating system and the Altos hardware in the Memphis system provide a strong communications

capability for dial-up and/or dedicated-line connnections. Orginate/answer modems are currently used to: 1) provide communications between the Memphis Area Rideshare computer and Crain and Associates Systems Development in California for system monitoring, de-bugging or modification of software; and 2) to allow staff in the MATA Transit Information Center to communicate with the Memphis Area Rideshare system on a dial-up basis. This second use provides MATA with the capability to access the POOLMATCH transit information database and a small test-file of rideshare applicant data in order to enter and test new route and schedule information as needed.

Fifth, the additional video terminals not only provide for multiple work stations, but also provide for the use of remote terminals or "traveling terminals." With the modems, a terminal can be taken to a work-site to perform data entry and matching or used at displays and other events for promotional purposes.

Recommended Configuration and Costs

Based on the Memphis Area Rideshare experience and the experiences of several other agencies that have chosen to implement in-house microcomputer-based information systems using POOLMATCH software, the following hardware configuration is recommended for a "typical" regional ridesharing program desiring to adopt the POOLMATCH system:

Basic Hardware Configuration

(1) Multi-user, 16-bit microcomputer with 512KB main memory
(1) Fixed-disk storage device, 20-40 MB capacity
(1) Floppy disk storage device
(2) Video display terminals

(1) Letter-quality printer, with tractor and friction feed
(1) Dot-matrix printer with tractor and friction feed
(1) UNIX (multi-user) operating system software

Optional Hardware
(1-4) Video display terminals
(2) Modems, 1200 baud
(1) Magnetic Tape Storage device

Based on 1983 prices, costs for the basic hardware in the first group above will generally range from $14,000 to $19,000, depending upon the particular equipment features chosen. The acquisition of the optional components in the second group would raise the total price to approximately $25,000. As previously mentioned, prices for computer hardware and peripherals are expected to show continued significant declines in the near future.

THE UNIX OPERATING SYSTEM

Finally, some considerations should be noted regarding the UNIX operating system. (A popular version of UNIX is called Xenix.) UNIX, which is a multi-programming, time-sharing operating system first developed for use on Digital Equipment Corporation minicomputers at Bell Labs in the late '60s and early '70s, has since been adapted for a variety of needs and continues to gain wider acceptance. While an operating system such am MP/M might appear to be a better choice because of the variety of commercial software currently available, UNIX offers substantially superior capabilities.

In addition, most major manufacturers of multi-user microcomputers are moving to UNIX-based operating systems.

This means that off-the-shelf software should become increasingly more available and less expensive for UNIX users in the very near future. Most observers agree that UNIX will likely become the predominate operating system and the industry standard. This will probably lead to increased transferability and communication capabilities between different microcomputer makes. All of the above considerations make UNIX-based operating systems a prudent choice for new microcomputer-based rideshare information systems.

Chapter 6 provides a summary of the experience and benefits gained through implementation of the Memphis Area Rideshare on-line information system project, including a review of some of the major lessons learned during the course of the project and indications of planned future system applications and activities.

Chapter 6:
Summary and Lessons Learned

INTRODUCTION

Until very recently, regional ridesharing agencies basically had two alternatives in terms of computer support for their data processing: (1) agencies selected a batch program from one of several available, had it installed at central computer facilities usually not located at or controlled by the ridesharing agency, and then organized their program activities around the capabilities of the chosen computer program; or, (2) if ridesharing agencies were very sophisticated and well-financed, they spent anywhere from $150,000 to $300,000 to develop their own custom rideshare information systems on an in-house minicomputer system.

However, with the implementation of the Memphis Area Rideshare on-line information system project and the simultaneous development of similar projects at several other ridesharing programs during 1983-84, it has been demonstrated that rapid advancements in relatively low-cost microcomputer technology will now allow computers to be used in-house by most established ridesharing agencies. New on-line, multi-user information systems such as that developed for Memphis Area Rideshare will make it possible to translate into action the new ridesharing organizational structure in which data processing capabilities <u>support</u> marketing strategies rather than dictate them.

MAJOR PROJECT BENEFITS

Implementation of the Memphis Area Rideshare on-line information system has provided a number of comparative and absolute benefits. A few of the maior ones include:

Improved Service

Compared to the previous batch-mode data processing arrangements, turnaround times for processing large sets of work-site survey data have been shortened from three to four weeks down to three or four days with the new in-house, on-line system. In addition, dial-in applicants can now receive same-day service. Improved service to area employers and the commuting public has improved the image and credibility of Memphis Area Rideshare and appears to be helping to increase private sector participation and community support for the program.

Greater Autonomy

The in-house system is totally under the control of Memphis Area Rideshare and, with proper management, has eliminated data processing delays previously experienced because of competing priorities and misunderstood communications.

Improved Carpool Formation Rates

Although it is difficult to document (at this writing, the new Memphis system had been operational for only 3 months), it is believed that the rapid response available

with the on-line system has improved carpool formation rates. This leads to improved rideshare program productivity and cost-effectiveness.

Energy and Related Benefits

In terms of absolute benefits, it is anticipated that the new on-line information system will be used to provide ridesharing information (carpool, vanpool and transit) to approximately 16,500 commuters in its first twelve months of full operation. Given current carpool formation rates, about 20 percent of this number, or 3,300 commuters, should enter into new ridesharing arrangements. This will conservatively translate into estimated direct annual benefits of 17.3 million miles of travel eliminated, 1.4 million gallons of gasoline conserved, $3.5 million in commuting costs saved, and 1.2 thousand tons of carbon monoxide air pollution removed. Based on available national ridesharing research, indirect benefits may equal or exceed these direct benefits.

LESSONS LEARNED

Planning and implementing the Memphis Area Rideshare on-line information system was a significant learning experience. As a result, there are some fundamental observations as well as some precautionary points that may provide helpful guidance for others contemplating the development and acquisition of in-house data processing systems for ridesharing or other business applications. Several observations, as decribed below, are of special significance.

Data Processing Costs

For ridesharing agencies that currently receive low-cost or donated data processing support, acquisition of an in-house computer system will dramatically increase data processing costs. However, for agencies which have to pay the true costs for outside data processing, a considerable portion of the initial investment in a new in-house system can be offset through the elimination of contracts and expenditures for outside computer support. In the case of Memphis Area Rideshare, the total cost of software and hardware for the new information system was approximately $55,000. In addition, Memphis Area Rideshare has had to assume new costs for annual software and hardware service/maintenance agreements (approximately $5,300 per year) and data processing supplies (estimated at $4,000 per year). But at the same time, $13,000 in annual costs previously incurred for outside data processing support have been eliminated. Thus, over the five-year minimum expected life of the new in-house information system, Memphis Area Rideshare may be able to save as much as $65,000 on expenditures that might otherwise be required for outside computer support. As the cost of computer hardware continues to decline, the economics of acquiring an in-house system should make such investments even more attractive for ridesharing agencies which currently pay for outside computer support.

An added economic benefit of acquiring an in-house computer system arises from the fact that an in-house system will protect an agency from future cost increases in outside data processing support. Agencies which currently pay for outside data processing have been subject to rapidly increasing costs for outside data entry services and time-sharing systems. The cost increases, which are expected to continue, have already created hardships for many agencies which are on fixed or limited budgets. With an in-house system, agencies

can enjoy unlimited computer usage and eliminate uncertainties caused by cost escalation in outside data processing support.

Risks and Benefits of Innovation

The purchase and maintenance of an in-house computer system is a strategic and substantial commitment which should only be made by mature and stable agencies. While a properly designed in-house computer system provides for the ability to innovate along with many other benefits, such systems require an ongoing commitment. Agencies acquiring an in-house computer system will have to resolve a number of problems that are not readily apparent with outside data processing. These problems include hardware and some software maintenance, arranging for data processing supplies, dealing with emergencies, and inevitably having to confront technological obsolescence.

If at all possible, any agency endeavoring to develop an in-house data processing system should use an existing package of software. Only if there are major differences between the capabilities of existing packages and desired functions should an agency consider developing new programs. Anyone embarking on the task of developing new programs would probably experience a long, arduous, and costly development period.

There is much to be said for adopting a commercial software package for use in a ridesharing system. Several firms are now offering interactive ridesharing software for in-house, multi-user microcomputer or minicomputer-based systems with pricing policies designed to spread costs across many users and to insure that advanced systems are available at a reasonable price. For example, the Crain and Associates Systems Development investment in the development and enhancement of the POOLMATCH ridesharing software chosen for

the Memphis system is being recovered through license fees charged to new users and through optional software maintenance and enhancement agreements available to current users.

Another advantage of commercial software lies in the availability of technical support and follow-up assistance. Although a few interactive multi-user ridesharing software packages are in the public domain and can be acquired for little or no cost, these packages tend to be inadequately documented and come without user support, performance warranties, or any other guarantees. A very real advantage in using commercial software is that user support is readily available (at a price, of course).

Hardware Selection Guidelines

Several basic recommendations concerning the selection of microcomputer hardware for ridesharing or other in-house business information systems have emerged from this project. These recommendations are: (1) consider only more powerful microcomputers capable of supporting multi-users, and avoid 8-bit machines entirely; (2) choose only equipment that is available from well-established manufacturers, even if the prices for such equipment are not the lowest available; (3) select a computer configuration with substantial reserve capacity in order to accommodate future growth; and (4) consider using UNIX-based operating systems--the greater capabilities, increased flexibility, and compatibility with other computer systems provided by UNIX will be appreciated over the long run.[5]

While the value of small, user-operated in-house computer systems is clearly well-established, some general observations can be made regarding the risks inherent in adopting new technology. The microcomputer field has been remarkable in its growth and the rapidity of technological development. This is, in part, because it is a highly-

competitive market, populated by many new companies. One of the beneficial results of this is that the prices of computer equipment continue to decline on the order of 15 to 20 percent per year. However, there is a negative side to this fiercely competitive market. Competitive pressures often produce undesireable corporate behavior. New products are announced prematurely, and product delivery dates are usually optimistic. In addition, initial deliveries of new hardware and software products are often not well-tested, and the availability of off-the-shelf software (such as word processing packages) usually lags new computer products by 6 to 12 months. Thus, the buyer should approach the highly-competitive microcomputer marketplace with considerable caution. Those who desire to be at the "cutting edge" should be prepared to take some substantial risks. Those who want to minimize risks should buy last-year's products and avoid anything that is too new.

The "Human-Computer" Relationship

Adapting to a new computer system can create a number of challenges and problems with respect to the human-computer relationship. New systems will usually impose new procedures on existing staff and, if not properly orchestrated, adaptation to these new procedures can sometimes generate frustration and resentment.

In addition, as new procedures are developed to fit the new system into the existing operational environment, these procedures must be documented. All too often, this has not been done, and it is rarely done well. Frequently, these procedures are passed along like folklore -- by word of mouth. If the communication network subsequently breaks down, the costs can be considerable.

Training staff to handle a new computer system can be a significant hidden cost; thus, training needs to be a major

consideration prior to the purchase of an in-house business information system. To emphasize the point by way of illustration, it can require 20 or more hours for a novice to learn to use a spread-sheet program proficiently. If this is multiplied times four or five packages, times the number of people on staff which need training, the time and cost of training can be quite large.

Development of an in-house computer also requires attention to data security. Backup procedures must be established to protect valuable data files in the event of hardware failures or staff mistakes in deleting data. Procedures are also needed to provide access security to prevent unauthorized use of private data and to provide internal security to protect against possible vandalism or inadvertant destructive acts by staff members which are not trained to operate particular software modules. Access and internal security are particularly important concerns with information systems which operate on-line in a multi-user environment with modems.

A Planned Incremental Approach

Once a computer system is installed, it is very tempting to launch into development of special-purpose software. While this may be justified in a few cases, the consensus is that these activities are usually a very expensive use of staff time. This cost is often hidden in the form of lost productivity rather than visible dollars. The preferred course is to first attempt to find an existing package of software that will perform the desired functions. If no existing package can reasonably provide the desired functions, then the next step is to carefully estimate the costs for modifying an existing package. Only as a last resort should an agency undertake the expensive task of new program

development. If required, such a project should be viewed with the same critical eye as any other agency programs and activities. The same reporting standards, productivity expectations, information feedback, leadership qualities, and management abilities required of other programs should also be required of data processing/computer programming staff.

The prudent course to take in acquisition and development of a new information system is to adopt an incremental approach. Although it may be tempting to try to acquire all desired data processing capabilities at once, implementation of a phased development plan will be more cost-effective. This incremental approach helps to ease budget and schedule pressures, provides more flexibility for changing circumstances, and provides staff with adequate time to gain experience with existing programs and routines before new ones are added.

Overall, based on the Memphis Area Rideshare experience, any regional ridesharing agency (or any other organization) contemplating the acquisition and development of an in-house business information system would be well-advised to develop a workable data processing plan at the outset. The plan should identify current and future data processing needs, identify the type of processing functions desired, outline information and management procedures, define staffing and training requirements, and, to the extent possible, examine related personnel, operational, environmental, and logistical needs. If appropriate in-house expertise is not available to develop a plan, then it is advisable to obtain it from outside the agency prior to initiating software and hardware procurement. In any event, a well thought-out data processing plan, combined with an incremental approach to adding new data processing capabilities, will help to provide for an orderly and crisis-free system development process.

FUTURE PLANS

The Memphis Area Rideshare on-line information system has been operational since October 1983. Basic ridesharing applications, including carpooling, vanpooling, and transit information capabilities, have been applied to daily rideshare program operations. Appropriate staff are currently becoming more proficient in the use of the peripheral word processing, spread sheet, and data base management packages. However, program staff members are still at the beginning of the learning curve of what has proven to be an extremely rich system.

Activities currently in progress or planned for the near future include:

- continued training for system administrators ("super-users") on the UNIX operating system;
- development of improved updating and purging procedures for the rideshare applicant master file;
- refining work schedules and file and data management procedures to optimize system performance and staff productivity;
- exploring communications capabilities for dial-up and/or dedicated-line connections to local government mainframe computer facilities;
- further examining remote access capabilities, such as locating terminals at large work-sites or other organizations which use rideshare program services;
- exploiting POOLMATCH system capabilities to more effectively target non-work trip ridesharing markets, such as day care and school trips, church trips, and neighborhood-based ridesharing matching;
- learning to use the advanced applications of the peripheral software packages, including the spread sheet and data base mangement software.

- Further exploring communication capabilities between the Memphis Area Rideshare system and a dedicated word processing system currently used in the Office of Planning and Development;
- working with the Memphis Area Transit Authority (MATA) marketing staff to use the Memphis Area Rideshare system to test various direct mail approaches to improve public transit information and outreach.

Notes

1. For additional summary information on the earlier batch mode and interactive computer packages available for ridesharing, see page 4-67 of The Organization and Operation of Ridesharing Programs - A Manual of Current Information, published by Federal Highway Administration and the Urban Mass Transportation Administration in March 1980 under the National Cooperative Highway Research Program. Copies of this report are available from the National Ridesharing Information Center, Federal Highway Administration (HHP-25), Room 3301, 400 7th Street, S.W., Washington, D.C. 20590.

2. The "third-party" Memphis Area Commuter Vans vanpooling service is funded by the City of Memphis through Memphis Area Rideshare and managed by Van Pool Services, Inc., a subsidiary of Chrysler Corporation. Under contract, Van Pool Services provides leased vehicles, insurance, and handles all fleet management responsibilities. Participating employers, commuters, and the City are thus relieved of most liabilities and administrative burdens which might otherwise be associated with employee vanpooling. Vehicle fixed and operating costs are covered through rider fare collections and the City pays administrative and marketing expenses incurred by Van Pool Services, Inc.

3. The memory resident operating system software carries the code that supports all system calls to maintain the data

file system in the computer. UNIX is a multi-programming, time-sharing operating system first developed by Bell Laboratories in the late 1960s and early 1970s. The Altos 586 computer and the POOLMATCH rideshare software chosen for Memphis Area Rideshare use Microsoft's XENIX, a 16-bit microprocessor adaptation of Bell Laboratories' Version 7 UNIX operating system. The XENIX system, under license from Western Electric, offers the same code as UNIX. Some useful references on the UNIX operating system include A User Guide to the UNIX System written by Rebecca Thomas and Jean Yates and published by Osborne/McGraw-Hill (Berkley, California: 1982), and The UNIX System written by Steve Bourne and published by Addison-Wesley (Reading, Massachusetts: 1983).

4. One megabyte (1MB) is approximately equivalent to one million characters of information.

5. Some operating systems available in the marketplace are described as "UNIX-like" or "based on UNIX technology". However, some of them do not offer true UNIX code.

APPENDIX A: REQUEST FOR PROPOSAL

I. INTRODUCTION

On behalf of the City of Memphis, the Memphis-Shelby County Office of Planning and Development (OPD) is soliciting proposals for the development of an in-house, on-line microcomputer-based interactive information system for the Memphis Area Rideshare Program. The system software will consist of carpool and vanpool information modules. In addition, as far as the budget established for this project will permit, OPD will also consider purchasing a transit information module, an on-line automatic geocoding capability, and a standard word processing package with spread sheet function. Section V describes computer software requirements in more detail.

In addition to software, OPD is also requesting proposals for a computer hardware configuration as described in Section VI. All Vendors desiring to submit proposals for the computer software must also submit a proposal for the hardware. However, OPD many, at its discretion, accept a proposal for only software and obtain compatible hardware from another source.

II. BACKGROUND INFORMATION

The Memphis Area Rideshare Program, which was initiated in late 1979 as a component of the Tennessee State Energy

Conservation Plan (SECP), is administered and operated by OPD. Through this program, employees at over 75 area work sites have been surveyed and computer matched to identify ridesharing opportunities, and over 25,000 commuters have been provided with personalized carpool, vanpool and public transit information.

The Rideshare Program is funded by the Tennessee Energy Authority (TEA), and the U.S. Environmental Protection Agency (EPA), and cash and in-kind contributions from local government and private sector sources such as the Memphis Advertising Federation, the Chamber of Commerce, and Federal Express Corporation. In addition, the U.S. Department of Transportation (DOT) has recently awarded discretionary funding to expand program operations, and the Memphis City Council has appropriated local funds to sponsor a third-party vanpool service through the program.

III. EXISTING DATA PROCESSING ARRANGEMENTS

The Ridesharing Program currently relies on outside data entry services and TEA computer support for processing and matching prospective ridesharing candidates identified through work-site surveys. Under current arrangements, rideshare survey responses from client employers are manually edited and coded by Rideshare Program staff in OPD. Coded surveys are then forwarded to NLT Computer Services Corporation in Nashville, which is under contract to OPD to provide data entry services. After data entry and verification is accomplished, NLT delivers a tape of the survey data to TEA for batch processing on State computer facilities in Nashville using rideshare matching software developed by Comsis Corporation. Products generated from computer matching include: personalized carpool match lists; vanpool

groupings; rideshare master files sorted alphabetically and by origin-destination zones; and, management reports which summarize the survey results, describe the commuting characteristics of the employer's labor force, and provide quantitative estimates of potential program benefits in terms of energy savings, reduced parking requirements, air pollution removed, and commuting dollars saved. After computer matching is completed, TEA sends the rideshare products to OPD for subsequent distribution to survey respondents through a network of on-site company rideshare coordinators or through the mail.

At the same time that the above data processing tasks are being accomplished, copies of the original rideshare survey responses are also forwarded to the Memphis Area Transit Authority (MATA). MATA manually prepares personalized transit route and schedule information for respondents who might be able to use MATA buses for their work trips. Personalized transit letters are prepared on a word processor and appropriate transit schedules are attached to each response. Transit reports, along with carpool match lists, are subsequently distributed by OPD.

The lack of data processing autonomy under current arrangements inevitably creates problems which are beyond the control of Rideshare Program staff. For example, delays created by coding errors, misunderstood communications, time consumed in shipping survey data and computer results between Memphis and Nashville, and competing priorities for State computer time frequently cause response times for processing employer survey data to run four or more weeks. These types of problems, along with the possible future loss of TEA computer support due to impending Federal budget cuts, have led OPD to the decision to acquire an in-house data processing capability for the Rideshare Program.

IV. GENERAL SYSTEM REQUIREMENTS

The objective of this project is to install and activate an interactive ridesharing computer information system that will allow the Memphis Area Rideshare Program to provide employers and commuters with timely carpool and vanpool matching assistance. In addition, subject to project budget constraints, on-line transit information, automatic geocoding, and word processing capabilities are also desired. The system may be adapted from existing rideshare information systems (such as those used in Baltimore, Maryland; Little Rock, Arkansas; San Francisco, California; Colorado Springs, Colorado; Dallas, Texas; Knoxville, Tennessee; Houston, Texas; Hartford, Connecticut; Hampton, Virginia; Richmond, Virginia; or other interactive matching systems). The system may be a modified version of systems such as the Federal Highway Administration (FHWA) Commuter Information System (CIS), or developed as a totally new system.

In general, the system should provide the following features: on-line data entry, updating and retrieval through the use of a video terminal; automatic validation of data as data are entered; system security provisions; system modularity; and integrated applications. The system should be "user friendly" and able to be operated and maintained by existing Rideshare Program personnel. In addition, the system should be flexible in order to provide for changing circumstances and allow for an incremental approach for adding new data processing functions in the future.

The contract awarded under this project will require that the vendor be responsible for performing the following services:

- acquisition and delivery of all necessary computer hardware and software;

- system activation, including installing all software, coding an origin-destination zone or grid system, installing the current Memphis rideshare data base (approximately 10,000 candidates, two records per candidate), and operationalizing the system;
- training appropriate Rideshare Program personnel to operate and maintain the system; and
- providing support, including user documentation, operations manuals, and appropriate guarantees and warranties.

The vendor shall present a proposed system design based on the specifications; however, if the vendor desires to propose an alternative technique or procedure, the vendor should provide a specific, clear reference to the specified technique or procedure which the proposed alternative is to modify or replace. Furthermore, the vendor should fully explain the advantages of the proposed alternative. The decision as to the acceptability of an alternative rests with the OPD and any such decision shall be considered as final. Any unclear and/or incomplete explanation and description will be sufficient reason for rejection of any alternative. Appeals or offers to modify alternatives will not be entertained.

V. SOFTWARE

The computer software provided for the on-line matching system should be modular in design. Each data processing application should be designed as an independent module of the total system, thus permitting the installation of additional applications as needed. In addition, the rideshare software should provide for automatic integration of data

among related data files. This last feature should allow one system to capture data and then automatically transfer a summary of the data to related files as appropriate. For example, if a vanpool rider is removed from the rideshare master listing then that individual would automatically be deleted from the vanpool rider listing.

Carpooling

The rideshare software package should feature the ability to perform carpool matching in either batch or on-line modes, the capability to alter matching parameters, and the capability to produce carpool match lists in a list format similar to those produced by the FHWA CIS system and in a personalized letter-style format. In describing the proposed rideshare software package, the proposer should submit brief descriptions of the search routine and algorithm to be used in carpool matching.

Special Listings

The software package must also provide for the production of special listings used in ridesharing. At a minimum, these special listings shall include: alphabetically and zonally sorted applicant master lists; applicant record print-outs; customized form letters; and, mailing labels. The software should provide the capability to produce special listings for relevant subsets of the master file.

Vanpooling

The software must also feature applications for vanpool planning and support. In the area of vanpool planning, the system should be able to generate a list of ridesharing candidates who live near prospective vanpool routes, as well as numeric and shaded density matrices similar to those produced in the FHWA CIS system. In the area of vanpool support, the software must provide for the maintenance of information on operating vanpools, including information on vanpool participants, number of seats, vacancies, etc. The intent is to provide a computer-assisted manual approach to vanpool planning which will enable the Rideshare Program to provide support to the third-party vanpool operator, owner--operators, and employer-sponsored vanpool programs in the Memphis area.

Additional Applications

In addition to carpool applications, vanpool applications, and special listings, OPD will also consider purchasing additional applications. These additional applications should be priced separately in the proposer's cost proposal. Three applications which must be included in all written proposals are on-line automatic geocoding, a transit information package, and a word processing package with spread sheet function. Other applications may be included at the option of the proposer. Such optional applications should be priced separately in the vendor's cost proposal.

The computerized geocoding package should provide for the automatic translation of the applicant addresses into home/work grid coordinates or origin-destination zones as applicant information is entered on-line. The purpose of this feature is to improve the efficiency of Rideshare

Program staff by reducing the need to manually geocode each rideshare applicant. At a minimum, the computerized geocoding system should be developed to cover all of the Memphis Standard Metropolitan Statistical Area (size = 2,286 square miles). The GBF/DIME file, which is maintained by OPD, is available to be converted into the format required for on-line geocoding.

The transit information package should provide the following minimum information to the ridesharing applicants: the name of the operator; route numbers; headboards; headways; descriptive text which covers items such as fares, express services, transfers, etc.; and, a number to call for further information. The intent is not to provide complete transit information with exact locations for boarding, alighting and transferring, nor to replace the transit information center currently operated by MATA. Rather, the intent is to direct market transit service to rideshare applicants by giving them a moderate quality and quantity of information at a moderate to low cost. The quality of information desired should approach that provided by the FHWA CIS system (sometimes referred to as "level 2" transit information). If OPD elects to purchase the transit information package, the vendor will be required to encode the necessary data to operationalize this feature. The current bus system operated by MATA includes 137 vehicles operating on 23 routes during peak periods. Total bus system mileage is approximately 600 miles.

The word processing package should provide features similar to the commonly used Word Star word processing package. The spread sheet program (VISICALC or functional equivalent) should provide the ability to automatically incorporate data files into reports generated by the word processing program.

VI. HARDWARE

The computer hardware configuration proposed for this project should provide substantial reserve capacity to ensure that future gorwth in data processing needs can be met. The system must be able to effectively support multiple users, and in the future OPD desires to enhance the system for up to eight mulitple users through the acquisition of additional terminals and modems.

The miminum acceptable sytem hardware should include one 16-bit microcomputer with at least 512 K memory capacity; one fixed disk storage device (at least 20 MB capacity); a video display terminal with keyboard; a letter-quality printer with tractor feed; and, operating sytem software (UNIX multiple-user or functional equivalent).

The above hardware is viewed as the basic hardware package desired for the rideshare information system, and the package should be priced as appropriate on the pricing sheet attached to this RFP. In addition, prices for the following optional computer hardware are also requested: an additional portable video terminal equipped with an auxillary printer plug and having the capability to support an auxillary printer which may be acquired in the future; a fixed disk storage device, as an alternative to the one described under the preceding paragraph, with at least 40 MB capacity; and high speed modems (1200 baud, originate/answer, acoustic coupler type) to facilitate communication between the microcomputer and the optional portable video terminal and provide communication capabilities on a dial-up basis with respect to a Honeywell 6600 mainframe computer (GCOS operating system). Prices for these optional hardware components should be entered separately as shown on the pricing sheet attached to this RFP.

Video terminals proposed for this project should provide 24-line, 80-character screen display, with lower case display to facilitate word processing applications. The terminals should feature full and split screen as well as horizontal and vertical scrolling. A 9-dot x 14-dot matrix screen resolution is preferred, with green phosphor or amber character display. Video terminals should also feature independent adjustments for brightness of characters and background as well as screen contrast. Video display tubes should have a non-glare coating.

Keyboards for data entry should feature a standard typewriter layout with upper and lower case letters. Keyboards should be buffered (or functional equivalent). An automatic repeat feature for all alphanumeric keys is also desired. Keyboards must feature numeric keypads for inputting numbers (like a calculator), and additional keys must be included to control the cursor and text on the screens. A rollover function is also required to allow keyboards to transmit the last key pressed, even if other keys are not released. The rollover function is to facilitate operator speed.

Proposers should also submit the prices of annual service-maintenance contracts for all components of the proposed system hardware configuration, along with information as to where service-maintenance would be accomplished. Although not required, it is preferred that regular service/maintenance for all hardware components be accomplished locally.

The computer hardware to be supplied for this project should be high quality equipment produced by well-established manufacturers that have developed a good record for technical support and maintenance for products in service. Hardware provided for the rideshare information system must be guaranteed by the vendor for at least twelve months following delivery and installation of the hardware

in the Rideshare Program office at OPD. This guarantee is intended to require high-quality design and reproduction and is not meant to include routine maintenance. The vendor will be responsible for satisfactory operation during the course of the project until final acceptance. The vendor will be required to assume responsibility for repairing and/or replacing hardware that is irreparable under normal procedures within the guarantee period. In addition, the vendor will also be required to provide replacement units as needed during the time for repair of unsuitable hardware, as well as cover the cost of transporting units. OPD will reserve the right to determine the unsuitability of hardware during the guarantee period.

VII. FORM OF PROPOSAL

The purpose of this section is to provide guidance on proposal formats and to specify essential items.

Technical Statement

All proposals must include a technical statement which describes in sufficient detail how the vendor intends to provide features and functions required in the specifications. The technical statement should address the following system features or characteristics:

- manufacturers;
- models;
- type of microprocessor
- memory capacity;
- disk capacity;

- screen capacity, including horizontal scrolling capability;
- screen color;
- keyboard features;
- ergonomic features;
- peripheral capacity;
- operating software;
- printer;
- processing speed;
- service-maintenance;
- training and documentation;
- other features or characteristics as appropriate.

The technical statement should also indicate the periodic maintenance requirements for each system component and the availability and accessibility of contract maintenance services for computer hardware.

The technical statement should also provide estimated data storage requirements based on the types of data files to be maintained. These estimates should be developed for both mandatory fles (such as the applicant master file, the vanpool file, and the operating system and application programs) and optional files (such as the geographic base file, the transit information files, and the word processing files). Estimated storage requirements should be given in terms of MB and assumptions concerning the number of records and bytes per record upon which the estimates are based should be specified.

Examples of methods or components furnished in another system can be used in the technical statement if they are specifically proposed for this project. In any event, the vendor must propose hardware and software which will fulfill the functional requirements of the specifications, as interpreted by OPD.

The vendor is also encouraged to submit supplementary descriptive information to further elaborate particular aspects of the proposed information system. Suggestions for improvements or exceptions to the terms and conditions of the RFP should be set forth in order to warrant consideration by OPD.

The vendor must also submit a description of a proposed acceptance test procedure. Acceptance tests should be performed by the vendor on-site, and must include a system equipment test, a system operational test, and a total system test.

Work Flow Chart

The vendor should include as part of the proposal a projected work flow chart. The chart may be simple, but the sequencing and timing of individual project tasks (i.e. - hardware acquisition, system installation, training, etc.) should be clearly indicated. The timing of interim reports and meetings should also be indicated.

Cost Proposal

As part of the proposal, the vendor must submit a cost proposal for hardware which lists each component in the system, the manufacturer, the model, major design features, the unit price, and the cost of a one-year service-maintenance contract.

The vendor must also submit a software cost proposal which gives the price for the carpool and vanpool packages, and which gives the incremental cost for each optional application given in the specifications. These optional applications must include the transit information package,

the computerized geocoding package, the word processing package, plus any others the vendor may wish to propose.

For all prices and costs given in the cost proposal, the vendor must indicate the time period for which such prices and costs will be guaranteed.

Additional Information

Vendor proposals must also present additional information which, at a minimum, should include the following: names and resumes of the proposed project manager and other key individuals to be involved in the project; a statement of the firm's qualifications and experience; the role and qualifications of any subcontractors (in the case of joint proposals); and provisions for training no less than three and no more than six OPD staff members in the application, operation and maintenance of the proposed rideshare information system. Training can be accomplished either on-site in Memphis, or OPD will pay for appropriate staff members to travel to an alternate site to receive training. However, if training at an alternate location is proposed, training must be provided on the same software systems and on hardware similar to that selected for this project.

VIII. ADDITIONAL PROJECT INFORMATION

The project will be financed through grants from the Urban Consortium Energy Task Force and the Tennessee Energy Authority. Therefore, the project will need to be accomplished within the time constraints required under grant agreements. The system should be operational by no later than April 15, 1983.

It is the intention of OPD to negotiate a contract with the successful proposer as a "firm-fixed fee" type of contract. The vendor will thus be required to assume full responsibility, in the form of profits or losses, for all costs under or over the total compensation established for the term of the contract. The total compensation will not be subject to adjustment upward or downward by reason of the cost experience of the vendor.

The successful proposer will be required to comply with all applicable equal employment opportunity laws and regulations and any other relevant policies and procedures of local, State and Federal authorities participating in the project.

IX. PROPOSER EVALUATION AND SELECTION PROCEDURE

The procedure for vendor selection will consist of the following steps:

1. Proposals will be evaluated by a review committee on the basis of the following criteria:
   a. Responsiveness and quality of the proposal in addressing the services requested in the RFP.
   b. Familiarity with ridesharing, rideshare matching systems, transit operations, and transportation planning.
   c. Cost/price.
   d. Previous experience of the firm with similar work.
   e. Qualifications of personnel to be assigned to the project.
   f. Imagination and innovation shown in the proposal.
   g. Ability to provide services within a specified time frame.

2. If the committee chosen to review vendor proposals deems it necessary, proposers will be required to attend interviews.
3. Based on the findings of step 1 (and step 2 if it is deemed necessary), the review committee will forward a final selection recommendation to the Chief Administrative Officer and Mayor for approval.
4. Award of the contract will normally be made to that proposer which has been determined to most responsive and which offers the most advantageous final price. However, the review committee will reserve the right to select a firm other than the lowest final proposer and price will not be the determining factor. Contract award will be subject to final agreement on the project design, schedule and contract provisions. The contract will be negotiated by OPD on behalf of the City of Memphis. If a contract cannot be negotiated with the first proposer selected, then the Chief Administrative Officer and the Mayor may select from those remaining on the list.

Any questions regarding this Request for Proposal should be directed to Mr. Alan D. Gray, Rideshare Program Coordinator, Memphis-Shelby County Office of Planning and Development, 125 N. Mid-America Mall, Room 419, Memphis, Tennessee 38103, phone number: 901/528-2604.

CONSULTANT SERVICES PRICING SHEET

	Price
Acquisition and Installation of Basic Software	
Carpool, Vanpool and Special Listings	
Sub-Total	_____
Acquisistion and Installatin of Optional Software	
Computerized Geocoding	_____
Transit Information Package	_____
Word Processing with Spread Sheet Function	_____
Sub-Total	_____
TOTAL	_____

HARDWARE PRICING SHEET

Basic Hardware

Item	Manufacturer	Model	Design Features	Price

Subtotal _____

Optional Hardware

TOTAL _____

APPENDIX B: SAMPLES OF SYSTEM OUTPUT

February 10, 1984

EDWARD ISEN
1920 DOWNING ST
MEMPHIS TN 38117

Dear Commuter:

Stop paying so much just to get to work. The best way to cut the high cost of driving to work alone is by sharing the cost with someone else. Memphis Area Rideshare is a free service designed to help you find people who both live and work near you who also want to save money by sharing the ride.

Attached is your personal carpool match list. You can call and get together with some of them to form a carpool or vanpool. In addition, if services are available in your area, we have also enclosed information on how you can join an existing Memphis Area Commuter Vans vanpool or take the bus to work.

By carpooling, vanpooling or taking the bus, you can save hundreds of dollars a year in gasoline, cut auto wear and tear, save on parking costs, perhaps lower your insurance rates, and maybe even eliminate the need for a second car.

Our number is 528-2604. If you are unable to form a carpool with the people on the list, or if we made any mistakes, please call us. If you move or change jobs, let us know. We'll be glad to provide a new match list or other ridesharing information at any time.

Remember, it pays to ride with a friend. You can help us and yourself by telling friends, neighbors, and your employer about Memphis Area Rideshare services.

Sincerely,

Alan D. Gray
Manager
Memphis Area Rideshare

ADG/ydk

February 10, 1984

EDWARD ISEN
1920 DOWNING ST
MEMPHIS TN 38117

Leaving from: 1920 DOWNING ST
Going to: 125 N MAIN
Phone Number: W/582-2768 H/685-812(
Employer: PLANNING & DEVELOPMT
Work Hours: 8:00AM- 4:30PM Flexible

The following people live and work near you. The better matches are listed first.

NAME, ADDRESS & HOME PHONE	WORK HOURS & PHONE	EMPLOYER
RUTH ACUFF MEMPHIS 767-6528	8:00AM- 4:30PM 529-7164 Car available	STATE OF TENNESSEE 170 N. MAIN ST. MEMPHIS
BERNICE TAYLOR MEMPHIS	8:00AM- 4:30PM 524-1500 Car available	DEPT. OF HUMAN SERVICES 17 S SECOND MEMPHIS
BOBBIE BRADLEY MEMPHIS	8:00AM- 4:30PM 525-1200 Car available	SOUTHERN LEATHER 274 MONROE MEMPHIS
PEGGY SELPH MEMPHIS 685-7846	8:00AM- 4:30PM 524-1677 Car available	GOODWYN-STATE OF TN 127 MADISON AV MEMPHIS
REBECCA PACHLER MEMPHIS 683-9551	8:00AM- 4:30PM 523-8990 EX 5364	V A HOSPITAL 1030 JEFFERSON AVE MEMPHIS
FRANCES BISHOP MEMPHIS 743-3900	8:00AM- 4:30PM 523-8990 EX 5573	V A HOSPITAL 1030 JEFFERSON AVE MEMPHIS
DOROTHY BLAIR MEMPHIS	8:00AM- 4:30PM 523-8990 EX 5956	V A HOSPITAL 1030 JEFFERSON AVE MEMPHIS

If you have any questions about this match list, or would like additional information, please call Your Employee Transportation Coordinator at PLANNING & DEVELOPMT - 7510 -TRANS

115,692/105,686 311160001

VANPOOLS SERVING YOUR COMMUTING NEEDS

VAN DRIVER	HOME PHONE	WORK PHONE/EX	WORK HOURS
JERRY HERMAN	754-5180	528-3366	8:00AM- 4:30PM
COLONIAL AT FLAMINGO		PICKUP POINT ALONG COLONIAL AND FLAMINGO	

Date 02/10/84 — JOB_MATCH — APPLICANT RECORDS — Page 1

ID / Home Address / Co. Address	Name / City	Home X-Y / Work X-Y / Zip	Mail / Supp	Work time / Remark / Co. Name	Int	Curr	Hrd / Emp.	Smkr / Dept	RTW / Room	G-val / Home Phone / Work Phone	Vane / Ext	Create / Locate
303072201 0 NEWELL 6753 QUAIL HOLLOW 4001 AIRWAYS	RHONDA CT MEMPHIS MEMPHIS	121-691 109-695 TN 38119	H Y	0000A-0000A FED EXPRESS AIRWAYS	I1	YYY	D 2025		220 0	0 901 7553217 901 3693600		830307 830307
303072202 0 OBYRNES 3062 CASTLEMAN 4001 AIRWAYS	GAIL MEMPHIS MEMPHIS	117-695 109-695 TN 38118 TN 38116	H Y	0900A-0530P FED EXPRESS AIRWAYS	N1	YYY	D 2025		220 0	0 901 7946228 901 3693210		830307 830307
303070003 0 ANTONE 1676 GALLOWAY 4001 AIRWAYS	ANITA MEMPHIS MEMPHIS	108-686 109-695 TN 38112 TN 38116	H Y	0800A-0500P FED EXPRESS AIRWAYS	N1	YYY	D 2025		220 0	0 901 2760142 901 3693301		830307 830307
303072204 0 MILLER 2978 CROLEY 4001 AIRWAYS	BETH DR MEMPHIS MEMPHIS	117-693 109-695 TN 38118 TN 38116	H Y	0930A-0600P FED EXPRESS AIRWAYS	N1	YYY	D 2025		000 0	0 901 7943278 901 3693455		830307 830307
303070006 0 KELLY 6765 QUAIL HOLLOW #2 4001 AIRWAYS	CARRIE MEMPHIS MEMPHIS	121-691 109-695 TN 38119 TN 38116	H Y	0000A-0400P FED EXPRESS AIRWAYS	N1	YYY	D 2025		220 0	0 901 901 3693620		830307 830307
303070007 0 MARTIN 3944 MERRYWIND 4001 AIRWAYS	DEBBIE MEMPHIS MEMPHIS	120-696 109-695 TN 38115 TN 38116	H Y	0830A-1230P FED EXPRESS AIRWAYS	N1	YYY	D 2025		000 0	0 901 7952244 901 3693600		830307 830307
303070008 0 SHEEHY 3876 APRICOT 4001 AIRWAYS	ELIZABET CV MEMPHIS MEMPHIS	118-695 109-695 TN 38115 TN 38116	H Y	0715A-0400P FED EXPRESS AIRWAYS	N1	YYY	D 2025		000 0	0 901 7946751 901 3455244		830307 830307
303070009 0 ANDRE 5721 BOYD 4001 AIRWAYS	SIDNEY BARTLETT MEMPHIS	118-688 109-695 TN 38134 TN 38116	H Y	0830A-0530P FED EXPRESS AIRWAYS	N1	YYY	D 2025		220 0	0 901 3884459 901 3693717		830307 830307
303070010 0 PEACOCK 1095 RICHLAND 4001 AIRWAYS	JON DR MEMPHIS MEMPHIS	107-698 109-695 TN 38116 TN 38116	H Y	0800A-0500P FED EXPRESS AIRWAYS	N1	YYY	D 2025		220 0	0 901 3962835 901 3693677		830307 830307
303070011 0 TAGG 5915 HOLMES 4001 AIRWAYS	PATSY MEMPHIS MEMPHIS	112-688 109-695 TN 38111 TN 38116	H Y	0600A-0500P FED EXPRESS AIRWAYS	N1	YYY	D 2025		220 0	0 901 3241844 901 3455244		830307 830307
303070012 0 GUERERRI 3359 LYNCHBURG 4001 AIRWAYS	EDDIE MEMPHIS MEMPHIS	118-688 109-695 TN 38134 TN 38116	H Y	1000A-0500P FED EXPRESS AIRWAYS	N1	YYY	D 2025		000 0	0 901 3723675 901 3693600		830307 830307
303070013 0 PARKER 8196 TIMBER HILL 4001 AIRWAYS	RENEE CORDOVA MEMPHIS	126-682 109-695 TN 38018 TN 38116	H Y	0730A-0430P FED EXPRESS AIRWAYS	N1	YYY	D 2025		220 0	0 901 7542517 901 3693131		830307 830307

DATE: 2/10/84 THIS FILE PROVIDES LISTING FOR FEDERAL PAGE: 1

ALPHABETIC MASTER LIST

ID.NO.	LAST NAME	FIRST NAME	ADDRESS		CITY	ZIP	PHONE	EXT	HOMEGRID	WORKGRID
303070065	ADAIR	PATRICIA	5746	PINOLA	BARTLETT	38134	345-5044		118,680	109,695
303070022	ALEXANDER	DAVID	3030	MORNING VIEW	MEM	38118	369-3455		111,698	109,695
303070017	ANDERSON	RHONDA	2823	TERRI CREST	MPHS	38115	345-5044		116,693	109,695
303070009	ANDRE	SIDNEY	5721	BOYD	BARTLETT	38134	369-3717		118,680	109,695
303070003	ANTONE	ANITA	1676	GALLOWAY	MEMPHIS	38112	369-3301		108,686	109,695
401050012	ANTONE	ANITA R.	1676	GALLOWAY	MEMPHIS	38112	369-3301		108,685	109,695
303070035	BARTON	NELL	2160	ST ELMO	AV MEMPHIS	38127	369-3839		110,678	109,695
303070030	BETTS	CYNDI	3513 S	MENDENHALL	MPH	38115	345-5044		116,694	109,695
401050010	BIRMINGHAM	GLADYS M.	1975	HAMPTON HILL	DR MEMPHIS	38134	369-2678		117,683	109,695
303070054	BRATTON	PEGGY	3431	BOXDALE	MEMPHIS	38118	369-3455		116,694	109,695
303070082	BROWN	MONICA	1592	GILSON	MPHS	38117	369-3210		115,691	109,695
303070069	BROWN	PAT	1500	KIRBY PKWY	MPHS	38119	369-3839		121,691	109,695
303070049	BURCHETT	LINDA	2277	UNION	AV MEMPHIS	38104	369-3389		109,688	109,695
401050011	BURCHETT	LINDA J.	2277	UNION	AV MEMPHIS	38104	369-3620	7711	110,687	109,695
303070031	BURNETTE	GERI	2593	ROSEHAVEN	G'TOWN	38138	345-5044		121,691	109,695
303070056	CAGE	BOBBIE	7199	EGGLESTON	RD MEMPHIS	38115	345-5044		122,695	109,695
303070079	CARNEY	RONALD	4386	TIMBER RISE	MEMPHIS	38115	369-3455		122,695	109,695
303070070	CLARK	BRENDA	160	HAYDEN #6	MEMPHIS	38111	369-3839		113,687	109,695
303070089	COPELAND	CHERY	1047	JUNE #5	MEM	38119	797-6142		118,688	109,695
303070039	DAVIS	ROBYN	2303	MONROE #9	MPHS	38104	369-3131		109,687	109,695
303070043	DOTSON	HELEN	802	WHITE CLOVER	LN MEMPHIS	38109	345-5044		102,697	109,695
303070036	DOYLE	JOHN	5696	QUINCE #9	MEPHIS	38119	797-6380		118,691	109,695
401050013	DOYLE	JOHN J	5696	QUINCE	MEMPHIS	38119	797-6380		119,691	109,695
303070019	ELLINGSWORT	MARTHA	2979	KIN	CO MPHS	38119			122,693	109,695
303070062	ETHERIDGE	PHYLLIS	2015	SIPES	AV MEMPHIS	38127	369-3389		109,681	109,695
303070015	GRAY	VALREE	4294	EAST WIND	MEMPHIS	38116	369-3600		108,697	109,695
303070066	GROCE	CAROL	801	MEDA	MEMPHIS	38104	369-3839		109,688	109,695
401050009	GROCE	CAROL H.	801	MEDA	MEMPHIS	38104	369-3839		110,688	109,695
303070012	GUERERRI	EDDIE	3359	LYNCHBURG	MEMPHIS	38134	369-3600		118,680	109,695
303070057	GUYTON	BARBARA	4900	BRADY	DR MEMPHIS	38116	345-5044		109,698	109,695
303070028	GWYN	SHERRIE	3990	CAMELOT #1	LN MPHS	38118	369-3600		115,694	109,695
303070086	HARRISON	LAISTEIN	1103	BRADLEY	MEM	38114	369-3839		111,698	109,695
303070025	HARRIS	TIMOTHY	3303	MADRAS PLC	MEMPHIS	38115	369-3210		118,693	109,695
303070042	HATHCOCK	BONNIE	4079	WARD	MPHS	38108	369-3600		115,683	109,695
303070090	HOBSON	OPAL	4405	CASTLE HGTS	MEMPHIS	38115	369-3882		121,697	109,695
303070041	HOOPINGARNE	SHARON	4010	FRIENDLY	WA MEMPHIS	38115	345-5044		120,696	109,695
401050016	HOOPINGARNES	SHARON K	4010	FRIENDLY WAY	MEMPHIS	38115	345-5044		120,696	109,695
303070073	HOPPER	PENNY	1189	DEARING	MEMPHIS	38117	369-3232		116,690	109,695
303070026	JONES	ROBERT	3080	RIDGEWAY	RD MEMPHIS	38115	369-3210		119,694	109,695
303070006	KELLY	CARRIE	6765	QUAIL HOLLOW #2	MEMPHIS	38119	369-3620		121,691	109,695
303070059	KERSH	LEIGH	1917	CENTRAL	MEMPHIS	38104	345-5044		109,688	109,695
303070033	KIDD	AMY	925	POPE	ST MPHS	38112			112,685	109,695
303070024	KLEINSCHMID	JOE	757	NORTHAVEN	DR MEMPHIS	38127	369-2089		106,676	109,695
303070060	LOOMIS	CHRIS	8086	BUCKINGHAM	SOUTHAVEN	38671	345-5044		110,720	109,695
303070055	LOVE	CATHERIN	2305	PENDELTON	MEMPHIS	38114	345-5044		111,692	109,695
303070018	LUSTER	FORREST	3539	BELLBRANCH #2	MPHS	38116	345-5044		109,695	109,695
303070076	MALLORY	IKEA		RTE 1 BX 178 BELLGR	OAKLAND	38060	369-3455		146,679	109,695
303070007	MARTIN	DEBBIE	3944	MERRYWIND	MEMPHIS	38115	369-3600		120,696	109,695
303070071	MASON	KANDI	6389	MISTY CREST CR	MPHS	38115	345-5044		120,697	109,695
303070064	MATHEWS	WALTER	791	WATSON	MEMPHIS	38111	369-5044		113,689	109,695
303070072	MATHIS	CYNTHIA	3441	JENKINS	MEMPHIS	38118	345-5044		116,694	109,695
303070038	MCDANIEL	CORENLIA	1828	FELIX	MEMPHIS	38114	369-3600		109,688	109,695
303070074	MCDIVITT	TERRIE	1547	ROOSEVELT	MEMPHIS	38127	369-3131		108,681	109,695
303070051	MCGLOWN	CLAUDETT	4717	CHEVRON	RD MEMPHIS	38118	369-3389		114,699	109,695
303070083	MCNUTT	CECELIA	5474	OAK HOLLOW	MEMPHIS	38116	345-5044		108,699	109,695

NAME		HOME ADDRESS		HOURS	WORK NO.	HOME NO.	COMPANY	ID.NO
	HOME CELL 097-685							
SHEILA	MORRIS	01114E	BARTON	0830A-0500PN	369-3839	732-1877	FED EXPRESS AIRWAYS	303070075
	HOME CELL 102-697							
HELEN	DOTSON	00802	WHITE CLOVER	0830A-0515PN	345-5044	785-2290	FED EXPRESS AIRWAYS	303070043
	HOME CELL 106-676							
JOE	KLEINSCHMID	00757	NORTHAVEN	0600A-0500PN	369-2089	353-2497	FED EXPRESS AIRWAYS	303070024
	HOME CELL 106-687							
CATHY	WINFREY	00611	ST PAUL #D	0100A-0500PN	369-3455	525-5724	FED EXPRESS AIRWAYS	303070032
	HOME CELL 106-692							
HARRIET	TAYLOR	00817E	DEMPSTER	0800A-0430PN	369-3839	774-7853	FED EXPRESS AIRWAYS	303070068
	HOME CELL 107-698							
JON	PEACOCK	01095	RICHLAND	0800A-0500PN	369-3677	396-2235	FED EXPRESS AIRWAYS	303070010
	HOME CELL 108-681							
TERRIE	MCDIVITT	01547	ROOSEVELT	0900A-0530PN	369-3131	357-0470	FED EXPRESS AIRWAYS	303070074
	HOME CELL 108-685							
ANITA R.	ANTONE	01676	GALLOWAY	0800A-0500PN	369-3301	276-0142	FED EXPRESS AIRWAYS	401050012
	HOME CELL 108-686							
ANITA	ANTONE	01676	GALLOWAY	0800A-0500PN	369-3301	276-0142	FED EXPRESS AIRWAYS	303070003
PATRICIA	WHITE	00443N	AVALON	0700A-0400PN	369-3467	278-1210	FED EXPRESS AIRWAYS	303070063
MICHAEL	RICHEY	01678	GALLOWAY	0830A-0500PN	369-2664	276-2821	FED EXPRESS AIRWAYS	303070084
	HOME CELL 108-688							
DOTTIE	SMITH	01381	CENTRAL	0745A-0430PN	345-5044	278-1414	FED EXPRESS AIRWAYS	303070047
	HOME CELL 108-697							
VALREE	GRAY	04294	EAST WIND	0115P-1000PN	369-3600	372-4344	FED EXPRESS AIRWAYS	303070015
PAULA	RANKINS	04345	MARTHAGENE	0730A-0530PN	369-3389	398-0385	FED EXPRESS AIRWAYS	303070045
	HOME CELL 108-699							
CECELIA	MCNUTT	05474	OAK HOLLOW	0830A-0500PN	345-5044	-	FED EXPRESS AIRWAYS	303070083
	HOME CELL 109-681							
PHYLLIS	ETHERIDGE	02015	SIPES	0730A-0430PN	369-3389	353-5275	FED EXPRESS AIRWAYS	303070062
	HOME CELL 109-687							
ROBYN	DAVIS	02303	MONROE #9	1000A-0630PN	369-3131	274-7038	FED EXPRESS AIRWAYS	303070039
	HOME CELL 109-688							
CORENLIA	MCDANIEL	01828	FELIX	1115A-0800PN	369-3600	274-7706	FED EXPRESS AIRWAYS	303070038
LINDA	BURCHETT	02277	UNION	0800A-0445PN	369-3389	276-1423	FED EXPRESS AIRWAYS	303070049
LEIGH	KERSH	01917	CENTRAL	1030A-0700PN	345-5044	272-3528	FED EXPRESS AIRWAYS	303070059
CAROL	GROCE	00801	MEDA	0900A-0600PN	369-3839	274-2089	FED EXPRESS AIRWAYS	303070066

REPORT AND INFORMATION SOURCES

Additional Copies of this Report, "Memphis Area Rideshare On-Line Information Sytem", are available from:

Publications and Distribution
Public Technology, Inc.
1301 Pennsylvania Avenue, N.W.
Washington, D.C. 20004

Further information concerning the Memphis Area Rideshare on-line information system project or related ridesharing activities in the Memphis area is available from:

Memphis Area Rideshare
125 North Mid-America Mall, Room 419
Memphis, Tennessee 38103
901/528-2604

Additional information on the POOLMATCH package of rideshare applications software is available from:

Crain and Associates
Systems Development Company
2007 Sawtelle Boulevard, Suite 4
Los Angeles, Californis 90025
213/822-2235

Order No. DG/83-314
12/83-100