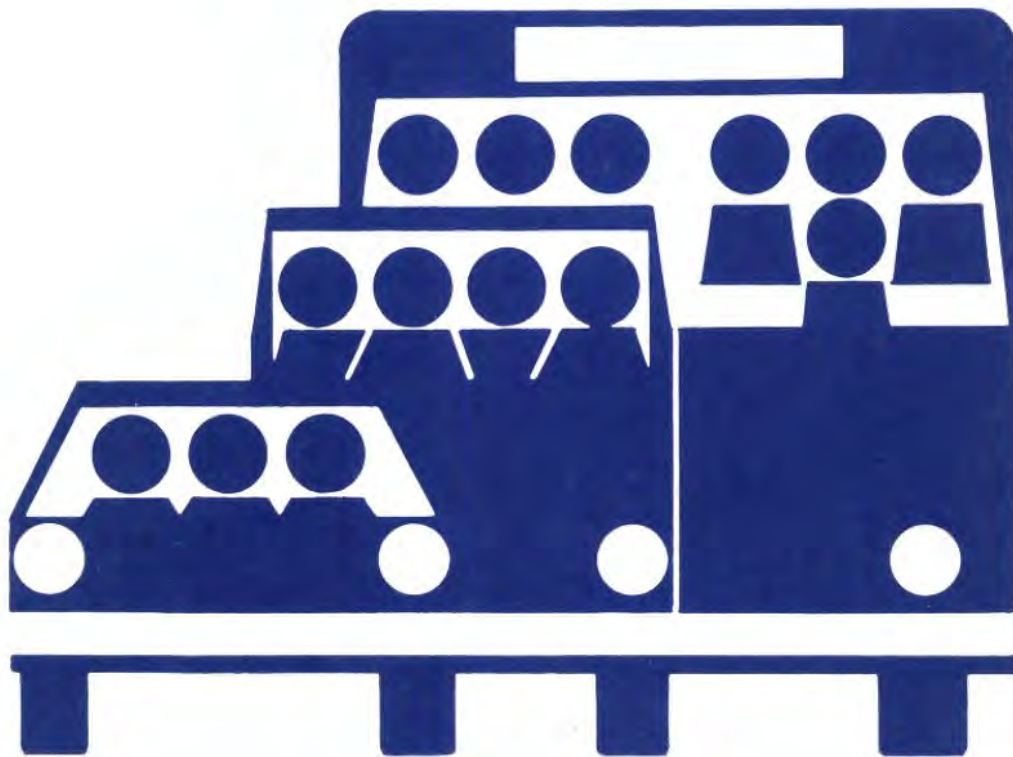


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Transportation Pooling



U.S. Department of Transportation
● Urban Mass Transportation Administration

January 1974

TRANSPORTATION POOLING

Prepared for

U.S. DEPARTMENT OF TRANSPORTATION
URBAN MASS TRANSPORTATION ADMINISTRATION

By

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PREFACE

With the advent of impending energy shortages in the winter of 1973-74, the U.S. Department of Transportation embarked on an accelerated program to promote increased use of high-occupancy vehicles -- transit and carpools. As part of this program, a series of reports was prepared that summarized the major aspects of carpool programs designed to assist local areas in initiating successful pooling action programs.

This volume is a collection of the ten individual reports originally published as separate documents in January 1974. The material, as a whole, is still timely. The matching software review, however, reports the status of existing programs as of January 1974, and many changes have been made since that time. Potential users should contact the developer of software to determine the current status.

A companion document, available from the Federal Highway Administration (FHWA), provides detailed user instructions on the use of two matching programs -- the FHWA program and a version of the Burroughs Corporation Operation Energy program designed to run on IBM equipment. These programs are also available from FHWA.

The reports which follow were prepared by Alan M. Voorhees & Associates, Inc., serving as prime contractor.



TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
THE FEDERAL EFFORT	1
LOCAL ACTION	3
CONCLUSIONS	4
1 REVIEW OF CARPOOL ACTIVITIES	5
INTRODUCTION	5
MAJOR CARPOOL ACTIVITIES	6
SPECIAL CONSIDERATIONS ON CARPOOLING	25
AUTOMOBILE OCCUPANCY IN THE UNITED STATES	28
CONCLUSIONS	37
2 ORGANIZATION FOR CARPOOLING	41
INTRODUCTION	41
CURRENT CARPOOL/BUS POOL ORGANIZATIONAL EFFORTS	42
LOCAL ORGANIZATIONAL GUIDELINES	52
STATE ORGANIZATION GUIDELINES.	61
APPENDIX A	64
OPERATION OXYGEN.	64
APPENDIX B	67
COLORADO AIR POLLUTION CONTROL COMMISSION REGULATIONS	67
3 APPROACHES TO MATCHING	69
INTRODUCTION	69
MANUAL MATCHING METHODS	70
GENERAL SYSTEM ELEMENTS	79
APPLICATIONS	83
CONCEPTS OF AUTOMATED MATCHING.	92
AUTOMATED MATCHING SOFTWARE	97
CONCLUSIONS	102
APPENDIX A	104
INTRODUCTION	104
DESCRIPTIVE PARAMETERS	104
RESULTS	105
PROGRAM DESCRIPTIONS	107
APPENDIX B	128
EXISTING APPLICATIONS OF MANUAL MATCHING METHODS	128

TABLE OF CONTENTS (Continued)

<u>Section</u>	<u>Page</u>	
4	LEGAL AND INSTITUTIONAL ISSUES	135
	INTRODUCTION	135
	LEGAL ISSUES	136
	SECURITY PROBLEMS	141
	COMPENSATION/INTERNAL REVENUE SERVICE ISSUES	142
	INSURANCE CONSIDERATION FOR CARPOOLERS	143
5	INCENTIVES TO CARPOOLING	149
	INTRODUCTION	149
	COST-RELATED INCENTIVES	149
	TRAVEL TIME INCENTIVES	155
	CONVENIENCE INCENTIVES	161
	INTANGIBLE, NON-TRAVEL RELATED AND	
	OTHER INCENTIVES	166
	ORGANIZATIONAL INCENTIVES	167
	SUMMARY OF INCENTIVE MEASURES	168
6	TRANSIT/TAXI COORDINATION	173
	INTRODUCTION	173
	CARPOOL IMPACT	176
	ADVANTAGES OF CARPOOLING TO TAXI AND TRANSIT.	177
	DISADVANTAGES OF CARPOOLING TO TAXI	
	AND TRANSIT	179
	EVALUATION	180
	STRATEGY GUIDELINES FOR COORDINATION	181
	CONCLUSION	198
7	VANPOOLS	199
	INTRODUCTION	199
	VANPOOL METHODS	199
	VANPOOL COSTS AND BENEFITS	204
	VANPOOL PROBLEMS AND SOLUTIONS	207
	SUMMARY	210
8	BUSPOOLS	213
	INTRODUCTION	213
	SUCCESSFUL BUSPOOLS	214
	CRITERIA FOR BUSPOOL OPPORTUNITIES	224
	DETERMINING BUSPOOL DEMAND	226

TABLE OF CONTENTS (Continued)

<u>Section</u>	<u>Page</u>
9 POOLING FOR THE DISADVANTAGED	231
INTRODUCTION	231
WHO ARE THE TRANSPORTATION DISADVANTAGED?	232
WHAT IS BEING DONE?	234
WHAT ARE THE OPPORTUNITIES?	239
WHAT ACTIONS MAY BE TAKEN?	249
SUMMARY	257
10 CARPOOL BACKUP SYSTEMS	259
INTRODUCTION	259
IDENTIFICATION OF PROBLEMS REQUIRING BACKUP	260
POTENTIAL BACKUP SYSTEMS OR METHODS	263
CONCLUSIONS	270

|
|
|
|
|
|
|
|
|
|
|
|

LIST OF FIGURES

<u>Figure</u>		<u>Page</u>
1-1	AVERAGE AUTOMOBILE OCCUPANCY CLASSIFIED BY PURPOSE OF TRIP	30
2-1	ORGANIZATIQNAL CHART FOR PILOT CARPOOL PROGRAM IN DENVER, COLORADO . . .	46
2-2	ORGANIZATIONAL CHART FOR EXISTING CARPOOL PROGRAM IN DENVER, COLORADO	47
2-3	CARPOOL SYSTEM MANAGEMENT - DALLAS, TEXAS	49
2-4	ORGANIZATIONAL CHART FOR CARPOOL PROGRAM IN KNOXVILLE, TENNESSEE	51
2-5	POSSIBLE LOCAL COORDINATING ORGANIZATION .	54
2-6	POSSIBLE ACTIVITIES FOR IMPLEMENTING CARPOOL PROGRAM	63
3-1	LOCATOR BOARD QUESTIONNAIRES	75
3-2	NASA LOCATOR BOARD	76
3-3	PENTAGON LOCATOR BOARD	76
3-4	TYPICAL OIL COMPANY MAP	81
3-5	MAP SHOWING GRID CELL DESTINATIONS	82
3-6	SURVEY QUESTIONNAIRE	84
3-7A	TYPICAL HOME-BASED QUESTIONNAIRE	85
3-7B	TYPICAL HOME-BASED QUESTIONNAIRE	86
3-8	PENTAGON LOCATOR BOARD	130
3-9	CLOSE-UP INSTRUCTIONS.	130

LIST OF FIGURES (Continued)

<u>Figure</u>		<u>Page</u>
3-10	CLOSE-UP INSTRUCTIONS	131
3-11	PENTAGON MAP.	131
3-12	PENTAGON MAP-CLOSE UP	132
3-13	NASA LOCATOR BOARD AND MAP	132
5-1	SUMMARY OF INCENTIVES	169
6-1	CARPOOL LOCATOR MASTER LIST	186
6-2	NUMBER OF PERSONS IN EACH HOME GRID DEPARTING FROM GRID X16Y22 FROM 3:30 P.M. .	187

LIST OF TABLES

<u>Table</u>		<u>Page</u>
1-1	AVERAGE AUTOMOBILE OCCUPANCY BY TRIP PURPOSE AND TRIP LENGTH	32
2-1	SAMPLE SURVEY OF CARPOOL ORGANIZATIONS AND COORDINATORS	43
2-2	CITY-EMPLOYER RESPONSIBILITIES DALLAS, TEXAS CARPOOLING PROGRAM . . .	48
3-1	STATUS AND SYSTEM SUMMARY	99
3-2	CAPABILITIES SUMMARY	100
6-1	3M COMPANY VANPOOL COST SCHEDULE . . .	205
10-1	CARPOOL PROBLEM MATRIX	262

NATIONWIDE CARPOOL/BUSPOOL ACTION PROGRAM

THE FEDERAL EFFORT

Introduction

On January 3, 1974 the Secretary of Transportation, Claude S. Brinegar, announced the inauguration of a nationwide effort to promote the use of carpools and buspools.

"Carpooling is a means immediately available to cope with the gasoline shortage without severely restricting urban mobility," Secretary Brinegar said. "As a matter of national energy conservation policy, Americans must be persuaded to give up single passenger commuter travel wherever possible and use mass transit or carpools. We must carpool or face the hard reality of gas rationing."

"If the Nation could increase auto occupancy for urban work trips from the present average of 1.6 persons per auto to just 2.0 persons, we could save 5 billion gallons of gasoline a year. However, this increase in auto occupancy should not come at the expense of transit ridership."

"It is most encouraging to know that many public-spirited organizations, as well as industry and state and local governments, are taking an active part in this vital effort to save fuel."

Program Goals

The goal of the Carpool/Buspool Program is to satisfy travel requirements more efficiently by increasing passenger occupancy in autos and buses, thereby reducing the number of vehicles using the streets and highways. Achievement of that goal calls for coordination among many institutions within a metropolitan region, including public agencies and citizen and business groups. Participation by all of these groups and their knowledge of necessary program elements are critical to the success of the program.

The information and techniques presented in this series of reports should be considered as a guide to the development of a sound program in a metropolitan area. The program should be designed to make the existing street and highway system more efficient, to have a significant effect relative to energy conservation, and to foster urban and environmental goals.

Carpooling and buspooling is a means immediately available to cope with the energy shortage without severely restricting personal mobility. An important factor to consider in persuading the single passenger commuter to use buses and carpools is that it may require a significant change in his life style. Such a change should be accompanied by measures which will smooth the transition and which make carpooling and buspooling as palatable as possible.

The program envisions a coordinated departmental activity of training, public information, technical assistance, project implementation and monitoring. The program combines the talents and resources of the headquarters and regional staffs of FHWA/UMTA in training Federal DOT, state and selected metropolitan area personnel in carpooling techniques and procedures. These personnel will then, in turn, work directly with each urbanized area in the nation and will be equipped with the necessary public information and technical resources to assist local officials in planning for and instituting carpooling systems.

Regional Seminars

The first step in developing the carpool program will be the conducting of two-day seminars in the Federal Regions during January and February 1974. Extensive knowledge related to carpooling now exists, and this knowledge will be applied at the seminars to train personnel to assist staff in the urban areas in planning and instituting carpooling programs. A description of this technology and available funding will be the main focus of the seminars.

Upon completion of the training seminars, the participants will be able to:

- Provide technical assistance to state and local government officials on carpool matching
- Describe the various incentives which may be used to encourage carpooling

- Advise on the availability and eligibility of Federal and state aid funds for carpooling programs
- Relate carpooling activities to public transportation
- Identify suitable actions which should be taken to increase carpooling

Analysis and Documentation

Most of this program has been made possible because of past efforts by the staffs of FHWA and UMTA. However, to make it more successful in terms of technical documentation to facilitate implementation and operation in urbanized areas, DOT augmented this ongoing work with the services of a qualified private consultant. The results of this combined effort is summarized in the following sections of this report.

LOCAL ACTION

The organizations which are expected to lead the carpooling programs will be primarily areawide agencies, such as Councils of Governments or Regional Planning Commissions, which have responsibility for metropolitan planning and governmental coordination. These metropolitan organizations would provide the organizational framework for a coordinated carpool program in each urban area between the transit operators, major employers, Chambers of Commerce, citizens organizations and others interested in carpooling.

The U. S. Department of Transportation intends to provide continuing technical assistance to the urban areas in order that an effective carpooling program can be implemented. Assistance will not be limited to the regional seminars at which orientation and dissemination of information is provided. Further help will be offered and provided in a committed fashion throughout the planning and implementation phases, and beyond if necessary.

The principal on-site coordinator at the Federal level would be an FHWA or UMTA field representative assigned to a particular urban area. The representative would be one who has successfully completed the Carpool Seminar and who has knowledge of activities and technology which can be applied to meet local needs.

CONCLUSIONS

The review of past, present and potential uses of carpooling, vanpooling and buspooling in the United States indicates that these special modes of travel promise to become vital and effective ways of coping with the national energy crisis and other transportation impacts on the public sector. It is hoped that the programs described in this review will encourage and inspire many others to participate in any activity that promises to alleviate the immediate crisis situation which affects all of us, and learn how best to weave pooling more permanently into the national transportation fabric.

SECTION 1
REVIEW OF CARPOOL ACTIVITIES

REVIEW OF CARPOOL ACTIVITIES

INTRODUCTION

This review describes and discusses the current state-of-the-art of carpooling in the United States. It has been prepared as an aid to businesses, institutions and organizations that wish to form carpools and need to know what others have done and are doing in the field. It is not a "how to" document. Rather, it attempts to put carpooling in the perspective of the nation's current energy crisis--a crisis that is having a profound effect on our familiar wasteful patterns of travel.

In addition to pooling in autos, significant activities in vanpooling and buspooling programs are also covered. These efforts are closely related to carpooling, serving, in essence, as higher occupancy modes of ride sharing. A well-rounded attack on low vehicle occupancy should involve all three classes of pooling, each being brought to bear where it can serve most effectively.

Not since World War II has there been such a high degree of interest in carpooling. And not since World War II has there been such a need for this activity. Though there are many dramatic differences between today's situation and that of World War II, both share one element of crisis: a critical shortage of petroleum products. During the war, people in great numbers responded to the crisis by forming carpools, either voluntarily or in conformance with government regulations. The greatest progress made during the war period was in the industrial categories where automobile occupancy for work trips rose from an average of about two persons per vehicle prior to July 1, 1942 to approximately three per car by March 1, 1943. (1) Today's typical average work trip occupancy rate, ranging from 1.2 to 1.6 persons per vehicle, offers us a real challenge to respond equally as well to our current national crisis.

This report is based on a quick but intensive review of carpooling activities throughout the country. It represents, first of all, an overview of carpooling programs and activities that now exist in the United States--who is engaging in carpooling, how the individual programs are being operated, and the successes and failures that are being encountered. This discussion is followed by a brief description of automobile occupancy in the United States--what it is, what factors affect it, and what attitudes are relative to carpooling. A conclusion summarizes the current state-of-the art and lists the ingredients that are essential to the success of any carpooling effort.

This review indicates that carpooling and buspooling in the United States shows promise of becoming a vital and effective way of responding to the national energy crisis. It is hoped that the programs described in this review will encourage and inspire many others to participate in any activity that promises to be a key factor in coping with an immediate crisis situation that affects the lives and well-being of all of us. During this coming period much can be learned about how best to weave carpooling and buspooling more permanently into the national transportation fabric.

MAJOR CARPOOL ACTIVITIES

The national energy crisis, with its prospect of a serious gasoline shortage, has inspired a recent dramatic increase in the creation of carpool programs in all segments of the country. Before the onset of the crisis, carpooling was not a widespread activity in the U.S. In view of the relatively low level of previous formal carpool-organizing activities, it is clear that the vast majority of carpooling practiced today is the result of individuals matching themselves up without assistance or externally applied incentives.

The intent of this section is to review the significant carpooling activities going on in the U.S. -- those that are well-established as well as the major ones that have been formed as a result of the energy crisis. This discussion is divided into the following major elements of carpooling programs:

- Motivation of organizations involved
- Manual carpool matching methods
- Computerized carpool matching methods
- Carpool incentives
- Public information activities
- Miscellaneous activities

Motivation of Organizations Involved

The vast majority of formal carpool programs, whether they were formed before or after the onset of the energy crisis were initiated by employers. In many instances, the successful programs were motivated by shortage of parking spaces for employees. Most of these

matched fellow carpoolers either by hand or through simple computer programs. They usually offered no incentives to carpoolers except, in some cases, preferential parking in the employer's lot. Virtually all of them were work-oriented. A few programs, however, involved the matching of carpoolers for specialized activities such as ski trips and special events. These programs have usually been initiated without reference to the energy crisis or other external influences.

Some of the newly created carpool programs are attempting to be more responsive to commuters' needs and therefore are broader in their application. These involve major sponsors, such as state highway departments, regional organizations, and radio-television stations, which attempt to match individuals throughout a wide area from a central location, using more complicated computer techniques. Many of them also encourage major employers in the area to form their own carpools, offering them guidebooks and other materials as aids. Because of their broader base, these programs must be promoted through the mass media, using announcements on radio and television and advertising and publicity articles in newspapers.

Activities initiated in the very recent past, in the context of the energy crisis, have been directly motivated by the plight of the driver -- his difficulty in getting enough gas or affording to pay higher prices for gas.

Manual Carpool Matching Methods

Manual matching refers to the methods and techniques used to form potential carpools without the aid of a computer. Manual methods are in more common use than computer-based methods, and they are not always confined to small groups of potential carpoolers. The Hallmark Card Company in Kansas City, for example, used a manual method at a plant that employs 4,500 persons. Generally, manual techniques can be implemented quickly at a low cost. Sometimes manual techniques are preferred over computer-based techniques because of "employee acceptance." Apparently, some people prefer to have as little personal information as possible on computer tapes. Manual methods should be considered as the first step in a matching process for any organization with fewer than 1,000 employees. This can be done without retarding development of a computer technique if common data forms are used.

Although there are many variations in the manual matching methods used throughout the country, most can be categorized as one of two basic techniques:

Supervised Questionnaire Techniques - Using questionnaires filled in and returned by employees, or in some instances personnel records, a carpool supervisor matches potential carpool partners by manual methods using similar procedures as those of a computer-matching program. Potential carpoolers are grouped by residential location and working hours. The employees are advised of those whose work trips are closely matched in time and space. Occasionally, this process is performed with the aid of an automatic card sorter or simple sorting systems such as edge-punched cards.

Locator Board Technique - This technique uses locator boards placed at convenient locations in plants or office buildings and frequently operates as a self-service system. Possibly the oldest matching technique, it has been used by the Federal Government in Washington office buildings and by McDonnell-Douglas in its St. Louis plant for many years. Generally, locator boards have a regional map with superimposed grids which potential carpoolers use to locate their residence. Once located the appropriate square is noted on a registration card, or sometimes a numbered map tack is stuck on the map board at the place of residence. Pins can be coded to indicate the characteristics of the potential carpooler (work hours, rider/driver, etc.) and can be numbered to keep the name of potential carpoolers confidential. Sometimes a box with pigeonholes corresponding to each grid square is used to file the registration cards. This technique can be used by itself or to maintain a carpool program after initial, centralized carpool matches have been made. One of the limitations of the locator board system is that the board is installed in one place in the facility and all persons interested must visit that location. When two or more boards are used in the same facility, the potential for efficient carpool matchups is diluted unless a central coordinator is actively involved.

A separate report in this series titled Approaches to Matching contains more detail on specific techniques and recommends the steps required in organizing and managing a successful system.

Examples of Manual Matching - Following are descriptions of three selected manual matching activities.

- The Hallmark Card Company is an example of a large corporation which used a manual matching method to get a carpool program working in a relatively short time. Several months ago Hallmark experienced a

parking supply problem that management felt could be solved with a carpooling program. A survey was conducted of Hallmark's 4,500 employees on all three shifts. On the return card employees indicated their desire to carpool and their addresses and zip code. To insure employee confidence, long-term trusted employees were assigned to handle the returns, the subsequent matching and general problems. A centralized manual matching process resulted in an expansion of carpools which substantially alleviated the parking shortage.

The formation of the carpools was accomplished by furnishing lists of potential poolers to those interested. As an incentive, a reserved parking space was provided to each carpool. The fact that Hallmark is now converting to a computer-based system suggests that for an organization of this size a manual matching method may not be a permanent solution. This conversion also illustrates the wisdom of designing employee data forms in the initial manual matching process which are compatible with a computer-based system.

- NASA Carpooling System - Another significant manual matching method has been operated by the National Aeronautics and Space Administration since 1964. The activity was initiated because of the scarcity of spaces at the NASA headquarters and the high cost of nearby private parking. Members of carpools must fill out a form entitled "Application for Official Parking Space." Spaces are assigned according to a point system based on the number of members in a pool, their government service grade and years of service. The manual matching technique used for the program involves a card catalog system, a visual wall display, and a periodic (6-month) survey of carpool members. All carpool members are listed alphabetically on index cards which show the individual's name, his permit number, and parking location. Program applications are filed by permit number in notebooks for cross-reference and as a supplement to the visual display board. The board is used to match potential carpoolers either with new carpools (shown in red) or with existing carpools that have a vacancy (shown in green). If a carpool can't be

accommodated through use of the visual display, employees can contact the program administrator who uses his card catalog system and permit records to aid them. Administration of the program requires about 20 percent of the administrator's time and a week of secretarial time every six months. About 800 NASA employees ride in officially registered carpools, and the average occupancy in these vehicles is 3.85 persons.

- Vienna, Virginia System -- Both of the previous examples illustrate how manual methods are used by major employers. Application of these methods can be broadened to home-based matching. This is illustrated by a carpool program started by the Town of Vienna, Virginia, a four-square mile community in the Washington, D. C. suburbs. In the summer of 1973, the town conducted a survey in which questionnaires were distributed to some 5,000 residents. Using volunteer workers from the Junior Chamber of Commerce, survey results (25 percent return rate) were processed manually. A grid was superimposed on a tax map of Vienna, and trip origins were located by grid cell using a color-coded tag for each potential carpooler. At the same time, a grid designation was overlaid on a map of Washington and destinations were identified. Calls were then made to groups of residents who worked in a common area and had compatible work hours. Individuals were contacted until one was found who was willing to take the initiative and contact others in his or her group. No follow-up monitoring has been pursued so no data exist regarding the efficiency of this program.

Computerized Carpool Matching Methods

The formation of carpools frequently involves the processing of large amounts of data. Information about each potential carpooler must be examined, categorized, and assigned to potential carpools. Thus, the problems of carpool formation lend themselves to computerized methods when the number of potential carpools is large. Computer methods should be seriously investigated by any group with more than 1,000 potential carpools. A considerable number of computer programs have been developed by organizations of all types and used throughout the country to perform carpool matching. These efforts

have tended to be independent and uncoordinated. While many of the programs are quite simple and designed for specific applications, many are designed for multiple applications. These latter programs are written in a generalized format with accompanying user documentation.

All of the computer methods in existence require substantial clerical and management efforts in data collection, preparation, information dissemination, and continuing system operation. Users who are planning computer matching programs too often overlook or underestimate the level of effort required to support such a system.

Examples of Computer Matching - The most widely distributed carpool matching computer program is that developed by the Federal Highway Administration. (2) It has been obtained by a large number of organizations and at least 50 groups are now using the FHWA program or modifications of it, and well over 100 groups have requested tape copies of the program. Because the program is written in COBOL computer language, many users have found it possible to modify it somewhat to make it operational on their own computer. The program is based on a grid system and is designed primarily for application at places of employment. It produces not only individual carpool matches but also a density matrix for use in identifying buspool demand.

Although the FHWA program is the most widely distributed matching program, and probably the best documented, there are a number of other generalized computer matching programs that should be mentioned. The most significant of these include programs developed by:

- Washington COG Program -- Developed by the Washington Regional Council of Governments, this program has received considerable use in the employer-based carpooling efforts of the Northern Virginia Transportation Commission (NVTC). Working at a census file level, the program produces lists that group commuters who live no more than a specified distance from one another and who have compatible work schedules.

- UCLA Program -- This program written in FORTRAN IV can be used for developing employer-based carpools for any institution in the Los Angeles Metropolitan Area. Residential locations are specified by a coordinate system coded manually before keypunching. Although it could be modified for use anywhere, thus far it has been used in Los Angeles by UCLA.
- CALTRANS Program -- This FORTRAN program uses Lambert coordinates as its method of geocoding. Only recently developed, it has not been applied to date. Special attention was devoted to the design of file maintenance techniques which permit efficient updating.
- COMPUTRANSIT Program -- A proprietary product of COMPUTRANSIT, this PL/1 program uses a grid system for geocoding. Although it has not yet been used in an actual carpool matching effort, the program has been tested with simulations of up to 2,000 randomly generated commuters.
- U.S. Census Program -- This program, which is written in multiple languages, uses geographic base (DIME) files to locate addresses at the census tract level. It is currently being implemented by the County of Los Angeles.
- American Academy of Transportation (AAT) Program -- A nonprofit organization, AAT has written a very promising matching program. Written in FORTRAN, the program uses coordinates for geocoding. It has been used to form carpools for several major employers in the Detroit area.
- Operation Oxygen Program -- Written by a volunteer, nonprofit organization with major assistance from Burroughs Corporation. Variations of this program have been used by many California groups, including five Los Angeles banks with 1,000 commuters in a common data base. It is written in COBOL and uses a grid system for geocoding.
- Connecticut DOT Program -- The Connecticut Department of Transportation has developed a program unique in that it covers an entire state. Geocoding is conducted at the township level. It is currently being applied in New Haven and has already been applied at several other locations in the state.

- Aerojet Program -- A proprietary product of Aerojet Corporation, this FORTRAN program uses a grid system for geocoding. The program is currently being used as part of a carpooling effort for Aerojet employees.
- George Washington High School Program -- Students at this Denver High School and their advisors have developed a matching program that has been used for a number of major employers in the Denver area. The program is written in FORTRAN and uses a grid system for geocoding.

A detailed discussion of computer matching techniques is presented in a separate report titled Approaches to Matching.

Incentives for Carpool Programs

The recent history of carpooling goes back primarily to the era when environmental issues were of more significance than the energy crisis, and the basic incentive was to reduce air pollution. Since the advent of the energy crisis, several special incentives have come about which are being used by many groups in carpool formation. It should be noted, however, that many carpool programs, perhaps the majority, offer no special incentives for carpools whatsoever.

A separate report, Incentives to Carpooling, describes in detail the incentives being offered by specific groups. Thus, this report will highlight only some of the findings. Incentives can be classified into three major categories related to the basic motivations which are addressed:

- Cost-Related Incentives
- Travel Time Incentives
- Convenience Incentives

Cost-Related Incentives - These incentives either reward the carpoolers by reducing their travel-related costs or increase the cost to non-poolers. The most frequently employed and most powerful incentive is parking cost subsidization wherein the employer pays for all or part of the cost of parking for carpoolers, but not for non-poolers.

Another significant cost-related incentive is the provision of company-owned or sponsored cars or vans for use as commuter carpools. This

gives the carpooler a significant saving in vehicle operating cost, because costs are spread over more occupants, but also may allow a reduction in household auto ownership expenses. The 3M Company has an especially successful company-owned vanpool system at its headquarters in St. Paul, Minnesota. The following descriptions are selected examples of significant cost-related incentives:

- Prudential Insurance Company (Boston) -- Prudential provides employees who carpool in groups of three or more with free parking in the company-owned garage. The normal parking fee is \$2.50 per day. Presently, 44 percent of the employees are carpoolers, and demand for the free spaces is threatening to exceed the available supply.
- Port of Portland (Oregon) -- On December 1, 1973, the Port of Portland instituted a program to increase both carpooling and transit usage among its 300 employees. The program provides the following incentives: for carpools of three or four (including the driver) the Port will pay the \$10 monthly parking charge; for carpools of five or more (including the driver), the Port will pay the monthly parking charge plus 11 cents per mile; and for transit users, the Port will pay up to 70 cents per day for bus fares. Approximately 25 percent of the employees are riding in buses and carpools. Some criticism of the program has been encountered, however, because of the use of public funds to subsidize the commuting cost of a few "privileged" Oregon residents. As a consequence, the program has attracted considerable local publicity and controversy.
- 3M Vanpool Project -- The 3M project merits special attention under incentives. Although its primary incentive is cost-related, it provides a unique combination of incentives to encourage its employees to use vanpools. As a pilot test of the vanpooling concept, 3M has conducted a small-scale vanpool demonstration project using six company-owned vans. Groups of 8 to 11 employees have been organized to ride each of the "commute-a-vans" regularly. At least two of the members serve as drivers, including the van coordinator who has the responsibility of arranging for servicing and maintenance of the van, fare collection, keeping ridership

at or above the minimum occupancy of eight, and training back-up drivers. The pool coordinator gets a free ride plus all passenger revenues exceeding the minimum of eight passengers. Riders' fares are paid monthly and are computed on a break-even basis (including ownership costs) covering the round-trip mileage of each vanpool. The cost on which the fares are based ranges from 83 cents per person for a 10-mile round trip, to \$1.45 for 100 miles. The pilot program was very successful and the vanpool system has been expanded to 40 vans, and 600 employees have requests on file to join the system. These results are especially significant because the 3M Center is situated in a suburban area where traffic problems are not as severe as typically experienced in central areas.

To a large extent, the success of the program appears to be due to the fact that the drivers run the program and are rewarded for doing so. All the company does is provide the means for operating the system (vehicle purchase, fare collection and payment of expenses) and communication (records for interested participants and drivers, screening and selection and training of drivers). Drivers must be responsible for organizing and running the vanpool system, and for this they must be provided incentives. The incentives for drivers include:

- Free ride to work
- Unlimited personal use of van during off-work hours at the rate of seven cents per mile
- Fares collected over operating expenses (for average 25 mile-round trip, this amounts to about \$2.00 per day for full occupancy)
- Status and recognition (selection for vanpool driving is considered recognition of employee's worth and leadership attributes)
- Drivers get first option for buying vans retired from service. To the extent possible, drivers are given the option of selecting the make and color of the van for their pool

Incentives for riders include:

- Savings in travel expenses and elimination of need for a second car (except for executive vanpool park/ride)

- Preferential parking close to building
 - Useful travel time for other than driving (work, conversation, card games, etc.)
 - Social aspects are emphasized (new friendships form, riding is enjoyable)
- Vehicle Usage -- A number of city and state agencies throughout the country are making state-owned vehicles available for carpools, thus providing riders a significant travel cost savings. The Arkansas State Highway Department in Little Rock requires that all state-owned vehicles taken home at night by employees have a minimum of three carpool riders. In some areas, carpools must be formed entirely of state or city employees while in other areas, a limited amount of usage by non-state employees is allowed.
 - Ski-lift Ticket Discounts -- In Colorado, a private, non-profit organization, Colorado Ski Country, organizes weekend carpools to the Colorado ski areas. Some of these ski areas are offering lift ticket discounts to carpools. Similar programs are underway in Utah and New England.
 - The Golden Gate Bridge and Highway Transportation District in San Francisco leases buses and drivers to members of "Commuter Clubs." Each club solicits its own members, collects the dues, and makes monthly payments to the District. The District sets the fares so that costs are met fully when all seats on each bus are used. Until then, the District subsidizes the club. The minimum number of seats required to start a club is 30. Routes and schedules are established by each club. The program, which began a year ago with one bus, now has three buses serving about 100 persons. Insurance is provided by the District.

Travel Time Incentives - The primary type of travel time reduction incentives is priority traffic control techniques, of which there are a wide variety. Incentives of this type grant time savings priority to carpools and buses and at the same time, in some cases, penalize with excess delay the low occupancy vehicle. Important priority traffic control techniques include:

- Exclusive (separated) Freeway Lanes -- Exclusive lanes for buses and carpools of four or more persons are used on

the Shirley Highway in the Washington, D.C. area. Approximately 15 minutes are saved during the peak hour.

- Reserved Freeway Lanes -- for buses and carpools are being implemented in Miami and may move ahead quickly in Los Angeles.
- Contra-Flow Freeway Lanes -- for buses only are operating in several cities. The most successful is on the I-495 approach to the Lincoln Tunnel in the New York metropolitan area. Approximately 40,000 bus passengers are served, and delay is reduced by 8 to 15 minutes.
- Priority Ramp Metering -- is being successfully operated at one ramp in Los Angeles. Carpool vehicles with two or more persons can bypass the entrance ramp queue and save 7 to 9 minutes during the peak hour.
- Reserved Toll Plaza Lanes -- for buses and carpools are used on the Oakland Bay Bridge in San Francisco. Delay reduction during the peak hour is about five minutes, and the number of carpools with three or more persons has nearly doubled.

Convenience Incentives - This class of incentive is designed to appeal most directly to the commuter's sense of comfort and his perception of the ease of commuting. Convenience measures often overlap with cost-related and travel time incentives. The methods may be either positive or negative; i. e., they may either increase the convenience of carpooling or decrease the convenience of non-pooling, or both. Important convenience incentives include:

- Preferential parking space allocation
- Special park-ride lots for carpools and buspools
- Special working hours adjustments
- Banning of low occupancy vehicles in certain areas
- Parking supply reduction

Presented below are selected examples of convenience incentives:

- National Aeronautics and Space Administration (Washington, D.C.) - - As mentioned previously, NASA's Washington headquarters assigns reserved spaces to carpools according to a point system based on the number of members in a pool, their government service grade and years of service.
- U.S. Department of Agriculture (Washington, D.C.) - - The Department uses a point system similar to that used by NASA except that distance is added to the list of factors making up the point system. As the work trip distance of carpools increases, more points are awarded to a carpool.
- McDonnell-Douglas (St. Louis) - - During the height of the aerospace boom when McDonnell-Douglas had 47,000 people employed at its facility at Lambert Field, the carpooling program increased average auto occupancy to 2.8 persons per vehicle. As an incentive, preferential parking close to the plant was provided. Presently, with 25,000 employees and smaller demands on the parking areas, average occupancy has declined to about 1.8 persons per automobile.
- In Little Rock, Arkansas - - 500 preferential, close-in parking spaces are provided for carpools at the State government facility. The number of employees using carpools has increased from 400 to 1,100.
- Colorado Ski County, a private, nonprofit organization supported by the ski areas of Colorado, arranges for skiers to meet on weekends at a high school parking lot in Denver, where carpools to the ski areas are formed. On a recent weekend 30 to 40 autos were parked in the lot, which is patrolled by local police.
- The Chicago Transit Authority is attempting to set up a carpooling program for vehicles that park at rapid transit stations in the area. Spaces may be reserved on a priority basis.
- Park-Ride Lots for transit riders are provided in many locations around the country. A notable example is the Blue Streak Project in Seattle. Similar park-ride lots are being implemented for buspool operations. In the Washington, D.C. area, for example, a large suburban employer, GEICO, provides buspool service from three scattered suburban park-ride lots.

Public Information Activities

Public information refers to methods and techniques used for (1) promoting the idea of carpooling, (2) informing potential carpoolers about the availability of carpooling programs, and (3) helping participants understand the use of the program.

The most significant local public information activities related to carpooling are being carried out by local radio stations, television stations and newspapers in conjunction with public carpooling programs which they themselves are sponsoring. These activities take the form of radio or television advertising and spot announcements (WBZ Boston, WIND Chicago, KYW Philadelphia, TV5 Atlanta, KFJZ Ft. Worth, KLIF Dallas, KRMG Tulsa), newspaper advertisements and publicity articles (St. Louis Globe-Democrat, New Haven Register), promotional kits containing bumper stickers, decals, and tips on conserving fuel (WBZ, WIND, the St. Louis Post-Dispatch) and slogans (the most common being "Pool It", coined by the Highway Users Federation for Safety and Mobility).

WBZ/ALA Program - Most of the radio-television carpool programs are patterned after one launched in September of 1973 by Radio Station WBZ in Boston with the ALA Auto and Travel Club as co-sponsor. This program computer matches persons in the Boston metropolitan area who fill out and mail a questionnaire on which they indicate their commuter needs and preferences. Each applicant receives as many as 10 names and telephone numbers of others making similar commutes, and it is up to him to contact others to arrange a carpool. Along with his printout, the participant receives a membership card, membership decals for applying to his car windows, a personal accident checklist (with the advice that he consult his insurance agent concerning any questions he may have about carpool coverage), and a "Visor Advisor," displaying maps of major commuter routes and parking facilities in downtown Boston containing 300 or more spaces.

The WBZ program is promoted through public service announcements on both radio and TV, through newspaper advertisements, and by corporations and organizations in the area, such as the Chamber of Commerce. The Mayor of Boston sent a letter to city employees describing the program and urging them to participate. (Form letters from the heads of the sponsoring organizations to potential carpoolers are probably the most common public information techniques used to promote carpool programs.)

Some 7,500 persons had returned questionnaires as of November 30, 1973, and approximately 23 percent of these were "matched" by the computer program. There are no data concerning how many pools were actually formed as a result. One reason for the limited impact of the program may be the absence of any carpooling incentives, according to DOT's Transportation System Center. (3) The main value of this type of promotion is in building positive attitudes about carpooling and informing commuters about ongoing carpool activities which can be beneficial. These functions are vital ones, regardless of the lack of success of KBZ's matching process. Previously, it has been observed that employer-based matching efforts are likely to achieve greater success than the regionwide approach.

Operation Oxygen, Inc. - Is a nonprofit volunteer organization, headquartered in Pasadena, which is dedicated to clearing the air on the Los Angeles Basin by reducing the number of cars on the road. They pursue their goals primarily through public information programs and technical assistance efforts.

The Operation Oxygen (4) plan to reduce the number of automobiles in use is the promotion of:

- Sharing rides by using carpools
- Utilizing available public transportation
- Walking or bicycling when possible

The organization's principal concern has been the promotion of carpooling. Computer programs and procedural guides have been prepared for use by various types of employers in providing carpool matching services for their employees. Even though it operates on a slim budget, raised entirely from voluntary contributions, Operation Oxygen has been an important force in Southern California as evidenced by the number of organizations requesting information or assistance. Approximately 500 organizations, including many outside of California, have requested Operation Oxygen information, and staff members estimate that perhaps 20 to 25 percent of these are actually planning or operating matching services.

Among the more significant carpooling activities that have been encouraged and assisted by Operation Oxygen are the following:

- Aerospace Corporation
- Burroughs Corporation

- California State University San Bernardino
- General Telephone Company
- I. T. T. - Gilfillan, Inc.
- Kaiser Steel - Fontana
- Long Beach Naval Shipyard
- Los Angeles County
- Los Angeles City
- Riverside County
- Seven Los Angeles Banks Group
- Singer Libracope
- Xerox Data Systems

Significant Integrated Carpool Programs

This section describes a selected group of significant carpool activities ongoing around the country. The most successful activities seem to be those which approach the problem with an integrated program composed of a combination of carpool matching, provision of incentives, and effective public information and employee communications programs. Most importantly, the degree of success depends on a firm commitment by top management of a company or other group to pursue a well-organized and adequately-supported program.

Government Employees Insurance Company - In a Maryland suburb of the Washington, D. C., metropolitan area, the Government Employees Insurance Company (GEICO) responded to a parking shortage crisis with a successful program of carpooling and buspooling. GEICO was expanding its facilities and number of employees, and zoning approval was denied for constructing additional parking spaces due to serious traffic congestion already existing in the general area. The response was a combined program of carpool matching, priority parking for carpools, and company subsidized buspools. A substantial increase in average vehicle occupancy has resulted from these incentives: 230 carpool parking permits have been issued; 300 employees are riding in eight buspools which provide service from three outlying shopping centers, where fringe parking areas are set aside, to the GEICO office.

McDonnell-Douglas, St. Louis - This large aerospace company has been engaged in successful carpooling activities for more than 20 years at its plant in St. Louis. The program reached its peak of success at the height of the aerospace boom when 47,000 employees worked at the facility, and average occupancy was 2.8 persons per car. Currently, the facility has 25,000 employees, and occupancy is still comparatively high at 1.8 per car. The success of this program can be attributed to the combined effect of the following elements:

- Carpool matching using locator boards
- Preferential parking in close-in spaces for carpoolers
- Excellent service by a private bus company providing McDonnell-Douglas with 20 premium buses from semi-rural residences 25 to 50 miles distant
- Public transit service by 14 buses which circulate through the facility. Four afternoon buses start their runs at the plant.

Connecticut DOT Carpooling Program - Beginning early in 1972, the Connecticut Department of Transportation has been aggressively pursuing a program to encourage carpooling among their employees and among other state employees working in the Capitol complex in Hartford, Connecticut. This program is composed of several elements, including computer matching, preferential parking, aggressive employee communication, and assistance to the private sector in organizing carpool programs.

A computer program was developed to match people in the same neighborhoods having similar work schedules. Using the results of the matchmaking program, groups of employees living in the same neighborhood area were invited to informal coffee klatches, held during office hours, for the purpose of matching up with each other through face-to-face contact. The groups ranged in size from 10 to 80 persons. It was believed that this group approach to the final step in the matchmaking process was useful in overcoming some of the psychological barriers present when potential carpoolers have to phone or correspond or visit individually with each other to make a compatible match.

During mid-1972 they initiated a campaign to extend the matchmaking service to other state government agencies located in the Capitol complex. There are 45 separate agencies employing a total of

approximately 3,300 persons. The majority of agencies, especially the larger ones, indicated an interest in joining the program.

In addition to the employee information program designed to encourage carpooling because of the transportation cost reduction benefits and the community benefits (reduced congestion and air pollution), the Connecticut DOT also arranged for reserved parking spaces for carpoolers as an additional direct incentive. A total of 245 reserved spaces in preferred locations in the State Office Building parking lot were designated as carpool spaces. Spaces were numbered and assigned to qualified carpools. The definition of a carpool was four or more persons commuting together three or more days per week. Some of the pool members can be non-state employees as long as at least three are state employees. Security guards make periodic checks of the reserved spaces, and unauthorized cars are subject to a \$15.00 fine.

The Connecticut DOT is also encouraging carpooling by private employee groups in Hartford and is offering the computer match-making service to private organizations.

George Washington High School, Denver - This extraordinary volunteer effort is operated nearly full-time by a high school mathematics teacher, one of his students, and 10 to 15 part-time student volunteers from the high school. Working with very little money, this group has achieved measurable success in providing carpool matching and promotion services to many companies and organizations in the Denver area including:

- Denver Water Board
- Johns-Manville
- 5 Area Hospitals
- Metro State and Auraria Colleges
- Council of Christians and Jews
- Honeywell
- A. F. Accounting and Finance Center
- Greater Western Sugar
- D.D.I. and United Bank of Denver
- A.A.A.

The student group developed an efficient operational computer program for carpool matching. They don't just provide the computer program -- they provide what amounts to a complete management service:

- They reach top management of each potential participating company to obtain a commitment.
- They provide data forms.
- They assist in training company personnel in coding and keypunching employee data.
- They run the program on the school's Univac 1106 and return match lists to the companies.
- They follow up with each company to provide continuing support and matching updates.
- They can't provide incentives, but they do encourage the companies to do so as part of their commitment to the program.

The group is currently pursuing advancements in the computer matching tools.

Knoxville, Tennessee - Commuter pooling efforts in this city were begun recently (Fall 1973) as a cooperative effort between the University of Tennessee and the Knoxville Transit Authority. It is an excellent example of an attempt by a transit agency to coordinate their service with carpooling. The carpool/buspool program is viewed as a low-cost systematic method of locating demand for transportation service. This is used to identify high-demand areas which can support excess buspool service and lower-demand areas where carpooling is encouraged.

The first survey identified a large residential area 10 miles from downtown as a candidate for premium fare express buspool service which was successfully implemented. The citywide carpool/buspool matching activity is now underway. A pilot survey of 5,000 employees was conducted in November 1973, to refine the computer matching tool. The program is coordinated through the Mayor's office and various organizations are represented on the Advisory Committee, including local businesses, the TVA, and the University. Newspapers, radio, and TV stations are promoting the effort.

SPECIAL CONSIDERATIONS IN CARPOOLING

Discussed briefly in the following sections are several special considerations related to successful carpool/buspool programs. Each of these considerations is the subject of a separate report.

Organization for Carpooling

Past successes and failures can be traced to the existence of, or lack of, a sound organizational structure. Previously, carpool promotion has been largely an isolated phenomenon, with most activities being carried on by individual employers for the benefit of their employees. Now, with the need more apparent for increasing the efficiency of transportation by increasing passenger occupancy in autos and buses, effective organizations are called for to lead and coordinate carpool/buspool programs in each urban area. In a separate report, Organization for Carpooling, examples of existing organizational structures are examined which have met with varying degrees of success, and guidelines are given on organizational structure, management, and public and private agency interrelationships.

The vast differences in each community make it difficult to identify all organizations, agencies, or individuals that should be involved in all communities since each agency and organization has a slightly different role in each respective area. Communities which have a very strong, popular Mayor might coordinate the local program through a transit authority or Mayor's office. In other communities, the Council of Governments, business leaders, civic groups, or the media may be the most logical choice. In larger cities it may be wise to have area coordinators who are responsible for subareas within each community. Whichever the situation, the organizational structure should be built around existing agencies and preferably, those already interested in transportation affairs. A totally new agency should not be necessary. Ideally, the organizational structure should tie in with the existing planning process and transportation system operations.

Legal and Institutional Issues

Various legal and institutional problems can act as significant impediments to carpooling, and these have been explored in depth in a separate report titled Legal and Institutional Issues. Six separate legal issues were investigated: (1) the legality of offering incentives to encourage carpooling; (2) the regulatory status of carpools employing share-the-expense arrangements; (3) applicability of guest statutes to

members of carpools; (4) liability responsibility of sponsors of carpool programs; (5) aspects of competition of carpooling with regulated for-hire motor carriers; and (6) possible applicability of the National Environmental Policy Act.

The potential problems of personal security arising out of widespread carpooling activities are also explored. First, attention is directed toward safeguards necessary in handling the personal information contained on carpool matching questionnaires. Second, personal security problems associated with sharing rides with strangers in "casual" carpools is discussed.

Since carpool arrangements may involve financial transactions which could create income subject to federal, state or local taxes, normal tax implications and several outstanding issues which require further clarification are discussed.

The increasing use of carpools raises questions regarding the liabilities of drivers and riders, and the impact of possible changed liabilities on automobile insurance. In most situations, the position of an insured driver will not change with the formation of a carpool. There are exceptions, however, and there is a need for review in all cases of the type and amount of coverage required.

Coordination with Transit and Taxi Operations

Carpooling will affect transit and taxi services over the long-term as well as the short-term. The effects can be positive or negative depending on whether transit and taxi operators gear their activities to capitalize on the opportunities generated by the carpooling program. There are a variety of innovative ways for transit, taxi and carpooling to be coordinated to achieve mutual benefits. A separate report, Transit/Taxi Coordination, discusses the potential problems and opportunities and sets forth strategies and guidelines for coordination.

Over the short-term, carpooling must play a primary role in the effort to increase vehicle occupancy for better transportation efficiency. Currently, transit and taxi systems do not have adequate peak-hour capacity to handle much diversion from commuter automobiles. It is estimated that the typical transit system has about 15 percent unused peak-hour capacity. Transit and taxis can benefit in the short-term, if extensive carpooling is practiced by serving increased demands for mid-day trips of all kinds for which private autos will be less available.

In the longer run, public transportation has the potential for serving a larger share of the urban travel market. Efforts are needed to ensure that, in the evolving transit complex, each mode of travel serves its proper role in a coordinated system.

Pooling for the Disadvantaged

One report in the series attempts to uncover some of the opportunities existing in carpool action programs to serve the transportation needs of those with special mobility problems. It appears that if conscious efforts are made as part of organized carpool/vanpool/buspool programs to give attention to elderly, handicapped and economically disadvantaged members of the society, then ways can be found to contribute to an alleviation of their transportation problems. Greatest progress can be achieved, in the short term, by employers through: giving top priority to helping the transportation-disadvantaged persons employed by the firm; providing company vehicles during the day to volunteer organizations who are helping to serve the transport needs of the community's disadvantaged residents; and making sure that transportation is effectively provided for their own job trainees. Volunteer groups are playing a useful role in helping elderly, handicapped, and low-income citizens with their travel problems, and much more can be achieved if the efforts of these groups are coordinated with those of employers engaged in carpool, vanpool, and buspool programs.

Back-Up Systems

What do you do when you miss your carpool? This basic question was the subject of a report in the series titled Carpool Back-Up Systems, which discusses the common difficulty experienced by carpoolers of finding an alternative means of transport when, for one reason or another, trips need to be made that can't be served by the regular carpool. The report identifies the various types of problems requiring back-up systems and the kinds of solutions which are available already or could be made available by private or public transportation operators. Additional analysis is needed to evaluate the feasibility, cost, and relative utility of alternative back-up systems.

AUTOMOBILE OCCUPANCY IN THE UNITED STATES

What is the average automobile occupancy in the United States? Does occupancy vary for different kinds of trip purposes? What other major factors affect the degree of carpooling employed? What is known about the characteristics of persons who have a propensity to use carpools? These are important questions to answer for a basic understanding of carpooling in the United States today. A substantial amount of factual information is available which helps answer these basic questions.

In recent times, the average automobile occupancy has been very low, especially for work trip commutes. The following sections review factual data collected on automobile occupancy, including the factors contributing to lower or higher occupancy.

Work Trip Occupancy

The most comprehensive source of information on automobile occupancy is the Nationwide Personal Transportation Survey. (5) The data in this study were collected during 1969-1970 by the Bureau of the Census for analysis and use by the Federal Highway Administration. This survey shows that the average automobile occupancy for trips to and from work approximates 1.4 persons per car. Interpreted another way, nearly 75 percent of all commuter vehicles have only one occupant -- the driver. During the past month, the Federal Highway Administration has analyzed the occupancy data in greater detail to properly weight the longer, higher occupancy work trips. Their preliminary estimate is that weighted average work trip occupancy for the nation approaches 1.6 persons per car.

The amount of carpooling taking place in some of our major cities is much lower than the national average. A recent study on the Hollywood Freeway (6) in Los Angeles revealed that the average occupancy was only 1.13 persons per car in the morning commuting hours. Nearly 90 percent of these cars carried only a driver.

It is ironic that the commuting trips, which badly strain the capacity of our nation's streets and freeways during peak hours, have the lowest levels of vehicle occupancy. Many transportation experts have viewed this situation with distress for many years. More recently, with growing concern over air quality and other social and environmental issues, a larger number of transportation planners and engineers have been exploring ways and means of increasing ridership in carpools and buses. Their goal was to make more efficient and

productive use of our existing transportation system. The developing energy shortage has vastly increased the alarm over existing low levels of auto occupancy and the belief that ways can be found to alter this wasteful commuter practice through more carpool and bus usage.

Occupancy for Other Trip Purposes

The Nationwide Personal Transportation Study revealed that trips to and from work had the lowest occupancy level. Trips made for any other purpose had higher average occupancies than commuting trips. The occupancies for major categories of trip purpose are shown below:

<u>Trip Purpose</u>	<u>Average Persons Per Car</u>
Work and related business trips	1.4
Family business (shopping, etc.)	2.0
Social, recreational	2.5
School, civic, and religious	2.5

Figure 1 presents a more detailed breakdown of trip purpose and the associated average auto occupancies. The higher occupancy values for non-work purposes raises the national average for all purposes to 1.9 persons per car.

Major Factors Influencing Carpooling

A large number of interrelated factors influence the commuter's decision about carpooling. Included among the major factors are the following:

- Family Income
- Auto Ownership
- Trip Length
- Parking Cost and Availability
- Employment Density
- Employer Size and Type
- Commuter Attitudes

The general effects of these factors on the commuter's propensity to carpool are discussed in the subsequent paragraphs. It must be

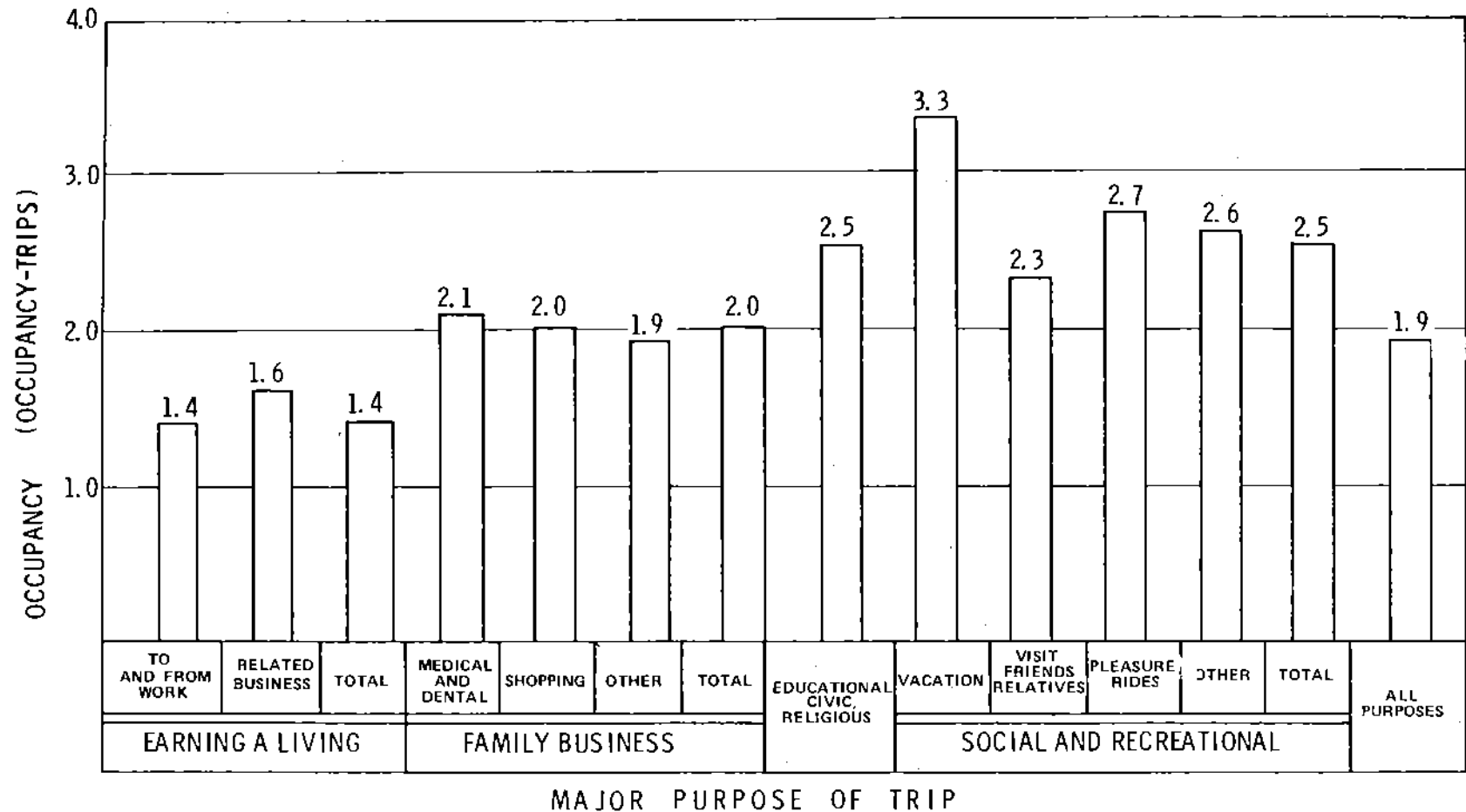


FIGURE 1. AVERAGE AUTOMOBILE OCCUPANCY CLASSIFIED BY PURPOSE OF TRIP

Source: Strate, H.E., Nationwide Personal Transportation Study, Automobile Occupancy, Report No. 1, U.S. Department of Transportation, Federal Highway Administration, April 1972.

remembered that these data on which the following discussions are based was collected when fuel was plentiful and relatively inexpensive. The current situation of scarcity of fuel, rising prices, and/or gasoline rationing will impact strongly on the relative importance of some of these factors as they relate to carpooling in the future.

Family Income - Many transportation planners have found that family income is a major determinant in choosing between private auto and public transit. Similarly, low income families, by necessity, are more likely to use carpools than higher income families. A good example is the Twin Cities statistical analysis (7) of work trip auto occupancy which showed sharp reductions in occupancy with increasing family income.

Continued rising prices in a free market environment can create a very real hardship for lower income families. They may find virtually no choice but to shift out of the automobile completely and into public transportation and carpools.

Auto Ownership - Automobile ownership is closely correlated with family income. Logically, families with fewer cars per family member make more frequent use of carpools to meet all kinds of essential travel requirements. (They also make more use of public transit when service is available.) This fact is clearly indicated in the FHWA study (8) which reports higher levels of auto occupancy among lower income groups in several cities. If scarcity of fuel continues and becomes more acute, or prices rise to higher levels, families with multiple automobile ownership will have to reevaluate the relative merits of carpooling versus the practical aspects of indulging in lone driving. The scales would seem to tip in favor of carpooling. There already exists some small movement back to being a one-car family.

Trip Length - Review of previous studies reveals a mixture of findings with regard to the impact of trip length on auto occupancy. The most authoritative Nationwide Personal Transportation Study does show that longer trips are associated with higher auto occupancy levels. This holds true both for work trips and all trip purposes combined, as shown in Table 1.

A study by Connecticut Department of Transportation (9) supports the Federal DOT findings. This study also determined, however, that for certain types of low occupancy commuting trips -- for example, to jobs in schools and hospitals -- the car occupancy levels are not very sensitive to trip length. Another finding is that for very long

TABLE 1. AVERAGE AUTOMOBILE OCCUPANCY
BY TRIP PURPOSE AND TRIP LENGTH

<u>One-way Trip Length</u>	<u>Trip Purpose</u>	
	<u>Home-to-Work</u>	<u>All Purposes</u>
<u>Miles</u>	<u>Occupancy</u>	
Less than 1/2	1.3	1.8
1 - 2	1.4	1.9
3 - 4	1.3	1.9
5 - 15	1.4	1.9
16 - 20	1.5	1.9
21 - 30	1.7	2.1
31 - 40	1.5	2.3
41 & Over	1.6	2.6
Average	1.4	1.9

Source: Strate, H. E., Nationwide Personal Transportation Survey Automobile Occupancy, Report No. 1, U.S. Department of Transportation, Federal Highway Administration, April 1972.

commuting trips by certain types of employees, such as those working for manufacturing companies and for retailers, the average occupancy is actually lower than it is for medium length trips. This is apparently caused by the added difficulty of finding compatible carpool partners by those living in the outermost fringes of the urban region. With severe fuel shortages and higher cost, the incentive for long distance commuters to carpool will be very strong. Special assistance in finding suitable carpool partners will be especially important for these commuters.

Parking Cost and Availability - The factor which perhaps has the greatest influence on the degree to which carpooling is practiced is the availability and cost of parking near the place of work. Where parking is scarce and costly, many commuters use carpools, buses, and other forms of public transit. Conversely, in employment locations where parking is plentiful and cheap, such as in many suburban places of work, many commuters drive to work alone. In Los Angeles and similar cities, where employees' direct parking cost is notoriously low and parking spaces are readily available, average auto occupancy levels are very low.

In cities like Washington, D. C., and New York, where parking rates are high and spaces are hard to come by, auto occupancy levels are high. In the National Aeronautics and Space Administration Office Building in Washington, D. C., the extreme scarcity of on-site parking space and the high cost of adjacent commercial parking has spawned a successful carpool management activity which has been in operation since 1964. Current average occupancy at this facility approximates 3.85 persons per car.

More scientific evidence of the cause and effect relationship between parking cost and carpooling is found in many metropolitan area transportation planning studies. A good example is the Washington, D. C., mode choice study (10) which shows that all income groups -- high, middle, and low income -- react in the same way to increases in parking cost by joining carpools and riding buses.

High parking cost is a strong incentive to encourage carpooling, even though it is negative in nature. Commuters carpool to avoid a direct cost to them. This factor also impacts more heavily on the lower income commuter whose discretionary income is less. For them, carpooling can be a forced situation rather than voluntary. However, parking availability and convenience are positive incentives. The assignation of reserved or preferential parking is a reward and probably has a stronger appeal for high-income groups than low-income groups.

Employment Density - A factor which is rather strongly correlated with parking cost and supply is the employment density, or concentration of workers in a given area, as expressed, for example, in persons per acre. The highest density places are the central business district and, in some larger urban areas, other outlying high activity business centers. These places usually have the highest work-trip auto occupancies. Pertinent comparisons are found in the Twin Cities study (7) discussed previously. For example, medium income commuters traveled to moderate density work locations in autos averaging 1.2 occupants; whereas, similar medium income commuters working in high density places traveled there in cars averaging 1.9 occupants. This clearly indicates that high priority should be given to high density locations. Furthermore, it appears that far greater returns can be expected in work-based matching, since higher densities are normally found in employment centers compared with residential areas.

Employer Size - Both the Connecticut DOT and the Los Angeles studies revealed a relationship between the size of the place of employment and the propensity to carpool. The average work trip occupancy tends to rise markedly as the number of employees working in one place increases. Carpools are easier to form in larger companies where opportunities are greater to match up with conveniently located partners. In essence, this means that carpools will increase when the number of potential matches are increased. This points up the importance of combining the data bases for neighboring groups of small and medium size groups of employees. This should not necessarily be based on a rigid geographic guideline but should consider factors such as whether or not the neighboring employee groups might have a high or low degree of social compatibility.

Characteristics of Carpoolers, Potential Carpoolers and Non-Poolers

One objective of the Los Angeles study was to identify discernible differences, if any, in the travel, demographic, and employment characteristics of existing carpoolers, potential carpoolers (commuters expressing an interest in carpooling), and hard core non-poolers (no desire at all to carpool).

Following are generalizations of the common characteristics exhibited by existing and potential carpoolers. These two groups were found to be highly similar in both characteristics and attitudes.

- Carpoolers tend to work in larger groups, although they are found in all group sizes.

- Carpoolers tend to work in the higher density activity centers.
- Carpoolers tend to pay more for parking than non-poolers.
- Carpoolers tend to have slightly lower average family incomes than non-poolers.
- Carpoolers tend to have somewhat less flexibility in their working hours, but this is frequently overemphasized.
- Carpoolers tend to have lower family auto ownership ratios (i. e. , fewer cars per family member).
- Carpoolers tend to travel slightly longer commuting distances, but this differentiation is another one which is frequently overemphasized.
- Carpoolers tend to be slightly younger people than non-poolers.

Significant differences were found between the group of potential carpoolers and the group of hard core non-poolers:

- The potential carpoolers tend to enjoy driving with others while the hard core non-poolers have a fairly strong desire to drive alone.
- Potential carpoolers tend to feel carpooling will save them money, whereas hard core non-poolers feel any savings are probably not worth the effort.
- Independence needs are much stronger among hard core non-poolers. Although both groups tend to dislike relying on others, the hard core non-poolers are much more extreme in this attitude.
- Potential carpoolers tend to not mind having people depend on them, but hard core non-poolers strike a neutral stance on this question.
- Both groups are relatively neutral in their civic obligation to help others, although carpoolers tend to feel slightly more positively.
- Both groups agree that rush hour is irritating, that carpooling would help reduce air pollution and traffic congestion. However, the potential carpoolers are significantly stronger in these beliefs than hard core non-poolers.

A note of caution: The survey data summarized above were collected in the summer of 1972 when gasoline prices were lower than today and before any prominent mention of the emerging fuel shortage.

In light of the vast difference in conditions then and now, general attitudes towards carpooling have undergone noticeable change. Greater numbers of people seem to be more receptive to the idea of carpooling, including some former hard core non-poolers. Their attitudes may not have changed dramatically, but their motivation to consider carpooling certainly has changed. Rationalizations and psychological needs, which were viewed as deterrents to carpooling, are being re-evaluated and different priorities are being established by individuals who wish to function without severe disruptions during the fuel shortage.

Consideration of these differences in attitudes should be given for both the marketing efforts and adoption of the carpool program to make carpooling more appealing and the transition from low occupancy cars easier.

Reasons for Not Pooling

In the Los Angeles study, many reasons were cited for not carpooling. The two most frequently given reasons -- working hour variance, and need for car during the day -- are believed, in part, to be more excuses than real problems. In fact, the study showed that those who do carpool actually have as much need to use a car during business hours as do the non-poolers. A little planning on the part of the carpool partners allows them to overcome many problem situations involving vehicle needs during the day. Schedule variance, while certainly a major problem for some lone commuters with demanding jobs, could undoubtedly be resolved for some with simple changes in personal work habits, given the proper motivation.

Neither of these reasons reflects the underlying psychological attitudes uncovered in the study. It was found that strong independence needs exist. Hard core non-poolers want the freedom to come and go at their own convenience. They do not want to depend on others or have others depend on them, especially if it interferes with their freedom. This factor may indeed be the biggest barrier to overcome in achieving increased carpooling. Like the tip of the proverbial iceberg, these needs suggest a stronger psychological and attitudinal resistance than is apparent on the surface.

It bears repeating that these findings predate the energy crisis. Given a real pinch on gasoline, whether arising through free market or regulatory forces, many of the subtle factors previously influencing propensity to carpool may fade into insignificance. Ways will easily be found to set aside the superficial reasons for not pooling and, in fact, many of the real barriers to higher occupancies will, out of necessity, be overcome by individuals. A well-conceived National Carpooling Action Program can help smooth the way for this problem solving process.

CONCLUSIONS

This report has attempted to provide an overview of the current state-of-the-art of carpooling in the United States by discussing automobile occupancy, the primary elements of carpool activities, and existing carpool activities. Overall automobile occupancies, which provide a measure of the extent of carpooling or ride sharing, are low in the U. S. Work trips in particular have the lowest automobile occupancies of any trip purpose. Although estimates vary depending on the numerical averaging technique, average automobile occupancy for work trips in the U. S. is approximately 1.4 to 1.6 persons per vehicle. Based on the national averages, nearly three-quarters of commuter cars are occupied by only one person.

There are a number of factors that tend to be correlated with automobile occupancy and therefore with the extent of carpooling. These include income, automobile ownership, trip length, parking cost, employment density, and employer size and type. In general, carpooling is most common in high-density employment areas with high parking costs. As incomes and the level of automobile ownership increase, the extent of carpooling tends to decrease; however, if rationing is instituted, and depending on the exact mechanism used, this relationship may no longer hold. In addition, carpooling tends to increase as the length of work trip increases above 15 miles.

Based on the review of existing carpool activities throughout the country, a general profile can be constructed as follows:

- Although many types of institutions are involved in carpooling, including some regionwide programs, the overwhelming majority of existing carpool programs are employer-based, employer-originated, and employer-sponsored. We believe that over the next six months the employer-sponsored activities will continue to be most vital.

- With the exception of carpool programs to ski areas and special event buspools, carpooling programs are focused on the work trip.
- A number of operational computer programs are available to assist in carpool matching; however, the preponderance of existing carpooling efforts use manual matching methods or simple computer sorting programs.
- When a special carpooling incentive is provided, it most commonly takes some form of preferential parking. In high-density employment areas, parking cost subsidies are sometimes provided to carpoolers by employers as well. In an energy crunch, such incentives will be less powerful than fuel shortages.
- With the exception of major traffic and highway improvements aimed at preferential treatment for buses and carpools, most carpool incentives are provided by the employer. Thus, there is a logical tie between the ability to provide special incentives and the level at which carpools are organized.
- One of the most exciting and promising of the recent carpool programs deserving special attention is 3M's Vanpool Program. It uses a unique combination of incentives to the van driver/coordinator and the rider. The 3M program has created a demand for vanpools that presently exceeds supply. Significantly, this program is proving to be successful in a predominately suburban area.
- As the next few months progress, the proper role of all levels of government will evolve through a reasoned process of planning, testing, and monitoring, various kinds of carpool action programs.

Based on an examination of the carpooling programs that are exhibiting some signs of success, a number of ingredients to a successful program have been identified. These include:

- The commitment and active support of top management in employer-based programs and of top public officials in regionwide programs
- The maximum involvement of the members of the potential user group so that it becomes "their program"

- The provision of tangible special incentives for carpools, such as parking charges preferred parking, or the use of company-owned vehicles
- A commitment to a continuing program with periodic updates instead of a "one-shot" program
- The development of procedures to encourage positive feedback to employee carpools in the form of newsletters, display posters, mass media publicity, etc. along with continuous program monitoring
- The use of proven and uncomplicated matching techniques to which potential carpools can relate
- A sufficient amount of promotion and program information to insure that potential carpools are aware of the program, its advantages, and how to use it

While attention to these essential ingredients will not guarantee success in every carpooling program, experience indicates that the chance of success without such attention is remote. The fuel shortage has created a situation in which a successful short-range nationwide carpooling program is crucial. For the long run, however, the opportunity has been provided for careful planning of the proper role of carpooling, buspooling, and related travel demand management methods in the nation's overall transportation system.

SECTION 2
ORGANIZATION FOR CARPOOLING

ORGANIZATION FOR CARPOOLING

INTRODUCTION

Nearly every urban area in the United States is experiencing "rush-hour congestion" on its highway system. This urban transportation problem is a direct result of an excessive number of automobiles -- nearly all of which have only one driver as the occupant. Transportation planners have realized for a long time that the individually driven automobile is the least efficient means of transporting people to work. It is inefficient because it places a great burden on the existing highway capacity, consumes vast amounts of energy, and is a major contributor to environmental pollution.

The realization of this inefficiency has prompted the use of carpool/buspooling. Pooling is a process whereby the nation can make more efficient use of its current transportation facilities through the shared use of vehicles. In so doing, it can help the nation meet its short-run energy shortage as well as its long-run management of congestion and pollution on urban highways. The term "carpool/buspool" is used because it indicates the range of vehicles that should be considered as a part of transportation pooling.

To be truly effective, carpool/buspool activities have to be coordinated to insure maximum implementation. The measure of pooling effectiveness is not based on whether cars, taxis, vans, buses, or any other vehicles are used, but rather on the amount of fuel saved and the extent to which congestion and air pollution are reduced without adversely affecting public mobility. However, in order to achieve this level of efficiency, carpool activities must be properly organized and coordinated at all levels.

Carpool/buspool activities involve many diverse groups of people, agencies and activities that have to be brought together in some fashion. This paper, then, addresses the issue of how carpool/buspool programs could be organized. Its purpose is to give local, regional, and state officials, and groups who have an interest in carpooling, directions as to how their area may organize the various agencies and groups into a unified body. Examples of existing organizational structures, which have met with varying degrees of success, are examined, and suggestions on organizational structure, management, and agency interrelationships are presented.

CURRENT CARPOOL/BUSPOOL ORGANIZATIONAL EFFORTS

There are many public agencies and private groups currently engaged in carpool/buspool programs. They range from large areawide carpool programs such as the Washington, D. C., Council of Governments program, to small destination-oriented programs organized by individual businesses, such as the successful Hallmark Company program in Kansas City. To date there has not been a trend or commonality in carpool/buspool organizations or implementation methods. This is largely because early carpool/buspooling efforts were motivated by localized or isolated incidents.

Carpool/buspool activities which have emerged recently as a result of air quality requirements and the energy shortage have been organized hastily and have not received sufficient information or guidance from either public or private agencies. Table 1 classifies primary and secondary support agencies which are coordinating carpool/buspool programs in selected cities and states where pooling activities currently exist. The agencies primarily responsible are designated "P" and those agencies providing assistance "x". This information, as well as information obtained from other sources, reveals several significant findings with regard to current carpool organizational structures:

- To date, the private sector has been more active in organizing carpool/buspool programs than the public sector. A majority of the present carpooling activities have been started by employer groups (either individually or collectively) or by private groups such as the Chamber of Commerce. This trend may well be changing, however, as more political leaders and state agencies, etc., are responding to the situation.
- At the state and local level, there has been no single source established to coordinate activities. In some areas the city traffic or planning department coordinates the activities, but in other areas it is the county, state or more frequently some quasi-governmental agency such as a Council of Governments or Transportation Authority.
- One of the groups most active in developing and coordinating carpool programs is the radio and television stations. In many cities they have joined efforts with private groups such as automobile clubs, computer firms and the Chamber of Commerce. The Westinghouse broadcasting stations

TABLE 1. SAMPLE SURVEY OF CARPOOL ORGANIZATIONS AND COORDINATORS

Coordinating Agency	Location	Private						Public							
		Chamber of Commerce	Business Firms	News Media (Radio, TV, etc.)	Auto Clubs (AAA, etc.)	Educational Institutions	Other	Transit Organizations	Council of Governments	City Planning or Traffic	County	Federal DOT	State DOT	Governor	Regional Transp. Planning Comm.
	Atlanta, Georgia	x	P	P											
	Austin, Texas			P						P					
	Boston, Massachusetts			P	P										
	California - Statewide											P	x		
	Charlotte, North Carolina	P	x												
	Chicago, Illinois		x	P											
	Dallas, Texas		x							P					
	Denver, Colorado		x(2)		x	P(1)	x								
	Fort Worth, Texas	P	x	P											
	Indiana - Statewide		P												P
	Knoxville, Tennessee					P(3)		P(4)							
	Michigan - Statewide											P			
	New Orleans, Louisiana			P											
	Northern Virginia		x												P
	Omaha, Nebraska	P	x					x							
	Philadelphia, Pennsylvania			P	P										
	Pittsburgh, Pennsylvania			P											
	Fort Huron, Michigan	P				P(5)									
	Portland, Oregon		x												
	San Francisco Bay Area, California		x							P			P		
	Santa Clara County, California														
	Seattle, Washington									P	P				
	St. Louis, Missouri			x					P						
	Winston-Salem, North Carolina		x							P	P				
	Wisconsin - Statewide			P								P			

- P - Primary Coordinator
- x - Provides Assistance
- (1) - George Washington High School
- (2) - Downtown Denver, Inc.
- (3) - University of Tennessee
- (4) - Knoxville Transit Authority
- (5) - Community College

in Boston (WBZ), Philadelphia (KYW) and Chicago (WIND) have been the primary instigators and organizers of carpool programs in those cities, and these efforts have spread to other metropolitan areas. However, if radio/TV stations should play a key role, it is desirable that all stations participate as a public service rather than give one specific station an exclusive role.

- The Chamber of Commerce in numerous cities has also been active as an organizer and as a provider of assistance to other groups. This group is able to act as the liaison between business firms (employers) and the local carpool/buspool coordinators.
- A weakness in some organizations is the equating of carpooling with computer matching. This blind faith in the computer must be tempered with the realization that the computer (or manual) matching process only identifies pooling candidates. The actual formation and continuation of pooling is dependent upon the well-organized, diligent promotion and recognition of pooling.
- National organizations such as the American Automobile Association and the Highway Users Federation for Safety and Mobility have played a significant role in guiding carpool efforts in various areas.

Most of these organizational structures that do exist are limited generally to no more than two or three coordinating or cooperating agencies. For example, in Philadelphia it is the KYW radio station in cooperation with the AAA Club that is running the entire program with no assistance provided by public agencies. In many other locations it is one or two individuals who comprise the "organization", while in other localities it may be the planning or transportation agency. In a few cities there is even competition and duplication of carpool/buspool matching services because of a lack of a central coordinating agency.

A few representative cities, however, do have a well-defined organization for coordinating and overseeing pooling efforts. In some cases the organization involves essentially private groups while in others it involves a combination of private groups and public agencies.

Denver, Colorado

For example, several private companies in Denver, Colorado organized during the summer of 1972 to promote areawide carpooling. Their organizational structure is shown in Figure 1. The initial program signed up approximately five percent of the employees contacted.

Interest declined until the fall of 1973 when the firms' representatives contacted Dr. Irving Hoffman at George Washington High School. Dr. Hoffman had been experimenting with a student computer program. As Dr. Hoffman and the students took more interest in carpooling, the coordinating effort switched hands. As shown in Figure 2, the AAA Club and Downtown Denver, Inc., (a downtown business association) are currently the promoters of the program, and the high school provides technical support. Downtown Denver, Inc., solicits participation from corporations in the downtown area, while AAA performs similar activities for businesses outside the downtown area and non-aligned employees. The Denver High Schools, through their computer math students, act as implementation counselors and explain to business groups how to fill out application forms, keypunch forms, and other technical activities.

Dallas, Texas

A carpool program is coordinated by the City through its Department of Traffic Control, which in turn works directly with employer coordinators. Responsibilities are shown in Table 2. Figure 3 shows the responsibilities of both the City of Dallas and employer coordinators with respect to carpool/buspool activities.

Knoxville, Tennessee

A good example of an organized carpool/buspool program exists in Knoxville, Tennessee, where it was felt that carpooling should be an extension of good transit service and, therefore, bus service should be closely coordinated with car and vanpools. In keeping with this philosophy, the carpool/buspool program was organized by the Knoxville Transit Authority with a member of the authority appointed as chairman. A planning committee was chosen to assist in selecting maps and survey documents and pre-testing the carpool/buspool concept. This committee consisted of technical staff from the University of Tennessee; personnel directors from Levi Strauss, Tennessee Valley Authority and Camel Manufacturing. Once the program was organized and ready for implementation, the Mayor appointed a Community Advisory Committee

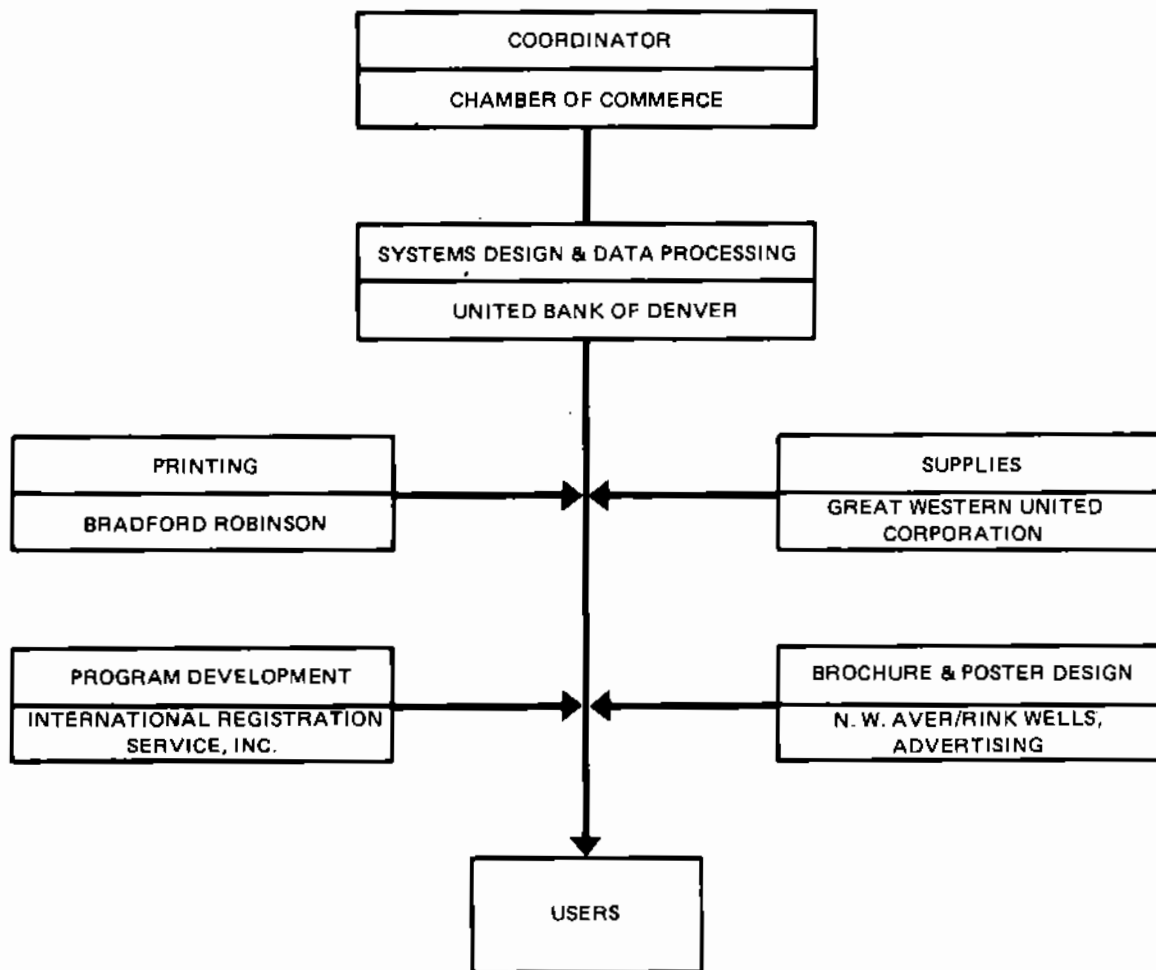


FIGURE 1.
ORGANIZATIONAL CHART FOR PILOT CARPOOL PROGRAM
IN DENVER, COLORADO

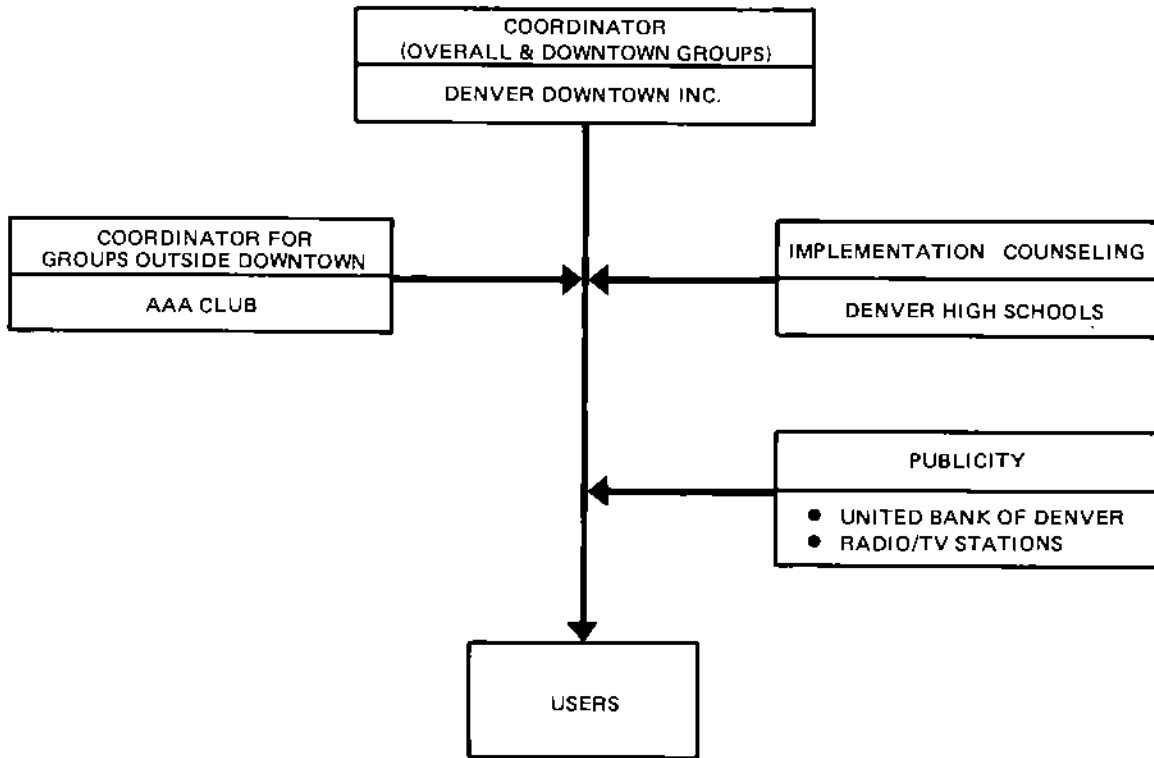


FIGURE 2.
ORGANIZATIONAL CHART FOR EXISTING CARPOOL PROGRAM
IN DENVER, COLORADO

TABLE 2. - CITY-EMPLOYER RESPONSIBILITIES
DALLAS, TEXAS CARPOOLING PROGRAM

<u>Step No.</u>	<u>Responsibility</u>	
	<u>City</u>	<u>Firm</u>
1.	Prepare master copies of necessary materials (maps, questionnaire, etc.)	X
	Reproduction of necessary materials	X
2.	Carpool promotion	X
3.	Distribute questionnaires	X
4.	Collect, code, edit and keypunch questionnaires	X
5.	Process (match) potential carpoolers	X
6.	Distribute lists to individuals	X
7.	Followup (updating)	X
8.	Reports	X
9.	Program evaluation	X
10.	Assign specific personnel to implementation of carpooling program. Send them to meeting for detailed information	X

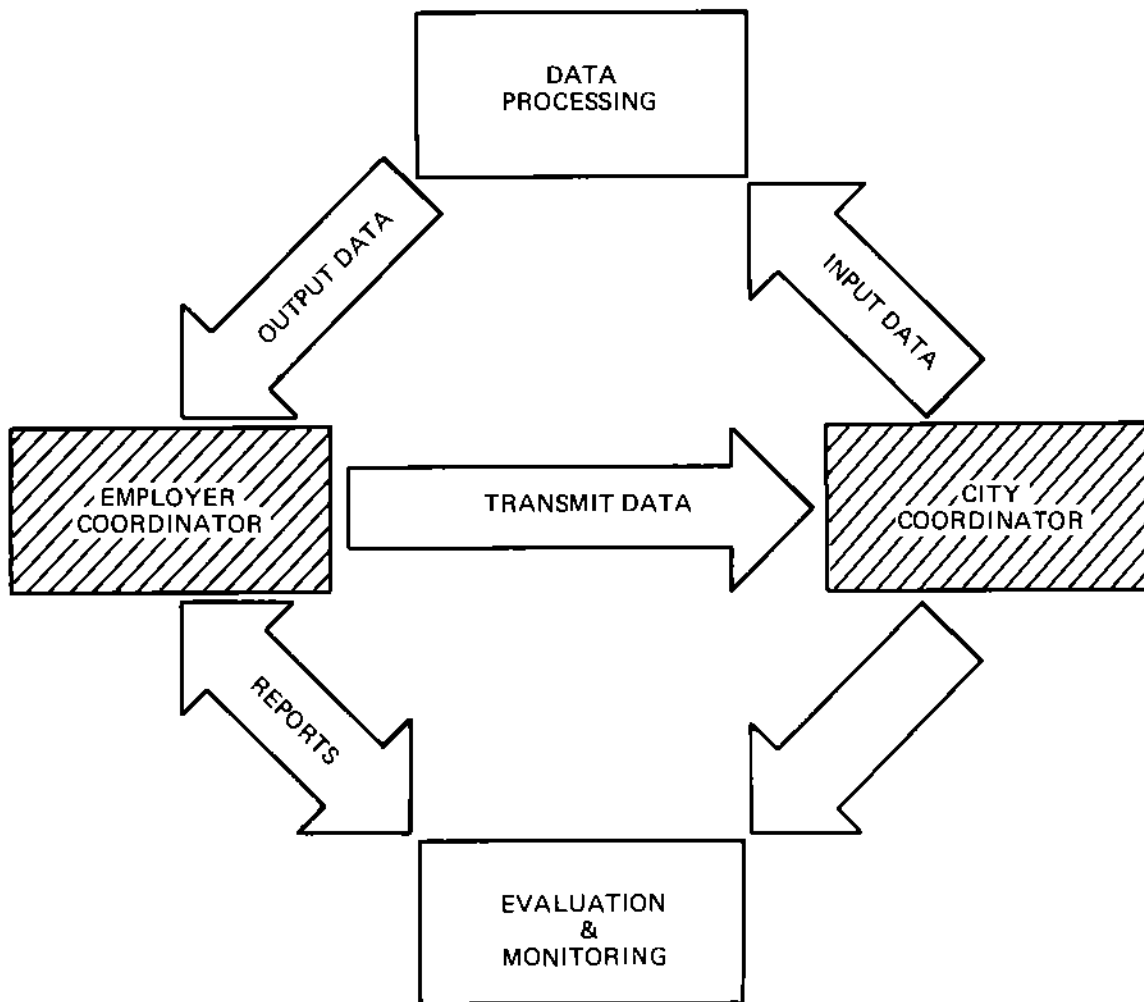


FIGURE 3.
CARPOOL SYSTEM MANAGEMENT – DALLAS, TEXAS

which was primarily responsible for developing broad community support and serving as liason between the Coordinating and Planning Committee and the various firms and community organizations. The program was then presented to the media since it was felt that the most important aspect of the program was broad public acceptance. The University of Tennessee Advertising Department developed themes and promotional packages for the media. The current organizational structure is shown in Figure 4.

One of the key figures in integrating taxi, transit bus, and other public transportation into the program, is a Market Coordinator. He is charged with examining the output of the carpool/buspool program and identifying areas where public transportation can effectively serve as liason between the buspool/taxipool candidates and the transportation authority. In cases where transit can effectively serve, the Coordinator develops market packages and sells the service by telephone. Where bus service is desired outside of the authorized transit operating area, the Coordinator contacts local bus companies to develop service packages and, if no service is available, he will support petitions for operating authority from the Public Service Commission if he can find individuals interested in providing the service.

Washington, D. C.

Finally, the Washington, D. C., Council of Government's program is an example of a quasi-governmental organization coordinating carpooling activities on an areawide basis. This agency, which coordinates all planning in the Washington metropolitan area, is acting as the coordinating agency. They are being funded in part by the U. S. Department of Transportation and assisted by the Washington Board of Trade and TV station WTOP.

In summary, it can be said that there does not exist any single set pattern across the country for organizing and coordinating carpools. Existing organizational structures range from individual businesses coordinating carpools for their own employees, to various public and private agencies working alone and, in some cases, in unison. It is apparent that many organizational structures are possible. What has been unsuccessful in some localities has met with success in others. Several important factors appear to be (1) the availability of a dedicated coordinator who is willing to make the extra effort necessary to make the program work; (2) assignment of the correct task to the correct group; and (3) coordination of all efforts at the correct level. Furthermore, it is necessary that some organizational structure be established

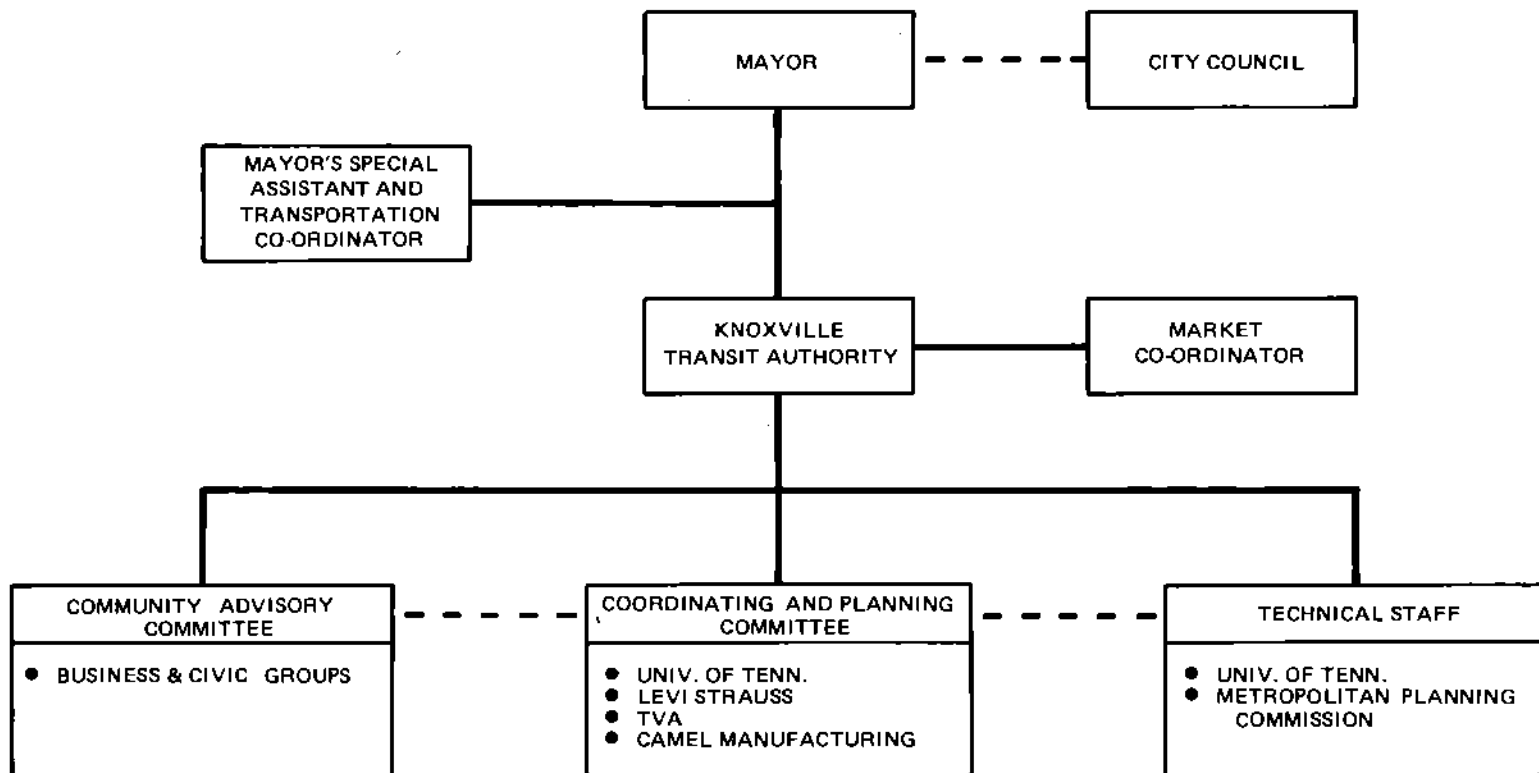


FIGURE 4.
ORGANIZATIONAL CHART FOR CARPOOL PROGRAM IN KNOXVILLE, TENNESSEE

so that all the various aspects of carpooling -- from matching, to promotion, to incentives -- can be coordinated effectively.

LOCAL ORGANIZATIONAL GUIDELINES

The vast differences in each community make it difficult to identify all organizations, agencies, or individuals that should be involved in all communities since each agency and organization has a slightly different role in each respective area. Communities which have a very strong, popular mayor might coordinate the local program through a transit authority or mayor's office. In other communities, the Council of Governments, business leaders, civic groups, or the media may be the most logical choice. In larger cities it may be wise to have area coordinators who are responsible for subareas within each community. Whichever the situation, the organizational structure should be built around existing agencies and preferably, those already interested in transportation affairs. A totally new agency should not be necessary. Ideally, the organizational structure should tie in with the existing planning process and transportation system operations.

Since the actual formation of carpool/buspools is so dependent on broad support, however, current local interest should definitely be encouraged and promoted. Local program coordinators should be able to satisfy the following objectives to insure an efficient, well-received local program:

- Serve as a focus for all community pooling efforts. Individual firms, organizations, trade groups, and the media need to have someone to look to for information, training, ideas, and coordination.
- Provide leadership necessary to rally public, industrial, organizational, and media support behind the pooling concept.
- Locate and coordinate the efforts of technically-qualified individuals and firms which have know-how in surveying and computer operations, as well as developing manual matching programs.
- Coordinate the dissemination of information to local transportation firms to assist them in increasing the efficiency of public transportation.

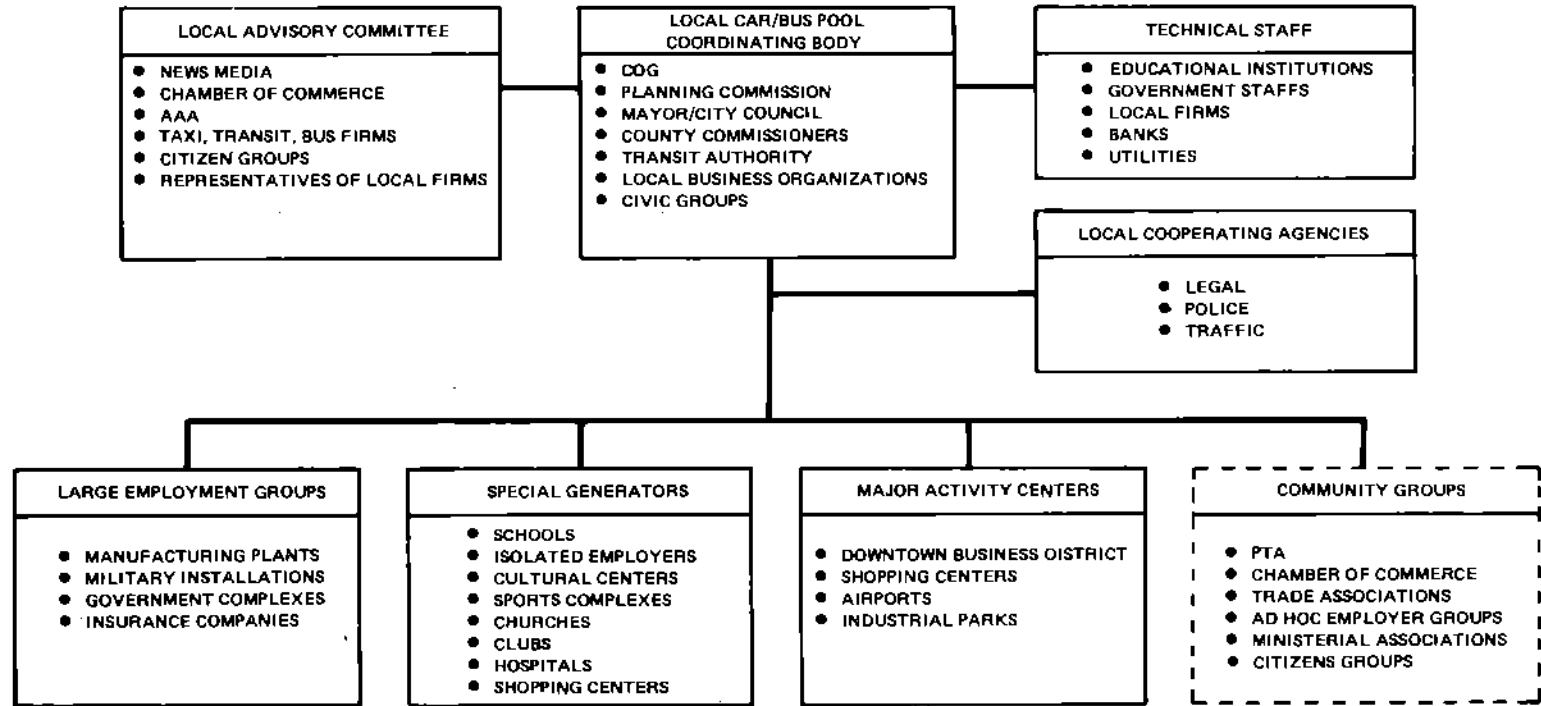
- Expedite the resolution of any legal, regulatory, security, insurance, or other issues which might develop.
- Work with local firms and public agencies to insure that efforts are not conflicting. This would be very important for pooling incentives such as express carpool/buspool lanes and parking adjustments for pools.
- Obtain funds whether private, local, state, or Federal, to effect the program.
- Stimulate innovation at the local level.
- Develop measures for determining the success of local programs and disseminating this information to the community and participants.

Obviously, in order to attain these objectives, an efficient local organizational structure should be created through a coordinating agency, commensurate with each community's needs. Figure 5 illustrates a suggested local organization for coordinating carpooling affairs.

Local Carpool/Buspool Coordinating Body

This body would have the responsibility for coordinating all areawide carpool affairs. The body membership would depend on local conditions and leadership could come from any one of several agencies (as shown in Figure 5) depending on the delegation of authority for transportation affairs. Nevertheless, the person who heads the body should have a strong rapport with local community leaders, have the time and commitment to coordinate the program, and be able to work with the technical staff.

Local Advisory Committee - Supporting the Local Coordinating Body could be a Local Advisory Committee composed of local community leaders whose primary function is to visit local firms, organizations and other groups to promote interest in pooling. It would be imperative that these participants set an example by pooling themselves, as well as adopting a carpooling program in their own organizations. For example, the president of a large firm who lends only his name to the committee would not be nearly as effective as one who would be willing to implement policy decisions, such as the allocation of priority parking for carpool/buspools or discontinuing all meetings promptly



**FIGURE 5.
POSSIBLE LOCAL COORDINATING ORGANIZATION**

at 5:00 p. m. to facilitate carpool/buspool arrangements of the employees. The committee could also include representatives of public transportation operations, citizens groups and news media.

Technical Staff - Technical representatives are available from many sources such as universities, government, banks, utilities, and local firms, and even high schools, as demonstrated in Colorado. This staff could assist in standardizing forms, explaining the various approaches to matching, and locating facilities and equipment.

While two groups would directly support the local coordinating body, it is also important to realize that in order to implement various carpool projects, the efforts must be coordinated with other local agencies.

Local Cooperating Agencies - The Local Coordinator or his staff should work closely with the local municipal agencies to insure that local policies support rather than prevent pooling. For example, possible policy changes may involve the selection of special carpool/buspool lanes to facilitate the flow of pooled traffic.

Having established the basic structure for organizing local carpool affairs, target groups should be identified for implementing local programs. Three basic groups have been identified in Figure 5: large employers, special generators, and major activity centers. Community groups may, in some cases, represent a fourth group; otherwise, they may be the means for contacting some of the three basic groups.

It would be the responsibility of the Local Cooperating Agency, with assistance from the Local Advisory Committee and Technical Staff, to direct the overall effort and decide which car pool programs are directed toward each group. In some communities, all four groups would be greatly involved; whereas in other communities, activities would be concentrated more in two or three groups. Several types of programs to consider would include:

- Areawide Programs - Areawide programs can be specifically directed toward employment centers where there are many employers with similar commuting patterns (downtown business districts, industrial or research parks, regional shopping centers, airports, etc.). ^{1/}

Since the commuting patterns are so similar, carpooling efforts can be particularly effective and deserve careful consideration. By creating carpool/buspools on an area-wide basis, there is greater probability of getting employees into carpools or of finding sufficient densities to justify buspools. The first step is to find someone who is familiar with each of the local firms in the area. This person, who can be referred to as "the Coordinator," would differ for each generator. Usually, however, most centers and industrial parks have rental or management firms which would be able to coordinate the programs. The downtown business district would usually have a promotional association which could act as the coordinating agency. This Coordinator would have a low profile, but by selecting a carpool/buspool advisory board (and designating a chairman) of dedicated leaders in major firms in the area, an effective program could be implemented.

The Advisory Board would be responsible for (1) contacting individual firms and assisting them in collecting data for matching programs, and (2) finding facilities for either computer or manual matching. Where sufficient demand exists, contact with the Local Coordinating Agency could be made, to determine if they would process the matches to determine if bus service was justified. Once the potential pooling candidates have been identified, the Advisory Board would be responsible for promoting pooling activities among the firms.

^{1/} The term "areawide" should not be confused with urban area, region, or other terms which imply a multiple community size. "Areawide", in this case, refers to a space occupied by more than one employer such as a downtown business district, shopping center, or industrial park.

- Special Generator Programs - Many special trip generators such as clubs, churches, schools and small shopping centers have unique travel patterns either, because they are located in remote or residential areas where there are no other activity centers nearby, or because work and meeting schedules do not coincide with the schedules of neighboring activity centers. In these cases, most pooling candidates are members of the same organization or neighborhood.

Special generators also have characteristics which are not too compatible to areawide matching programs. In this case, the Local Coordinating Body would work through community groups, such as the PTA or citizen groups, to aid in the identification of special generators. During this contact, the potential for pooling would be discussed, along with the means for locating candidates and various incentives which could be used. The groups contacted could then help in determining the best means for promoting and implementing carpool/buspooling among special generators. Of course, if there were no community groups associated with the special generators (i. e., sports complexes), direct contact would be made by the Local Coordinating Body.

- Large Employment Program - Where there are large concentrated employment groups, there are usually enough people within the organizations to offer adequate pooling opportunities. In this case, the first step is to designate a Program Supervisor from the large employment group. This individual should be competent, dependable, and committed to the program. Equally important, he must have or make the time needed as a volunteer to do the job properly. He should be selected from the middle management level and be able to organize and communicate effectively. One individual from each cooperating employer firm should be appointed as Program Coordinator. The important elements in organizing a successful carpool program for large employers are described as follows:

Initiate and Plan Program -- The program initiation and planning stage is the most critical one of the entire effort since it sets the direction and defines the conceptual guidelines for subsequent efforts.

Inform Employees -- The initial communication that a carpool/buspool program will be established should come from top management. The announcement could be done by individual letter or memo to be distributed to all employees simultaneously. Too little, too much, or too generalized information at this point can confuse employees or threaten them. They should be told of the need for such a program, management's commitment to the program, that it is voluntary, and that a meeting(s) will be held to explain and discuss the program more fully. The meeting date(s), time, and place should be included in the initial announcement. The meeting(s) should be set up as soon as possible after distribution of the announcement to minimize speculation and rumors. Management can again cover the need for and commitment to the program. Other areas for management to communicate to employees are the scope of the program on a nationwide basis, the benefits, company goals, and incentives offered. The Program Supervisor or Coordinator should be introduced and discuss the specific aspects of the program: what data is needed; who will use it; how will it be used; its security; its collection date; when interested employees can expect to get names of a prospective carpooler(s); and how to meet their future car mates. At the end of the meeting(s) a question and answer period should be scheduled. Any questions unanswerable at the time should be noted. Answers should be found and communicated back to all employees in written form.

Collect Data from Employees -- This phase of the carpool/buspool matching program involves the collection of pertinent information regarding the home and work locations of potential pool members. While the specific elements of the carpool/buspool matching program will be determined by the particular matching method chosen, the steps to

be taken in the data collection phases are generally the same for all methods.

Questionnaire forms should be prepared, reproduced and distributed to potential participants in the carpool program. The forms used should be simple and easy to complete. Attempts to standardize these forms should be made at the local level to facilitate training people involved in implementing the program, as well as for setting up a carpool/buxpooling program on a regional basis at some later date. For home-based carpool/buspool programs, this would involve mailing questionnaires to members of the community using master lists of residential addresses from such things as utility or tax records. Distribution of questionnaires in an employment-based carpool/buspool program could be accomplished simply through the use of normal interoffice communication channels.

Completed questionnaires are returned to the Program Supervisor who then checks each questionnaire for completeness, accuracy, and legibility before proceeding to the matching phase of the process. When participants have the responsibility of coding their residence grid cell from a map, a system should be established to double check the coding for accuracy. For programs where it is not feasible to have respondents code the grid cell containing their residence, the Program Supervisor must accomplish this task before proceeding to the matching phase. To achieve as much standardization in program operations as possible, a local map that has wide distribution throughout the specific area should be used. The map should be familiar to the people using it. State highways and city maps which are commercially prepared and have wide urban area distribution are particularly adaptable for this type program.

Transmit Matching Information to Potential Carpoolers -- Those matched will be notified and sent lists, consisting of names and business phone numbers, for those persons for whom it is

practical to form carpool/buspools. Some pools will proceed to form at this point; however, it may require some additional effort on the part of the Program Supervisor to overcome the natural reticence of some people to call a potential pooler who is only a casual acquaintance.

Provide Personalized Assistance -- This activity will be initiated by the Program Supervisor and may take the form of a social activity where selected groups of potential poolers meet on an informal basis to get acquainted and discuss the formation of carpool/buspools.

Register Operating Carpools and Buspools -- The most straightforward method for accomplishing this function lies with the Incentive Program. The carpool/buspoolers should be required to apply for employer-offered incentives, whether it be preferred parking, parking, or fare subsidies, use of company owned vehicles, or whatever. The registration will provide the yardstick for measuring program success and will also highlight the areas where additional work needs to be done to achieve better results.

At this point the Program Supervisor should consider feedback to the program participants on a regular basis; employees should be apprised of the progress of the program. This might include the program's success, failure, problems, solutions, new developments, recognition of individuals, or efforts of other organizations. The information can be transmitted through in-house publications, departmental or company memos, local newspapers, or industry magazines.

Continue System Management and Monitoring -- With the carpool program operational, a system for managing and monitoring the program should be established. It is critical that the program be viewed as a continuing process so as to improve operational efficiency, expand upon the initial effort, and avoid any dissipation of the initial success of the program.

Appendix A contains a description of Burroughs Corporation's Operation Oxygen program in Pasadena, California, which represents a typical application of carpool program initiation and planning concepts.

These examples of large employer programs are intended to illustrate the broad range of methods the Local Cooperating Body can utilize to effectively implement the program.

STATE ORGANIZATION GUIDELINES

The State's role in a carpool program could involve providing information, training, and expediting local programs. Specific objectives could include:

- Support the carpool/buspooling concept -- Local perception of the importance and potential of carpool/buspooling would be largely determined by the emphasis placed on it at the State and Federal level.
- Provide information and technical assistance -- Local Coordinators would look to the State for organizational and technical direction -- especially at the beginning of the program. This assistance would insure that each local community would not have to "reinvent the wheel."
- Encourage local organizations -- Local community groups should be contacted and instructed on the potential of a strong program and need for implementation. This leadership should filter down from the state.
- Conduct research and develop measures of effectiveness - Local organizations would benefit from state coordinated research efforts which devise improved programs and methodology, as well as develop standards which can be used to determine or measure the effectiveness of ongoing carpool/buspooling programs.

- Set examples as employer -- The key to the success of any carpool/buspooling effort is leadership by example, especially since the State is often one of the largest employers.

Regardless of where carpool activities are focused at the State level, it is important, however, that the coordinating group initially contact other interested agencies to discuss the program and begin to define appropriate roles and participation. The State group designated for carpool responsibilities could be supported by a State Advisory Committee composed of interested state agencies; statewide organizations such as business, labor, and automobile clubs; and selected local community coordinators.

This State Advisory Committee can insure that the many efforts, currently being initiated by various groups and agencies, will compliment the carpool/buspooling effort. The Colorado Air Pollution Control Commission, for example, is holding public hearings on a regulation which would require the promotion of carpools, transit, and bicycles. A copy of this proposed regulation is contained in Appendix B. Other communities, such as Baltimore, Maryland, are considering similar regulations promoting carpool/buspooling.

It should be emphasized, however, that the State role is primarily one of motivating local communities to organize local efforts and to provide the information and assistance necessary to support local organizations once they have been formed.

Figure 6 was prepared to illustrate possible activities necessary for implementing a carpool program at the State and local level.

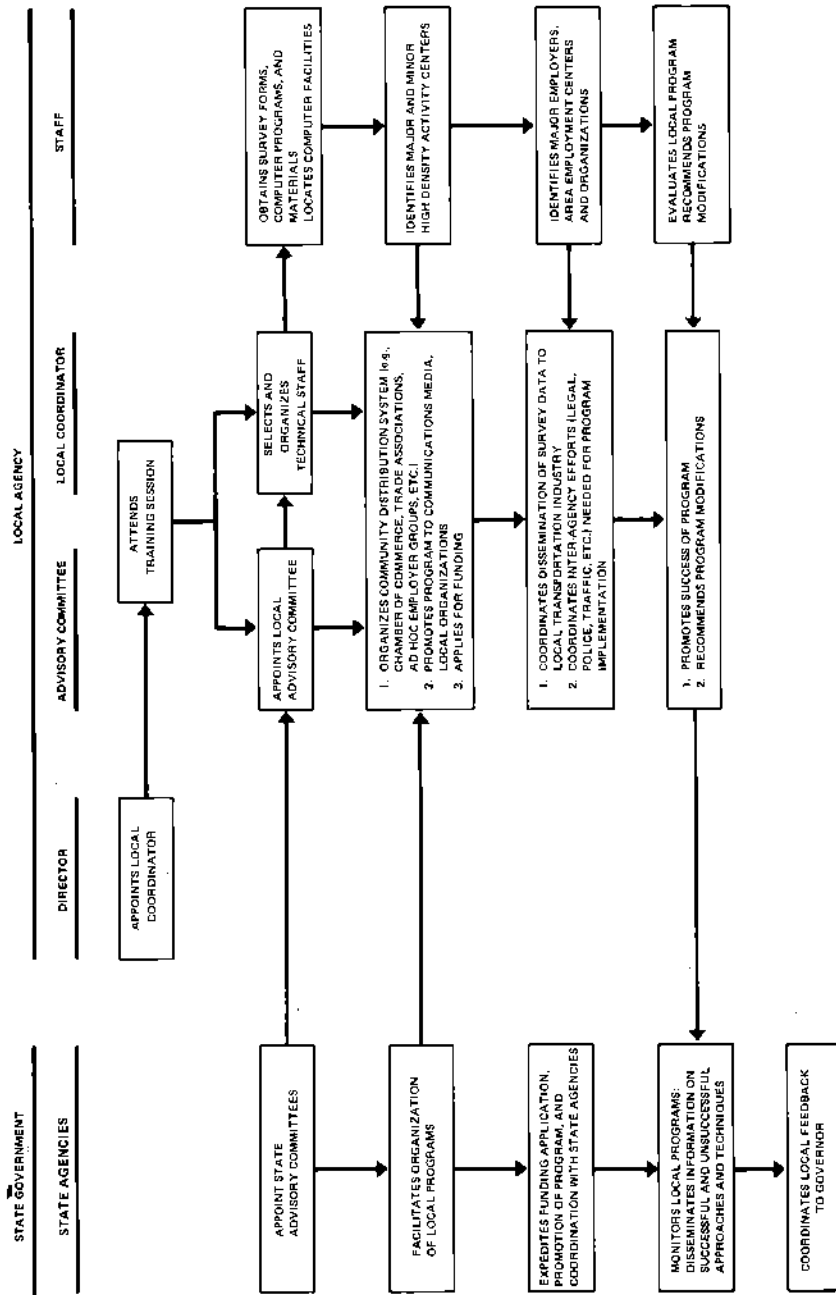


FIGURE 6
POSSIBLE ACTIVITIES FOR IMPLEMENTING CARPOOL PROGRAM

APPENDIX A

OPERATION OXYGEN

Background

Operation Oxygen (OO) is a nonprofit, non-partisan organization dedicated to cleaning the air in the Los Angeles Basin by reducing the number of cars on the road. OO was founded in February 1971 by a small group of employees on the Medium Systems Plant of the Burroughs Corporation in Pasadena, California, but membership has expanded now to include citizens, the business community, service organizations, and large industrial corporations. The Director of OO is Mr. Jack Novak, who is also Production Manager for the Burroughs Pasadena facility. He is assisted by two secretaries. OO operates within a very slim budget which is financed by employee payroll deductions and additional support by the Burroughs Corporation itself as a public service.

Program

Operation Oxygen has a three-fold approach to reducing the number of cars on the road: (1) share rides through carpooling, (2) increase ridership on available public transportation, and (3) encourage walking and bicycling when possible. By far, the greatest effort has been put into carpooling. To date, no large-scale transportation density studies have been conducted to aid in the development of new routes or schedules for public transit; OO has simply encouraged commuters to use existing services. Attempts at encouraging bicycle use have been thwarted by a general lack of bicycles available in the Los Angeles area, if not by the impracticality of their use by commuters. Thus, the rest of this discussion will concentrate on OO's carpool program.

Organization - The first step recommended by OO in establishing a carpool program is to select a chairperson who has a "high degree of personal interest in reducing air pollution" in addition to leadership and organizational abilities. This chairperson then appoints a committee from a cross-section of the target group for carpooling to provide broader exposure of the program and to enlist the additional skills and manpower needed to make the program successful.

Promotion - The announcement of the appointments of an OO Chairperson and committee specifically are made by the top official in the organization participating in this program. Furthermore, the top official should also express his personal endorsement of the program. For employee-oriented programs, further information about OO is communicated in employee newsletters, bulletin boards set aside exclusively for OO, and car bumper stickers and decals. For larger-scale programs, radio announcements and public conferences have been used.

Incentives - As an anti-air pollution organization, OO appealed to many persons who simply desired cleaner air; however, it was found that the desire for independence and privacy plus fears of commitment and loss of flexibility kept many persons from carpooling who otherwise had a time schedule and commuting route which might have permitted them to participate. For these people, a number of incentives were developed such as raffles, preferential parking, and free periodic servicing of anti-smog automobile equipment. However, with the energy crisis, incentives used previously are no longer needed. The scarcity and high cost of gasoline along with the patriotic spirit of helping the country solve its energy problems have produced tremendous interest and support for OO.

Survey - OO suggests two different approaches to identify persons interested in carpooling, depending on the size of the effort. For smaller organizations, OO recommends that each employee be personally interviewed and information regarding commuting route and schedule, home address, work address and telephone, and type of participation (i. e., as driver, rider, or both) be recorded on an employee roster. Then each participant's home location can be indicated on a map with pins numerically coded to each participant, and persons from common areas can then meet around the map to form their own carpools from there.

For larger organizations, potential participants must be surveyed by questionnaire covering the same information collected for smaller surveys, except that departure and destination points must be recorded as map coordinates (OO recommends using letters for the horizontal coordinate and numbers for the vertical to avoid errors caused by accidentally reversing the coordinates). Burroughs has developed a computer program and coding package which is free to anyone (write Mr. Richard Brady, Corporate Director of Public Relations, Burroughs Corporation, Detroit, Michigan) to sort the names into potential carpool groups. But rather than merely sending people a list of telephone numbers of strangers, OO believes that

that everyone should have an opportunity to meet face-to-face before making any commitments. This is accomplished through informal meetings of all persons from a given area before work, during lunch periods, or after work in the employee cafeteria. In addition to determining personal compatibility, these meetings also "fine tune" the system to match persons together with more detailed requirements than could be listed on the survey questionnaire. For example, some carpools operate only two or three days a week, or some people ride in one carpool two days and in another one three days. Provisions should also be made for updating the system for people whose transportation needs change or who merely want to join a different carpool.

Measures of Success

Due to lack of funds, OO has not been able to evaluate the results of its efforts as well as they would like. Burroughs did realize a 35 percent drop in cars in its parking lot in one auto count, and over 500 firms across the country have requested information about OO. In the Los Angeles area, California State College at San Bernardino and a group of seven Los Angeles banks have implemented OO programs. In a fairly recent development, Burroughs has announced that it will open its program to other organizations in the area up to a maximum of 10,000 participants as a community service. Burroughs is the first corporation in the country to do this, and other companies have shown much willingness to assist Burroughs as needed.

APPENDIX B
PROPOSED

COLORADO AIR POLLUTION CONTROL COMMISSION REGULATIONS

Employee Carpooling and Use of Bicycles and Public Transportation:

- A. So as to encourage carpooling arrangements and the use of bicycle and public transportation, by April 1, 1974 all public and private employers which employ more than fifty (50) employees at any one time in any one plant or other business location, shall:
1. Provide a carpool locator service for said employees; and
 2. Provide information to said employees as to the carpool locator service and as to the availability of bicycle lanes and public transportation to and from the area of the plant or location; and
 3. Provide incentives for employee carpooling and use of bicycles and public transportation, singly and in combination, such as:
 - (a) Reimbursement of parking fees for carpooled vehicles;
 - (b) Reimbursement of fares for use of public transportation;
 - (c) Exclusive lanes and preferential parking locations where employee parking is provided;
 - (d) Free parking or parking rate adjustments in favor of carpooled vehicles where employee parking is provided;
 - (e) Imposition of parking charges for non-carpool vehicles where employee parking is provided;
 - (f) Provision of secure and convenient parking for bicycles
 - (g) Other similar fringe benefits

4. Provide the division with a plan or report showing immediate implementation and compliance by October 1, 1984 with the requirements of this Section IV.
- B. For the purposes of this Section IV, A carpooled vehicle shall mean a vehicle which transports at least two employees in addition to the employee-driver.

SECTION 3
APPROACHES TO MATCHING

APPROACHES TO MATCHING

INTRODUCTION

The premise that increased auto occupancy through carpooling can avoid or reduce the impact of gasoline rationing in the short term and increase the person capacity of urban streets and highways in the longer term is based on the knowledge that there are many people, now commuting alone in their cars, who share closely located homes and work places as well as common working hours. In order to entice these commuters to form carpools two types of action are required. First, incentives must be offered, either directly or indirectly, to carpool and second, the individuals must be made aware of potential carpool mates.

The first item, incentives, is discussed at length in a companion report. The second item, techniques for making commuters aware of carpool mates, encompasses several techniques, some of which are covered in this report.

In many cases commuters through activities at their places of work or home neighborhoods will meet others with common travel patterns. These are the most easily, although not necessarily the most efficiently, formed carpools. In other cases single employers, groups of employers or neighborhood groups will use manual matching techniques for groups ranging up to several hundred.

However, since the probability of finding successful matches increases with the total number of commuters considered, for any single origin or destination area (that is, with increasing density) there are distinct advantages in treating larger groups for matching. These groups will range upwards from approximately 1,000 for office complexes and large industrial plants to data bases covering entire metropolitan areas. For groups of this size automated computer based matching techniques are essential.

The decision on the matching technique to be used--manual or automated--will depend on the particular situation and resources of the group involved. It is one of the basic management decisions to be made when embarking on a carpool program.

It is assumed that the organizational structure for carpool implementation will include some type of regional organization whose primary responsibility will be to encourage and coordinate employer and community group programs; to disseminate information on organization, incentives, techniques, etc.; to develop regional public information campaigns and; in some cases, to provide computer support on a regional or case-by-case basis. Functioning within this metropolitan framework will be employer and community groups which will play the major role in carpool organization and data collection.

Thus, an individual's first contact will likely be through his employer. Each worker will be contacted by his employer and asked to fill out a form with the basic information required for carpool matching. This data will then be assembled and processed, either manually or with automated techniques, by the individual employer to set up carpools consisting of employees of a single organization. The data will then be passed either to a larger group made up of several employers in close proximity or directly to the regional organization. That portion of the population not covered by their employer or community group would likely apply directly to the metropolitan agency.

Each employer, in some fashion, will be directly involved in carpooling and matching. For small employers, those up to about 30, matching within the firm can be handled on an informal basis simply by calling together all employees. These groups will probably associate with other employers in an effort to seek more effective matches.

Manual matching techniques have been used easily for groups of up to 500 persons. One employer manually matched 2,500 workers but reported the effort to be excessive. The breakpoint between manual and automated techniques lies somewhere within this range. The decision on whether to use a manual or automated process should take into account the availability of appropriate computer equipment and trained staff, the costs of computer access and the availability of staff to perform the manual matching process. Those employers or groups in the range of 500-2,500 persons should review both the manual and automated techniques prior to making a decision.

MANUAL MATCHING METHODS

Three basic types of manual methods have been identified as having widespread application. These methods are identified as the Centralized

Matching Technique, Locator Board Method and the Roster Technique. These methods are described in the following sections which describe in detail the methodology used in operating, monitoring and maintaining a carpool matching system.

Carpool and buspool matching has been most successfully used at places of employment. It is important to note that the vast majority of employers have fewer than 1,000 employees at a given site. If the effort to increase vehicle occupancy is to achieve success then these smaller employers must be persuaded to engage in carpool and buspool matching and related promotional activities. These groups are prime candidates for applying manual matching techniques.

Manual matching methods can also be used by home-based groups such as neighborhood volunteer groups, home-owners and apartment dwellers associations, PTA's, churches, and government agencies in suburban cities. It should be recognized, however, that past successes in carpool matching, such as the massive campaign during World War II, were organized at places of work. These are only a few examples of very successful large scale neighborhood based carpool and buspool matching processes. Most of the neighborhood pools are formed by informal matching between neighbors and friends.

Work-based matching seems to work best for various reasons including:

- The higher concentration of people at work locations, therefore easier to contact potential poolers
- The employer involvement in the matching activity
- The opportunity to offer tangible incentives to the carpooler at the work location
- The existence of problems, such as parking scarcity at some work locations, which can be used as opportunities for incentives

Centralized Matching Technique

This matching method, also known as the Supervised Questionnaire Technique, is termed "centralized" because a single person or group has the responsibility for managing and operating the carpool/buspool matching program. They become the focal point for distributing questionnaires, geocoding of questionnaires, matching potential carpoolers, monitoring and other related items to insure a successful, ongoing program. The method is described in the context of an

employment location environment, but it can be modified for application in residential areas (see Applications).

Data Collection - The first step in the program involves the preparation and distribution of questionnaires by the program supervisor. The forms should be distributed to all employees at the same time and could be either sent through normal inter-office mail or simply given to each employee along with his or her pay envelope on payday. The questionnaires should be in general conformance with the example shown later (see Figure 6) except that references to self-coding or home location grid squares and cells may be deleted. After completing the questionnaire, the employee returns it to the carpool/buspool program supervisor.

Editing and Sorting - As the questionnaire forms are received by the carpool/buspool program supervisor, each should be checked for legibility, completeness and accuracy. If incomplete, illegible, or obviously erroneous data is found, the form should be returned to the employee for correction.

Using a large scale map of the area (see section on "Maps" under General System Elements) upon which a suitable grid system has been drawn, the supervisor locates the grid cell containing the residence of each employee (using the employee's home address) and codes the grid cell designation in the boxes in the upper-right-hand corner of the questionnaire. In addition to the grid map, the supervisor should be provided with city directories and/or detailed street maps showing the house numbers on each block. The questionnaires are then sorted into groups on the basis of grid cell number.

Once the forms are sorted, the supervisor simply records the names, addresses, telephone numbers and working hours of all respondents within a particular grid cell. The list would then be copied and distributed to all respondents in that grid cell for their use in organizing carpools. If a cell contained fewer than 4 persons (to allow some choice in compatible poolers), the supervisor should expand the list to contain data on persons living in adjacent grid cells. If the adjacent grid cells still supply less than 4 persons, the coverage area should be further expanded along major transportation facilities which would provide logical routings for the home-to-work trip of the cell in question. The supervisor should look for locations of possible park-and-pool facilities, such as shopping center parking lots, and note these on the list of potential carpool/buspoolers which are returned to the employees.

Pools will begin to form through individual initiative once the match lists have been distributed; however, additional personalized encouragement by the Carpool Supervisor may be helpful in overcoming the reticence of some people to call a potential pooler who is only a casual acquaintance. The supervisor may also organize social contacts, such as coffee breaks and lunches, where potential carpool partners can get acquainted.

Monitoring - Once the matching process has been completed and the listings sent to employees, the supervisor should distribute a second form asking those persons who have formed carpool/buspools to notify the supervisor. Alternatively where incentives are offered, the poolers will be registered as they apply for the incentives. The effectiveness of the company's carpool program can be monitored through simple techniques such as counting the number of cars in the parking lot, sampling the occupancy levels of cars arriving at the lot, and keeping track of the number of carpools which are receiving company offered incentives.

Maintenance - Periodic surveys should be made to insure that the central carpool data files are kept up to date. The supervisor should furnish lists of potential new members to existing carpoolers who have a vacancy to be filled. The Personnel Department should inform the Carpool Supervisor of employee terminations and transfers, new hires, and changes of residence or working hours.

Small and medium size employers who have conveniently located neighboring employers may find it possible to improve the overall effectiveness of their carpool program through teaming up in a joint effort. Supplying data to a Regional Coordinating Agency may enhance the opportunity for buspooling and will be generally useful in analyses of travel demand leading to transit service improvements.

Locator Board Method

This method involves the display of a large map of the metropolitan area on which a grid system has been drawn. The employee using the system fills out a questionnaire card and deposits it in the appropriately numbered pigeonhole compartment corresponding to the grid cell in which his residence is located. To locate potential carpool mates, an employee can simply pull the questionnaire forms from the display cabinet slot corresponding to his grid cell and scan the forms in the slot. If suitable matches are not found, he can pull cards from adjacent grid cells.

It is recommended that two similar cards of different color be used in the Locator Board Method to aid carpool matching. Examples of locator board questionnaire cards are shown in Figure 1. A green form is used by those persons who have a vacancy in an existing carpool which they wish to fill. The form should be filled out by one of the driving members of the carpool. The carpool member would obtain the card from a supply located at the display board. He would then place the completed form in the appropriate pigeonhole in the questionnaire display cabinet. Those persons wishing to join an existing carpool would simply fill out a red colored card as shown in Figure 1 and likewise place their completed questionnaire in the appropriate pigeonhole in the display cabinet.

A large scale map of the metropolitan area covering the major residential areas should be displayed in a central location in the building which is convenient to most of the employees. (See the section on "Maps" under General System Elements of this report). The display should be arranged so that it is immediately recognized as a carpool/buspool locator map for the building and should contain, in addition to the map itself, posters describing the carpool/buspool system and how potential poolers may participate in the program. Figures 2 and 3 show typical map and Locator Board displays. Whenever Locator Boards are used in cities with a public transit system, a map of the transit routes and a full supply of transit schedules should be located alongside the Locator Board. Signs should encourage employees to try the bus as well as carpool/buspools.

The Locator Board Method of sorting and displaying completed questionnaire forms require the construction of a cabinet containing a number of small compartments or pigeonholes which are large enough to hold the completed questionnaire forms. For a company or building with a large number of employees (1,500 or more) the supervisor may wish to consider the construction of a cabinet containing as many compartments as there are grid cells on the carpool/buspool locator map. For most applications, however, it will be sufficient to have one slot for every five grid cells.

The Locator Board Method is largely a self-service system and requires only minimal supervision. However, some supervision is required to insure that the Locator Board area is kept clean, neat, and properly maintained, and that employees are using the system according to instructions. During the initial stages of the carpool/buspool system, the supervisor should check frequently (perhaps every other day) to insure that the forms are properly maintained in the display cabinet.

TYPE OR PRINT. DO NOT REMOVE FROM LOCATOR COPY INFORMATION NEEDED.	OFFICE	ROUTING SYMBOL	MAP GRID NO.
	WORK HOURS		OFFICE PHONE
NAME			HOME PHONE
RESIDENCE ADDRESS			
TYPE OF DOT PARKING PERMIT <input type="checkbox"/> MASSIF BLDG. <input type="checkbox"/> FOB 10A <input type="checkbox"/> OUTDOOR			
COMMERCIAL PARKING LOT (Location)		STREET PARKING (General Location)	
NOTES (i.e., Driver/rider wanted irregular schedule, etc.)			
<i>When vacancy is filled, remove this card from board.</i>			
Form DOT F 1700.14 (11-71)		CAR POOL VACANCY	

(COLOR - GREEN)

TYPE OR PRINT. DO NOT REMOVE FROM LOCATOR COPY INFORMATION NEEDED.	OFFICE	ROUTING SYMBOL	MAP GRID NO.
	WORK HOURS		OFFICE PHONE
NAME			HOME PHONE
RESIDENCE ADDRESS			
NOTES (i.e., willing to share driving; small cars; irregular schedule, etc.)			
<i>When arrangements have been completed, remove this card from board.</i>			
Form DOT F 1700.13 (11-71)		CAR POOL APPLICATION	

(COLOR - RED)

FIGURE 1. LOCATOR BOARD QUESTIONNAIRES

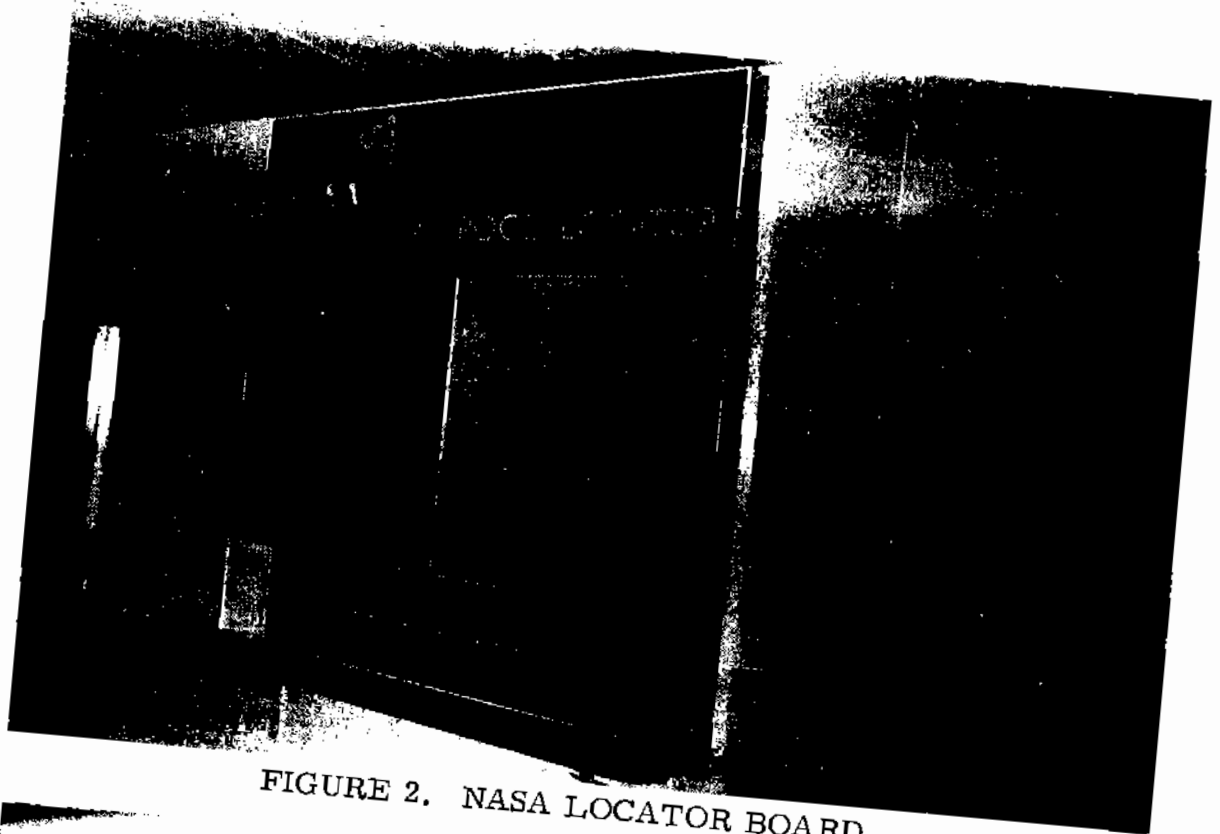


FIGURE 2. NASA LOCATOR BOARD

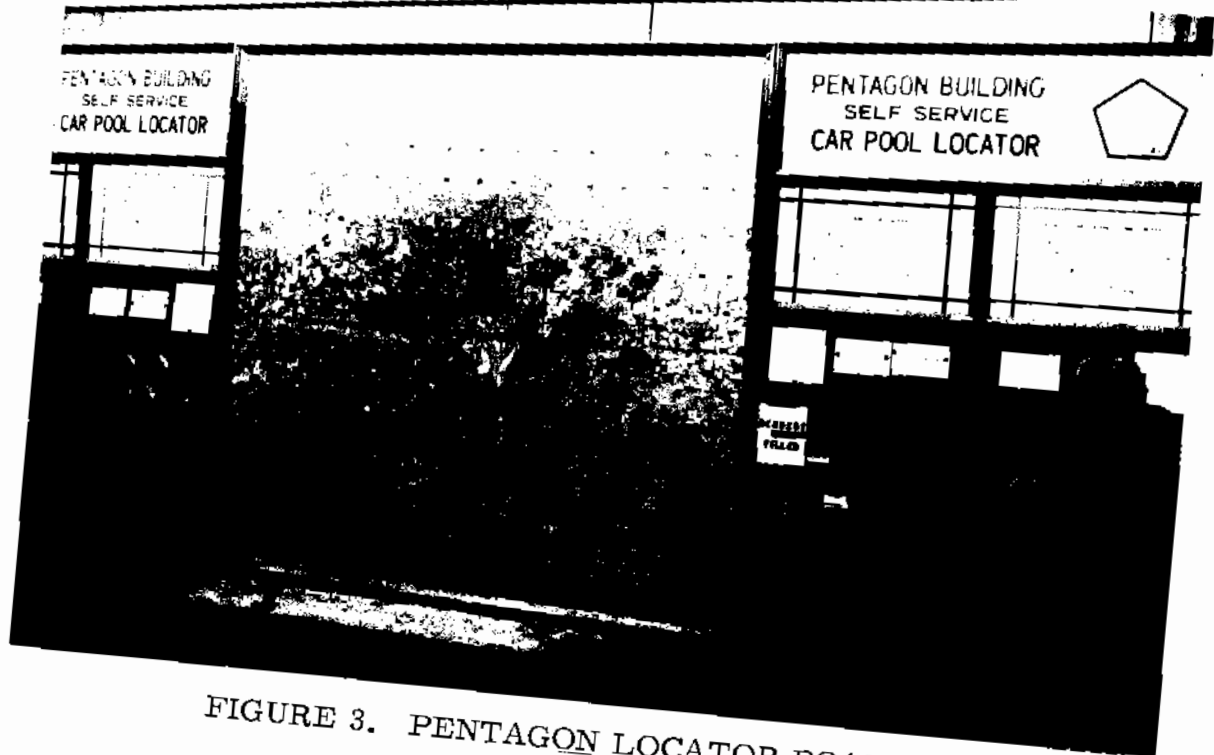


FIGURE 3. PENTAGON LOCATOR BOARD

If there are many small and medium-sized employers housed in the same office building, the Locator Board Method could be easily applied as a cooperative project, or could be supplied and supervised by the building management.

Once a carpool has been formed the members of each pool should remove their cards, staple them together or seal them in an envelope provided for this purpose and deposit them in an appropriately labeled box. This step is very important to avoid wasted effort by those who are still searching for carpool partners.

One shortcoming of the Locator Board Method is that only one board should be used to serve a group of employees. Participants must either pass by this location frequently or somehow be informed of its existence. Using more than one board in a large facility may attract participants but the effectiveness of matching will be diluted.

Monitoring - The Carpool Supervisor collects the cards of the formed carpools which have been deposited in the box and maintains a file of these, organized by grid number. If carpool incentives are offered the Supervisor also maintains a record showing who has applied for and who is receiving incentives provided by the company.

The initial phase of the carpool/buspool matching system should last several weeks in order to allow sufficient time for a substantial number of employees to form carpool/buspools. After this time the carpool/buspool supervisor should evaluate the success of the initial system and attempt to determine any particular problems encountered. One useful measure would be simply the number of completed questionnaires which were returned indicating that carpools had been formed. The number of carpoolers compared to the total number of questionnaires returned in the initial phase of the program survey and compared to the total number of employees in the company yield measures of the success of the program.

Maintenance - As long as the cards are kept up-to-date and the Locator Board is checked periodically by the supervisor, the system is basically self-maintaining. After the initial phase of the system, these cards should be checked periodically (perhaps monthly) to insure that cards remain in their proper compartments, and that a sufficient number of red and green cards are provided at the Locator Board.

Roster Technique

For smaller groups of employees (or residents), a Roster Technique using a numbered list of names, addresses, and phone numbers in conjunction with numbered tacks on a map of the area is probably sufficient to achieve a reasonable level of carpooling within the organization. This method involves posting on a centrally located bulletin board a simple roster form which consecutively numbered lines containing space for the employees name, home address and telephone number. Beside each number would be a map tack with a matching number. Those employees interested in carpooling would write their name, address and phone number on the appropriate spaces on the form. He or she would then take the map tack whose number corresponds to the line number containing their name and place it on the areawide map at the location of their residence.

To locate potential carpool mates, an employee would inspect the map and determine visually the map tack numbers most conveniently located for pooling, then go to the numerical list and determine the names and telephones of the corresponding persons. If there were no tacks near his home, the employee could look for tacks which were along his route to work or look for potential park-and-pool locations, such as shopping centers located at the junction of two major routes normally used by commuters to his place of employment.

Monitoring and Maintenance - The Roster Technique requires little or no monitoring or maintenance after the initial roster and map have been posted. Employees should be asked to remove their map tacks and cross off their names from the roster once they have formed car-pools.

Summary of Techniques

Each of the three methods or techniques may be applied in its pure form, however, most operating programs are hybrids of two or more techniques. The NASA program described in the Appendix uses elements of all three. The Hallmark Card Company program, also described in the Appendix, is an example of a pure Centralized Matching Technique.

In general the Roster Technique is the least costly in terms of manpower and direct expenditures and is probably most appropriate where there are only 100 or so potential carpoolers being matched.

The Locator Board Method can be effective where the number of potential poolers is substantial, maybe 100 to 2,000. It can also be effectively used as a team effort by a group of small to medium-sized employers who are located in the same building.

The Centralized Matching Technique should always be used where the potential exists for going from manual matching to computerized matching. It's chief drawback lies in the higher manpower requirements than the other two methods. However, if incentives are being offered by the employee it may be the most desirable of the three methods.

GENERAL SYSTEM ELEMENTS

The following are discussions of carpool matching system elements which are common to more than one of the manual matching methods.

Maps

The primary function of the carpool/buspool map(s) is to locate accurately the home and work places of participants. The following are general criteria for use in selecting a map(s). It should:

- Show a geographic area large enough to include the origin and destination points for the majority of potential poolers
- Show all streets and street names
- Indicate address (block) numbering
- Differentiate communities, well known districts and areas and natural land features by marked boundary lines
- Use a boldfaced type to identify the names of communities, districts and areas
- Utilize colors to distinguish the various incorporated and unincorporated areas
- Clearly show and identify major highways, freeways and expressways
- Be presented on one sheet
- Not include extraneous information such as advertising, topographic contour lines, etc.

To achieve standardization in system operation among various employers, a local map that has wide distribution throughout the urban area should be used. The map should be familiar to the people using it. State highway and city maps which are commercially prepared and have wide urban area distribution are particularly adaptable to use in a carpool system effort. It is recommended that a public agency in each urban area be responsible for preparing and distributing a standard grid map of the area for use in carpool/buspool systems. Figure 4 shows in black and white an example of a map suitable for use in a carpool/buspool system. If no local map common to the area is available, then alternative sources such as oil company maps can be used. The oil company maps have an advantage in that most commuters have used them. It is important to avoid special purpose use maps such as land use and topographical maps which are not generally familiar to most people.

The scales used on oil company maps typically range from one inch equals 2,000 feet to one inch equals 5,000 feet. These are suitable for finding home locations accurately. In very large cities, it may not be possible to show as much detail as desired without going to an unreasonably large map. However it is considered better to give up some detail than to have more than one map, each for a different section of the city.

Grid Configuration

In defining the grid system, a combination of letters and numbers should be used to define grid cell coordinates since this is less confusing than using two sets of numbers as they may be easily reversed. Grid designations should be put on each cell as shown in Figure 5 so as to reduce errors in grid number coding. The size of the grid cell used will be a function of land development. In the higher density residential areas, smaller grid cell size may be necessary, such as one square mile. A larger grid cell, possibly four square miles, may be adequate in suburban fringes of a large city.

If carpool matching is being applied as a home-based system (i. e. work locations are being matched), it is advisable to use a special, fine-grained grid of the CBD and other high activity centers where separation by more than a few blocks would be a real impediment to carpooling.

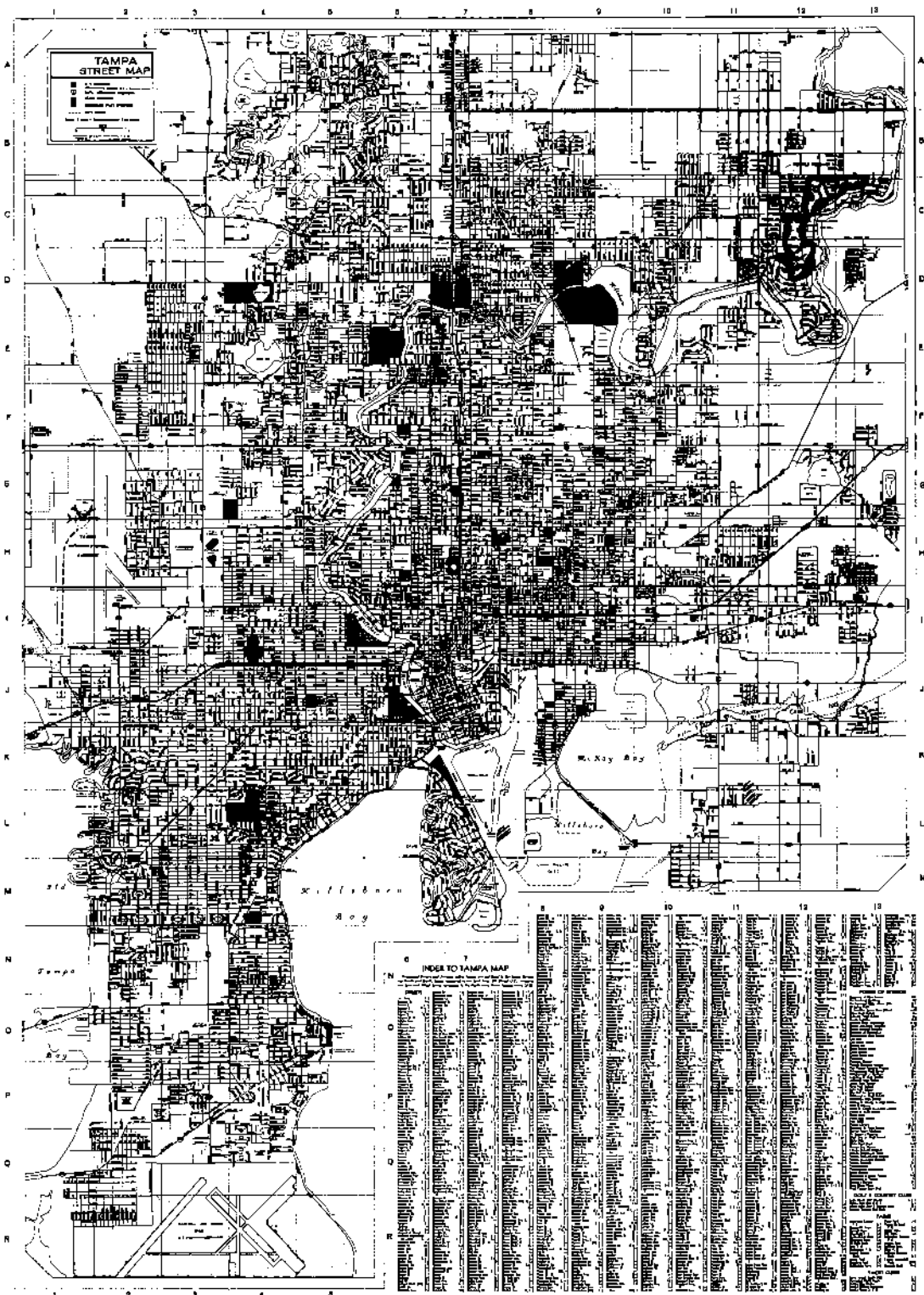


FIGURE 4. TYPICAL OIL COMPANY MAP

WASHINGTON, D. C. & THE METROPOLITAN AREA

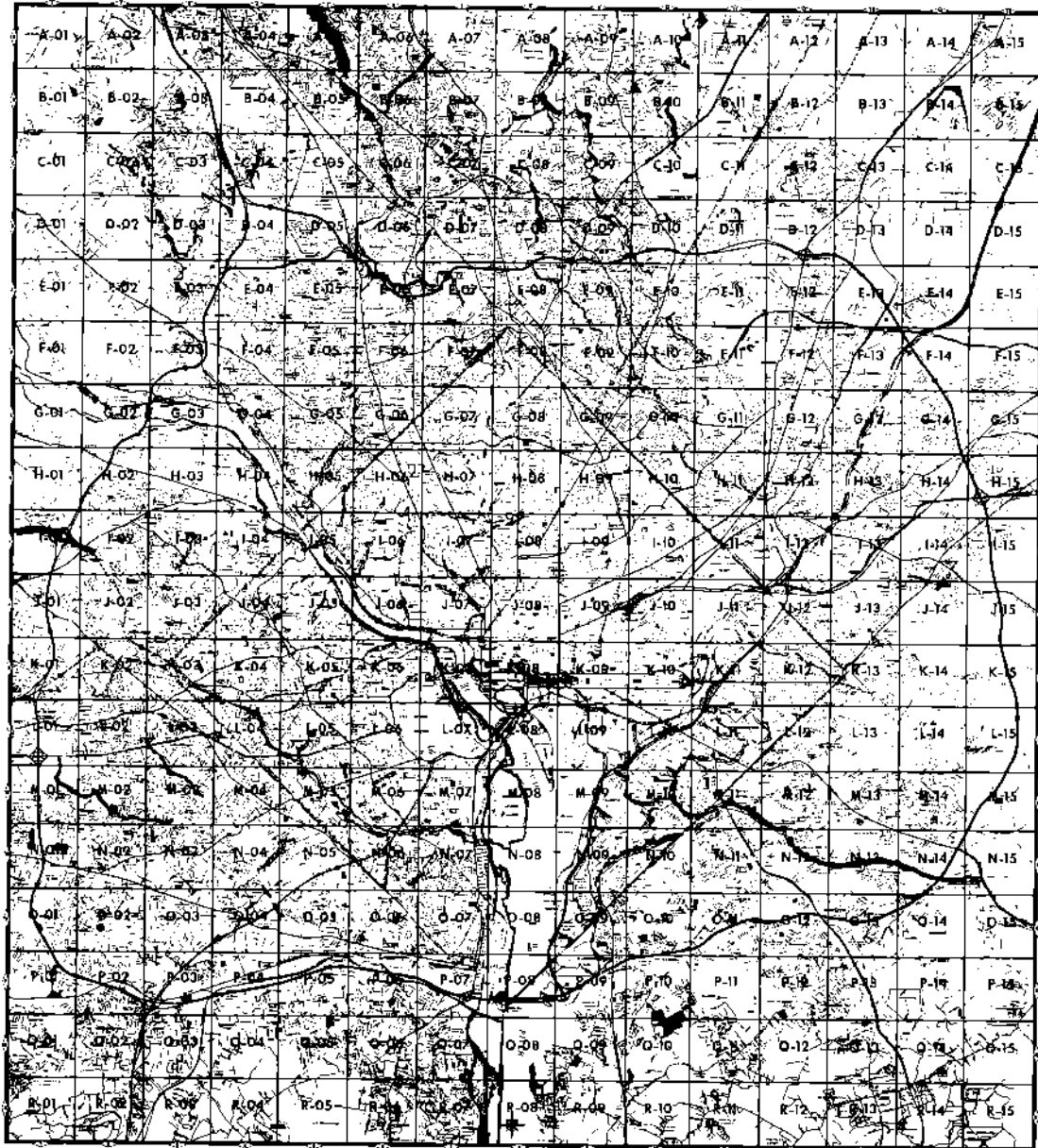


FIGURE 5. MAP SHOWING GRID CELL DESIGNATIONS

Questionnaires

An integral element in the centralized carpool/buspool matching process is the questionnaire which is used to gather appropriate information on potential carpool/buspool members. Attempts should be made at the local level to standardize the data forms used to obtain place of work and residence, commuting time of day, and other pertinent information used in the carpool matching process. This standardization would make it significantly easier to train the different agencies and people involved and to implement the systems. It would also make it possible to combine information of various companies within a given building or within a complex of buildings so that carpooling and buspooling can be done on a broader base. Standardization would also make it possible to set up a regional carpool/buspool system, although it is recommended that the initial emphasis be placed on the individual businesses, neighborhood groups, or a combination of these groups.

For these reasons, this study recommends that carpool systems adopt a standard data form such as the one shown in Figure 6. These forms represent the basic data which should be collected in any carpooling survey system, regardless of the matching techniques selected. Figure 7A and 7B shows an example of the form modified for a home-based type survey. The shaded blocks are optional items which can be omitted if desired. Both forms request the same data and provide a message from a local government official, citizens group leader or employer describing the carpool/buspool system and urging participation by the recipient as well as instructions on completing the questionnaire. The message should be tailored to fit the particular carpool system, but should follow the general lines in the examples. The questionnaires should be printed on heavy paper such as 110 pound vellum bristol card stock. This will facilitate handling of the survey forms during distribution and matching phases of the system.

APPLICATIONS

Employer-Based System

The greatest chance for success in carpool/buspool matching is in its application by employers for the benefit of its employees. The organization and management of an employer-based carpool/buspool program should be accomplished in three major phases:

GENERAL INSTRUCTIONS

This form asks for six types of information: (1) your name; (2) your work telephone number; (3) your home address and telephone; (4) your employment address; (5) your working hours; and (6) your desire to participate. If you need another Form, check No. 7.

Please print all information using the "SAMPLE COPY" as your guide. Please fill out and return the Car/buspool Survey Questionnaire form as soon as possible if you are interested in joining a carpool or buspool.

Specific Instructions

1. Name—Use only initials for your first and middle names.
2. Your Employment Telephone Number
3. Address—Skip one space between the street number and the street name. If you live in an apartment, fill in the apartment number. If you live in a subdivision or specific neighborhood, print the name in the appropriate boxes.
4. Employment Address—Print the building name and address of your place of employment.
5. Working Hours—Be sure to designate your starting and quitting times as AM or PM.
6. Participation Desired—Place an "X" in the appropriate box.
7. Additional Form—Check only if you need another form.
8. Grid Cell Number—After completing parts 1-7 of this form, go to the Car/buspool locator board in the lobby and find your residence on the map. Place the attached map tack on the map where your home is located and code the coordinates of the grid cell in which your home is located.

(REVERSE SIDE)

MAP TACK NO.

CAR/BUS POOL SURVEY QUESTIONNAIRE

WORK HOME
GRID CELL NUMBERS

1. INITIALS

FIRST	MIDDLE	LAST NAME	2.	WORK TELEPHONE
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3. HOME ADDRESS: STREET NUMBER AND NAME

HOME ADDRESS: STREET NUMBER AND NAME	SUBDIVISION OR NEIGHBORHOOD	APT. NO.	HOME TELEPHONE
TOWN OR CITY	SUBDIVISION OR NEIGHBORHOOD	ZIP CODE	ZIP CODE

4. EMPLOYED AT: BLDG. NAME

EMPLOYED AT: BLDG. NAME	WORK ADDRESS: STREET NO. AND NAME	TOWN OR CITY
STATE	ZIP CODE	STATE

5. WORKING HOURS

BEGIN	M	END	M
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6. PARTICIPATION DESIRED:

- SHARE DRIVING RESPONSIBILITY
- DRIVE ONLY—WANT RIDERS
- RIDE ONLY—SHARE EXPENSES
- NOT INTERESTED IN CARPOOL

7. NEED ADDITIONAL FORM

(FRONT SIDE)

FIGURE 6. SURVEY QUESTIONNAIRE

Car/buspool office
Date

Fellow Citizen:

Your participation in a carpool will save you money! Even more importantly, by joining a carpool or buspool you can help conserve energy and gasoline, and reduce automobile congestion and air pollution.

Please fill out and return the attached postage free Car/buspool Survey Form to the Car/buspool Program Coordinator's office. If you are not interested in joining a carpool, simply check the appropriate box under No. 6, but—interested or not—please return the postcard to help make an accurate survey of citizen interest in carpooling.

The form asks for six types of information: (1) your name; (2) your work telephone number; (3) your home address and telephone; (4) your employment address; (5) your working hours; and (6) your desire to participate. If you need another Form for your spouse, check No. 7.

Please print information, all of which will be kept confidential in my office. Names of those interested in carpooling will be assigned to home and work grid maps. You then will be informed of other persons in your grids with whom you may form carpools.

We will succeed in this worthy endeavor *only* with your help. Please fill out and return the Carpool Form as soon as possible—and thank you for your cooperation!

John Doe
Car/buspool Coordinator

-- (PERFORATE AND FOLD) --

Mr. John Doe
Car/buspool Program Coordinator
City Hall
Anytown, Maryland 00000

(FRONT SIDE)

FIGURE 7B. TYPICAL HOME-BASED QUESTIONNAIRE

- Program initiation and planning
- System implementation
- Continuing system management and monitoring

Each of these phases is outlined below, indicating the major elements and the order in which they should be accomplished.

Program Initiation and Planning -

- Community leaders or employee representatives obtain commitment from top management
- Management selects and assigns staff
- Staff selects matching method to use
- Management and staff develop an incentive plan
- Staff prepares schedules and cost estimates
- Management approves program and makes budget commitment

System Implementation -

- Management and staff inform employees of the program
- Collect employee data
- Execute carpool/buspool matching
- Transmit carpool/buspool matching information to employees
- Provide personalized assistance to achieve matching
- Register operating carpools/buspools

Continuing System Management and Monitoring -

- Record updating
- Effectiveness monitoring
- Coordination with other carpool/buspool activities
- Continuing employee communications

Home-Based System

Attempts have been made to establish carpool/buspool programs by communities or by agencies such as radio stations and automobile clubs. These programs have had very little success, primarily because the matching problem involves both ends of the trips in addition to working hours and compatibility factors. The lack of offering any tangible incentives, other than community cost savings, has also had a limiting impact on success.

Such programs could be enhanced by orienting them about a focal point such that one end of the trip is common for the poolers much as it is in the Employment-Based programs. Examples might be pooling by residents of high density residential areas such as an apartment complex. Another example might be the members of a PTA where the school is the focal point and might function as a meeting point for "park and ride" or "kiss and ride" carpooling or buspooling.

To be successful, the program organization and management for the Home-Based program must be especially strong to make the program work in the absence of strong incentives of the type employers could offer. In some high density residential complexes, a self-service Locator Board System may work well, particularly if the complex has a common lobby or some other suitable common area. In other cases, a centralized matching technique with questionnaire may be required.

The delivery of the questionnaire by mail or by volunteers and the subsequent return by the same method would be appropriate. Once the matching is completed lists of possible carpool/buspool matches should be delivered to all respondents on the list. The people on each list should be encouraged to contact each other, preferably in some kind of social setting so that they can meet informally and discuss the actual organization at their carpool. A volunteer staff worker would be helpful in setting up a social affair and could act as an information source on how to organize.

The organization and management steps are essentially the same as those in the Employment-Based System except that the employer is replaced by a community leader working with a volunteer staff. Funding may be a problem, but the costs are not large and can be defrayed by the participants.

Manpower Requirements and Costs

With three different types of systems:

- Centralized Matching Techniques
- Locator Board Method
- Roster Technique

and two basic applications:

- Home-Based
- Employment-Based

It has not been feasible to develop definitive costs for each possible combination. However, these costs have been determined for two types of programs and are given below as examples.

The first was a Home-Based program implemented by the Town of Vienna, Virginia. This program requires matching at both ends of the trip. Its success has not been determined since there was no provision for follow-up with the participants to ascertain whether they formed lasting carpools as a result of the matching effort.

The Town of Vienna, Virginia, implemented a home-based carpool matching program which cost approximately \$450 for composing and printing 5,200 questionnaires (8.7¢ each) and \$325 in postage [\$225 for mailing out questions (4-1/3¢ each) and \$100 for returned responses (20% at 10¢ each)]. The Town's planner spent 10 days over a five-month period organizing and executing the program, while a local service organization provided 8 manday's of effort in the matching phase of the program. Since feedback to potential carpool members was limited in the Vienna program, the following costs and manpower requirements for the recommended home-based carpool program are somewhat higher than the Vienna program:

Direct Costs

Questionnaires

Printing	\$100 for 5,000 (2¢ each)
Mailing Costs (Direct Mail Permit)	\$200 for 5,000 (4-1/3¢ each)
Return Mail Costs	\$100 for 1,000 (10¢ each)

Carpool Lists

Paper	\$10 for 1,000 sheets
Postage	\$80 for 1,000 lists

Manpower Requirements

Program Coordinator	10-15 mandays over 3 months initially plus 1/2 manday per month for maintenance
Matching Personnel	10-15 mandays over 1-2 weeks

The second program was a hybrid Employment-Based System utilizing elements of the Centralized Matching Technique and the Locator Board Method. The system was applied to a plant with 400 to 500 employees.

In the employment-based techniques surveyed, the majority of the program coordinator's time was devoted to the supervision of the incentive program. The carpool/buspool locator systems were largely self-administering. However, those programs which received even minimal attention from the program coordinator were much more efficient than those which received no attention at all. The largest direct cost is the construction of the carpool/buspool locator board containing the urban area map and pigeonholes for completed questionnaires.

Direct Costs

Questionnaires

Printing	\$5 for 500 (1¢ each)
Map Tacks	\$30 for 500 (6¢ each)

Locator Board

Total Costs	\$250
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Manpower Requirements

Program Coordinator	8 mandays over 2 months initially, 1 manday per month for maintenance
Secretary	5 mandays over 2 months initially, 1 manday per month for maintenance
Matching Personnel (centralized method only)	5 mandays initially

Overcoming Carpool Problems

Even with the best intentions and administration of the program, problems will occur in the day-to-day operation of carpools. Some will be unavoidable -- emergency situations requiring either passenger or driver to leave before the close of day, illness, meetings away from the office, vehicle breakdowns, unexpected overtime requirements. Others can be avoidable -- incompatibility among members of carpool, chronically late drivers or passengers. Consideration should be given as to how these problems can be solved.

For unavoidable situations occurring during the work day which would leave passengers without a ride, some back-up system should be operating if convenient public transportation is not available. Passengers could be absorbed into other carpools for the occasion or have access to a company vehicle. Company vehicles might also be made available to the passenger who must leave during the day. Employers might also consider subsidizing the cost of a taxi on those occasions when passengers are without a ride. The same back-up systems could be employed when business demands require either passenger or driver to be away from the office during the work day or after normal business hours.

Whenever possible, potential conflicts in schedules should be avoided. Schedule meetings during the morning or early afternoon rather than as breakfast or late afternoon meetings. Give employees as much notice as possible of overtime or out-of-town travel requirements.

Hopefully, carpoolers will work out problems occurring within the pool by bringing it out into the open. However, if it appears they cannot work it out satisfactorily, they should have some recourse to a "higher authority," most likely an employer representative. In a highly successful program with many carpoolers, peer group pressure, applied in a variety of subtle and natural ways, is perhaps the single most important force in achieving cooperative, dependable behavior from the vast majority of participants. If a problem should persist, carpoolers should be encouraged to reorganize the carpool or join other existing carpools rather than dissolve the pool and return to being single commuters.

Incentives

For most commuters in the United States carpooling is not a way of life. They have been used to the freedom of automobile travel, the privacy it affords, and the independence to come and go as they please. Before the energy crisis, with threatened shortages and substantial price increases, the motivation to carpool was largely unplanned. Shortage of parking and high parking costs were outstanding reasons leading to high frequencies of carpooling. A few successful carpool programs, recognizing the importance of creating real motivations among commuters to carpool, engaged in planned programs of incentives to encourage carpooling.

The most powerful incentives arranged by employers have related to parking policies. Free parking to carpoolers where costs are high, reserved spaces or parking permit priorities for carpoolers where parking is scarce, and preferential parking space assignments for carpoolers in large lots where a close-in space is a real convenience have all been employed successfully. Employers have also given cash rebates to carpoolers and transit riders and in a few places company or agency owned vehicles have been made available to employees willing to pool it.

Even though the energy crisis brings with it powerful motivations for commuters who need to save scarce fuel and money, additional incentives offered by employers can smooth the transition to higher vehicle occupancy travel modes. Incentives also reward those who are willing to make the greatest contributions to the solution of the energy crisis.

Another report in this series, Incentives to Carpooling, presents an in-depth review of a full range of incentives -- many of which can be applied by an employer engaged in carpool matching.

CONCEPTS OF AUTOMATED MATCHING

The basic operations of an automated matching program are fairly simple compared to some other applications for which computers are used. The matching process requires neither higher math nor

sophisticated algorithms. Due to the potentially large files to be processed, however, care must be exercised in program logic and file design to ensure efficient operation. The problem is additionally complicated by the need to associate machine processable geographic location identifiers with both ends of each commuter's trip.

For purposes of this discussion carpool matching software may be considered as consisting of four basic modules--(1) file maintenance, (2) geographic identification, (3) matching and (4) reporting. All automated techniques perform these functions in some manner although not necessarily in this sequence nor are all functions necessarily fully automated.

File Maintenance

Entry of a given commuter into the automated matching system is carried out by establishing a record containing the user's name, trip end locations, telephone numbers and working hours. Other information such as an identification number, data for compatibility matching (e.g., age, sex, job status), travel pattern information (e.g., mode now used, desire to drive or ride, frequency of overtime work, etc.) or file maintenance data (e.g., entry date, date of last transaction) may also be included.

Typically this data record is created by keypunching from a form completed by the individual commuter. Other techniques such as mark-sense forms, optical scan or push-button telephone entry are also under investigation. One can envision a system similar to those used for airline reservations in which data entry is achieved by a phone call to an operator who enters the data via a Cathode Ray Tube (CRT) terminal and responds with a list of potential matches but no system with this level of sophistication is now available or likely in the near future.

After the initial entry of a given commuter's record into the system the file maintenance module functions are performed. These include edit checks on the data for both entry accuracy and logical consistency. The maintenance module should also enter records into the proper location on the file, depending, of course, on the organizational structure used, and keep track of other file structure information such as record pointers used in the system.

If a management decision is made to maintain the file in a current status over a long period of time the file maintenance module will

also serve to update records to account for changes. For example, the module should be able to delete those who wished to be dropped from the system and periodically report those for which no transactions have been reported for some time, say two years. Alternatively, this module would also handle those individuals who change their residence, place of work, etc. This latter feature is recommended in a semi-permanent system to avoid expansion of the file with unneeded data. If some type of monitoring system is established by Management to follow up on the success or failure of the carpool program the file maintenance module would also keep track of those who have formed pools and those who are still searching for use in later matches.

In summary, some level of file maintenance will be required even for the simplest systems. The degree of sophistication will depend on Management decisions related to program scope, duration and monitoring.

Geographic Identification

At the heart of carpool matching systems is the system for establishing matches of those with common (or close) geographic trip ends. Thus a technique for geographic identification is essential both for locating common points as well as for searching out trip end points which are near but not common.

The technique used in carpool software and most other applications requiring geographic identification is that of point coordinates. Thus the locations of each end of the commuter's trip are recorded as a pair of X-Y coordinates based on some common system uniform over the area of consideration. These coordinate measures need not be precise for matching purposes. Systems using X-Y grids with precision of one to two miles are being successfully used. There is really no basic difference between the "grid square" and the more precise coordinates techniques, except that use of the "grid square" or any other system of bounded areas, may result in missing nearby matches which are located across the boundary.

Much attention is being given to carpool software which includes use of the Census GBF/DIME files to assign coordinates based on origin and destination street address. This technique is limited to the area covered by the GBF/DIME system and requires maintenance of GBF/DIME files as a separate activity. However, the accuracy of coded addresses and the elimination of the need for special maps tend to offset these limitations in the metropolitan areas which have an up-to-date and usable geographic base file.

Another method is the manual coding of trip end coordinates by a trained staff. A small (3-6) trained central staff working from good sets of maps and directories could constitute the geographic identification element of the system. The speed of coding will depend on the precision of the coordinates or grid used in the system and the amount of self-coding performed by individual respondents.

Other geo-coding techniques can be described such as use of standardized maps upon which the user marks trip end locations without attempting coding. The proper coordinates can then be added either manually or using an inexpensive digitizer, thus increasing markedly the rate of coding. At any rate, one module of the matching system which may be either automated or manual and which may precede or follow data entry must deal with the problem of geographic identification.

Matching

Two basic types of matching are found in carpool software. The first type may be described as "one-end matching" in which one end of the trip, either origin or destination, is considered to be fixed for all respondents and only the other end need be searched. This is the basic structure of those programs which utilize complete file searches. This is appropriate for single employers or clusters of several employers.

The second type may be described as "two-end matching" in which no assumption of origin or destination commonality is made at the time of entry and the files must be properly ordered for efficient matching. The goal of the ordering is to reduce the file to groups of records with a common end point (or area) so that the "one-end technique" may be applied within the group. Two-end matching programs are more general, and more suitable for regional application. In concept and in application they are a simple extension of the "one-end programs" and, when implemented properly, should be less expensive to use than the "one-end" programs operated in series. This also eliminates the need for separate batches of data.

With large files such as those which will likely be found with "two-end match" applications the complete file search technique is obviously inefficient and more appropriate file storage and search algorithms must be implemented. Thus searches may be achieved with pointers rather than full records, greatly increasing search speeds.

The primary match criteria used is geographic location. To this other non-geographic criteria such as working hours may be added but these may be treated as subset searches once the set of records with common trip ends has been established.

With the use of less precise coordinate systems (e.g., grid squares) the question of "common" location is simplified since comparatively large groups will be associated with the same coordinates. When more precise systems are used fewer records will have the same coordinates approaching a limit uniqueness if absolute precision is achieved. Hence, those programs utilizing precise coordinates must implement a search routine to establish the "nearness" of other commuters' trip ends to the record under consideration. This is achieved through use of airline distance computation and typical rules are developed prescribing the order of origin and/or destination search, the direction of the search (i.e., circular, toward the destination, etc.), the maximum distance to be considered and the number of matches to be found before the search is ended.

An extension of the basic search techniques includes provision for along-the-route matching. This can be described in principal but its value for short-term implementation and efficient means for such a search are yet to be demonstrated.

After the basic set of geographic match records has been assembled and the other match criteria satisfied, the information is passed to the reporting module.

Reporting

The purpose of the reporting system is to inform commuters and public transportation services of groups of people with similar travel patterns. The type of reporting system to be used, the frequency of reports, and their content should be closely coordinated with the management of the pool.

The primary report, of course, is addressed to the individual commuter and carries information on the potential poolmates and methods of contact. The scope of this report deserves some consideration since a balance must be drawn between confidentiality and information useful to potential poolmates. At a minimum the list must contain the name, contact phone number at home and work location, and working hours of those to be contacted. More extensive information such as residence, home phone, and compatibility measures make it easier to evaluate and contact potential mates.

Other information which could be included on this report include legal caveats to protect the matching agency and further user information such as the phone numbers of transit or taxi agencies, locations of park-and-ride lots or transit route information for the user's particular area. Of particular concern is the need to locate backup carpools or taxi-pool services in case of unusual circumstances or flexible working hours. These latter elements might involve addition of another module tailored to each individual metropolitan area.

Finally a set of reports must be considered for use by public transportation agencies and those maintaining the files. These reports include simple lists of all those in the file prepared in differing sorts (e. g., alphabetical, origin area, destination area, time, etc.) and sort combinations. Pictorial displays, such as the destination specific density grid maps produced by the FHWA and the Metropolitan Washington COG matching program are most helpful in the planning of higher occupancy services, such as vanpools and buspools. Vanpool, transit and taxi backup service data indicating which larger groups are to be found are also necessary with other reporting needs becoming evident as experience in system use grows.

AUTOMATED MATCHING SOFTWARE

Available Programs

Over the past two years many groups have developed programs for automated carpool matching. These efforts have been largely uncoordinated with each group developing programs tailored for their specific situation, computer system, etc. Generally the programs have been applied only by the developers so that documentation for other potential users has been lacking.

With the introduction of carpool action as a nationwide program, resources can be saved by making use of previously developed software as opposed to continued new development of carpool matching software in each metropolitan area. To do this the best of the existing programs must be evaluated in terms of user needs and be documented for widespread use.

The discussion and tables which follow present factual data relating to the most applicable existing software and recommendations on those which should be considered by potential users.

Tables 1 and 2 present summaries of the operating characteristics of each major software system including such items as programming language, host computer, size of group which may be treated, etc. Additional details on each, including the name of the contact person, are presented in Appendix A.

Program Selection

Clearly none of the candidate software systems is the "best" for all applications. Although their primary use has been with single employer applications, the FHWA and CENSUS systems were designed for use in areawide applications. The rest were designed with only a single employer in mind; however, the Burroughs system could be used as a multiple employer system.

The individual administrator of each carpool matching program must make his own decision as to which system is appropriate to his application.

In a decentralized system, where the data processing will be accomplished at multiple computer facilities within a metropolitan area, software compatibility, transportability and maintainability is probably more important than the throughput speed. This is particularly true of the initial release of the candidate software, assuming that significant increases in speed can be accomplished by polishing the original code. From the point of view of having to maintain the software throughout the country this is particularly true.

In a centralized system, where only one computer is to be used and the data bases are assumed to be very large, running time and core requirements are extremely important. Initially, however, the metropolitan data base may be small and most likely the processing will be done in batches for individual employers or groups of employers. Thus, circumventing this problem to a degree, this initial build-up period will also allow time for subsequent program enhancements to solve many of the size related problems known to exist in the candidate (region-wide) software.

A thorough analysis of the data capture and subsequent matching and reporting aspects of the problem should result in an input form containing all relevant information in the correct format. Thus, at any stage of software development the input data will always be valid -- independent of the version of the software being executed at a particular

TABLE 1. STATUS AND SYSTEM SUMMARY

Organization	Language	Host Computer	Core Required	Disk/Tape	Time* Matches	Documentation
FHWA	ANSI COBOL	IBM	122K	1/0	<u>29 min.</u> 2100	Users Guide Program Documentation Sample run
Census	COBOL PL/1 FORTRAN, ALC	IBM 360	110K	0/3	<u>40 min.</u> 5000	Users Guide No sample runs No listing
AAT-Detroit	FORTRAN IV	IBM 370/ 168	Time Sharing	1/0	--	Not available at this time
Operation Energy	ANSI COBOL	Burroughs 4700	Small	1/0	<u>37.4 min.</u> 750	Users Guide Sample run Documented listing
UCLA	FORTRAN IV	IBM 360/ 65	Varies with pool size	0/0	--	Users Guide
Washington COG	COBOL	IBM 360/ --	100K	3/3	<u>17 min.</u> 1300	Program Listing Sample run
Denver-GWHS	FORTRAN V	UNIVAC 1106/1108	Time Sharing	0/0	<u>5 min.</u> 2000	Program Listing only
Connecticut Com- puter Program	ANSI FORTRAN	UNIVAC 1108	32K (Words)	-/-	--	Very limited
WBZ/ALA	RPG	IBM 360/20	20K	0/0	--	Users Guide

-- Unknown or missing information

* These data are not necessarily comparable

TABLE 2 - CAPABILITIES SUMMARY

Organization	Geocoding	Matching		Reporting			Maintenance
		Geographic	Compatibility	Master List	Master List	Van or Buspool	
FHWA	49 x 49 bi-level grid	Many-to-one, Grid cluster* at O	Time	All or Nothing	All or nothing	Yes	Reformat of files required for adds, deletes and changes
Census	Address match to census tracts	Many-to-one, Tract cluster at O	Time and driver/pass.	All or nothing	All or nothing	No	None furnished
AAT-Detroit	Machine read X-Y coordinates	Many-to-one, Coordinate cluster at O	--	Yes	Yes	Yes	--
Operation Energy	99 x 99 grid 99 work sites	Many-to-one, Cluster at O	Time	Selected	Selected	Yes	Complete
UCLA	Looked-up box-and-page	Many-to-one, Clusters of box and page	Time	Selected	Selected	Yes	Clumsy
Washington COG	50 x 50 grid	Many-to-one, Grid cluster at O	Time and driver/pass.	All or nothing	All or nothing	Yes	--
Denver GWHS	Scaled X-Y coordinates	Many-to-one, Coordinate cluster at O	None	All or nothing	All or nothing	None furnished	Complete
Connecticut Commuter Program	Hand coded to traffic zones	Many-to-one, Match for O-Zone and D-Zone	Time	Yes	Form letter	None	Manually (sort utility required)
WBZ/ALA	ZIP codes	Many-to-one	Time Rider/driver	Yes	Form letter	None	Deletes and adds required for changes

-- indicates missing information O = origin end of trip D = destination end
 * Cluster - Group of neighboring grids, zones, etc., containing possible poolmates.

pooling operation. This input data should also be compatible with manual techniques implemented in the area. This means that extensive changes in the software can be made, transparent to the user of the system, to enhance the running time, reduce the core requirements and increase analysis capability.

The selection by any given employer, agency or metropolitan area of specific carpool software for their use will depend on the level of resources committed to the project, the computer equipment available and the degree of coordination desired. It is suggested that all groups and agencies in a given metropolitan area adopt the same program or at least a common data format. This will permit later merging of separate files by a centralized metropolitan agency. It will also permit local interchange of talent for program modification and application as well as backup computer services.

At this time the program most suited for general application is that provided by the Federal Highway Administration (FHWA). It may be run either by individual users or by a metropolitan agency. It is comparatively well documented with a rapidly growing base of user experience. The reports, while voluminous in some elements, provide data for buspools and vanpools as well as carpools. It is programmed in COBOL and while initially implemented on IBM equipment has been successfully converted to other machines. Data collection is simple and suited for manual coding either by the respondent or a central staff.

Users with Burroughs equipment may wish to consider the proprietary package available at no cost from the Burroughs Corporation. It appears to be both well designed and well documented. The ability to handle up to 99 destination areas makes it well suited to use by large individual employers or groups of individual employers. Users with other hardware should also consider this system if they have a trained software staff and are willing to make a moderate investment in a conversion effort.

The program distributed by the Census Bureau requires extensive use of independent IBM software. It is most suitable for application by metropolitan agencies having both a knowledgeable software staff and an up-to-date geographic base file (GBF/DIME).

The program developed by George Washington High School in Denver has been well received by those who have used it. It is suitable only for individual application and its widespread use is limited by the lack of documentation and the unavailability of a full-time support staff.

In summary it appears that it will not be necessary for most users to develop their own software except in very unique situations. Sufficient work has been done and is underway that existing programs will suffice for almost all users. The FHWA program and files, as it now exists and with planned enhancements, will suit the needs of most users and provide a standard base for longer-term developments. Detailed instructions on the use of this program are available from FHWA.

CONCLUSIONS

Carpool matching can be carried out effectively through a variety of means -- both computer based and manual. Generally speaking, the manual methods should be considered for smaller group sizes, for example ones with fewer than 500 or so potential carpoolers.

Well designed maps are crucial to the success of a carpool matching program. Ideally, the agency coordinating carpool activities in an urban area should develop a standard map for all users. This should be given top priority scheduling so that others can move ahead quickly with their matching processes. The grid system and the questionnaire should also be standardized for an urban area at the earliest possible time so that companies engaged in carpool matching can share data with each other and with the coordinating agency. One especially useful role of the coordinating agency is in the analysis of travel demand concentrations warranting buspool service.

The greatest chance for success in carpool/buspool matching is in its application by employers for the benefit of its employees. Home-based matching activities have met with little success in the past. Such an activity could be enhanced if applied to a high density apartment complex or oriented around some other neighborhood focal point, such as a school or a church, where one end of all trips can be thought of as a single point as is the case in employment-based matching.

Based on an examination of the carpooling programs that are exhibiting some signs of success and the analysis completed in developing this handbook, a number of ingredients to a successful program have been identified. These include:

- The commitment and active support of top management in employer-based programs and of top public officials or dedicated volunteers in home-based programs
- The maximum involvement of the members of the potential user groups so that it becomes "their program"

- The provision of tangible special incentives for carpools, such as parking subsidies, preferred parking, or the use or company-owned vehicles
- A commitment to a continuing program with periodic updates instead of a "one-shot" program
- The development of procedures to encourage positive feedback to carpools in the form of newsletters, display posters, mass media publicity, etc. along with continuous program
- A sufficient amount of promotion and program information to insure that potential carpools are aware of the program, its advantages, and how to use it

While attention to these essential ingredients will not guarantee success in every carpooling/buspooling program, experience indicates that the chance of success without such attention is remote.

APPENDIX A

DESCRIPTION OF SELECTED CARPOOL COMPUTER PROGRAMS

INTRODUCTION

Development of computer programs to carry out automated matching has been underway for about two years by such groups as FHWA in Washington, D. C., and Operation Oxygen in Los Angeles. These efforts have been comparatively well publicized. Other organizations and companies have developed programs for local use but have not attempted to make them widely available. With the energy crisis still more groups have begun to develop and implement matching software.

The result of this widespread activity is that the agency or firm wishing to implement an automated carpool program is faced with the problem of developing a new program or selecting the proper existing software for their particular situation and computer equipment. While some attempt has been made to record the existing software activities there has been no readily available source from which the user may review the capabilities, availability and limitations of the many programs. This has led to duplication of effort and wasted resources.

This review attempts to fill this gap. The inventory included in this review represents the status of carpool software as of January 1, 1974. It discusses the range of applicability of the various programs, the status and scope of program documentation, the extent to which each program has been used, the language in which each is written, the computer facilities required, an estimate of program run-times, and the types of reports produced. In addition, the name of a contact individual is given so that more detailed and current information may be obtained if desired.

DESCRIPTIVE PARAMETERS

While all the carpool matching software performs basically the same function, the techniques for performing carpool matching are sometimes quite unique. In order to standardize the cataloging of the software the data concerning each program is grouped into five categories: software status, capability summary, documentation, system management, and limitations. Some of these categories are in turn subdivided into various subtopics where appropriate. In addition to these categories the name, address and phone number of a primary contact are included.

The status category is intended to convey the current status of the software; that is, the language used, the hardware, the extent of utilization, the degree of development and so forth. This gives an indication of whether or not a particular piece of software can be implemented on a particular machine and the chances of successful implementation.

The capabilities summary addresses the task of describing what the software does and how it does it. This includes specific descriptions of the geo-coding technique, the matching techniques, the reports generated and the file maintenance capability. The intent here is to describe the techniques used and not pass judgement as to their suitability. It should be noted that some of these techniques were originally developed to serve specific user requirements and have been successfully implemented to serve this purpose but otherwise may not have broad appeal.

The documentation section describes the status of the current documentation. This was difficult to assess since in many cases the actual documentation was not in hand at the time of evaluation; therefore, the existence or non-existence of the documentation was sometimes all the information available. It seems clear that "adequate" documentation means different things to different people and that this area in general has been neglected by the system developers.

The system management category aims at giving an impression of how the current version of the program has been implemented, where it was implemented and who is doing the work. In many cases the "glowing reports of success" are difficult to assess because of the lack of any real data in this regard. In short, what works in one set of circumstances may not work in another.

Finally, the limitations section attempts to describe the weakness of the system with respect to itself and not other systems. This is not an attempt to assess any technique of carpool matching itself but to describe weaknesses within the individual system. For example, the UCLA system results in an excessive amount of card handling which could have been circumvented to a large extent by using tape or disk instead of unit record equipment.

RESULTS

During the data collection phase of this effort many identifiable developers of carpooling software and other informed persons were

contacted. There have been some duplications of effort as not a few organizations have developed or are currently developing their own software. Since most of these individual efforts are unique to a particular situation they do not have broad enough appeal to be considered as candidates for wide distribution. There are, however, some rather unique ongoing efforts that deserve to be singled out for closer examination because of a strong capability in one or more areas. These programs are operational in one or more installations.

As a final note the carpool matching software described in the following writeups represent the current state-of-the-art as of January 1, 1974. Because of the tremendous interest in carpooling software and the large number of efforts underway new techniques and implementable software will become available in the near future. For that reason the following tables and writeups have been designed in expandable format to accommodate the new software as it becomes available.

DISCLAIMER

The software review presented in this report is based on information gathered and interpreted by Alan M. Voorhees & Associates. While every effort has been made to correctly portray the requirements, capabilities and limitations of each system errors of fact or interpretation may be present, especially due to the short time available to gather information and the rapidly changing status of some programs.

The judgments expressed are solely those of Alan M. Voorhees & Associates and do not necessarily represent the views of the Department of Transportation, the Urban Mass Transportation Administration or the Federal Highway Administration.

PROGRAM DESCRIPTIONS

Organization/Name FHWA/Carpool Matching Program

Contact Bob Redmond
Federal Highway Administration
Urban Planning Division
Washington, D. C.
Phone: (202) 426-0210

Software Status

Inquiry Date:	12/28/73
First Used:	August 1972
Current Version:	1973
Installed at:	Over 125 locations (distributed by Federal Highway Administration)
Language:	(ANSI) COBOL
Computer:	IBM 360/65 (presently running on Burroughs 6700, UNIVAC 1106 and others)
Core Required:	122K bytes
Disk Required:	Random Access
Time Required:	29 minutes
Test Case:	2100 matches

Capability Summary

Geocoding--Uses a system of grid squares for the participant to identify his home and work grid, but only allows a 49 by 49 grid square.

Matching--The program will match participants within specified working time ranges and home and work grid squares. Matching at the home end will include adjacent surrounding grid squares if a participant has less than 8 matches residing in his home grid. The program is capable of handling multiple destinations.

Reporting--A master list--for each work grid the program will print all carpoolers having this common work cell and information pertaining to the participant. A mail list is produced for the above master list sorted by home grid cell and arrival and departure times. A request list produces "along the route" matches for selected participants within specified working time ranges and with a common work grid cell. A grid density matrix is printed representing the number of participants residing in each home grid with a common work grid and reporting or departure time for potential van- and buspools.

File Maintenance--Updating of master file for additions, changes, and deletions is available. You can also get a request list for selected participants without update but the requestor is not added to the data base.

Documentation

Full documentation is available for both user and program.

System Management

Some people have had success with the program, and others, because of their particular situation, have gone to other programs and/or have written their own programs. This mainly concerns the verbose report generation and the lack of detail in the 49 x 49 grid.

Limitations

The FHWA carpool program is written in ANSI COBOL but people using UNIVAC and Burroughs hardware have had considerable difficulty in converting the program to their system. The program generates a considerable amount of extraneous data that is never used or is too cumbersome to handle. The program is limited to a 49 by 49 matrix and is limited when the region size is large. The mail list option could be improved upon for easier reading and handling. The COBOL code could be simplified and better documentation introduced within the program.

Some of these limitations have been circumvented by various users:

1. The University of Tennessee has implemented a 100 x 100 grid system
2. The City of Los Angeles has reduced the volume of the printouts and is looking at making some of them optional
3. Utah has implemented the program on a Honeywell computer

Organization/Name Department of Commerce
Bureau of the Census/Census CARPOOL

Contact Ron Crellin
Bureau of the Census
Washington, D. C.
Phone: (301) 763-7533

Software Status Inquiry Date: 1/3/74
First Used: 1973
Current Version: 1973
Installed at: Los Angeles County Board
of Supervisors
Language: FORTRAN
Computer: IBM 360/65
Core Required: 110K
Tape Required: 2
Disk Required: --
Time Required: 40 minutes
Test Case: 5000 matches

Capability Summary

Geo-coding -- The program assumes that participant addresses contain census tract or other geographic areal code. A separate system, ADMATCH, is available to accomplish this coding using a DIME/GBF reference file. The center-point coordinates of all census tracts are placed in a Center-Point File.

Matching -- The many-to-one, location/time (or other areal codes) matching of candidates for each census tract is determined from the Candidate File and the Center-Point File. If the minimum number of candidates (an input parameter) falls within any census tract it is placed in the Domain File; if not, the surrounding tracts are combined with the original tract until the minimum number is reached. This cluster of tracts is then added to the Domain File. This Domain File contains matched sets of domain numbers and census tracts. Third, the Domain File is matched to the tracts in the Candidate File to form a Candidate Domain File by assigning domain numbers to each candidate in the file. Finally, on a domain-by-domain basis, a series of non-geographic matches (e. g., temporal) are isolated and the results written on the Matched Candidate File.

Reporting -- The Matched Candidate File is then sorted in the desired order (e.g., by division) and matched pools are listed individually. Master lists may be printed using a utility program.

File Maintenance -- The documentation states that each user is expected to develop his own file maintenance programs; otherwise, use manual techniques.

Documentation

User Documentation -- The user documentation is complete except that no sample deck-setups are provided to illustrate the use of the utility programs and required JCL. A process flowchart and sample card formats are provided.

Program Documentation -- The extent of the program documentation is unknown but listings of the source code can be made available.

System Management

The current version of this system has been implemented at the Los Angeles County Board of Supervisors. Although no operational listing is available from the documentation the system seems complex.

Limitations

An up-to-date DIME/GBF file is necessary for any area that wants to use the automatic address coding aspect of the program. No edit check is made of the data cards entering the program. Manual updating of the program is required since no file maintenance program is available with the program. There is a reliance upon utility routines.

Organization/Name American Academy of Transportation/AAT Detroit

Contact Herbert Norder, President
American Academy of Transportation
2222 Fuller Road
Ann Arbor, Michigan 48105
Phone: (313) 665-0625

Software Status Inquiry Date: 1/3/74
First Used: 1972
Current Version: 1973
Installed at: Ford Motor Company-Detroit
Language: FORTRAN
Computer: IBM 330/168
Core Required: Time shared
Tapes Required: --
Disk Required: --
Time Required: --
Test Case: --

Capability Summary

Geocoding -- This system uses a coordinate based system to geo-code home and work locations. The coordinates are measured from a set of gridded maps, developed by AAT for the Detroit region, by trained personnel using a coordinate digitizer. At one point AAT considered ZIP codes, but rejected this technique as ineffective. AAT also feels, based upon the observed error rates they have experienced, that geocoding should be done by trained personnel and not by the carpoolers themselves.

Matching -- The AAT system is capable of affecting many-to-one matches in two ways: by identifying clusters of potential bus- and vanpoolers along the route to a common work site and by identifying clusters of carpoolers. The first is done by inspection of plotted (by computer) origin clusters. The second is done by forming and reporting clusters of potential poolmates for each person desiring carpool matching information. The size of the cluster is based upon the estimated maximum tolerable deviation from a direct path to the destination. This deviation, which determines the size of the cluster, is calculated as a preset (can be input) fraction of the air-line distance between the origin and destination.

Reporting -- Three types of reports are available: an alphabetical master list, the results of a carpool match request, and plotted output for buspool and vanpool matching.

File Maintenance -- The file maintenance capabilities are unknown.

Documentation

User Documentation -- The status and availability of user documentation is unknown.

Programmer Documentation -- The status and availability of programmer documentation is unknown.

System Management

The current AAT software has been selected for implementation at all of the Ford plants in the Detroit region and seems well suited for this type of application. The personnel office at each of the plants is responsible for gathering the geographic data and maintaining it with the usual personnel records.

Limitations

There is not enough data to assess the limitations from an operations standpoint. It appears from the data available that it would be difficult to implement the system on a small machine.

Organization/Name Operation Energy

Contact Thomas Grier
Coordinator, Operation Energy
Burroughs Place
Detroit, Michigan 48232
Phone: (313) 972-7000

Software Status Inquiry Date: 1/3/74
First Used: Dec. 1973
Current Version: 1973
Installed at: Detroit, Michigan
(distributed by Burroughs
Corp. as a public service)
Language: (ANSI) COBOL
Computer: B4700 (smallest) otherwise
any machine with ANSI
COBOL compiler, e.g.,
IBM 360/30
Core Required: "small" (20,000 bytes)
Tapes Required: 0
Disk Required: 1
Time Required: 37.4 min. for 750 people (up
to 18 matches each) on 4700
Test Case: 750 matches

Capability Summary

Geocoding -- Uses a system of grid squares similar to the FHWA program, but allows a 99 by 99 grid. Assumes that the users are able to locate and code their own grid correctly.

Matching -- This system performs a many-to-one match for up to 99 destinations; destination end search is not made. The origin cluster is formed as follows: (1) candidate's home grid; (2) if required, adjacent grids--first toward the destination; last, away from the destination until at least n (n is an input parameter) possible matches are found. This technique, called vectoring, could be extended into enroute matching analysis.

Reports -- "Vectored" lists of candidates for all inquiries excluding secured (optional by user) information such as home address and home phone. Master lists are by destination zone only for security. Matched lists are output in sort by department and in alphabetic sort within department.

File Maintenance -- This system will perform additions, deletions, and changes. New printouts reflect only those employees affected by the updates to reduce the file maintenance effort. Buspool data can be obtained from dumps of the master list by grid.

Documentation

Users Documentation -- The users documentation which is contained in a Management Guidelines report and in the programmers documentation is sufficient for an experienced programmer to implement the system.

Programmers Documentation -- The programmers documentation is sparse (no flow chart) but a detailed and well documented listing is included.

System Management

The system is especially tailored for the large employer with several work sites and a well defined organizational structure.

Limitations

For the purpose the program is expected to serve, the system is quite complete. The vanpool and buspool data capabilities could be expanded as an extension of the obvious enroute matching capabilities.

Organization/Name UCLA

Contact Robert Kibrick
4819 Andasol Avenue
Encino, California 91316
Phone: (213) 784-9688

Software Status Inquiry Date: 1/3/74
First Used:
Current Version: 1973
Installed at: UCLA and University of
Pittsburgh
Language: FORTRAN IV (G or H)
Computer: IBM 360/65
Core Required: Varies with data base
Tapes Required: None
Disk Required: None
Time Required --
Test Case: "Has handled several thousand"

Capability Summary

Geocoding -- The user specifies his street address, city and ZIP code. Trained staff then look the address up in the Thomas Brother's Street Atlases of Los Angeles, Orange and Ventura Counties. The "page and box" number indicated by the Atlas becomes the coordinate which is then coded in the requestor's card.

Matching -- Depending upon the size of the match list to be provided, all candidates in contiguous "page-and-boxes" are grouped into potential pools for each requestor.

Reports -- Full or partial lists of the master list may be produced as well as a well-developed individual match report. Statistical information as to sex and size of pools, and density maps are produced for analysis purposes.

File Maintenance -- The file maintenance routine is a simple update system requiring the in-core merging of two card decks to produce a third sum.

Documentation

User Documentation -- The user documentation from all reports is adequate since the system has been installed at several universities by the developer.

Programmer Documentation -- We assume that the program documentation is sparse since this appears to have been a student project without much outside financial support.

System Management

Trained staff conduct surveys, coding of coordinates, keypunching and the execution of programs. The staff is usually trained students of universities.

Limitations

The author states that the coordinate matching routine is unique to the Los Angeles area but is easy to fix as it was altered for the Pittsburgh area with no problem. If the user's documentation is not giving the wrong impression the use of the system in an efficient manner requires considerable card handling.

Organization/Name Washington COG/Carpool Program

Contact Jack Barrett
Washington Council of Governments
1225 Connecticut Avenue, N.W.
Washington, D.C. 20036
Phone: (202) 223-6800 x 248

Software Status Inquiry Date: 1/3/74
First Used: August 1973
Current Version: 1973
Installed at: Washington Council of
Governments
Language: COBOL
Utility Sorts
Computer: IBM 370/158
Core Required: Approximately 100K
Tape Required: Several
Disk Required: Presently disk sort (no-
random access needed)
Computer Time: Extremely fast
Test Case: 1300 people-80 seconds

Capability Summary

Geocoding -- Requires DIME reference file for recoding of address to grid coordinate.

Matching -- The many-to-one, location/time matching of candidate poolers requires several data sets and computer runs. Documentation for the system of programs is presently being implemented at Washington COG.

Reporting -- Several reports are generated such as master lists and mailing lists for driver/driver and driver/rider participants.

File Maintenance -- The system has full capability of updating (adding, deleting and changing) any carpooler in the system. Also, file maintenance is required for all DIME reference files.

Documentation

User Documentation -- In preparation

Program Documentation -- Insufficient

System Management

Requires someone with a fair knowledge of systems to initial carpooling program.

Limitations

Requires several utility sort routines. Several programs and sorts are required but little system documentation is available at this time. Requires DIME reference files which will put constraints on who will use the system.

Organization/Name Denver GWHS/Carpool Program

Contact Mark Frank or Dr. Irving Hoffman
George Washington High School
Denver, Colorado
Phone: (303) 399-2214

Software Status Inquiry Date: 12/20/73
First Used: 1973
Current Version: 1/74
Installed at: George Washington High School
Language: FORTRAN
Computer: UNIVAC 1106 (Time Sharing)
Core Required: 32K words/2000 people
Tapes Required: None
Disk Required: Program Residence
Time Required: 1 second per match
Test Case: Civic & Corporation Groups

Capability Summary

Geocoding -- The home end of the participant is coded in X-Y coordinates by trained personnel. Coordinates were coded from maps supplied by the telephone companies. Coding techniques were applied in tenths of a mile.

Matching -- It is presently being modified to run in a batch or remote/batch environment. It will carpool selected or all users of the system. The search technique is applied as follows:

1. Reads and sorts all data in core
2. Searches for all possible destinations in increments of one-tenth of a mile until it finds four matches (2-mile maximum)
3. If it cannot find four possible riders it will go into a "radar search" where it will search in one degree increments up to five degrees all people along the path to the point of destination
4. It then prints all selected carpoolers

File Maintenance -- The program itself is in continuous update mode. It will allow the user to change, delete or add users into the system in a conversational mode (timesharing).

Reports -- Will list master file and report findings of all matches for participants.

Documentation

None

System Management

The procedure for implementing the GWHS program was unique, inexpensive and extremely easy to implement. After the program was implemented in the G.W. High School, several organizations contacted the high school requesting the program and consultation. Two students were assigned to each organization to talk to the administrators and train the secretaries to code employees' addresses, phone numbers, working hours, etc. Within two hours after contacting the organizations, the coding of all potential carpoolers was implemented. After coding the forms, the students picked up the forms and proceeded to code in XY coordinate using Bell Telephone grid maps. By sorting the forms by ZIP code first, then coding the XY coordinates in the forms, they were able to code 1000 XY coordinates/day. They keypunched the forms, processed the cards and gave back to the corporations carpool matches with a cover letter to all employees. All computer time and student time was free of charge.

Limitations

The GWHS has no program or user documentation; however, the program contains only 274 source statements and could easily be documented. The search technique is an exhaustive one -- that is, it searches all possibilities until it finds four riders. This would constrain the number of employees one could put into a system. The program has a fixed destination end but could easily be modified to match multiple destination ends. There are some shortcomings in the "radar search" technique used in the program if the rider toward the destination wanted to be a driver also.

Organization/Name Connecticut Commuter Program

Contact Mrs. Lucille Fox (Phone 203/556-4520)
Charles J. Gudaitis, P.E. (Phone 203/566-2414)
17 Van Dyke Avenue
Hartford, Connecticut

Software Status Inquiry Date: 12/28/73
First Used: 1973
Current Version: 1973
Installed at: Connecticut Department of
Transportation
Language: ANSI FORTRAN
Computer: UNIVAC 1106
Core Required: Small Amount
Tapes Required:
Disk Required:
Run Time: Fast

Capability Summary

Geocoding -- The geographic coding is based on statewide traffic zones which consist of very large zones (townships, boroughs, cities, etc.) surrounding the metropolitan area.

Matching -- Processing the data for computer runs and distributing to employees is as follows:

1. Questionnaires are distributed to employees at the same time promotional efforts are initiated
2. Coding procedures are applied to identify the town of origin, location of employment, working hours, existing mode of transportation and cocer's unique number
3. Data is sorted onto a master file and edited for errors
4. Errors are corrected and updated master file is created
5. The master file is sorted and matched for origin, destination and time of day and a page of printed output is generated for each employee in the form of a letter
6. The letter is distributed to each employee

Reporting -- A master list may be reported and output of matches is in the form of a letter.

System Management

The program has been run successfully several times using data in the Willersfield and Hartford area. The management of the entire operation was conducted by Connecticut DOT.

Limitations

Program and user documentation is very limited and not explicit. The program has an updating process if corrections or more people are added to the data base file. However, if new people are added to the master file the data base must be sorted again and so on through the entire process of matching all people rather than matching a selected few. The system data base file contains 200 characters per record for each person and is maintained throughout the entire matching process. This generates an excessive amount of I/O time. Because the zones are on a very large scale, perhaps the program could be used for "park and ride" bus- or vanpool service as opposed to carpooling. There is a large amount of coding involved when processing employees.

Organization/Name WBZ/ALA Commuter Computer Clubcar Campaign

Contact Jerry Wishnow
WBZ Radio Station
Boston, Massachusetts
Phone: (617) 254-5670

Software Status Inquiry Date: 1/10/74
First Used: 1973
Current Version: 1973
Installed at: ALA Travel Club
Language: RPG
Computer: IBM 360/20
Core Required: 20K bytes
Tapes Required:
Disk Required:
Time Required:
Test Case: Boston area; 10,000
participants

Capability Summary

Geocoding -- The program uses ZIP codes for the home end of the trip and there are 85 possible "desired" destinations.

Matching -- The program will match people with plus or minus thirty minutes arrival and departure times about the destination end. Participants may choose to be a driver only, rider only, or driver/rider. The average matching is about four people per participant.

Reporting -- All participants in the master file are listed periodically. All matching are in a letter form.

File Maintenance -- Programs have complete updating process. Changes are made by deleting old records and adding new ones to the master file.

Documentation

User Documentation -- Complete

Program Documentation -- Unknown

System Management

The commuter club is promoted by WBZ radio station and keypunched and executed on the ALA Travel Club computer.

Limitations

ZIP codes are very large and irregular zones. Report Generator Program is vendor specific language.

TABLE A. OTHER CARPOOL SOFTWARE DEVELOPMENT EFFORT AND USERS

<u>Organization</u>	<u>Contact/Date</u>	<u>Computer/ Program Status</u>	<u>Remarks</u>
Michigan DOT Lansing, Michigan	Larry Britton (517) 373-2316 12/28/73	Burroughs/5700 Development	Developing their own program. Many-to-one match. Uses grid squares.
New York State Dept. of Transportation Albany, N.Y. 12226	Fred Genero (518) 474-8232	Burroughs/5700 Completed	Modified FHWA program. Developed sort to list utility programs.
American Automotive Association Philadelphia, Penna.	Bertrand Clotheir (215) 864-5000 12/28/73	IBM 360/40 (128K) Not Finished	Developing own programs on many-to-many match.
Management Informa- tion Systems Penn. DOT Harrisburg, Penna.	Terry Mosser (717) 787-3307 12/28/73	Burroughs/6700 Completed	Running FHWA programs. No modifications. Also wrote own programs.
University of Tennessee Knoxville, Tenn.	Tom Bennett (615) 974-5311 12/28/73	UNIVAC 1106/ Completed	Made several changes to FHWA programs.
Dept. of Traffic City of Los Angeles Los Angeles, Calif.	Ed Rowe (213) 485-2788 12/28/73	IBM 360	Modified FHWA programs.

Table A. - Continued

<u>Organization</u>	<u>Contact/Date</u>	<u>Computer/ Program Status</u>	<u>Remarks</u>
Northern Virginia Transportation Commission		Wash. COG's Computer	Served as test case for COG's areawide program. Test results unknown.
Aerojet* # Los Angeles	I. Doshey 12/28/73	IBM 360, 300K FORTRAN	Uses grid system, matched pool listing, vanpool data, space documentation
Automatic Data* # Processing (Los Angeles)	B. Shaw 12/28/73	IBM 360, 64K COBOL 1, 000 matches	Uses grid for destination, ZIP for origin, matched pool listing, sparse documentation
CALTRANS*	J. Kenen (213) 620-4815 12/28/73	IBM 360, 60K FORTRAN	Uses coordinates for matching, matched pool listings, sparse documentation
COMPUTRANSIT*#	B. Goldstine (213) 922-3998 12/28/73	IBM 360, 128K PL/1 2, 000 matches	Uses grid system, matched pool listings, sparse documentation
Operation Oxygen*	J. Novack (213) 351-3551 12/28/73	Burroughs, 24K COBOL 1, 000 matches	Uses grid system, matched pool listing, sparse documentation
U.S. Bureau of Standards, Md.	Judy Gilsinn (301) 921-3481 12/28/73	Univac 1108 FORTRAN	Uses coordinates, matched pool listings, sparse documentation

Table A. -Continued

<u>Organization</u>	<u>Contact/Date</u>	<u>Computer/ Program Status</u>	<u>Remarks</u>
AUTO*MATES, Inc. Detroit, Michigan#	Glen Wetherington (313) 756-7998 1/3/74	IBM OS Completed	Uses grid coordinates. Many-to-one match. Matches on time interval. Also searches toward destination.
ECCO Omaha Jaycees	Bill Woodham (402) 348-4905 1/3/74	IBM OS	Uses grid system, matched pool listings, documentation complete

*Data obtained from an evaluation performed for the Automobile Club of Southern California by Suzanne C. Miller of The Aerospace Corporation.
Proprietary Product

APPENDIX B

EXISTING APPLICATIONS OF MANUAL MATCHING METHODS

Hallmark Card Company

This is an example of a fairly large corporation which used a centralized manual matching method to get a carpool program working. In 1973 Hallmark Card Company experienced a parking supply problem that management felt could be solved with a carpooling program. A survey was conducted of Hallmark's 4,500 employees on all of three shifts, of which approximately 2,500 workers responded. On the questionnaire, employees indicated their desire to carpool, their telephone numbers, and their addresses including zip code. To insure employee confidence, a long-term trusted employee was assigned to handle the returns, perform the manual matching and solve problems in the program.

The matching process was quite time consuming, as one employee spent nearly 100 percent of his time for more than two months in performing the matching process and sending lists of names to potential carpoolers. Since the questionnaire asked only for address and zip code, it was often necessary to use detailed street maps to locate the employee's residences as the zip code boundaries covered large areas (many square miles) in many instances.

One unique feature of the Hallmark system was the use of a piece of 8½" x 11" double thickness paperboard sheets which contained ten slots capable of holding the questionnaires. The response from the potential carpoolers were placed in these slots so that only the names and work telephone numbers of the respondents were showing. These were then photo-copied and distributed to potential carpool members. This centralized manual matching process resulted in a substantial expansion of carpools which alleviated the parking shortage. As an incentive, a reserved parking space was provided for each carpool. The program has resulted in approximately 300 officially registered carpools, each with a minimum of three persons per vehicle. In other words, roughly one-quarter of the employees are officially registered as carpoolers.

The fact that Hallmark is now converting to a computer-based system suggests that a manual matching method may not be a feasible method for an organization of this size.

Pentagon Locator Board

The Pentagon Building in Washington, D. C. area utilizes a self-service Locator Board approach. The Locator Board is situated in the Mall area of the building, a high traffic area with shops and other attractions. The Locator Board is complete with instructions and a map marked with numbered grids as shown in the Figures 8 through 12. Incentives related to reserved, close-in parking have for many years provided the motivation for carpooling.

A carpool supervisor registers the carpools and assigns parking. The supervisor also does the minor housekeeping chores such as clearing outdated cards from the pigeon holes and maintaining a reasonable reservoir of blank cards. However, an inspection of a sample of cards in the pigeon holes revealed that many were incomplete, illegible and/or incorrectly filled out.

NASA Carpool System

Another significant manual matching method has been operated by the National Aeronautics and Space Administration since 1964. It can be considered an example of a combination of the Centralized Matching, the Locator Board (see Figure 13) techniques. The activity was initiated because of the scarcity of spaces at the NASA headquarters and the high cost of nearby private parking. Members of carpools must fill out a form entitled "Application for Official Parking Space." Spaces are assigned according to a point system based on the number of members in a pool, their government service grade, and their years of service.

The manual matching technique used for the program involves a card catalog system, a visual wall display, and a periodic (6-month) survey of carpool members. All carpool members are listed alphabetically on index cards which show the individual's name, permit number, and parking location. Program applications are filed by permit number in notebooks for cross-reference and as a supplement to the visual display board. The board is used to match potential carpoolers either with new carpools (shown in red) or with existing carpools that have a vacancy (shown in green). Both pigeon hole cards and map tacks are employed in this system.

If a carpool can't be accommodated through use of the visual display employees can contact the program administrator who uses his card catalog system and permit records to aid them. Administration of the program requires about 20 percent of the administrator's time and a week of secretarial time every six months. However, the majority



FIGURE 8. PENTAGON LOCATOR BOARD

IF YOU HAVE A VACANCY OR WANT TO FORM A CAR POOL

- ① Locate your residence area on the map & note the area number.
- ② Complete the green (car pool vacancy) form & place in green slot under your map area number.
- ③ Look in the corresponding numbered red slot below your map area number to find persons wanting a ride or to form a car pool. Should application seem to suit your needs, contact the person but allow applicant's card to REMAIN IN SLOT.
 - When your car pool is filled, remove your card & place it in the box provided for "Requests Filled".

NOTE: Once a car pool is formed, individuals concerned must report to their Parking Control office for proper entries on permits & location cards. Any questions or suggestions regarding this locator system should be referred to Central Parking Office, Room 1E 4306, the Pentagon, Extension 76251.

FIGURE 9. CLOSE-UP INSTRUCTIONS

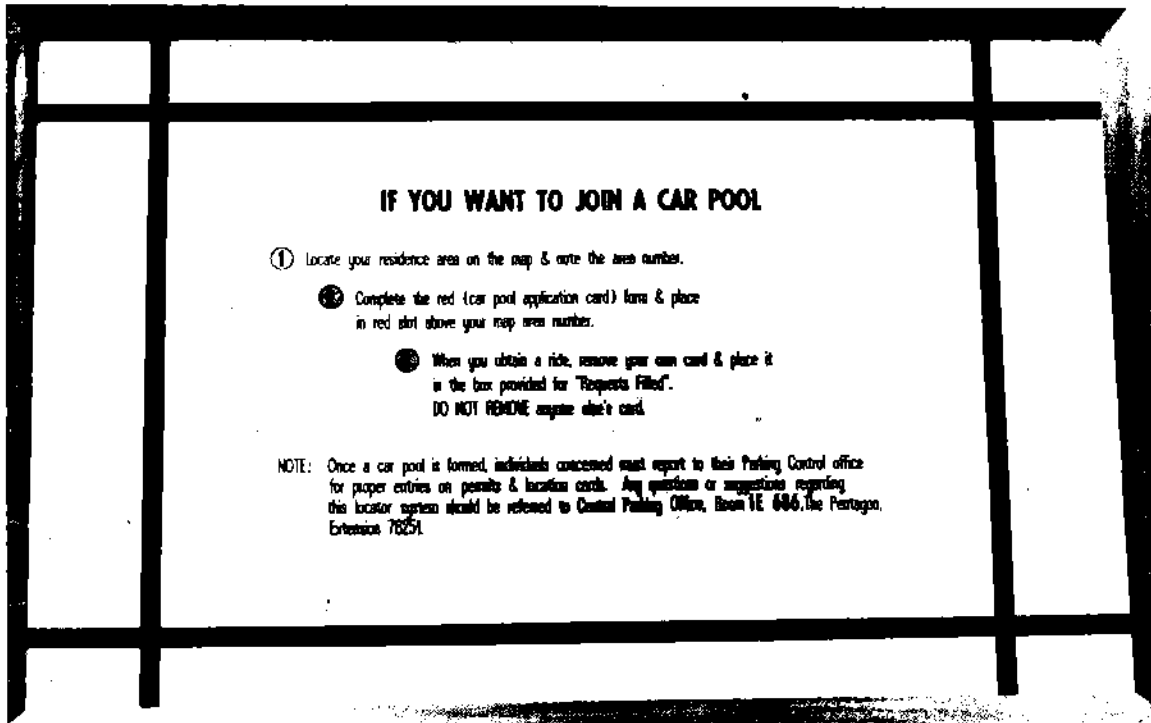


FIGURE 10. CLOSE-UP INSTRUCTIONS



FIGURE 11, PENTAGON MAP



FIGURE 12. PENTAGON MAP-CLOSE-UP

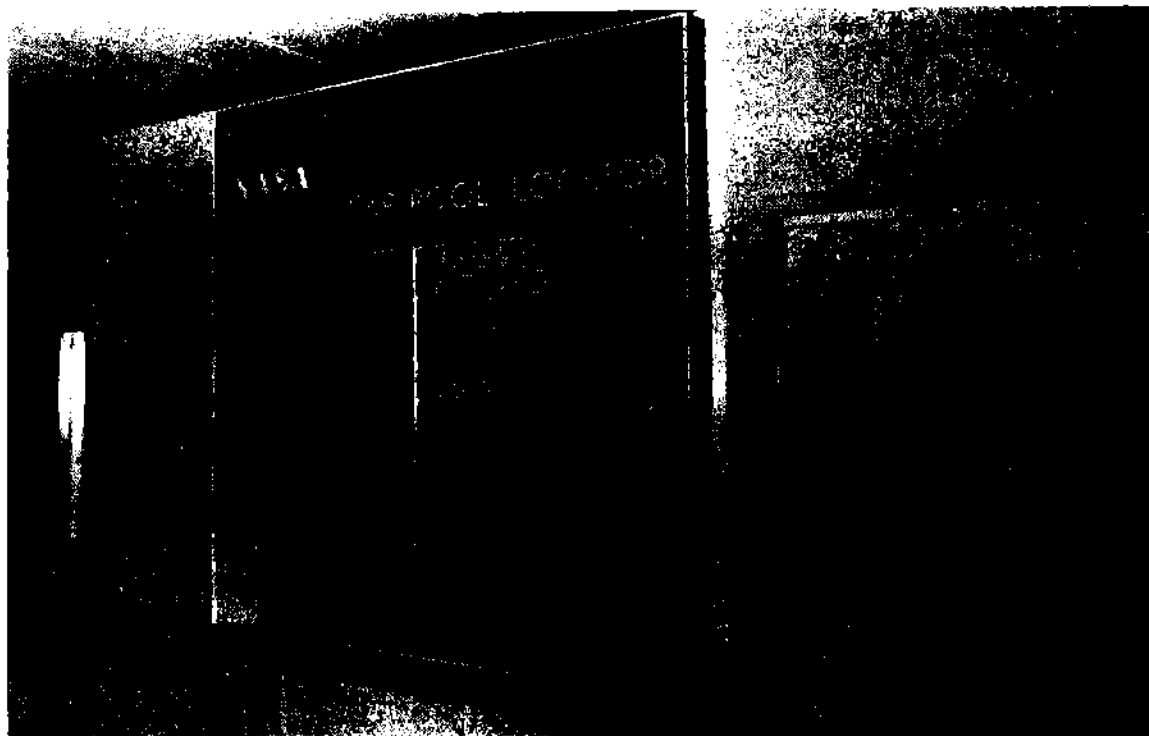


FIGURE 13. NASA LOCATOR BOARD AND MAP

of the manpower is devoted to maintenance of the incentive program rather than the actual carpool locator display. About 800 NASA employees out of a total employment of 1,524 participate in the program, with an average vehicle occupancy of 3.85 among the poolers.

McDonnell-Douglas

This company has had a Locator Board carpooling program in effect for over 20 years at its plant located near Lambert Field in St. Louis. During the height of the aerospace boom when 47,000 persons were employed at this facility, the program was responsible for increasing average automobile occupancy to 2.8 persons per car. Presently, with 25,000 employees, average automobile occupancy has declined to 1.8 persons per auto. Preferential parking is still provided for carpools and the carpool matching effort is continuous. Matching is accomplished manually using three boards -- a grid map of the region, a street index, and one holding pins for cards. The cards are color-coded to indicate people who are looking for pools and carpools which are looking for additional riders.

Vienna, Virginia

One of the few examples of the Centralized Matching technique at the home end of the commuters trip was found in Vienna, Virginia, a four-square mile town located in the Washington suburbs. The activity has been spearheaded by the Town Planner as a special project. In the summer of 1973, the town conducted a survey in which questionnaires were distributed to some 5,000 residents. Using volunteer workers from the Junior Chamber of Commerce, survey results (25 percent return rate) were processed manually. A numbered grid was superimposed on a tax map of Vienna and trip origins were located by grid cell using a color-coded tag for each potential carpooler. At the same time, a grid was overlaid on a map of Washington and destinations were identified. Calls were then made to groups of residents who worked in common areas and had compatible work hours. Individuals were contacted until one was found who was willing to take the initiative and contact others in his or her group. It was then left to this individual to make the carpooling arrangements.

Due to the absence of feedback from those who responded to the survey form, no measure of program success is available.

Motorola Transportation Availability Console

An electronic Locator Board method of carpool matching hardware (though non-computerized) was developed and implemented by Motorola Inc.'s Communications Division in the Chicago area. The original idea behind this concept was conceived when the company's Communications Division was moving to a new plant several miles out in the Chicago suburbs. The old plant had been located in the fringe area of downtown and the move meant that many valuable employees of long standing would have difficulty getting to and from work. The system is termed the "Motorola Transportation Availability Console" and is shown in Figure 14. The console consists of an equipment enclosure with an illuminated map of the surrounding area. The person who desires a ride or has a vacancy in an existing carpool completes a color coded card. The card contains such information as name, department number, plant phone extension, and starting time. The card is inserted into a numbered slot which corresponds to the number on the map in the vicinity of his home. A green light on the map will be illuminated for a driver available; a red light will designate a rider available. At a glance, an employee can check the console for transportation availability.

The console was placed in a high traffic location in the plant where it would have visibility to the greatest number of people. It has been in use for five years and has received good support from the employees. With the recent advent of fuel shortages and increase costs of fuel, the console has experienced a resurgence of use. Furthermore other divisions of the company have ordered the units for their major facilities. One division has already set aside prime parking locations for carpool parking. In order to qualify for this space, the members of the pool must present their cards at the personnel office for validation; this also allows data to be gathered on usage of the system.

It should be noted that all cross referring and contact is made by the individual, and one of the main common denominators is the "work area". The term "work area" is used as it could mean the same company, building, or possibly industrial park.

SECTION 4

LEGAL AND INSTITUTIONAL ISSUES

LEGAL AND INSTITUTIONAL ISSUES

INTRODUCTION

With the existing energy crisis, action has been taken by the Department of Transportation to encourage the implementation of carpooling programs at state and local levels. To insure that a carpool program operates at its maximum effectiveness, it is important to identify legal and institutional issues prior to implementation. In keeping with this strategy, this report was prepared to help state and local program administrators understand and respond to various legal and institutional issues that arise. This report describes issues related to four aspects of carpool operations; it is directed specifically to carpool operations.

- I. Legal Issues -- Recognizing that the establishment of carpooling programs may require resolution of legal questions raised by interested parties, a review was made of five relevant Federal, state and local issues.
- II. Security Issues -- Security among persons participating in carpooling is usually not a problem when all pool members know each other. Pooling on a wider scale, however, requires that important security issues be considered. First of all, there are issues related to the use of participant information gathered, processed, and distributed because certain information may be considered personal, and by getting into the wrong hands, be used for non-carpooling purposes such as marketing. Secondly, there are personal security issues associated with sharing rides with strangers.
- III. Compensation/Internal Revenue Issues -- Since carpool arrangements may involve financial transactions which could create compensation or Internal Revenue Service problems, it is important to understand various issues to avoid not only tax problems at the Federal and state level, but also at the local level.
- IV. Insurance Issues -- No matter what the carpool situation, it is important to understand various insurance implications associated with carpooling so that liability is fully understood, and the most reasonable coverage is assured.

I. LEGAL ISSUES

This section identifies and briefly discusses the possible legal implications of carpooling programs. Some of the issues below affect only sponsors of such programs while others affect only participants. In some cases, the interests of potential sponsors and potential carpoolers are adverse and must be balanced or compromised to achieve a carpooling program which satisfies the various parties. The legal issues described below are presented with a view toward making that compromise an informal one:

1. Incentives to Encourage Carpooling

The problem of establishing incentives to encourage carpooling is essentially a question of who has authority to establish what. The Emergency Highway Energy Conservation Act was signed by President Nixon on January 2, 1974. The Act includes, but is not limited to, funding incentives such as preferential carpool or carpool/bus highway lanes, and preferential parking. The Act contemplates that these and/or other incentives will be included in proposals for funding originated by local officials and submitted by states. A more basic question is who should provide incentives, and who has the necessary authority? A copy of the Act and implementing procedures can be found in Appendix A.

Preliminary research indicates that the Secretary of Transportation has no authority under existing law to decree preferential lanes for carpools or otherwise control the use of Federally assisted highways. The letter and spirit of the Federal Aid Highway Act leave control of highways to the states.

States, in the exercise of their police power to regulate use of highways, do have sufficient authority to set aside lanes for carpools and a few states have already done so. For example, by Act of the General Assembly of the Commonwealth of Virginia, Code of Virginia, 1973 supplement, S33. 1-46.2, the State Highway Commission may designate commuter lanes and prescribe hours for their use. This section also provides penalties for citizens violating its provisions. Pursuant to the statute, a commuter lane for buses and cars with multiple occupants has recently been designated on Interstate 95 running north through Virginia to the District of Columbia.

Local governments also have authority to set aside preferential carpool lanes if they are acting under properly delegated legislative authority and the ordinances they enact are reasonable and not in conflict with state law.

Preferential parking for carpools also presents jurisdictional considerations. Whether the power to make provision for such preferential parking lies solely with the states or the municipalities, or inheres in both, depends on the extent to which each state has delegated such power to municipalities. A tax on parking, either as an incentive to carpools or as a disincentive to non-carpools, is also available as a preferential device. There appears to be no constitutional impediment against the levy of such taxes by either the Federal, state or local governments, so that the matter is only one of legislative authorization.

2. Regulatory Status of Carpool or Share-the-Expense Arrangements

Carpooling encompasses two types of arrangements: (1) members of the group may alternate in driving their own vehicle, or (2) one or more members of the group may provide the car and drive while other members may simply contribute to the expenses. The differences in the arrangements do not appear to be significant from the standpoint of regulatory status. It is to be recognized that in each arrangement an element of compensation or consideration is involved, but that element is not determinative of whether either arrangement is within the regulatory ambit. The controlling factor, it would appear, is whether the arrangement is one for business or private gain, as distinguished from one involving the use of highways in the ordinary course of life and business. The use of streets and highways under the former arrangement is considered a privilege subject to governmental control, whereas the latter arrangement is considered a right inherent in members of the public. The grant of a Certificate of Public Convenience and Necessity, a franchise or permit by whatever name called, is required for entry into the regulated sphere and the rates and other aspects of the business are subject to regulation.

It does not appear that the status of carpooling under municipal ordinances regulating local transportation has been judicially considered, and no ordinance expressly applicable to carpooling readily has come to attention. There is no basis to assume, however, that the criteria for determining whether carpooling should be made subject to government regulation would be different or more stringent for local than state regulation. As stated above, the critical factor, under state law, is whether the public ways are being used for the conduct of a business. It appears that through definitions, regulation under local ordinances is directed to the same character of transportation activities.

3. Applicability of Guest Statutes to Members of Carpools

It is variously stated that between 27 and 34 states have statutes which, in effect, impose upon the driver a lower standard of care towards a passenger who is a guest than to a for-hire passenger. In a few jurisdictions, the concept has been judicially imposed. This dual standard of liability towards passengers in more than half of the states will be discussed generally here, but because of its importance in any carpool program, each sponsor should investigate the law in its jurisdiction.

Although there is an absence of uniformity among the statutes in the wording used to define or classify "a guest", in general, the definition of a guest is one who is invited, either directly or by implication, to accept transportation in the vehicle of another without making any return to, or conferring any benefit upon the owner or operator of the vehicle. There is also a lack of uniformity among the states in the factors or criteria relied upon to determine the status of the passenger. Three factors are frequently mentioned in the cases: (1) the existence of an enforceable agreement for the transportation, (2) the relationship between the parties, and (3) the existence of consideration. The latter obviously is the most relevant for the carpool program.

It is well-established that the consideration or the benefit need not be in money to satisfy the statutory requirement for payment or compensation. The test appears to be whether there is an actual or potential benefit which is not of a social nature and which was the inducing cause or motivating influence for furnishing the transportation. Under this test, it is generally considered that a reciprocal driving arrangement makes the guest statute inapplicable. Thus, carpools, as well as share-the-expense arrangements, have been held not to be comprehended with guest statutes.

It is interesting to observe that the trend of the cases appears to hold that the consideration, which creates a for-hire relationship for the purposes of the guest statutes, is not considered to create a business relationship within the meaning of statutes regulating motor carriers. Although this situation may appear to present an element of inconsistency, the effect is to establish the same standard of care in states where carpools are not considered as regulated carriers and where members of the carpools are not considered guests.

Closely related to the guest statute issue and another facet of the liability problem, is the extent to which carpool members may be jointly liable with the driver for negligence causing injury to third parties. Liability in this area is variously predicated upon concepts

of joint enterprises or joint venture on the basis of which each member of the enterprise may be liable to third parties for damages caused by the negligent operation of a motor vehicle (regardless of which member is driver or who owns the vehicle). In its simplest terms, liability rests upon a showing that the vehicle was operated for a common purpose, and that each member of the joint venture had an equal right to control the operation of the vehicle, whether or not exercised.

4. Responsibility of Sponsors of Carpooling Programs

Preliminary research has not revealed any judicial precedents bearing directly upon the question of whether sponsors of voluntary carpooling programs may be required, as a matter of law, to provide assurance of any kind with respect to vehicle or driver safety; nor was any discussion of this specific point found in the secondary sources. However, the responsibility of the sponsor will depend upon what kind of pooling arrangement the sponsor organizes -- the less mandatory the plan, the less likelihood of sponsor liability. Thus, the sponsoring agency would not be held to a standard of care to investigate questions relating to safety and security of carpool participants in any case where, as sponsor, it organizes and administers a voluntary carpooling program in which drivers and passengers with common transportation interests are identified and matched but are not assigned or in anyway compelled by the sponsor to participate.

Although it would not appear that an agency or an employer which simply sponsors or renders limited assistance in the development of a carpool program would, as a general rule, have responsibility to take any steps to secure passenger safety, a standard of care may be imposed upon the sponsor if the nature of the program is such that there is reason to believe that the participants may rely upon some effort by the agency to determine whether the transportation offered by the program is reasonably safe. For example, if the carpooling plan has been imposed upon employees by an employer as a condition of employment, and the employer or sponsoring public agency actually assigned employees to a specific carpool, a standard of care to make some investigation with respect to safety matters may arguably be implied upon a contract or a tort basis. Similarly, a labor organization, which, in conjunction with an employer participated in the establishment and management of a planned transportation program of this kind, may also be exposed to liability upon this basis. And, of course, the most likely situation in which liability would be imposed upon the sponsor is one in which the sponsor provides the vehicle; the sponsor would necessarily be responsible, at a minimum, for its condition.

For example, the Group W Radio Television Stations which sponsor commuter computer systems in the Boston area, require participants to sign statements releasing the sponsor from any liability "for any action taken or omitted in good faith by WBZ or ALA (Automotive Legal Association) and their agents and employees in connection with the 'commuter computer' service" provided by the stations. It appears that these releases were required to be signed by the participants out of an abundance of caution. It is suggested here that, although a formal disclaimer of this kind may not be needed and may in fact be void because they are unfair to carpoolers, the program participants should, nonetheless, be given explicit information describing the limits of responsibility as outlined above.

5. Competitive Aspects of Carpooling

The issue here is whether any action by affected transportation interests would lie either against state or local governments, private sponsors of carpool programs, or participants in carpool programs, for interference with rights of any bus or mass transit system, including taxi operators, under a Certificate of Public Convenience and Necessity, a franchise or operating permit. The issue would be presented in its strongest light where the operations were conducted under an exclusive grant. The case law context in which the issue may be considered does not provide definitive guidelines. On the one hand, there is the line of cases which hold that carpools and share-the-expenses arrangements are not comprehended within the motor carrier statutes. On the other hand, there is the line of cases which hold that such arrangements are for-hire transportation for the purposes of the automobile guest statutes. In the absence of authority on the issue, any prejudgment is speculative, but it would appear that the cases narrowly construing the motor carrier statutes (example, Kentucky) will prevail as the more analogous precedents. At the state and local level, it would seem unlikely, if carpools and share-the-expense arrangements are considered beyond the regulatory pale (not a regulated motor carrier), that such activities would be held to interfere with transportation interests which are subject to regulation.

Conclusion

In conclusion, the relevant legal issues previously discussed vary according to the applicable state laws. All potential sponsors and participants are urged to check the statutes and ordinances in force in their jurisdictions on each legal issue examined. Nor is the discussion intended to be exhaustive. Other Federal and State statutes may be applicable to various aspects of carpooling projects. For example, the Equal Employment Opportunity Act will apply to the staff of any Federally funded carpool project.

II. SECURITY PROBLEMS

For all intents and purposes, the security of persons participating in carpooling should not be a significant problem when all pool members know each other -- because they either work for the same organization or live in the same neighborhood. For pooling on a wider scale among persons who have no common relationships, security issues should be considered. For example, as far as the control of information is concerned during the matching process (either manual or computer) necessary to unite potential carpoolers, there are security problems related to the use of participant information gathered, processed, and distributed. Presumably, if satisfactory matches are made, there are no further security problems except for casual use; when carpooling is used as a backup or casual system, security problems similar to hitchhiking are introduced.

Control of Information -- Security issues related to the control of information center around the type of data gathered from potential participants. The more complete the file of information, the easier it is to secure a successful match, and the more risk there is for the person surveyed. Obviously the trade-off on data gathered is related to there being more responsibility as more data are collected, processed, and distributed.

Processing/Distribution Phase -- Once the information is gathered, the problem becomes controlling access to the data file during processing and physical distribution of the information. Those wishing to use the information for its intended purpose must be separated from those who wish to use it for other purposes. This could range from individuals seeking contact with others for the purpose of theft or assault, as well as representatives of companies or other organizations seeking access to the information for marketing purposes.

- How Else Can The Information On Participants Be Utilized? -- Since little research has been done on car-pools and related transportation problems, the data accumulated for forming car-pools will provide information attractive to transportation planners. Careful screening should be done as to the purpose and scope of such research before information is released. Under no circumstances should the information be released for marketing purposes or for mass mail campaigns and solicitations. Transportation planners should find the information useful. However, requests for use of the information in this way should be reviewed by local government officials and group responsible for transportation policy.

The supervision and control of the final data/tape should be decided in advance by the sponsors of the project and project directors. Such questions as to who obtains complete copies of the data, including printouts, who obtains copies of the data tape or disc, need to be answered early in the program. Policies on distribution should seek to protect the privacy and security of individuals.

In summary, security issues related to the control of information imply that it will be necessary to limit data gathered, to limit access to the data, and to take steps to insure that the data are disseminated only to personnel authorized by the supplier of the data and only for its intended purpose. Methods of abstracting the data for use while preserving sensitive facts should be adopted. Unfortunately, it is difficult to impart anonymity to location of residence, name, working location, and travel time for a carpooling data base. Thus, separation should be made on the basis that there is no need to hide a name and address that can be found in a standard telephone directory, but there should also not be a need to print-out a public listing of who leaves home at a certain time.

III. COMPENSATION/INTERNAL REVENUE SERVICE ISSUES

The following statement from the Cumulative Bulletin of the Internal Revenue Service (IRS) 1955-2C.B. (also Section 262. Rev. Rul. 55-555) describes the IRS position with respect to carpools:

"It has long been the position of the Internal Revenue Service that a carpool arrangement in which the members share the responsibility for furnishing transportation to and from their places of work and each takes his turn at driving his own automobile is not an arrangement which gives rise to taxable income or deductible expenses. The Service has been asked whether the same rule applies to a carpool arrangement in which only one member uses his own automobile and his fellow members pay him a stated sum of money for transporting them to and from work.

It is the position of the Service that money received by an automobile owner from fellow employees for transporting them to and from work constitutes reimbursement by them for their share of the personal expenses incurred in the operation of the automobile for their mutual convenience. Such money is not includible in computing the gross income

of the automobile owner for Federal income tax purposes. The automobile expenses incurred by him in commuting between his home and place of employment are personal expenses for which no deduction is allowed for Federal income tax purposes. However, this Revenue Ruling is not intended to apply to the situation where a particular car owner has developed his carpool arrangements to the extent that he can be said to have established a trade or business of transporting workers for hire from which a profit is derived."

This current IRS position implies that there are no significant compensation problems with respect to carpools; however, if special incentives such as employee subsidy, insurance subsidy, or extra payments for serving the handicapped are introduced, then problems may arise.

Carpool users should also consider the following factors:

- Commuting costs are non-deductible expenses.
- Since a share-cost arrangement is not a trade or business, the use of a private auto in carpool service does not change the auto's status as a non-depreciable cost.
- While state and local tax implications would be investigated on a local level, it is not expected that the rulings would differ significantly from the above IRS position.
- Minimize conflicts with IRS rules by encouraging only those incentives which do not encourage taxable income.
- If carpools are developed on a taxable basis, suggest that a carpool club or other institutional framework be created to handle taxes, insurance, regulatory report and if necessary, customer billing procedures.

IV. INSURANCE CONSIDERATION FOR CARPOOLERS

The increasing use of carpools as a response to the energy crisis raises questions regarding the liabilities of drivers and riders, and the impact of possible changed liabilities on automobile insurance. In most situations, the position of an insured driver will not change with the formation of a carpool. There are exceptions, however, and there is a need for review of the amount of coverage in all cases.

Insurance Issues

Typical carpools are formed either with a group of individuals taking turns as drivers or with one driver regularly providing rides for a number of passengers. There can also be combinations of these two typical patterns, as well as situations in which a company provides transportation by making company vehicles available to groups of employees or by arranging for special use of a mass transit vehicle.

Setting aside for the moment the situation with company-provided transportation, in any kind of carpool where there is no payment of money for expenses or otherwise, each driver's insurance offers protection on the day he or she operates the vehicle. The only factor a driver need consider is the adequacy of coverage for bodily injury. (A group of three or four wage earners riding as passengers represents a substantially greater potential for damages in the event of a serious accident than would normal riders in a typical family car situation.) This is a matter for each individual to weigh, balancing the cost of insurance with the risk of loss of personal estate. This factor applies only to bodily injury. Medical payments coverage need not be increased since the dollar limit applies to each passenger separately, and carpoolers are not likely to have higher medical costs than anyone else. Similarly, with property damage insurance, the addition of one or more riders would not normally contribute to the amount of property damage in the event of an accident.

Some companies provide lower rates for carpoolers when all drivers have insurance with the same company. The reason is obvious: there is less exposure and thus less risk with four drivers in one car each day than with the same drivers in four separate cars. Normally, these reduced rates apply only during the commute to and from work, and generally when the one-way distance is more than ten miles.

In all events, the controlling factor for insurance companies is the degree of risk (the likely dollar loss in case of an accident). Insurance rates are based on experience. At present, there is scant history relating to carpoolers compared with other identifiable segments of the population. Drivers of vehicles for hire (such as taxicabs) pay considerably higher rates than do average drivers, because taxi companies and bus companies get sued more frequently and tend to have higher damages awarded against them. Taxis also have greater exposure inasmuch as they operate with an annual mileage of 5 to 10 times the average for a private auto. On a per mile or per hour basis, the difference in insurance cost is not as significant as one might otherwise suspect.

At some future date, if experience shows that carpoolers also tend to become the targets of large judgments, the rates can be expected to increase accordingly. On the other hand, if future experience tends to demonstrate that carpoolers as a group have lower than normal claims against them, then one can anticipate reduced insurance rates for this group.

If the riders pay the driver some amount of money for the journey to work, there may be a significant change in the insurance picture; much depends on the amount of payment. If the money is clearly only a contribution to cover actual expenses of vehicle operation, there should be no problem. If the amount of money is in excess of the cost of operation of the vehicle (and the exact amount may not be easily ascertained), a legal issue arises. When a passenger does not make payment for the service of providing transportation, in some jurisdictions the passenger is considered, in the eyes of the law, as a guest of the driver. Legally, a driver has a responsibility for a guest's injury only if the injury resulted from gross negligence. On the other hand, if there is compensation for the transportation, then the driver is responsible for the passenger's injury if it results from ordinary negligence. For more details on legal aspects of carpooling, see the Legal Section of this report. The importance from an insurance viewpoint is that judgments are rendered more readily against "for hire" drivers than they are against the average driver. Thus, most insurance companies have no exclusion for bodily injury coverage except when the vehicle is used "for hire," in which case the owner is expected to pay rates comparable to those for taxicabs. Variations in state laws, affecting whether or not a carpool rider is a guest and thus, whether the insurance carrier is exposed to gross or ordinary negligence, should be reflected in rate increments in the various states. An individual considering entering a carpool arrangement should discuss with the insurance agent the matter of payment for the commute. There is variation among insurance companies and variations in state laws regarding this matter. In Massachusetts, for example, an extra premium of \$2.00 per year for carpool drivers is permitted.

One other consideration for the incipient carpooler is the situation where the family car was not previously used for the journey to work but is under a new group arrangement. The change in use could make the car owner subject to a new rate. However, there should be no cancellation or invalidation of an insurance policy if the company is not notified, provided the new operation is properly reported at insurance renewal time. The reverse condition might also occur. If a car has been used on a daily basis for the journey to work and then a carpool is formed so that the car is only used once or twice a week, a lower insurance rate may result.

Sometimes businesses get involved in carpooling, using various ways to encourage their employees to share rides. If incentives such as cash, stamps, or merchandise, are offered by the employer, these are considered by the Internal Revenue Service to be deductible business expenses for the company and income to the recipient employee. If an arrangement is made with a transit company or authority to provide special shuttle bus service to and from the job site, the liability of the transit company or authority would normally cover such an operation. If the company provides vehicles for employees to use to and from work, the company has the liability, which is normally covered with the insurance for the ordinary use of these vehicles on company business. It would be wise, in any event, to check with the insurance agent to make sure no additional coverage is required.

There are two further areas that carpoolers might explore which would not normally be practical but, in certain circumstances, may be. One is commercial insurance. The drivers who make a profit by transporting fellow workers may find it prudent to have coverage comparable to a taxi driver's. It would not be necessary to get full-time commercial insurance; this coverage can be obtained from some companies on a part-time basis, either by the hour or by the mile, to cover the commuting trip only. Almost any coverage can be obtained by a special rider being added to a standard policy, although usually the necessary amount of detailed negotiation is large.

Another possibility is for a large number of carpools to incorporate as a club and take out special insurance on behalf of the club. There are few insurance companies that have such policies available, and the legal aspects may be complex. Where such a group exists, however, as in a new town or a large residential development, the potential savings to the individual carpoolers may be worth investigating.

Carpool Insurance in Pennsylvania

Representatives of the Pennsylvania Insurance Department indicate that their carpool insurance efforts have only involved the private automobile. To date, four insurance companies have announced special carpool rates in Pennsylvania (State Farm Mutual, State Farm Fire and Casualty, Nationwide, and Erie Insurance Exchange). In announcing their carpool rates, State Farm explained that it was a change in risk classification rather than a discount to encourage the use of carpools. A differentiation is made between long-trip commuters and short-trip commuters on the basis of whether they drove more or less than ten miles each way to work. A man who commuted

15 miles each way would be listed as a long-trip commuter; but if he joined a carpool and drove the distance only two days a week, he would drive only 60 miles a week. Under the new, more liberal rules, he would be considered a short-trip commuter because his daily average driving to and from work would be only six miles each way.

In Pennsylvania, this change in risk classification would mean a premium savings of about 15 percent in the commuter's bodily injury/property damage liability insurance program. Motorists who decide to leave their cars at home and take a train or bus to work could realize savings up to 35 percent on property damage and liability insurance.

The Utica Mutual Insurance carpool classification, approved by the Pennsylvania Insurance Department, Bureau of Regulation of Rates and Policies, is more typical of the insurance industry:

- A. Pleasure Use -- means that there is no business use of the automobile, and it is not customarily used in the course of driving to or from work a distance of 30 or more road miles per week.
- B. Work less than 10 miles -- means there is no business use of the automobile, but it is customarily used in the course of driving to or from work a distance of 30 or more but not less than 100 road miles per week.
- C. Work 10 or more miles -- means there is no business use of the automobile, but it is customarily used in the course of driving to or from work a distance of 100 or more road miles per week.

The Pennsylvania Insurance Department considers programs that would force other members of a carpool to be insured with the same company to be out of order, and they would strenuously object. They have also indicated that there should be actuarially-based reductions in insurance for legitimate carpools because after approximately six months of operation their actuaries will have a firm definition on the guidelines that they see insurance companies being able to follow. The need to disseminate information between the insurance commissioners is clearly an issue which requires assurance that either it will happen in its informal way, or that a mechanism can be developed to make certain that rate reduction policies for carpools are implemented to the maximum extent possible as a significant incentive for carpooling.

A position paper is being organized by a consortium of insurance carriers now being queried by HUFSAAM and should shed some more light on this subject when the results become available. 1/

Corporate Carpooling

If corporations become involved in organized carpooling, and particularly in providing financial incentives such as paying the driver an extra fee and collecting or withholding from passengers a fare, the IRS rules on taxable income would be satisfied since the employer would be withholding appropriate IRS contributions. The primary issue of importance in this situation would be the vicarious liability the corporation might incur by providing financial incentives.

A group insurance rate could be promulgated to cover the extra exposure which either the corporation or the drivers would face under these situations. A procedure in insurance cases such as this is to submit prepared insurance rules for bidding through Lloyds of London or major U.S. underwriters. Since insurance is regulated on a state level, assistance should be secured from the state insurance commissioners.

Finally, no matter what the situation of the carpooler, whether a beginner or a veteran in this commuting mode, it is strongly recommended that the insurance agent be contacted and the policy and coverage be thoroughly reviewed. The insurance business is quite complicated, and one is cautioned against assuming there is no problem. Learning about local laws and policy restrictions after an accident can be a costly lesson.

1/ Highway Users Federation for Safety and Mobility.

APPENDIX A

Federal-Aid Highway Program Manual
Transmittal 16, February 26, 1974

VOL. 4, CHAP. 8
SEC. 3, Attach. 1



Public Law 93-239
93rd Congress, H. R. 11372
January 2, 1974

An Act

To conserve energy on the Nation's highways.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act be cited as the "Emergency Highway Energy Conservation Act".

CARPOOL SECTION OF THE ACT

Sec. 3. (a) To conserve fuel, decrease traffic congestion during rush hours, improve air quality, and enhance the use of existing highways and parking facilities, the Secretary of Transportation is authorized to approve demonstration projects designed to encourage the use of carpools in urban areas.

(b) Proposals shall be originated by local officials and submitted by the State in accordance with the provisions of section 105(d) of title 23, United States Code. The Secretary of Transportation shall approve for funding those projects which offer reasonable prospects of achieving the objectives set forth in subsection (a) of this section.

(c) A project may include, but not be limited to, such measures as systems for locating potential riders and informing them of convenient carpool opportunities, designating existing highway lanes as preferential carpool highway lanes or shared bus and carpool lanes, providing related traffic control devices, and designating existing publicly owned facilities for use as preferential parking for carpools.

(d) A project authorized by this section shall be subject to, and carried out in accordance with all of the provisions of chapter 1 of title 23, United States Code, applicable to highway projects, except that the Federal share of such project shall be 90 per centum, the Federal share shall not exceed \$1,000,000 for any single project, and only funds apportioned under section 104(b) (3) and (6) of such title shall be available to carry out projects authorized by this section. The Secretary shall not approve any project under this section after December 31, 1974.

(e) The Secretary of Transportation shall conduct a full investigation of the effectiveness of measures employed in the demonstration projects authorized by subsection (a) of this section. In addition, he shall, in cooperation with the Internal Revenue Service, the Environmental Protection Agency, and other appropriate Federal and State agencies, study other measures, including but not limited to tax and other economic incentives, which might lead to significant increases in carpool ridership in urban areas throughout the country, and shall identify any institutional or legal barriers to such measures and the costs and benefits of such measures. He shall report to the Congress not later than December 31, 1974, his findings, conclusions, and recommendations resulting from such investigation and study. Funds authorized to carry out section 307 of title 23, United States Code, are authorized to be used to carry out the investigation and study authorized by this subsection.



U. S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

FEDERAL-AID HIGHWAY PROGRAM MANUAL

VOLUME 4	PLANNING
CHAPTER 8	SPECIAL PROGRAMS
SECTION 3	CARPOOL DEMONSTRATION PROJECTS

Transmittal 16
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- Par. 1. PURPOSE
2. AUTHORITY
3. POLICY
4. ELIGIBILITY
5. LIMITATIONS
6. PROCEDURES
7. AVAILABILITY OF INFORMATION
8. TERMINATION

1. PURPOSE

- * *The purpose of this directive is to prescribe policies and procedures for administering a program of carpool demonstration projects. The objectives of the program are to conserve fuel, decrease traffic congestion during rush hours, improve air quality, and enhance the use of existing highways and parking facilities in urban areas.*

2. AUTHORITY

This directive is issued under the authority of Section 3 of the Emergency Highway Energy Conservation Act, Public Law 93-239, 23 U.S.C. 315, and the delegation of authority by the Secretary of Transportation.

3. POLICY

- a. Based upon the provisions of Section 3 of the Emergency Highway Energy Conservation Act, it is the policy of the Federal Highway Administration (FHWA) to encourage State highway departments to program funds apportioned under Section 104(b)(3) and (6) of Title 23, U.S.C. for demonstration projects that will increase the use of carpools in urban areas. If necessary, State highway
- * Regulatory material is italicized

departments should be encouraged to reprogram such funds so as to assure that funding is available for such demonstration projects.

- b. Based upon the provisions of Section 101(e) of Title 23, U.S.C., dealing with minimization of redtape and the deadline of December 31, 1974, for approval of demonstration projects under the Emergency Highway Energy Conservation Act, it is the policy of FHWA that these projects be approved as rapidly as possible. Field offices of FHWA shall exercise considerable initiative and use maximum discretion in the application of Federal-aid project approval procedures for demonstration projects that offer reasonable prospects for encouraging increased use of carpools. As these are demonstration projects, they are necessarily experimental in nature, and Division Engineers may approve them even though they do not employ established technology of fully-tested principles.
 - c. *It is the policy of FHWA that Federal-aid funds for carpool demonstration projects do not participate in projects which will encourage substantial numbers of persons who use mass transit systems to switch to carpools. For demonstration projects which the Division Engineer has reason to suspect that this might be the case, he should obtain the advice and comment from the Urban Mass Transportation Administration (UMTA) field representative. The development of demonstration projects, or the concurrence of the projects, by the local transportation planning organization with transit operator involvement will also provide advice to the Division Engineer on this point.*
4. ELIGIBILITY. *Except as provided in paragraph 5 of this directive, Federal-aid funds apportioned for extensions of the Federal-aid primary and secondary systems in urban areas and for the Federal-aid urban system may pay 90 percent of the cost of carpool demonstration projects of the following types:*
- a. *Systems, whether manual or computerized, for locating potential participants in carpools or buspools and informing them of the opportunities for participation. Eligible costs for such a system may include costs of use or rental of computer hardware, costs of software, installation costs (including both labor and other related items), and reasonable public information and promotion expenditures, incurred until the system is fully developed and operational. The time required for a system to mature, from its initial implementation*

stage to its fully developed stage, will vary with the type of system, its complexity, and the problems encountered in implementing it. Normally, the time required for a system to become fully developed and operational should not exceed one year.

- b. *Work necessary to designate existing highway lanes (whether or not the highway is on a Federal-aid system) as preferential carpool lanes or bus and carpool lanes. Eligible costs for the work may include expenditures for preliminary engineering type of work to obtain traffic flow data and information about roadway features, and to develop a traffic flow model to determine the best carpool criterion for the specific highway. In addition, eligible costs may include the required signing and marking, as well as minor physical modification to permit the use of designated lanes as preferential carpool lanes or bus and carpool lanes. The costs of providing the initial enforcement equipment, personnel costs, reasonable public information and promotion expenditures, and reimbursement for any actual losses in toll revenue occasioned solely by designating lanes on toll facilities, other than those resulting from a reduction of the per vehicle toll charge for use, to assure the project is fully developed and operating properly, are also eligible. The time required for the project to reach the fully-developed stage will vary, depending on its complexity and the problems encountered, but will not normally exceed 6 months from the date it first becomes operational.*
- c. *Traffic control devices that are necessary to advise motorists and control the movement of carpools. Eligible costs would include expenditures for informational or directional signing and sensing equipment that responds to carpool vehicles, or carpool vehicles and buses when both use the facility.*
- d. *Signing of, and minor modifications to, publicly owned facilities to provide preferential parking for carpools. Eligible costs would include trail blazers, on-site signs designating highway interchange areas or other publicly owned facilities as fringe parking for carpool participants. Reasonable public information and promotion expenditures, and reimbursement for any actual losses in income or additional costs occasioned by designating space for carpool vehicles, other than those resulting from a reduction of the per vehicle user charge for parking, during the demonstration period are also eligible.*

- e. *The risk or "abort" cost of making commuter-driven vanpool service available. Eligible costs may include the difference between the initial cost of a reasonable number of commuter-driven vans (but not privately owned passenger cars or buses) and the residual value of the vehicles less the accumulated depreciation, if the demonstration project is aborted prior to the agreed termination date of the demonstration project. Federal-aid funds may not participate in any form of operating subsidy. A user fee based on a reasonable number of riders per vehicle must be charged for the use of each van. The fee must cover the cost of reasonable vehicle depreciation, as well as its operating and maintenance costs. Normally, the duration of the guarantee of risk costs should not exceed the first 12 months of the project's operation.*

5. LIMITATIONS

- a. *Federal-aid funds for carpool demonstration projects may not participate in the construction of new facilities, such as special highway lanes or parking areas for carpools, buses, or both. Projects of this type should be considered as normal Federal-aid highway projects, using the funds and Federal share applicable to the Federal-aid system on which they are located.*
- b. *The maximum amount of the Federal share for a single carpool demonstration project is \$1,000,000. There is no limit on the number of projects in a single State or urban area. Since many projects may be small, it may be desirable to establish an approval agreement that provides for one-time approval of a program of projects in an urban area, with individual projects handled as line items in the approved program, as is the case with the annual HP&R work program.*

6. PROCEDURES

- a. *Each project or program of projects in an urbanized area must be initiated by or have the concurrence of the local organization which has responsibility for transportation planning in accordance with 23 U.S.C. 134. If this organization is not also the clearing-house agency under OMB Circular A-95, notification of and consultation with that agency if necessary is also required. Each project or program of projects in an urban area having a population of less than 50,000 must have the concurrence of the mayor or chief administrative officer of the area.*

- b. *A project or program of projects must be submitted by the State highway department to the FHWA Division Engineer for that State.*
- c. *Division Engineers are authorized to approve proposed carpool demonstration projects in accordance with the rules in this directive. The Division Engineer should exercise maximum discretion in approving demonstration projects that are consistent with this directive. The types of projects identified in paragraph 4 of this directive are only examples and do not constitute an exclusive listing of types that may be authorized. In case of doubt, questions should be referred to the Office of Highway Planning for advice.*
- d. *Because of the emergency nature of these activities, simplified procedures dealing with mutually acceptable ways for handling clearinghouse notification, negative environmental declaration, and public hearing requirements may be approved by the Division Engineer. The use of force account procedures, abbreviated plans, and other timesaving procedures may also be authorized as appropriate for demonstration project elements.*
- e. *The following construction-type codes concerned with carpool operations and change of mode operations shall be used.*
 - Y025 - *All change of mode transportation facilities involving public transportation (bus and/or rail).*
 - Y036 - *All projects for locating and informing potential riders of convenient ride sharing opportunities.*
 - Y026 - *All other projects not involving public transportation modes. This might include carpool-only lanes, carpool-only parking, vanpool demonstration, etc.*

7. AVAILABILITY OF INFORMATION

- a. *Before the FHWA Division Engineer approves a demonstration project, he must find that the State is willing, and has the capability to, provide information concerning the effectiveness of the project, (either alone or as one of a group of projects) so that the Department can, on or before December 31, 1974, make the report to Congress required by Section 3(e) of the Emergency Highway Energy Conservation Act. State highway departments may use Federal-aid funds authorized for research and planning under 23 U.S.C. 307(c) to finance obtaining and assembling the information.*

- b. The administration of the carpool demonstration program nationwide will require that the Washington office be kept advised on the progress of projects in a timely fashion. It is also important for each division office to have the benefit of ideas and actions of other division offices. For this reason, each Division Engineer shall prepare a report, "Carpool Demonstration Program," to arrive in the Office of Highway Planning by the 15th of each month, beginning in March 1974. In this report, the Division Engineer shall describe in a succinct manner the status of any project activity and the nature of the items approved for funding. The description of the activity should identify the urban area. If there is no activity in a State or urbanized area, the lack of activity should be reported, and the Division Engineer should set forth an assessment of the reasons for it. The Office of Highway Planning will assemble these reports and distribute them so that all Division Engineers and other DOT units will be fully apprized of activities in the carpool demonstration program on a nationwide basis.

8. TERMINATION

A carpool demonstration project may not be approved after December 31, 1974.

The text of Section 3 of the Emergency Highway Energy Conservation Act is attached.

SECTION 5
INCENTIVES TO CARPOOLING

INCENTIVES TO CARPOOLING

INTRODUCTION

Some type of motivation is behind every decision to form or join a carpool. For most pre-energy crisis carpools, this motivation was largely unplanned -- shortage of parking spaces, parking costs, and automobile operating costs. Successful carpool programs recognize the importance of these existing motivations but rely on planned programs of incentives to encourage carpooling.

Carpool incentives are planned measures offering inducements for the use of carpools. Incentives are offered by a wide variety of agencies, employers, groups, and individuals. Incentives can be devised for carpool riders, carpool drivers, organizers, and combinations of all three.

Carpool incentive measures can be sorted in numerous ways; for example, according to sponsor, segment of society benefited, ease of implementation, start-up cost, etc. As yet, however, there is no existing formal structure for the organization and study of incentives. The following discussion of specific carpool incentives is structured on the basis of the basic motivations which the transportation planning process has established as the most meaningful determinants of travel behavior:

- Travel Cost
- Travel Time
- Convenience
- Intangible and Non-Travel Related Factors

In addition to the above types of incentives aimed at the traveler, a fifth category of incentives -- those intended to induce others (employers, etc.) to offer incentives -- is discussed.

COST-RELATED INCENTIVES

Travel cost is one of the most significant factors in the decision to form or join a carpool. Cost-related incentives can be devised to reduce automobile parking costs, ownership costs, operating costs, or all three. Conversely, cost-related incentives can be devised to increase the cost to non-carpoolers of operating and parking an automobile.

Parking Cost

The offer by either a public or private employer to cover all or a portion of the parking cost for carpoolers has been cited as an effective incentive to carpooling. The reduction in perceived out-of-pocket costs for commuting can encourage auto drivers to pool, depending on (a) current parking charges, (b) the potential of increased parking charges or surcharges, or (c) the opportunity to switch to alternative parking sites with no appreciable increase in parking cost.

Conversely, an increase in parking rates can produce the similar result of providing an incentive to carpooling. A general increase in parking rates for all parkers tends to promote the use of carpools without risk of diversion of existing transit riders to carpools. More selective parking rate increases can be achieved with varying amounts of increase, depending on automobile occupancy.

There are several examples of successful parking cost incentives. A recent survey of the employees at the King County assessor's office in Seattle, Washington indicated that free parking was nearly twice as effective as other methods in encouraging carpooling. In this case the average daily cost is \$.75. A pilot program will be instituted early in 1974, which will provide free parking at private lots within a two to three block radius of the employment site for 100 King County employees and 200 Seattle employees in carpools of three or more persons.

Another public employer in the Pacific Northwest, the Port of Portland, Oregon, implemented a trial program in which the Port pays the \$10 per month parking fee for employees in carpools of two to four persons. If the carpool is comprised of five or more, the Port pays the parking fee plus \$.11 per mile. (The Port will also pay \$.70 per day to bus riders.)

In San Francisco, California, a 25-percent increase in the parking tax resulted in a significant decline in the number of all-day parkers. A substantial portion of this reduced parking demand appears to be accounted for by an increase in carpooling.

Traveler's Insurance, Hartford, Connecticut, permits free parking (cost savings: \$10 monthly) to carpoolers. Prudential Insurance Company, Boston, Massachusetts, gives free indoor parking to carpools of three or more (regular cost: \$2.50 daily).

Automobile Ownership Cost

The rising costs of owning, insuring, and maintaining an automobile enhance the effectiveness of incentives related to these costs. In general, this type of incentive offers relief from some or all auto ownership costs in exchange for organizing and operating a carpool.

Provision of Company Cars - Employers may find it cost-effective to provide company-owned vehicles to employees for the purpose of driving several employees to work together. The vehicle then may be used during the day to conduct company business. The effectiveness of this incentive measure depends on several factors, such as the expense and tax position of the company, the availability of alternative transportation to the members of the carpool, and the potential for forming and maintaining a carpool under these circumstances. The driver responsibility may be assigned to one individual or may rotate.

A variation of this is a vehicle which is leased or assigned from a motor pool to one employee for both business and personal use with the stipulation that the vehicle be used for carpooling during the weekly commute hours.

A similar method has been used to provide transportation for low income workers to hard-to-reach places of employment. The usual result in these cases has been that the worker, as soon as he had sufficient income, would purchase his own vehicle.

Company-Sponsored Vanpools - A variation on the use of vehicles for a carpool is the provision, by the employer, of vans or other vehicles suitable for pooling. In this case, a driver, who also may be a paid employee of the sponsoring organization and who may be paid additionally for the responsibility of collecting and driving the pool riders, has an active role in creating and maintaining the pool. This service can operate in a circulating pattern within a small area or from a central collection point. The vehicle can have other use during the day and, as with other use of company vehicles, the cost might be borne by the company or by the riders.

In the highly successful program at 3M Company, St. Paul, Minnesota, vans are purchased by the employer (3M) and then operated by employees in a manner similar to a small private business.

An example of breakeven costs of this program (including ownership) for a 50-mile round trip is \$1.77 per mile, or \$1.11 per day for each

of eight passengers. The program has been very successful with 35 vans in operation and long waiting lists of persons wanting to participate. Some of the reasons for the success of the program are the following incentives:

- For drivers:
 - Free ride to work
 - Unlimited personal use of van during off-work hours at a rate of seven cents per mile
 - Fares collected over operating expenses (for an average 25-mile round trip, this amounts to about \$2.00 per day for full occupancy)
 - Status and recognition; selection for vanpool driving is considered recognition of employee's worth and leadership attributes
 - Drivers have first option for buying vans whenever the vans are retired from service. To the extent possible, drivers are given the option of selecting make and color of van for their pool
- For riders:
 - Savings in travel expenses and elimination of need for second car
 - Preferential parking close to building
 - Automatically heated vehicles for vehicles parked next to the administration building
 - Useful travel time for other than driving (work, conversation, card games, etc.)
 - Social aspects are emphasized: new friendships formed, riding is enjoyable

Provision of Vehicles for Carpoolers - Most governmental agencies at the Federal, state, county, and local level have a pool of motor vehicles which are used to conduct government business. These are generally returned to a garage or lot at the end of the day to remain idle until the next morning. Such capital equipment could be more effectively utilized by allowing employees to drive the vehicles home at night if they form carpools. This can reduce the number of auto-trips as well as reduce costs for the individual employees.

An example of this type of incentive is the widespread usage of police cars for the work trip. This was originally undertaken for the purpose of increasing the presence of police vehicles on the street; an additional

benefit has been the formation of carpools with cost-related benefits to users.

One problem with this carpool incentive technique is that taxpayers tend to view use of government property as a discriminatory benefit to government workers. This objection can be countered in several ways:

- Public information programs to show fuel savings from carpooling in the public interest
- Daily recording of mileage while vehicle is not on government business with a pro-rata mileage charge assessed against the carpoolers, possibly through a payroll deduction
- A flat monthly assessment for the carpool based on established mileage

This program is in operation at the Arkansas State Highway Department in Little Rock, Arkansas. State vehicles carrying a minimum of three carpool riders are permitted to be taken home at night. Information on degree of success is not yet available.

Automobile Operating Cost

In general, this type of incentive falls into two major categories: negative incentives which increase auto operating costs (generally brought about by either economic forces or legislation); and positive incentives, reductions in operating costs for carpoolers. Either can be implemented by employers and various levels of legislative bodies.

Gasoline Tax Rebates - Repayment, to the carpooling motorist, of some portion of state and/or Federal fuel tax is a possible incentive. This would require state and/or Federal legislation, but could result in shifting the tax burden to non-carpool drivers. The rebate could be handled at the point of purchase, or the authority could repay the tax at some later date. The major disadvantages in utilizing this type of incentive is that it could be very difficult and costly to regulate. Proof of regular carpooling and effective rebate arrangements could involve much administrative detail. A further disadvantage is the lack of immediate impact on the motorist, due to the possible time lag between purchase of fuel and reimbursement, as well as the fact that the initiative for repayment rests partially with the motorist.

State License and Local Tag Rebates - A similar approach would permit carpoolers to purchase state licenses or local tags at reduced fees. This, too, would require legal action and would be cumbersome to administrators.

Tolls for Non-Carpoolers - On some existing toll-free facilities such as bridges, tunnels, or even highways, it may be possible to establish a toll that would, in effect, penalize one-or two-person cars during peak commuter hours as a positive incentive to carpooling. There are, however, some serious obstacles to such tolls:

- Tolls cannot be imposed on highways of the Federal Interstate System (they may be applied at time of construction in some cases, but must be removed after revenue bonds are redeemed)
- Truckers and bus operators may have objections to newly imposed tolls on all vehicles
- Other facilities might become more congested
- Such toll pricing could be considered discriminatory to non-carpoolers

Reduction or Elimination of Tolls for Carpoolers - This is a clearly defined incentive in those areas where toll crossings handle large volumes of commute traffic. Reduction or elimination of a toll is a perceived advantage in terms of out-of-pocket cost to a commuter and will tend to encourage carpooling -- especially if combined with reserved lanes on the facility for buses and/or carpools.

Because of pre-existing tolls on such facilities, implementation costs and obstacles are considerably less than in the previously cited incentive of imposing tolls on non-carpoolers.

On January 1, 1974, a rate schedule favoring carpools was initiated on the Walt Whitman and Benjamin Franklin Bridges linking Philadelphia with New Jersey. Rates for commuter carpools (three or more persons) are now \$.25 per crossing, compared to a non-carpool commuter rate of \$.40 and a cash rate of \$.60 per crossing.

Another example is the successful San Francisco-Oakland Bay Bridge toll reduction program, where reduced tolls are combined with reserved lanes for buses and carpools. The number of three or more person carpools have increased from approximately 1,000 to 1,800 in the morning

peak period. A monthly pass is issued for a fee of \$1.00; the pass is displayed as the vehicle goes through the toll area.

Congestion Tolls - Congestion tolls have been proposed in many areas as a means of reducing traffic on crowded highway facilities. With relation to carpooling, rates could vary by the number of occupants in a vehicle, with the highest occupancy vehicles paying the lowest fee. This can be coupled with time-of-day pricing to encourage high occupancy vehicles during the peak travel periods without undue cost to lower occupancy vehicles during less critical periods of the day.

TRAVEL TIME INCENTIVES

The primary area in which travel time incentives can be implemented is the journey itself. Thus, almost all travel time incentives involve travel on public streets and are implemented by public agencies only.

Some parking convenience measures also yield travel time savings. However, since the primary appeal of these types of measure is to comfort and ease of travel, they are included with "Convenience" incentives.

Vehicle Priority Traffic Control

Various types of traffic control techniques can be applied to give priority treatment to high occupancy vehicles. Many of the methods currently in operation give priority to buses only, but there are several examples where priority is given to any high occupancy vehicle -- whether it be a bus, carpool, or vanpool. Priority traffic control techniques include:

- Exclusive (separate) freeway lanes
- Reserved freeway lanes
- Contra-flow freeway lanes
- Reserved lanes at toll plazas
- Reserved lanes on surface streets
- Exclusive freeway ramps
- Priority metered ramps
- Priority traffic signal control

The basic motivation associated with all the above priority techniques is reduced travel time for high occupancy vehicle occupants. Typically, the priority treatments are in force only during peak periods and, thus, are applicable primarily to commuter vehicles.

Exclusive (separate) Freeway Lanes - This concept consists of providing a physically separated lane or lanes, within the freeway right-of-way assigned exclusively for use by high occupancy vehicles. This technique is perhaps the most powerful one in terms of time savings compared with peak period travel on the normal freeway, but it is also likely to cost more to implement than other priority methods because of the substantial amount of roadway construction involved. However, some freeways were constructed initially with features, such as reversible roadways in the median strip, which facilitate conversion to exclusive lane operation. The enforcement of the proper use of exclusive lanes is of proven feasibility.

An excellent example of the exclusive lane concept is the Shirley Highway (I-95) which connects the Northern Virginia suburbs with downtown Washington, D. C. This facility has two reversible lanes in the median strip which are used exclusively by high occupancy vehicles during commuting hours. In the initial stages of operation, only buses were permitted on the exclusive lane, but in December 1973 these lanes were opened also to carpools with four or more occupants. Even though the section of this facility approaching the bridges to Washington, D. C., is still under construction at this time (January 1974), travel time savings for high occupancy vehicles is dramatic. Approximately 15 minutes travel time is saved by buses and carpools during the height of the peak period. Impressive increases in bus ridership along the Shirley Highway corridor have been achieved. Currently, over 15,000 bus passengers are served on the exclusive lanes during the morning commuting period. Data on the number of carpools using the facility has not yet been reported. Violators of the exclusive lane rule are subject to heavy fines, and no serious enforcement problems have been experienced.

Another example of exclusive freeway lanes is the San Bernardino Freeway in Los Angeles where construction of an 11-mile section of exclusive bus lanes in the median strip is nearing completion. This facility is a heavy commuter corridor connecting the Los Angeles CBD. Currently, the 7-mile long outer section is in operation. When completed, substantial travel time reductions for buses are anticipated.

Reserved Freeway Lanes - This concept involves reserving one or more of the existing freeway lanes for use by high occupancy vehicles.

No physical separation of the reserved lane is believed necessary, although this hypothesis has yet to be tested in the field. High occupancy vehicle flow in the reserved lane would be "with-flow"; that is, in the same direction as normal traffic flow in the adjacent lanes. Traffic control would be accomplished through special lane-use control signs and markings. The number of reserved lanes assigned and the vehicle occupancy level required for eligibility can be varied depending on the unique characteristics of each freeway. A computer simulation model, called PRIFRE, for use in testing and evaluating reserved lane strategies, has been developed by the Institute of Transportation and Traffic Engineering at the University of California, Berkeley, under FHWA sponsorship.

In concept, restricting the use of one or more free-flowing lanes to buses and carpools while low occupancy autos move along at a slow pace in adjacent lanes has great appeal as a timesaving incentive. However, there is not complete certainty that the concept will function in perfect accord with theory. Initiation of the scheme may cause severe overloading of the unreserved lanes and overall delay increases for the total stream. This is expected to induce shifts into buses and carpools. If a sufficient amount of shifting actually occurs, then the person-moving capacity of the freeway will increase. Vehicle miles traveled and total travel time on the facility will be reduced. The amount of shifting it takes to produce these benefits depends on the initial freeway traffic characteristics and initial vehicle occupancies. Some traffic engineers fear that severe traffic congestion and safety problems could occur both initially and during the transition period.

Several other potential problems with the reserved lane concept have been identified, including lane-use enforcement difficulties, lane change hazards caused by the high speed differential between the reserved and unreserved lanes, and difficulty and delay in weaving across the congested unreserved lanes to get to and from the reserved lane. These concerns are just as real as the potential benefits of reserved lane operation.

Reserved freeway lane projects are in various stages of development, but none is yet operational. In Miami, one extra lane in each direction is being constructed on a 10-mile section of I-95 for use as reserved bus and carpool lanes. In Northern New Jersey, a feasibility study for reserved lanes is almost underway. In Los Angeles, plans are moving rapidly for an early implementation of the reserved lane technique on the Santa Monica Freeway -- this project may be out into operation in early 1974.

Contra-Flow Freeway Lanes - This concept involves reserving a lane for buses on the "wrong-side" of the freeway during peak hours. This scheme is designed to take advantage of the fact that on many freeways peak-hour traffic flow in the opposite direction is very low (for example, outbound traffic in the morning peak period is light). The excess capacity can be assigned to buses traveling in the heavy flow direction. The contra-flow bus lane traffic and the opposing flow are separated with traffic posts and extensive lane-use control signing. In some cases, an extra buffer lane is also used as a separator to increase the level of safety.

The contra-flow lanes implemented to date have been for buses only. The addition of carpools raises serious questions regarding safety and the handling of vehicle breakdowns.

The most successful example of a freeway contra-flow lane is in Northern New Jersey where such a lane is operating on a 2.5-mile section of I-495 connecting the New Jersey Turnpike with the Lincoln Tunnel to New York City. The technique is applied during the morning commuting hours when 950 buses carrying 40,000 passengers typically use the contra-flow lane. Bus riders save 8 to 15 minutes compared with the previous situation when buses were mixed in a heavily congested stream with autos. No significant safety problems have arisen as a result of this contra-flow lane.

A five-mile contra-flow bus lane was implemented on Route 101 in Marin County, California, north of the Golden Gate Bridge. This lane carries commuters on buses outbound from San Francisco during the afternoon peak period. A buffer lane separates the two minor flow direction lanes from the contra-flow lane.

In New York, the Long Island Expressway has a two-mile long contra-flow lane for city-bound buses between the Brooklyn-Queens Expressway and the Queens-Midtown Tunnel. The buses travel this section in under four minutes compared to 18 minutes for normal peak-hour traffic.

Reserved Lanes At Toll Plazas - This concept involves reserving one or more channels at toll plazas (e.g., bridges, tunnels, turnpikes). Frequently, toll plazas are high-delay points during peak-commuting periods. Reserved lanes present the opportunity for substantial time savings for high occupancy vehicles. This concept is operational at the San Francisco Oakland Bay Bridge toll plaza processing San Francisco bound vehicles in the morning peak period.

Two lanes are reserved for carpools with three or more persons, and one is reserved for buses. The high occupancy vehicles have monthly permits, at reduced rates, which eliminate the need to stop at the toll plaza. Approximately five minutes is saved by buses and carpools during the peak hour. The number of carpools using the bridge during commuting hours has increased from 1,000 to over 1,700, and approximately 500 well-loaded buses benefit from the scheme.

Reserved Lanes on Surface Streets - Reserved lanes for buses are widely employed on surface streets in U.S. cities, including both with-flow lanes on two-way streets and contra-flow lanes on one-way streets. Although these schemes have definitely improved bus operations, the magnitude of time savings by bus riders making relatively short-haul trips on surface street reserved lanes is not very large. This technique is not considered a very strong incentive to switching to a bus. However, if employed on a widespread basis, it may result in a worthwhile improvement in travel time and efficiencies in utilization of bus fleets. The addition of carpools raises serious questions regarding enforcement, lane capacity, turning movements, etc.

Exclusive Freeway Ramps - This concept involves the complete reservation of specified freeway entrance ramps for buses and carpools during peak hours. This scheme can provide a substantial time saving incentive for bus riders and carpools and may, as well, cause added delay or inconvenience to low occupancy vehicles. So far in practice, exclusive ramps have been used only for buses. Other high occupancy vehicles have not been included.

A good example of the concept is found in the Blue Streak Project in Seattle where buses traveling on the reversible lanes of Interstate 5 freeway use an exclusive exit ramp to avoid delay in getting to the downtown circulation loop. In the afternoon peak, the process is reversed, and the exclusive ramp is used by buses entering the freeway.

Priority Metered Ramps - A widely used freeway traffic control technique is ramp metering. The rate of vehicle entry to the freeway is controlled by special traffic signals operating during peak periods. In the priority scheme, a second lane is provided on the ramp for use by high occupancy vehicles. This lane gives the multi-occupant vehicles preferential treatment by passing the queue of vehicles waiting at the metering signal.

This concept has been operating since June 1973 on the Lakewood Boulevard entrance ramp to the San Diego Freeway in the Los Angeles area. The low metering rate used during the afternoon peak period causes delays of 7 to 9 minutes. Any vehicle with two or more persons now avoids this delay. After the first two weeks of operation, the number of carpools using the ramp increased by 120 percent, and the average occupancy increased from 1.2 to 1.5 persons per car. Approximately 60 percent of these carpools are newly formed, while the remainder are carpools that shifted to the priority ramp from other ramps or city streets. Violations by single occupant vehicles have averaged about five percent even though only limited spot enforcement has been applied.

In Minneapolis, nine metered entrance ramps to Interstate 35 are set up for priority entrance by buses. Implementation is scheduled for early 1974.

Priority Traffic Signal Operation - Operation of traffic signals to give buses priority treatment has been tested successfully in several cities, including Los Angeles; Kent, Ohio; Madison, Wisconsin; and Washington, D.C. Delay reduction is accomplished through a bus preemption device which permits either an early start of the green signal or an extension of the green signal, or both. The FHWA Urban Traffic Control System Project in a network of 112 signals in Washington, D.C., is the first large scale test of the concept and results are not yet available. None of the previous priority signal operation schemes has been coupled with reserved bus lanes, but it is felt that combining the two schemes is essential to produce delay reductions large enough to be considered as incentives to shifting into buses. There does not appear to be any feasible way to include carpools in priority traffic signal control systems.

Priority traffic control techniques described above should be applied only after thorough traffic operations analyses have been made. Each freeway facility has unique physical and traffic flow characteristics, and the impact of any proposed priority technique will be highly dependent on the initial characteristics.

CONVENIENCE INCENTIVES

Convenience-related incentives increase the attractiveness of carpooling. There is some overlap between convenience incentives and cost or travel time incentives, since time and cost are often elements of convenience. In general, however, the following incentives appeal most directly to the motorist's sense of comfort and his desire to minimize the effort related to travel.

Preferential Parking Space Allocation

This procedure may be applied by individual employers either public or private, who control a single parking area, or by coordinated management at a multi-employer site. The purpose of this method is to offer carpoolers an advantage over other drivers at the work site in terms of convenience, time savings, or comfort. The methods of application include:

- Assignment of close-in spaces to carpoolers in parking lots
- Assignment of reserved parking spaces to carpoolers
- Assignment of parking spaces nearest street level of multilevel parking structures to carpools
- Assignment of sheltered parking spaces to carpoolers where some parking areas are not sheltered
- Assignment of all parking spaces to carpools only

The most common procedure for implementing preferential parking is the issuance of stickers which are applied in a readily visible spot on the vehicle, thus permitting easy identification of unauthorized cars either at point of entry or while patrolling parking areas. Enforcement must include a method for inspecting incoming or outgoing vehicles to ascertain that the vehicle is indeed carrying the number of persons specified.

This incentive is most successful only when employees can perceive a distinct advantage to themselves over their fellow employees who do not carpool, not merely a marginal improvement over an existing parking situation.

Preferential parking can be implemented quickly and inexpensively. It has been proven of significant value in a large number of applications; among them, McDonnell Douglas Corporation, St. Louis. With

reserved lots for carpoolers, they have achieved a car occupancy of 2.8 persons per car arriving at the plant. Connecticut DOT, Hartford, has reserved 245 choice parking spaces for carpoolers. The successful NASA program, Washington, D.C., allocates preferred spaces on the basis of car occupancy as well as years of service. The ECCO program, Omaha, Nebraska, cites preferential parking as the first suggested incentive. Hartford Insurance, Hartford, Connecticut, offers preferential parking in a covered garage for carpoolers. In Little Rock, Arkansas, the provision of 500 close-in parking spaces has been a factor in an increase of carpoolers from 400 to 1,000 at state offices.

Facilities for Carpoolers

Employers and public agencies can provide a number of facilities to encourage the use of carpooling. Such facilities are generally being provided with little capital or maintenance cost. In some cases, the required facilities already exist and need only be designated for carpool use.

Park and Ride Lots for Carpools - One successful method for encouraging carpools is to locate and designate certain parking areas for use of carpoolers as a rendezvous point. Many shopping center lots now are being used in this manner either with or without the agreement of the management.

Other likely locations are areas around highway interchanges where it is convenient for drivers coming from various compass directions to assemble in one vehicle for the major portion of the trip. In some cases it is possible to pave over a portion of the area beneath a freeway interchange; in other sites, merely paving or stabilizing a shoulder of the roadway will permit cars to park safely off the main roadway.

Three lots, with a total capacity of 10,000 spaces, were opened by Nassau County, Long Island early in 1974. These park-and-ride lots are expected to serve commuters working in New York City and those using various Long Island expressways. Large numbers of carpoolers are already meeting at expressway interchanges in Nassau and Suffolk Counties.

Carpool Loading Areas - To encourage carpooling from the employment site the employer may set aside a sheltered area where carpoolers may comfortably wait for their driver. This area may be a

bay or simply a reserved area that will permit standing for a short time while carpool vehicles are loaded without interfering with the normal outflow of traffic from the employee parking lot or garage.

The cost of these pick-up zones could vary from a minimal cost for some curb paint and a sign to several thousand dollars for additional construction for a bay outside the main traffic lane.

Carpool Shelters - As an additional encouragement to carpooling from the employment site, the employer can provide sheltered waiting areas for carpool riders. These areas may simply be designated in existing buildings that are convenient to carpool parking areas, or they may be shelters constructed specifically for this purpose.

The cost of this type of facility ranges from an almost negligible cost for designating space in an existing building to a cost of several thousand dollars for a new bus-shelter type of building.

Carpool Gates and Plant Entrances - Large employers, with company grounds and buildings having various gates and entrances, may reserve some for the exclusive use of carpools. Carpools would also be permitted to use any other gate or entrance open to employees.

This type of incentive is more effective in situations where existing access to grounds and buildings is hampered due to congestion or circuitous routings.

The cost of this type of incentive consists of an almost negligible amount to designate existing gates and entrances as carpool facilities. Construction of new gates, entrances, required roadways and connectors can involve major capital expenditures not likely to be justified unless it is part of a broad and vigorous carpool program involving other elements.

Carpool Use of Restricted Roadways - Campuses, industrial parks, office parks, and other institutions having restricted internal roadway systems can permit carpool use of restricted roads. This incentive can permit door-to-door service for carpoolers.

Provision of Other Carpool Aids - Company provision of bulletin boards and information kiosks can be of benefit as part of an incentive program. Costs range from an almost negligible amount for the designation of existing bulletin boards for carpool use, to several hundred dollars for the placement of new bulletin boards.

Adjustments to Working Hours

Both public and private employers can apply carpool incentives which will permit employees greater flexibility and freedom to arrange carpools with other employees who may have different work hours. This may be accomplished by changing the shifts of individuals who carpool, or by merely allowing them an earlier start-and-leave time to meet a carpool.

All of these incentives, however, would require modification of union contracts and working rules if implemented in unionized work sites. The effects on productivity would also have to be weighed by employers.

Shorter Working Hours - Entire carpools could be granted a few minutes earlier leave time as an incentive to avoid waiting lines in a parking lot at quitting time. This essentially would be a reduction in working hours.

A further working hour incentive is an overall reduction in working hours for persons who carpool, perhaps applied to both ends of a shift, or work day.

Other Working Hour Incentives - Other incentives may be related to working conditions, such as shift rotation preferences for carpoolers or even a day or half-day off.

Another approach is for management to encourage the maintenance of normal work hours so that employees will not be subjected to overtime and can meet their carpools. This has been done at the Pentagon, for example.

Flexible Working Hours - This incentive measure would not reduce the total number of working hours by a carpooling employee, but would permit working hours to be arranged so that starting and quitting times fall within a specified range (for example, starting times 8:00 - 9:00 a.m. and quitting times 4:00 - 5:00 p.m.)

This measure can be implemented for little cost other than any initial bookkeeping changes that might be required. On the basis of the popularity of this type of plan in companies already applying it to all employees, it appears to be an effective incentive.

Adjustments in Academic Hours and Policies - Various types of incentives can be offered through variations in policies at colleges

and universities. For example, carpooling students could be given first priority in class registration, a privilege already granted to various special groups at many universities. As large employers themselves, universities are also capable of providing any of the employer-sponsored measures relating to parking convenience, restrictions, cost, etc.

Vehicle Restriction

A series of rather severe measures could be imposed by local governments to restrict entry to entire areas to carpools and buses only, at least during the peak commuter hours. This could be applied to high activity centers such as the central business district of a major city or an airport area (applicable to employees only). Such a measure would eliminate any exceptions and would, of course, require extensive enforcement procedures. Adequate planning, provision of collection points, and possibly even barriers would be required.

Parking Restriction

Carpooling is encouraged if the supply of parking spaces is inadvertently or artificially reduced. This may be done by regulating the number of new or existing parking spaces available through parking authorities or other agencies.

Reduction of Existing Spaces for Non-Carpoolers - A specific reduction in the number of parking spaces available for non-carpoolers could be imposed. Local jurisdictions might permit only carpools in designated public and/or private lots and garages during commuter hours. Restriction might be applied on a proportional basis, allowing some provision for single drivers on a priority basis. This technique is employed at the NASA, GSA, and several other federal office buildings in Washington, D.C.

Restriction of On-Street Parking Supply - Most urban areas presently forbid on-street parking on arterial streets during rush hours; this could be further augmented by restricting all parking in the CBD during the peak hours.

Control of Parking Supply - Local governments can control the number of parking spaces, especially in the CBD, by prohibiting a new increase in the number of spaces. This has been done in Boston where the only new construction of parking space can be on a one-for-one basis to replace existing parking supply. Other centers, such as London,

England, are controlling parking supply by severely restricting the number of parking spaces permitted in any new construction.

Legislative

Local traffic, public works and regulatory agencies could cooperate in a program to aid carpoolers by relaxing rules on no parking, stopping, or standing on city streets to permit carpools to pick-up and drop passengers. As with on-site facilities, a shelter to protect waiting passengers could be furnished. These areas should not interfere with traffic flow. In some places bus-loading zones could be extended with carpools restricted to one portion of the bus zone. Existing bus terminals or bays would be ideal locations. Newly constructed bays or islands should be located near parking lots or other high density areas which can be reached easily by foot or car.

INTANGIBLE, NON-TRAVEL RELATED AND OTHER INCENTIVES

A variety of schemes not directly related to travel can be utilized by employers, civic organizations, universities, and merchants. These may provide incentives in the form of social-consciousness reinforcement or as refunds for purchases of goods or services.

Registration Information at Colleges and Universities

A computer printout listing potential carpool matches can be provided in registration packets given to students with class schedules. This has been done at Metropolitan State College in Denver.

Recreational Areas and Sports Areas

In the Rocky Mountain area two ski resorts offer either reduced lift tickets or a half-day free lift ticket to carpools of four or more. Football, baseball, and other sports organizations could offer free or reduced parking fees for carpoolers attending events.

On-Site Food Facilities

In suburban locations, employers could provide and maintain good facilities for food service so that employees would not need a car to leave the premises for a meal.

A consortium of restaurants in McLean, Virginia, has initiated service to transport workers to and from a research park area to any restaurant in the center of town at the noon hour.

Awards

Recognition or monetary awards may be an incentive to carpooling, such as:

- Listing of carpoolers in company newspaper
- Announcing carpoolers on the radio, especially on "commute" type stations
- Time off or bonuses to carpoolers

Other Incentives

Some personalized techniques could be applied to meet special needs. For example:

- Matchmaking schemes could try to match non-smokers as an inducement to relieve the anxiety of persons who do not like to ride in a crowded vehicle with smokers
- Face-to-face meetings could be arranged on company time for potential carpoolers to get acquainted
- Employers or sponsors could assure potential carpoolers of the safe driving habits and records of the participants
- Community organizations could establish special services, such as:
 - A carpool "Welcome Wagon" for new residents
 - "Hotline" telephone service for general information and matching
 - Public information clearing house
 - Speakers bureau

ORGANIZATIONAL INCENTIVES

It is quite clear that business is beginning to appreciate that promoting car, van, or buspooling is important to them. They are recognizing that assuring access to their property is a fringe benefit they must provide if they are to be competitive. Many companies are now providing their employees with a \$1/day or more fringe benefit

by picking up the bus fare or parking fee, providing vehicles, and sponsoring other incentives referred to in this report.

Although the motivation of organizations, such as businesses, to initiate carpool incentives is somewhat beyond the scope of this discussion on incentives, it is useful to note some of the factors encouraging the organization of carpools and vanpools:

- Limitations on parking space. Many employers and businesses are faced with a worsening shortage of parking spaces.
- Employee pressure. Organizations which originally located at remote sites, due to zoning, land prices, etc., are now faced with increasing competitive pressure (with respect to employees) compared to more advantageously located employers.
- Cost of parking facilities. Even when land is available, rapidly escalating construction costs are an incentive to seek other means of accommodating employee travel.
- Traffic impact. Increased environmental awareness has resulted in closer scrutiny of traffic impacts of large employment centers. Encouragement of carpools is a means of alleviating adverse traffic effects, as well as the related employer-borne cost of street improvements.
- Zoning. There are examples of employers developing carpooling plans in response to requirements by a local zoning board.
- Corporate prestige and good will. For many companies, the "Good Neighbor" incentive is a powerful motivation. Various public relations benefits are derived from some type of carpool and vanpool programs.
- Economic incentives. For tax reasons or for outright net revenues, some companies may find investment in carpooling to be profitable.

SUMMARY OF INCENTIVE MEASURES

Table 1 summarizes the types of incentive measures outlined and discussed in the preceding sections of this report. Included in this table are identification of potential sponsors of the various measures,

TABLE 1. SUMMARY OF INCENTIVES

	Potential Sponsor					Cost to Sponsor		Implementation	
	Government Agency	Employer	Citizen Group	University/ College	Other Organization	Initial Cost	Continuous Cost	Operational	Planned
Cost-Related Incentives									
Parking Cost	*	*		*	*	Low	Low (or net revenue)	*	
Automobile Ownership Cost	*	*		*		High	Varies, can break even	*	
Automobile Operating Cost	*	*		*		High	Low (or net revenue)	*	
Travel Time Incentives									
Vehicle Priority Traffic Control	*					Moderate/ High	Moderate/ High	*	
Convenience Incentives									
Preferential Parking Space Allocation	*	*		*		Low	Low	*	
Facilities for Carpoolers	*	*	*	*	*	Low/ Moderate	Low	*	
Adjustments to Working Hours	*	*		*		Low/ Moderate	Moderate High		*
Vehicle Restriction	*					Low	Moderate		*
Parking Restriction	*	*		*		Low	Low		*
Legislation	*					Low	Low		*
Intangible, Non-Travel Related and Other Organizational Incentives									
Intangible, Non-Travel Related and Other	*	*	*	*	*	Variable	Variable	-	-
Organizational Incentives	*	*	*	*	*	Variable	Variable	-	-

as well as broad ranges of initial and continuing costs associated with their implementation.

In the following sections, some important elements common to all incentive measures are identified. An understanding of the nature of these elements is helpful in developing new and innovative incentives.

Sponsor

A sponsor is an agency, organization or individual having the capability to provide incentives for carpooling. Major existing and potential sponsors include the following:

- Local Government, Transportation and Planning Agencies. Transportation-related agencies include traffic engineering departments, parking departments and authorities, and toll facility authorities. These agencies exist at the local, regional, county and state levels. Planning agencies include planning departments, Councils of Government, multijurisdictional planning councils, zoning boards, and local government legislative bodies.
- Employers. Almost all employers are potential sponsors of carpool incentives. Public employers and large private employers are particularly likely sponsors of incentive programs.
- Citizens and Transportation-Related Groups. Various types of organizations not related to employment or governmental agencies can sponsor carpool incentives. Typical of this type are neighborhood associations, volunteer agencies, property owner consortiums, retail merchant associations, automobile clubs.
- Universities and Colleges. The large concentration of employees and students attracted by universities makes possible the use of some incentive measures not generally feasible elsewhere.
- Other Organizations. Other organizations capable of offering carpooling incentives include military installations, labor unions, recreational facility operators, sporting events promoters, transportation terminal operators, radio stations, apartment owners and managers.

Basic Motivation Employed

In any discussion of carpool incentives, it is helpful to consider the basic motivation for forming or joining carpools:

- Travel Cost is one of the most powerful factors in the decision to carpool. Cost-related incentives include those which reduce the parking cost, the driving cost, or both. Examples of parking cost incentives are the reduction in parking costs for carpoolers, or, conversely, an increase in parking cost for non-carpoolers. Driving cost incentives include reduction in tolls or provision of company vehicles.
- Travel Time is also a strong factor in the decision to carpool. Examples of incentives related to travel time include the allocation of preferential parking spaces, the allocation of reserved street and freeway lanes, priority ramps for carpoolers, and reduced working hours.
- Convenience motivating measures include, for example, the allocation of close-in or weather-protected parking to carpools or the allocation of first choice of working hours to carpoolers.
- Intangible Factors, such as the image of carpooling as a highly desirable activity, can be significant factors in decisions to use carpools.

Impacted Trip Segment

With respect to the journey itself, there are three points at which carpool incentives are applied:

- Origin: Incentives can be applied to the gathering of carpoolers prior to the beginning of the carpool trip. (Example: park-and-ride facilities for carpoolers)
- Trip Itself: Many incentives can be applied to some aspect of the journey. (Example: reserved freeway lanes for carpoolers)
- Destination: A number of incentives are applied at the destination point. (Example: preferential parking for carpoolers)

Duration of Incentive

The duration of incentives is dependent on the type used.

- One- Time Incentives are those measures applied only once or infrequently. (Example: Promotion campaign)
- Continuing Incentives are those measures which apply continuously or at frequent intervals. (Example: Preferential parking plan)

Degree of Restrictiveness

Most incentive measures can be applied in either a positive or negative manner:

- Positive Incentives are designed to render carpool travel more attractive than non-carpool travel. (Example: Lower parking fees for carpool vehicles)
- Negative Incentives are designed to render non-carpool travel less attractive than carpool travel. (Example: Higher parking fees for all non-carpool vehicles)

Both types are presented in this section. Positive incentives which reward carpoolers are more acceptable than negative incentives which, in essence, punish non-carpoolers.

Careful consideration should be given by all potential sponsors as to which specific incentives are implemented as to effect, cost, east of implementation.

SECTION 6
TRANSIT/TAXI COORDINATION

TRANSIT/TAXI COORDINATION

INTRODUCTION

This report discusses potential opportunities and problems facing transit and taxi operations which may result from a carpool program. Strategies and guidelines for coordinating carpooling and integrating transit/taxi interests are outlined.

Background

As the energy crisis deepens, with gasoline shortages progressively restricting the accustomed mobility of all Americans, more and more people will turn to carpooling. It represents one of the best ways (and perhaps the only way) of maintaining mobility and still saving fuel. To preserve essential mobility within limited fuel allocations, vehicle occupancy must be increased, whether the vehicles are private automobiles, taxis, or transit.

Carpooling will affect transit and taxi services on a long-term as well as a short-term basis. The effects can be positive or negative according to the manner in which transit and taxi operations gear their activities to take advantage of opportunities generated by the carpooling program and improve their own services to remain competitive.

There are a variety of innovative ways for transit, taxi, and carpooling to operate synergistically to their mutual benefit. Society benefits as well by acquiring better mobility and conserving fuel. There may also be costs. This report discusses the various ways in which coordination for mutual advantage can be achieved, and the benefits and costs of carpooling in terms of their relationship to taxi and transit operations and to society.

In the present energy crisis, all forms of multi-passenger transportation will be called upon to expand their operations and increase their occupancy ratios. Each will have a specific role to fulfill. Transit will serve, perhaps in more varied ways, the higher density portions of our cities where there is sufficient demand to make use of transit's greater capacities. In low density suburban areas, rural areas, and small towns where transit cannot function economically due to low ridership, carpools could be the mode of choice. Between the two exists a market for what has come to be called "para-transit" -- forms of public transportation with capacities higher than

the private automobile but retaining many of its features of flexible time schedules and routing to best serve low-to-moderate density areas. Examples of para-transit include taxis, vans, jitneys, dial-a-ride, subscription bus, and rental cars.

Conventional transit functions best where demand is sufficient to provide high levels of peak and off-peak ridership. The high capacity of transit facilities make such conditions a prerequisite to economic viability. For this reason, transit's basic system usually consists of a network of line haul facilities (either rail rapid transit, commuter rail, or express buses) often arranged in densely populated radial corridors focused on the city center. Local collection/distribution or feeder facilities may exist to link the basic system to neighborhoods lying outside its walking range. These local systems can consist of park-and-ride automobiles, carpool-and-ride arrangements, or bus or para-transit service.

While such a functional division of roles and tasks among transportation modes and types of vehicles (each matching capacity and operating characteristics to consumer demand) approaches the goal of efficiency, there are difficulties in its immediate achievement. The nation is currently faced with limitations on the capacity of transit and taxis to cope with the totality of the demands for increased vehicle occupancy that will likely emerge as a result of fuel shortages.

At the present time carpooling must play a primary role in the effort to increase vehicle occupancy, because transit and taxi systems do not have the necessary amount of excess capacity now during peak hours of operation to achieve desirable goals within a reasonable time frame. There are approximately 170,000 taxicabs and 61,000 transit vehicles in the United States as opposed to 35,000,000 commuter trips by private automobile per day. Present taxi and transit capacities would have to be 20 times greater to accommodate a full diversion of automobile drivers to these modes.

In World War II, the last period in which gasoline shortages were experienced, transit and taxi took up much of the slack in mobility. They were able to do so because these modes had more vehicular capacity available in that period, travel habits had not become so auto-oriented, and the population had not become suburbanized to its present extent.

Today, transit's and taxi's total capacities are lower. The consensus is that typical transit systems have only approximately 15 percent unused peak-hour capacity. Residences and jobs have moved in large

numbers to the suburbs. The automobile that made suburbanization possible largely remains the only mode capable of effectively servicing the dispersed infrastructure.

In the long run, public transportation has the potential for carrying a larger share of current automobile travel. It will mean, however, additions of large numbers of vehicles to present fleets and a reorientation of land use infrastructures to public transportation's operating characteristics and capacities. Both processes operate slowly, and it will take a number of years to achieve public transportation's potentials.

For the short term, transit and taxi operations can do their share in alleviating the present crisis by:

- Instituting more effective marketing programs to assure that they capture as many of the riders diverting from single-occupant automobiles as possible, up to transit and taxi capacity constraints
- Using the carpooling programs to obtain information useful to their operations and generate added ridership using the program as a public information vehicle
- Evolving additional necessary services as demand appears for them: for example, tailoring special "pool" services of their own to meet the specialized needs of certain groups of commuters

There are understandable fears in the taxi and transit industries that carpooling efforts could attract a portion of their existing patronage. While this may occur in some instances, there is good reason to believe that any reduced ridership will be short term and limited in magnitude. This belief is supported by these considerations:

- Carpooling may increase the off-peak demand for taxis and transit, considering that all carpoolers, except drivers, will lack an automobile for personal mid-day travel. This offers special advantage to transit operations, one of whose major problems is that capacity created to handle peak-hour demand is under-utilized in the off-peak. From this cause stems a large share of operating deficits. Such deficits may thus be reduced indirectly by carpooling programs.

- Carpoolers will more likely come from the ranks of those who presently drive their own car than from those who ride taxis or transit. Transit and taxi users have no more reason to shift to carpools now with a fuel shortage than they did before the shortage. The real loser will be the single occupant automobile whose use will diminish in favor of all the alternatives: carpool, taxi, transit, walking, and bicycle, or choosing not to travel.
- The amount of reduction in commuting fuel consumption due to shortages has been pegged at various levels. Assuming 25 percent as a realistic figure, this would mean removing 8 to 10 million vehicles daily from the traffic stream. Not all those necessarily diverted from the automobile can or will carpool. Transit and taxi may well have problems coping with their share of this new demand rather than losing patronage.
- Previous experience with gasoline shortages in World War II indicates that people, faced with a choice of carpooling and public transportation, choose both according to which best serves their travel needs and preferences.

It would appear that, with increased emphasis on public transportation, operators will have little to fear. However, should ridership and revenue reductions occur, in spite of the above considerations, they can be minimized if local officials, public and private, are: (1) aware at the outset of the problems this could bring to them, and (2) aware of steps that might be taken to aid public transportation in its several forms. As carpool and other urban gasoline crisis efforts mature, the transit and taxi industries can grow substantially if financial aid, regulatory practices, and genuine cooperative planning and marketing efforts are equal to the task.

The remaining sections of this report highlight the various strategies considered necessary for proper transit/taxi coordination during the course of a carpooling program.

CARPOOL IMPACT

The implementation of a carpool program could have both positive and negative impacts upon transit and taxi operations. In World War II, when large-scale carpooling occurred as a result of gasoline rationing, operating income for the transit industry almost doubled from \$76 million in 1940 to \$149 million in 1945. At this time, when carpooling

on a large scale may remove the need for gas rationing, the national mood is not quite as crisis-oriented. People may not accept transit's occasional drawbacks (e. g., crowding, waiting, walking to stops) as readily as they did in wartime. For this reason, it is not sufficient to say that just because more emphasis will soon be placed on carpooling throughout the nation, transit and taxi operating income will increase as significantly as during World War II. There is reason to believe, however, that with sustained long-range emphasis on carpools, and proper coordination, there could be distinct advantages to transit and taxi operations. If the emphasis should soon die, though, there is a possibility that the benefits derived by transit and taxi operators may also diminish unless offset by the attractions of improved service.

ADVANTAGES OF CARPOOLING TO TAXI AND TRANSIT

After a careful review of operational characteristics, the following possible transit and taxi associated advantages, short and long range, were identified if a carpooling program was implemented:

- Carpoolers, other than the driver, lacking an automobile for business, luncheon, and shopping trips during the business day, will turn to available transit and taxi services. This increase in transit demand at off-peak hours will not only increase transit usage but also improve the peak-to-off-peak ratio relationship. Service improvements and enlightened marketing may be needed to capture this market as there are the options of walking to destinations or deferring certain activities until after hours when a personal vehicle is available. Aggressive marketing on the part of taxi and transit operations during this time of public concern for energy conservation may expose new demands for service. For example, a restaurant owner may wish to charter a bus to circulate through an employment area transporting patrons to and from lunch. This type of demand would, of course, improve off-peak bus utilization.
- Transit and taxis can function as back-up systems and thus capture additional riders whenever the regular carpool ride is not available for such reasons as vehicle malfunction, driver illness, inclement weather, or unanticipated working hour changes.
- Carpools will often serve as feeders to line haul transit facilities from low population density suburban areas that would be otherwise uneconomical to service. This would help increase transit ridership.

- From a long-range point of view, carpooling may develop group-riding habits that will eventually turn carpoolers into transit riders when transit offers certain advantages such as more flexible schedules or time savings due to exclusive bus lanes.
- Information from carpooling questionnaires can be used to develop information on the location and magnitude of potential transit and taxi markets, trip origins and destinations. Such information can be used to modify routes and schedules to serve more patrons; support the offering of subscription, charter, and express services; and justify the elimination of non-productive routes and services.
- Carpool program sponsors can provide transit and taxi user information (e. g. , route maps, schedules, information phone numbers, and numbers to call for cab service) along with carpool matching names and numbers. Transit and taxi information provided in this manner could (1) help persons become more familiar with public transportation services often unused due to lack of information; (2) allow persons to choose among their total range of options the one which best matches travel needs; (3) may provide the information needed to form carpools that interchange with park-and-ride or kiss-and-ride transit opportunities; and (4) make persons aware of transit available for other than commuter trips, thus increasing off-peak travel.
- Carpooling and taxis may relieve pressures to provide added peak-hour transit capacity in corridors or systems where demand already exceeds capacity, and where the transit operator is reluctant to add such capacity since this would seriously increase the deficit by worsening the peak-to-off-peak ratio.
- Carpooling's propensity to involve longer commutes in a single mode may, in combination with appropriate parking restriction or pricing policies, generate demand for transit or taxi shuttle services between parking facilities on the edge of downtown or other major employment centers to final destinations within the complex.
- Increasing numbers of carpools may generate justification for exclusive highway express lanes usable jointly by transit, taxis, and carpools. Exclusive bus lanes cannot always be justified because there are not enough buses to fill the capacity of one lane which could result in a net increase in congestion in the remaining lanes.

- A massive shift to save fuel by combining riders could, in many locations, increase demand sufficiently to justify establishing buspools, taxipools, or jitney service for the entire work trip or for segments of the trip, such as home to line haul transit line, or fringe parking lot to destination.
- Carpool availability may relieve transit operators of growing pressures to establish routes that are loss-productive due to low trip volumes, such as crosstown and urban fringe service.
- Taxi operations may find opportunities to expand their present services and clientele by the institution of taxi-pooling or vanpooling.
- Many possible traffic operations improvements, such as special turnouts, reserved lanes and streets, and progressive signal timing to aid carpools, could also be of benefit to transit under joint use. The combined need may help increase governmental funding.
- Carpooling, by reduction of traffic volumes, will ease congestion, thereby producing faster travel times for taxis and transit buses.

DISADVANTAGES OF CARPOOLING TO TAXI AND TRANSIT

Certain disadvantages to transit and taxi operations are also possible if a carpooling program is implemented.

- Carpooling may reduce ridership in some instances, but usually only in the short-run, when carpool efforts are just beginning. Such adverse impacts can probably be offset or avoided by adoption of strategies such as marketing programs, service improvements, and coordination with the carpool program itself. Such actions would cause transit and taxi services to function as part of an integrated transportation system of which they, like carpools, are component parts with well-defined roles.
- Carpooling's attractiveness may be enhanced, to transit's disadvantage, by allowing carpools to have reserved lane, busway, and toll privileges usually granted to transit. Buses and automobiles have different operating characteristics, and combining them in constrained situations should be carefully analyzed for relative benefits and cost. For example, buses travel more slowly on grades and

during acceleration. However, they load and unload passengers more rapidly. The speed differences will be apparent on the line haul portion of the trip, while loading time efficiency conflicts may appear on downtown streets where buses and carpools encounter limited curb space. Traffic management techniques can be used to address some of these problems; such as by separate bus and carpool streets and turnouts downtown.

EVALUATION

It is important to realize that the same condition of fuel shortage which necessitates carpooling is also likely to increase transit and taxi ridership significantly. The advantages to the taxi and transit operators outweigh the disadvantages, but because of the nature of the services offered, coordination is essential to insure that the advantages are fully realized.

There is every reason to believe that coordination will provide taxi and transit operators an opportunity to (1) derive and disseminate useful information, (2) develop and offer added services, (3) in both short- and long-range situations, attract sufficient peak and off-peak ridership to improve their financial situation, and (4) develop intermodal linkages in an integrated comprehensive transportation system that can reduce congestion, air pollution, and energy consumption and provide better mobility to the total community.

There is also reason to believe that, even with a strong carpooling program, transit or taxi services will be desired. A 1973 survey of a large manufacturing plant in Knoxville, Tennessee, by the University of Tennessee, revealed that of 400 workers, 43 percent preferred express bus service, and 37 percent preferred carpool service to work. In Peoria, Illinois, a premium special buspool service, which provided peak-hour service to workers at the Caterpillar Tractor plant attracted a substantial number of auto drivers and carpool riders; 43 percent of the riders were former car drivers; 20 percent were bus riders, 20 percent were car passengers, and 9 percent were carpools. A recent survey of users of the Reston, Virginia, charter bus service to Washington, D.C. revealed that 88 percent would not carpool if the opportunity to do so was available.

In the long view, public transportation will preserve and expand ridership to the limits of its capacity as it always has; not out of necessity due to energy shortages or by suppressing competing modes, but by

providing increasingly attractive service that is modern, efficient, convenient, economical, and responsive to the demands of the varied markets it best serves.

STRATEGY GUIDELINES FOR COORDINATION

To achieve the fullest degree of carpool program efficiency and energy conservation while also advancing the status of mass transit and taxi, the active support of the transit and taxi industries and local operators is needed. Only by proper coordination between common carriers and the carpool program and by the adoption of appropriate strategies can carpooling work to the mutually beneficial and reciprocal advantage of both forms of passenger transportation. This section outlines some of the strategies that appear best suited to produce such advantages.

Organizing for Coordination

As a minimum, a deliberate effort must be made to coordinate transit and taxi operations with carpooling program activities. There are distinct benefits to the public through action of this nature, because it insures efficient transportation.

For purposes of maximizing the utility of carpool matching efforts to the transit or taxi operator, he should become directly involved in the program, perhaps to the extent of even operating it in some communities if so doing is profitable or to his advantage. This approach is based on the definition of carpooling as a form of mass transportation which requires coordination with other forms for efficiency and maximum effectiveness in energy conservation.

Transit and taxi operators are an available resource already in the public transportation business. They have the potential to coordinate all multiple occupancy vehicle modes using each to its best effect. This potential management role should be brought to the attention of carpool program administrators -- if necessary, by the transit or taxi operators themselves.

The extent of carpool program participation by public transportation operators will vary according to local circumstances. At the very least, transit and taxi operators should function in an advisory capacity to the local carpooling program and actively support it. In that capacity they can voice their concerns over any potential problems foreseen as a result of the program.

At a higher level of coordination, there is potential mutually beneficial information gathering and dissemination. A next step would involve joint efforts in attacking problems of mutual concern such as obtaining reserved transit-taxi-carpool lanes or off-street passenger loading facilities. In such efforts it will likely be necessary to extend the coordination to public planning and other agencies capable of implementing solutions to the various problems. This emphasizes the value of undertaking various strategies in concert, rather than unilaterally, to avoid diluting the justification for mutually needed improvements.

A still closer meshing of carpool-public transportation interests would involve coordination of operations to avoid duplication and overlap of services, and provide inter modal integration and interface opportunities. With intelligent pooling policies and responsive public transportation operators, citizens can probably have mobility that approximates that which they have been accustomed to in spite of fuel shortages. It is a matter of developing new ways of organizing the provision of transportation services.

At the far end of the involvement spectrum is the yet undeveloped concept of "carpool companies." While not clearly defined as to function, the growing use of carpools may generate needs that can best be met by transit, taxi, or other companies getting into the carpool business. Such service can be at two levels: supplying the matching function and/or the vehicle.

Several of the problems encountered in carpooling might be solved by the services such a company could provide: leasing of carpool vehicles, group accident insurance, regular vehicle maintenance, towing and vehicle replacement in case of breakdown, vehicle substitution during maintenance periods, organizing persons with similar trip origins and destinations for carpooling -- or buspooling or taxipooling -- and accounting for a fair division of costs among carpoolers.

If such carpool companies can be operated at a profit, benefits to the community may be obtained at no cost to the government. The concept appears worthy of encouragement, further study, and development. Government support might be appropriate to investigate any legal barriers that presently prevent the organization of carpool companies by public transportation operators or others.

It is recognized that there are regulatory and union problems that may need to be overcome to implement such arrangements. The impetus to do so may come from the severity of the energy crisis. Necessity could force a rethinking of our entire concept of public versus private transportation.

Besides the transit/taxi strategies to facilitate coordination and understanding of the problems and potential solutions, further steps could be considered:

- Joint urban organizations to consider and plan new strategies for meeting opportunities by transit, taxi, carpooling, and street traffic management
- Employer financial aid to employees using public transportation, at least if there are direct or indirect financial incentives to carpoolers
- Government financial assistance such as extension of present transit/taxi service subsidy programs for specific groups, and funds for special data gathering and planning studies directed toward the entire para-transit area
- Transit/taxi operator initiative to become more deeply involved in the multi-modal approaches to serving urban transportation demands that are surfacing in the balanced transportation planning process
- Broad-based efforts to increase transit capacity for the longer run solution to urban travel needs

If these steps are taken, the transit and taxi industries will be in a better financial position, will be better informed, and will be more inclined to join in efforts to restructure urban travel patterns and habits caused by the reduction in automobile travel. The fact of the matter is that the crisis really presents a unique opportunity for growth, if encouraged. There are many strategies and service innovations to consider. Examples of these include:

- Developing joint suburban or fringe park-ride facilities and joint advertising for carpools, taxipools, and bus routes

- Many variations in demand-responsive service which can be operated by taxi or transit as the specific case may be
- New public transportation services or novel pricing schemes in general

Managers of the operating and planning functions of the various modes need to begin communicating among themselves how they can be more mutually coordinative as well as competitive, and can have a part in squeezing the most transportation service out of limited energy supplies. A great deal of innovative thinking can be done in this whole area.

Data Collection

Carpool matching programs, whether manual or computerized, usually require the dissemination of a questionnaire to obtain essential data from would-be carpoolers; e. g., name, phone, home address, work place location, work hours, whether they choose to drive, ride or alternate, and choice of fellow carpoolers (male, female, or mixed). The same questionnaire, with transit and taxi agency participation, can be expanded to gain information useful to the agencies. Such information might include:

- Interest in transit service -- either feeder, regular, express, subscription or charter -- or taxi service -- jitney or taxipool
- Willingness to join or organize a buspool or taxipool
- Desire to have specific route or schedule information forwarded

From data compiled from the completed questionnaire, the transit and taxi operators could:

- Locate peak demand locations and times for transit or taxi service which would assist in (1) modifying transit routes and schedules, or taxi stand locations; (2) tap latent but unserved transit or taxi demand; or, conversely, (3) justify the avoidance or discontinuance of low patronage transit routes.
- Identify and facilitate the organization of groups with similar commuting characteristics large enough to necessitate a buspool or a charter, subscription, or regular express service basis or taxipool or group taxi service.

A carpool/transit information system was developed as a cooperative effort between the University of Tennessee and the Knoxville Transit Authority during the Fall of 1973. Workers for major employers were asked to complete carpool matching information and state their preference for transit or carpool service. The data provided was analyzed by a computer program which produced printouts displaying: (1) a matrix showing the number of persons desiring to travel between pairs of geographic zones at a given hour; (2) employee names, addresses, phone numbers; and (3) carpool versus transit preference listed by zone. Samples of the printouts, now proving useful in arranging Knoxville transit and carpool services, are contained in Figures 1 and 2. The information gathering system is about to be expanded to cover the entire city.

Public Information

Carpool matching mailouts, containing the names of potential carpoolers sent to questionnaire respondents, can become a total transportation information kit. Transit and taxi operator coordination with this effort can provide recipients with, in addition to carpool information, transit route maps, fares, and timetables; maps of taxi service areas, taxi stand locations, and fare zones; plus telephone numbers to call for transit information and taxi service. Kits might be tailored to the individual recipient to the extent of informing him of the location of his nearest transit stops or taxi stands, and the time schedule of transit/taxi vehicles that match his work hours.

Possession of this information aids the commuter in deciding whether carpool, transit or taxi, best serves his travel needs. Should he choose to carpool, it can also make him aware of what "back-up" services are available should his carpool ride be occasionally unavailable.

Carpool Back-Up Service

As carpooling becomes more widespread, the incidence of carpool arrangements breaking down with one or more commuters left stranded will occur more frequently. Taxis and transit are logical choices to provide alternative back-up service. Operators can anticipate and promote business from this source by effective dissemination of information concerning the availability of their services for this purpose. Taxi operators may desire to increase their potential for offering such service by seeking to remove any impediments to group/shared riding or taxipooling that may exist.

FIGURE 1

CARPOOL LOCATOR MASTER LIST
FROM GPID X15Y25 TO GPID X16Y22

NAME	HOME ADDRESS	PHONE	CARPOOLING ^{1/}	EXPRESS BUS
FROM GPID X15Y25				
0000-0000				
000000	0000	0000	0000	0000
000000	0000	0000	0000	0000
0700-1500				
0000	0000	000	000	000
000000	0000	000	000	000
0000	0000	0000	0000	0000
0000	0000	0000	0000	0000
1530-1200				
000000	000000	000	000	000
1600-1200				
000000	000000	000	000	000
0000	0000	000	000	000

^{1/}VI - Very Interested
I - Interested
M - Most Interested

FIGURE 2

NUMBER OF PERSONS IN EACH HOME GRID DEPARTING FROM GRID X16Y22 FROM 3:30 P.M.

	1	3	5	7	9	11	12	13	14	15	16	17	18	19	21	23	25	27	29	31	33	35	
1																							
3																							
5																							
7				1	3	4						3		4									
9		2	4	14	1							1		2		5	1						
11										7		32		13	1				1	5			
13			1		2	2				4		1		1	34								
15				1		5		7		2				7	6	2							
17				2	11	6		20		3		4		9	8	6	4	1					
19			2		2	2	4	1	5	19	3	9	7	8	18	2							
20						3	21	5	22	24	3	5	15										
21		1	1	2	1	4		4	14	14	26	13	12	1	2						4	1	
22						6	8	20	33	71	73	40	10										
23	2	1		3		5	4	10	17	12	13	6	13	2	1			8	1				
24						3	2	8		11	17	1											
25				6	3	1	2	2	1	12		3	9	2		1	1	1					
26						2				5			1										
27	1	1		5	7				1	1				11	3	1			1				
29		4	9	1	1					1				1									1
31		2	4	2				11		1													
33	3	1						2		9													
35																							

Another aspect of carpool back-up service with which transit and taxi operators should be prepared to deal is the added demand generated for numerous short business, shopping, and luncheon trips made by carless carpool members during the business day. Transit will absorb many of these trips. Taxis will also serve a large number based on door-to-door convenience. Large employment centers and downtowns will be the focus of much of this demand.

A final dimension of back-up demand exists where employers have encouraged their employees to use their personal vehicles for around-town business trips in return for reimbursement for mileage. The cost of maintaining a carpool or fleet of company cars is thereby avoided. Carpooling may eliminate many of the cars formerly available for such business travel. The back-up systems used will often be taxis and transit.

Priority/Preferential Lanes

Interest has increased greatly in the past two years in preferential and priority treatment for buses in the general traffic stream. Strong support for this is coming from traffic management people, making the interest a reality. It has been found desirable in some locations to extend use of the priority lane to taxipools and carpools.

Opening priority lanes to all multiple occupant vehicles above a certain minimum increases justification for their provision. Priority treatment for buses and pools means faster travel, more reliable service, and reduction in annoying congestion. For public transportation, this means happy customers and ultimately more customers. It also means more utilization of vehicles in the peak period by faster trip turn-around (at least in the larger cities). Finally, it means lower operating costs and fuel consumption. Eventually, as traffic volumes grow, the preferential lane may be justified for transit vehicles exclusively. This would provide added incentive for transit use while reducing that for carpooling, bringing riders from the lower to the higher capacity mode for added energy savings. A necessary condition to such diversion would be a concurrent increase in transit capacity and attractiveness to avoid a return to single car occupancy.

The success of preferential lanes has been repeatedly demonstrated. In Houston, 100 percent use of curb lanes by buses (no right turn vehicles, no trucks or taxis) on only two-thirds of a mile of downtown Main Street saved from 5 to 10 percent of the total running time from terminal to terminal for one-third of the buses operating in the peak period. On the New Jersey I-495 approach to the Lincoln Tunnel, a

contra-flow lane for buses only for 2.5 miles reduced the travel time for 470 buses in that segment of the route by 15 minutes each in the morning peak hour. A 2.2 mile contra-flow bus lane on the Long Island Expressway saved 8 minutes each for 100 buses in that peak hour.

Service Options - Transit

In addition to those strategies described above which apply mutually to transit and taxi coordination with carpooling, there are various service options that can provide further opportunities for coordination with carpool programs and help preserve mobility for those who might otherwise suffer its loss during the energy crisis. This section describes some of these options as they apply to transit operations.

Buspools - Whereas carpools represent a means of combining trips of a few persons with similar origins and destinations and travel times into a single vehicle of limited capacity, buspools simply expands the concept to include large numbers of persons riding in a high capacity vehicle where warranted by sufficient demand. The same information used to identify carpools can also identify buspools. As carpools from a given area reach a certain number, buspool service can be offered. A variety of buspool arrangements are possible, and several examples of their success are available.

- Employer Sponsored Service - In one case example, the buspoolers are the employees of one large company coming from a common geographic area. They receive a monthly "subscription" pass by paying a lump sum which entitles them to ride the bus express between the same locations each work day.

Some major Los Angeles employers sponsor express buspools from park-and-ride lots, usually in shopping centers, to the work place. The employers initiate the arrangements, sometimes collect the subscription fare as a payroll deduction, and occasionally subsidize the service to reduce its cost to the employee and provide an added incentive for its use. Southern California Rapid Transit District, which provides the buses for the subscription buspool services, reports the services as becoming quite popular since their introduction in the Spring of 1973.

- Citizen-Organized Service - In cases where citizens initiate buspool service, it usually involves organizing enough persons and collecting from each, sufficient money to charter a bus for their exclusive use in commuting. The prime example is the Reston, Virginia, community-organized charter bus service to downtown Washington, D. C.

Buspools can frequently accommodate their patrons sufficiently to swing loops through neighborhoods or destination areas to cut down walking distance or avoid the need to park and ride.

When the popularity of a charter buspool service grows, as in Reston, additional buses can be chartered. These additional buses provide riders with alternative departure times and destinations so that flexibility is added to their schedules. The service gradually resembles a regularly scheduled express bus operation.

Detailed descriptions of buspools are contained in the report in this series bearing that title.

- Transit-Initiated Express Bus Service - This form of service is usually a regularly scheduled service of the transit operator, initiated by citizen requests or market demand. It qualifies as buspooling by reason of catering to the needs of a specific group of riders who use it habitually or to a neighborhood which has requested it.

Express bus service seeks to shorten trip times by linking two local locations over high speed roads without intermediate stops enroute. Various route configuration and operating policy combinations exist: park-and-ride, feeder bus to line haul express, door-to-door service, neighborhood, and destination area loops. The attractiveness of this service has been increased by such means as reserved bus lanes or busways for faster trips; free park-and-ride facilities, often in shopping centers, public, church, or theatre lots; and provision of such conveniences as waiting shelters, newspapers, and refreshments.

Examples of successful express bus operations are numerous. They include Seattle's Blue Streak , Washington's

Shirley Highway, and Los Angeles' San Bernardino busways -- all of which operate on reserved lanes.

Express bus service has found applications even in the moderate size cities and acceptance in what have been thought of as unlikely transit marketing areas. In Knoxville, Tennessee, an 800-family higher income subdivision requested bus service. A local firm offered to cover any deficit for the first month of operation. A door-to-door, premium fare express bus service was instituted and now carries from 40 to 60 passengers on each run.

Specialized Transit Services - Carpooling, air pollution controls, and the energy crisis, in combination, may generate demand for certain more specialized transit services, some of which have only been treated on a conceptual or experimental basis. Transit service opportunities include: shuttle services, feeder bus to express line haul transit, local coverage circulation within confined areas, dial-a-ride demand-responsive or subscription service, and special mobility services for elderly and handicapped persons.

These services respond to market needs that have previously existed or that are emerging as a result of fuel shortages. They appear to have in common sets of needs that are not met by traditional line haul transit service or even the more recent buspool express services just described. Such needs include: short journeys between two locations that fall slightly outside walking range; service with flexibility, mobility, and demand-responsiveness more nearly matching that of the automobile but with fare levels lower than taxi due to higher capacity vehicles and longer routing and travel time; and services that match the particular mobility needs or physical limitations of such groups as the elderly, handicapped or those with lower incomes.

Many of these needs are now served by private automobile. As the auto's availability declines or grows more expensive in a fuel shortage period, demands for such specialized services may require greater transit agency response to preserve essential mobility.

Problems of Service Additions - Buspool, express bus and specialized transit services that may be generated by public demand entail a variety of problems. Examples of the problems necessary to be addressed in the provision of added bus service, especially in the peak hour, include:

- Lack of express capacity in the form of unutilized equipment may deter service additions.

- Diverting equipment from what may appear to be underutilized routes to serve more productive ones may be difficult due to such political and social considerations as the responsibility to serve captive rider groups without mobility options.
- Adding service in the peak hour without a concomitant rise in off-peak demand just increases the deficit by generating additional idle or underutilized labor and equipment in off-peak hours.
- Express bus services usually involve long distances making possible only one peak-hour trip per bus.
- Obtaining park-and-ride lots is sometimes difficult. Reaction of shopping center owners to permitting their lots to be used varies on a case-to-case basis. Considerations of amount of surplus parking space available, liability incurred, and degree of trade that can be expected from park-ride commuters enter into decisions. Underutilized public, theater, church, and school lots provide other possibilities.
- Uncertainties as to the true demand potential may make experimentation with new services costly. Occasionally, groups demand service which, when provided, is not utilized by a sufficient number of persons; sometimes not even by the persons demanding the service.

Strategies that have been used to counter some of the problems listed above include:

- Obtaining employer agreements to stagger working hours to stretch out the peak period, thereby permitting more bus runs and reducing overloads. (This makes carpooling more difficult, however.)
- Reduced fares and marketing of charter services to school, church, senior citizen, club, and other groups to increase off-peak utilization
- Designation of reserved bus lanes and streets to speed peak-hour operations and permit more runs
- Utilization of highway funds to create publicly-owned park-and-ride facilities
- Arranging driver schedules to avoid idle time and overtime to the extent possible

- Obtaining guarantees of subsidies from local governments, employers, businesses, community groups, or others to cover losses incurred in providing services whose economic viability is uncertain
- Having the groups desiring service organize and administer it by contacting and signing up potential riders, collecting fares, and chartering service at a fixed rate per bus regardless of actual ridership. The carpool data collection process described previously can provide lists to community organizers that would be useful in canvassing for buspoolers.
- Carpooling itself can promote viable new service by dynamically growing to levels that would justify a buspool.

Service Options - Taxi

The following strategies appear potentially useful to taxi operators in coordinating services with a carpooling program for mutual advantage.

Taxipooling - Analogous to carpooling, taxipooling involves a small group of commuters, or other users with similar origins and destinations and time schedules, hiring a taxicab on a regular basis for their travel purposes. The group is considered a single client for fare purposes. By splitting the common fare, the cost to each taxipooler is less than what a lone passenger would pay. By combining their contributions, however, the taxi operator will usually end up with a greater amount than he would have collected from one rider. Both passengers and drivers thus benefit from the arrangement.

Taxipooling has often been used in the past for transporting groups of school children, handicapped, elderly, and others requiring door-to-door public transportation. Its use for commuters is somewhat rare but is becoming more common. A taxi operator in Huntington, Long Island, New York, operates a subscription taxipool to transport commuters from home to the local commuter rail station. The use of taxipools as feeders to line haul rail or express bus lines from low density residential areas appears to represent a particularly beneficial application of the concept. In Houston, Texas, would-be taxipoolers can arrange with the taxi dispatcher on the previous evening for next morning pickup at their choice of 13 suburban shopping centers. Service users will also be dropped off at any one of three downtown destination locations. Fares for a month of rides add up to \$10 or \$20 less than the usual downtown parking fee for the same period. Salt

Lake City, Utah, has a similar taxi service that transports taxipoolers from their home to one of four city center destinations. A St. Louis, Missouri, operator is promoting the idea to employers with evidence of interest.

None of the existing taxipool services is yet serving large numbers of persons on this basis, but the feasibility and potential of the concept for solving problems of gasoline shortages, parking, traffic congestion, and air pollution are demonstrated in these examples.

Some problems with taxipooling appear to be the following:

- Taxi companies can market the idea but cannot, by regulation, solicit individuals to join taxipools. A person desiring the service has to take the initiative in making the arrangements to join an existing pool or asking fellow employees or neighbors to join together for pooling. Government could assist taxipooling by removing this restriction.
- Some companies may be constrained from making the service too large a part of their operation by public utility commission regulations or franchise conditions that require them to provide a uniform level of service throughout their operating area, and to be demand-responsive at all times. Again, a change or relaxation of the constraints would alter the situation.
- It is not difficult to assemble a taxipool group for the morning commute, but different quitting times, last minute delays, and after-work activities and errands make it difficult to reassemble the same group in the evening. Where existing taxipool operations operate for the evening commute, the procedure involves curbside starters filling cabs at designated pick-up points with groups assembled by common destination.
- Fare regulations occasionally require modification to permit charging a group a common fare or a group rate different from an individual passenger rate.
- To be successful, taxipooling requires a high demand level around a trip origin point to fill a taxi and reduce pickup time before starting the trip. It appears to work best in denser close-in areas and among income groups that can afford a more expensive ride than transit normally

offers (though in some instances it may even be cheaper). However, in a fuel shortage period, taxipooling may well be most needed in low demand areas transit cannot feasibly serve. The lower taxi fares due to taxipooling also appear desirable for taxi's captive market: non-car owners who are also likely to have lower incomes.

- Regulations may specify taxi load limits (e.g., 4 versus 5 passengers) that cut down the number of riders and increase each passenger's share of the common fare.
- Fare collection system options appear to range from collection on a per-ride basis to a prepaid weekly or monthly subscription pass. The subscription advantage accrues to the taxi operator who is paid whether the subscriber rides or not. For taxipoolers, fares paid by the ride give the advantage of payment only for services received.

Group/Shared Riding - Group and shared riding differs from taxipooling, in that multiple passengers may fill a cab on a pickup basis at point of origin (group) or enroute (shared) rather than by prearrangement. Group/shared riding is subject to a variety of constraints that requires modification to obtain full utilization. They include:

- Regulations may prohibit shared riding by driver's choice except under emergency or peak-demand conditions. Sharing with passengers' permission may not be obtainable due to passengers' preference to travel in privacy or without enroute diversions and delays or fears of inadequate protection if a person with criminal intent happens to be the one picked up.
- Fare arrangements may promote or inhibit sharing or grouping (each passenger pays full fare versus each passenger pays only fare from previous drop-off point). Group/shared riding appears to work to the taxi operator's advantage in a zone fare system with each passenger charged by zones crossed rather than dropping the flag after each drop-off.
- Regulated procedures for grouping and delivering passengers may also promote or discourage group or shared riding. The dispatcher may quote a fare by straight line distance between each passenger's origin and destination

to avoid charging for distances deviated to assemble group. Drivers may add passengers as hailed, provided there is little if any deviation in direction for pickup or delivery. The requirement that passengers be delivered in the same order as they are loaded may cause some to bypass their destinations and have to pay for back-haul.

- Taxi operators are sometimes given exclusive franchises to pick up fares in specified areas or locations, such as airports. Other companies may deliver but not pickup fares in those zones. This can lead to wasteful deadheading by outside companies.

In anticipation of greater application of shared/group riding in taxi operations as a means to greater efficiency in the use of energy resources, there have been proposals to research and develop computer programs capable of quickly assembling phone-in customers into groups, with similar origins and destinations, for dispatcher use in making cab assignments. For very large cities or operations, this may be necessary and applicable. For others, the extraordinary capabilities of many dispatchers to achieve the same result by manual and memory means should not be overlooked nor underutilized.

In the final analysis, however, the major impediment may be regulations rather than technical problems. Regulations that limit taxi occupancy ratios or cause deadheading should be identified by taxi operators as a first step in a lobbying effort for their removal.

A significant incentive to taxi companies to seek changes in regulations that would permit taxipools and group/shared riding is to justify obtaining sufficient fuel allocations. Higher taxi occupancy ratios may be required to qualify taxi operators for adequate gasoline supplies.

Vanpool Services - Instances are known of taxicab companies acquiring fleets of vans, accommodating 10-12 passengers each, for use in contract transportation of school children. After making one or two runs with the vans mornings and afternoons, drivers shift to their cabs for the balance of their work day (or could use the van for goods movement).

Such examples suggest there may be applications of the concept to transport peak-hour commuters in vanpools as a part-time operation of cab companies. The concept appears to apply particularly to areas having no transit operator and to low density suburbs where regular transit service is infeasible due to cost.

Low patron price, due to a shared common fare or subsidies from government or employers, could make such service attractive to

potential users. A guaranteed level of reimbursement could provide incentive to taxi operators to provide such service as long as it did not violate their franchise obligations by becoming too large a part of their business or conflict with transit franchises in the same area.

The principle of taxi companies being "total transportation" enterprises appears to be well-established, from large cities where taxi operations sometimes encompass van, delivery and trucking services, to small cities and towns where cab companies at times also operate transit vehicles, school buses, car rentals, ambulances, and funeral cars. Vanpools appear to add another possible dimension to such integrated comprehensive operations.

Transit operators should also be aware of such potentials for increasing vehicle capacity and occupancy, and perhaps explore ways in which they might offer similar vanpool services where they are the more appropriate operator. Another transit option would appear to be using vans for peak-hour commuting service and the rest of the day in a shuttle mode or for local circulation service.

Jitney Services - Jitney service presently operates in some areas on an unofficial and sometimes illegal basis. It usually involves a car, van, or bus with a driver who circulates through an area, stopping when hailed, and often diverting to deliver passengers to their door. Usually a fare is collected. Areas with lower income populations or lacking in transit service have been the usual locations of jitney services. Jitney service comes in response to a need apparently inadequately served or served at a higher price by other means. Informal jitney services usually avoid regulation as to safety and fares and may have drivers unlicensed for for-hire passenger service.

If the need for the type of services jitneys offer grows, it may be desirable to study how to bring such service within the law for the safety and protection of its patrons. Transit and taxi operators, who have viewed jitney service as unfair competition, may wish to examine how their services could be expanded to cover the needs met by jitneys at comparable fares -- or seek to operate jitneys themselves.

Jitney operations, if regulated to complement mass transit by serving as feeders to line haul routes or replacing unproductive low volume bus lines, could prove more palatable to transit operators. This would answer some transit operator objections to jitney services on grounds that, by running service parallel to transit lines, they siphon off ridership.

CONCLUSION

It might be better if the carpool program were to carry a more broadly-based label, one which suggested that a multimodal transportation industry program was being mounted to alleviate the gasoline shortage in urban areas. It is quite clear that the transit and taxi industries could not begin to meet the problem alone, but there is need to be concerned that they might not be encouraged to do enough.

Major, permanent changes in urban travel practices will probably result from the energy crisis and, perhaps, from the clean air program needs too; there is ample justification for transit and taxi services -- call it public transportation -- to have every opportunity to grow and alter their services in this transition period.

SECTION 7
VANPOOLS

VANPOOLS

INTRODUCTION

Vanpooling is a concept which is gaining recognition as an attractive way of reducing peak-hour congestion, cutting travel costs, and conserving energy. Like carpooling and buspooling, vanpooling is oriented primarily to serve a specific type of transportation need -- the home-to-work trips which are generally concentrated in the morning and evening peak periods of travel. Vanpools can also serve as an efficient travel mode for other purposes such as shopping, medical, school, and social-recreational. As discussed in another report in this series on Special Mobility Problems, vanpools have been used to solve the problems of the transportation disadvantaged -- the elderly, handicapped, and economically disadvantaged. Opportunities exist for more widespread organized use of vanpools for such purposes.

Like carpooling, vanpooling affords the convenience of door-to-door service and avoids the higher labor cost of providing special drivers which are required for buses. The primary advantage of the vanpool over the carpool, however, is the higher occupancies which can be achieved. A disadvantage of the vanpool is the extra travel time needed to pick up a greater number of passengers, but this can be minimized if riders are well matched and routes and schedules are properly planned.

This overview of vanpooling is presented in non-technical terms for distribution to employers, public agencies, and other groups interested in starting a program. It describes the methods, benefits, costs, and problems associated with implementing a vanpool program.

VANPOOL METHODS

Vanpool Definition

A vanpool can be defined in terms of vehicle and operational characteristics which distinguish it from conventional carpooling and buspooling. In terms of vehicle characteristics, a vanpool is defined as a pool of riders using a van type of vehicle which has a seating capacity greater than a standard passenger car but generally not more than 15 passengers. In other words, the van is larger than a standard sedan but smaller than the conventional bus.

In terms of operation, a vanpool is defined as a pool in which the vehicle is driven by one of the members of the pool rather than by a professional driver.

Vehicle Types and Characteristics

A vanpool operation might utilize a wide range of vehicle types and features. The type of vehicle selected for a given pool may depend on the number of riders in the pool, vehicle capital and operating costs, fuel economy, availability of existing vehicles, and other considerations. The special features of the vehicle-- such as air conditioning, carpeting, special seating, etc.--can be varied according to climate, commuting distance, and the particular needs and desires of the vanpool riders. Van-type vehicles with seating capacities ranging from 7 to 15 passengers are available as stock items from several manufacturers. Custom models with special seating arrangements can also be ordered from the manufacturers, or custom interiors can be prepared by local jobbers if such special features are desired. Special configurations will result in less than maximum seating capacity for a given van size but can make the van more luxurious and attractive with features such as more leg room, reclining or swivel seats, table tops for writing and games, television and music set-ups, etc. The cost of purchasing a van may vary from about \$4,000 to \$7,000, depending on the size and auxiliary equipment desired.

Recommended options which should be included in a van purchased for use as a vanpool include the following:

- Eight-cylinder engine with minimum of about 300 cubic inch displacement
- Heavy duty clutch
- Heavy duty springs and shock absorbers
- Air conditioning, front and rear
- Auxiliary rear-section heater
- Exterior rear-view mirrors, both sides
- Push-out type side windows
- Seat belts on all seats
- Power steering
- Center side door with low step for easy entry
- Vinyl seats for ease of maintenance

The 3M Company in St. Paul, Minnesota, operates a successful company-owned vanpool program. They use standard 12-passenger vans, costing about \$5,400, equipped with front and rear air conditioning, automatic transmission, power steering, and radio.

A privately-owned vanpool used by a group of FHWA employees in Washington, D.C., formed in 1967, first utilized an 11-seat van purchased at a cost of \$2,800. The present vehicle used by the vanpool is a 12-seat Ford Custom Club Wagon which was purchased new for \$4,800. This vehicle is equipped with heavy duty springs and shocks, two heaters, and air conditioning. Independently operated lights are provided in the driver's area, in the center seat reading area, and over the center-facing rear seats normally used for a bridge game.

Vehicles other than conventional vans may also be used for vanpooling. For example, with a small investment, some types of recreational vehicles could be converted to serve as vanpools. The existing problem of oversupply of recreational vehicles could potentially be alleviated if manufacturers and dealers were to make such conversions after testing the marketability for such use.

Vehicle Ownership

Several different forms of vehicle ownership might be employed successfully in vanpooling programs, including:

- Individually owned
- Employer owned
- Vanpool service agencies
- Vehicle leasing agencies
- Private group owned

Individually Owned - The FHWA employees vanpool, previously mentioned, is an excellent example of a van owned by an individual. Some people might consider the burden of a personal investment in such a vehicle to be a barrier. However, many persons desire a van-type vehicle for a variety of non-work purposes, such as weekend recreational use. The possibility of using the van for daily vanpool commuting, where riders pay their proper share of the costs, could indeed be an important incentive for purchasing such a vehicle.

Employer Owned - The 3M Commute-a-Van program is a good example of an employer-owned vanpool system. This form of ownership usually implies a longer term commitment than an individually-owned vanpool and carries with it an added advantage of a more structured organization and management framework. Advantages to the employer include improved employee relations, reduced parking facility costs, and the availability of vehicles for various business purposes during the day. Some employers already own vehicles which are currently used during the day for business purposes but could easily be converted into commuter vanpools to serve a dual purpose.

Personnel records and other information are available to the employer to assist in matching commuter trips. The employer has the necessary information and can exercise some degree of control over employees who must be responsible for the operation of the vanpool. Finally, the employer-operated vanpool is more likely to provide the immediate additional incentives to encourage vanpooling, such as preferential parking.

Smaller employers who can justify only one or two vanpools might find it more desirable for an external agency to assume responsibility for operating the system. In this case, the employer's responsibilities might be limited to encouraging vanpooling among his workers through incentive techniques, such as subsidization of operating costs and preferential parking space assignments.

Service Agencies - A New York City area vanpooling system was created and operated by Monarch Associates as a private enterprise. Monarch Associates provided the vehicle and took care of gas, maintenance, garaging, insurance, tolls, and all other operating expenses. The vanpool riders paid weekly fees, ranging from \$9.50 to \$10.50 each, to cover the costs of the van operation. This operation was successful from a customer-demand point of view but experienced regulatory problems (which were eventually resolved) and financial difficulties. Operations were discontinued as a result of these problems.

Leasing Agencies - Another type of van ownership form might utilize vehicles leased from automobile leasing agencies. The leasing company would provide the vehicle, special coverage insurance, and take care of vehicle maintenance and service functions, while gasoline and administrative costs would be borne by the sponsoring agency and/or vanpool.

Private Group Owned - Many organizations, such as churches, synagogues, service clubs, and citizens' groups of various types may either own vans or wish to purchase van-type vehicles. These vehicles might be used for a multiplicity of functions, including commuting for the group's members and volunteer services to the disadvantaged during the midday.

In areas where groups of small employers are located, a vanpool might serve employees from more than one company. In this case, it might be appropriate for an external agency to be responsible for the ownership and management of the vanpool.

The form of van ownership desirable for a given application will vary, depending upon the size of the employer, the availability of existing vehicles, the economic risks involved, and other factors. Regardless of the ownership form selected, however, effective management, promotion, and matching of work trips will be essential if the vanpool program is to be successful.

Special Service Vanpool Operations

In addition to the more typical type of vanpool operation with door-to-door service on both ends of the trip and fixed schedules, other types of special services are possible.

Park-and-ride vanpooling, like park-and-ride transit, has the disadvantage of requiring an extra car for the commuter trip. Still, park and ride vanpooling is less expensive and requires less energy than individual auto driver travel. The private vehicle is driven by the commuter to a predetermined point, parked, and the commuter then joins the vanpool from the central pickup point to his place of employment.

Although rigid adherence to a fixed schedule is usually necessary for successful vanpool operation, flexible scheduling has been successful for two executive vanpools formed at 3M. These vanpools generally arrive a little earlier and leave a little later than other vanpools, and if special meetings or other special activities occur, the vanpool schedule is adjusted accordingly.

Because of the varying work requirements of the vanpooling executives -- out of town business trips, times when they need a personal car for business or when special needs arise--the typical 3M executive only uses the van about three days a week. The most significant aspect of

this variation in scheduling and usage is that vanpooling is still an attractive alternative to driving individual cars. Even at 60 percent utilization, the vans still maintain an occupancy of over six passengers.

Multiple Employers/Drivers

Most vanpools operate a "many-to-one" type of service, consolidating work trips from several residential locations bound for a single employment location, usually one employer. A "many-to-many" service with multiple locations of employment is also possible using vanpooling. The Monarch Associates vanpool system in metropolitan New York City typically provided this type of service. Two drivers may be required, one for each end of the vanpool route. In this case, the rider who works the "closest in" would be responsible for keeping the van during the day. The person who lives the farthest out along the vanpool route would drive the van home at night.

VANPOOL COSTS AND BENEFITS

By consolidating work trips, vanpooling results in reduced transportation costs and other advantages which benefit the employee, the employer, and the community. These benefits are discussed below by comparing vanpool costs to those associated with conventional passenger car costs.

Van Costs

Vehicle capital and operating costs vary with the type of vehicle, ownership, amount of travel, and operating conditions. The cost for operating the 3M vanpool is based upon the following estimates prepared in September 1973.

Fixed Costs

Vehicle Costs

Retail Price	\$5,400
3-year trade in value	\$2,500
Net 3-year cost	<u>\$2,900</u>

Annualized Capital Costs	\$ 967.00
Annual Insurance Costs	460.00
Annual License Costs	<u>80.00</u>
Total Annual Fixed Costs	\$1,507.00

Operating Costs

Maintenance \$100/10,000 miles	\$	0.01/mile
Gasoline 12 mile/gal @ \$.36/gal.		0.03/mile
Oil \$10/2,000 (incl. filter)		0.005/mile
Tires \$200/20,000 miles		<u>0.01/mile</u>
Total Operating Costs	\$	0.055/mile

Assuming 250 working days per year, the unit costs for operating a 3M owned van are \$6.10 per day, plus \$0.055 for each mile driven. However, operating costs are obviously higher now than in September and, assuming gasoline costs of \$0.54 per gallon, the total operating cost would be changed from \$0.055 per mile to \$0.07 per mile.

The 3M rider fares are paid monthly and are computed on a break-even basis (including ownership costs) and are based on the round trip mileage for each vanpool. The table below presents the cost data upon which fares are based.

TABLE 1. 3M COMPANY VANPOOL COST SCHEDULE

<u>Round Trip Miles Per Day</u>	<u>Total Cost Per Mile</u>	<u>Total Cost Per Day</u>	<u>Cost per Person Per Day</u>
10	\$.665	\$ 6.65	\$.83
20	.360	7.20	.90
30	.259	7.77	.97
40	.208	8.32	1.04
50	.177	8.85	1.11
60	.157	9.42	1.18
80	.131	10.38	1.31
100	.116	11.60	1.45

Summary of Benefits and Incentives

Vanpooling offers potential benefits to the commuter, the employer, and the community. Some of these can be measured in economic terms, while others must be considered in terms of their social and environmental value.

The Commuter - The commuter is benefited in many ways, primarily by reducing the amount of personal income he must spend commuting to work, as previously stated. In addition, there are a number of

social and recreational advantages which, according to a recent survey by 3M, are very important to the vanpool riders and to the success of the Commute-a-Van program. New social contacts are made, and a camaraderie seems to form between vanpoolers. Commuting becomes a "fun" thing to do. Passengers may indulge in card playing or other games or utilize their time by reading, completing a work assignment, or just relaxing.

3M attributes the major portion of success of their vanpooling program to the driver incentives which were built into the program from the outset. Essentially, the vanpool drivers run the vanpool system. They organize the vanpools, are responsible for maintaining the vehicle, and are responsible for insuring regular, dependable service. For this responsibility he is given:

- A free ride to work
- All fares collected from additional passengers above that required (8) for the vanpool to meet expenses (This amounts to about \$0.93 per day, on the average.)
- Personal use of van during off-work hours at a rate of seven cents per mile
- Free option for purchasing vehicle at the end of its service to the system

Riders of vanpools can be offered a variety of incentives by their employer to join in vanpooling, including:

- Partial subsidies to cover travel costs
- Preferential parking
- Special parking lot entrances and exits (to avoid delay)
- Flexible working hours

The Employer - Several benefits of vanpooling accrue to the employer. First of all, the demand for employee parking can be reduced. Surface parking in moderately developed areas may cost as little as \$300.00 per space, which nevertheless is significant. Structure parking in a more heavily developed area may cost as much as \$3,000.00 per space or more, with annual maintenance costs of \$10/\$25 per space. Company overhead costs in many cases can be reduced by a reduction in the number of spaces that normally are paid for by the company. A major vanpooling program might also alleviate traffic access and circulation problems, which would benefit both employee and employer.

Perhaps more important than these direct benefits, a successful vanpool program might have a major impact on employee morale and tend to improve personnel relations. In areas where parking costs are high, a provision for vanpooling on a wide scale might come to be viewed by employees as an important fringe benefit. In order to compete effectively for good personnel, a company may also want to consider providing such a system. The potential value of vanpools, as perceived by the employee, will also rise with increasing fuel prices.

The Community - The community would benefit from vanpooling as a result of reduced congestion during peak periods. On-street parking demand and the need for additional public parking in intensely developed areas could be reduced significantly. Air pollution and fuel consumption would be reduced as a result of decreased automobile travel and improved driving conditions.

VANPOOL PROBLEMS AND SOLUTIONS

Organization and Management

The 3M approach to managing their Commute-a-Van program emphasizes the responsibility and initiative of the van drivers, or coordinators. The management function is limited to a supporting and guiding role by giving proper attention to:

- Establishment of basic ground rules for operation of the vanpool
- Careful selection of drivers to operate the vanpool in a responsible and reliable manner
- Simple but effective ways for maintaining the necessary records associated with van usage
- A forum for the discussion and exchange of ideas between vanpool drivers

Routing and Scheduling

If a vanpool is to provide travel time comparable to that by private car, passenger pick-up times must be kept to a minimum. This can be done by minimizing the travel distance required for pick-up and by minimizing loading time per passenger.

In order to shorten the travel distance, some riders may be required to wait for the vanpool on the opposite side of the street from their

home, or perhaps walk a block or two to eliminate unnecessary circuitous routing. Maximum waiting times per passenger, say two to three minutes, must be rigidly adhered to. If waiting time becomes routinely excessive, the success of the program could be jeopardized because of impatience of fellow riders, who cannot afford the delays and by tardiness at the place of employment, which may place the riders' employment in jeopardy as well.

Driver Selection

Because the driver is the key person responsible for operating the vanpool system, drivers must be carefully screened. This can be done by checking his attendance record, driving record, responsibility characteristics, and general enthusiasm toward the project. An initial questionnaire form can be completed by each prospective driver and a subsequent interview held. 3M has done this rather successfully without causing the driver to feel that his ability is being questioned.

Records and Fare Collection

At 3M, the driver is made responsible for maintaining, servicing, and operating his vehicle. Maintenance and fuel expenses are submitted each month as part of the driver's expense report. Fares are paid directly to the company on a monthly basis by the riders, regardless of whether or not he fully utilizes the service. At the same time, reimbursement for operating expenses and for fares exceeding the break-even cost of the vanpool operation are remitted to the driver.

"Rap Sessions"

Problems with the 3M Commuter Van Program have been minimal and these have generally been worked out by the drivers themselves. "Rap" sessions are conducted periodically so that drivers can get together to discuss common solutions. In addition, items of interest and suggestions are mailed out to the drivers from time to time concerning such items as people problems, operating problems, etc.

Organizing Vanpools

An initial study was conducted by the 3M Company to determine the feasibility of vanpooling. Based upon that analysis, a vanpool plan was formulated, and management guidelines were established. From that point, the organization of the vanpool program became the responsibility of the drivers.

The basic steps used to organize the initial program were as follows:

1. Employees desiring to participate in the vanpool program, either as riders or drivers, were asked to register their name, address and phone number.
2. Potential drivers were carefully screened and selected for vanpooling.
3. After being selected, it became the responsibility of the driver to contact residents who lived in his area and to organize his vanpool, including a back-up driver. Once he had completed the organization of his vanpool, his name was put on the waiting list for a new vehicle.
4. When the vanpool vehicle arrived, the driver made several "dry" runs in order to determine the overall route mileage, (which is the basis for determining fares) and to refine his route and schedule.
5. The vanpool driver then notified the members of his vanpool of when service would begin and informed them of the schedule and routing.

Competition with Existing Transit and Taxi Service

Although more apparent than real, the existing transit and taxi operators may feel that vanpooling will compete with the type of service they already offer and thus reduce their patronage level. In spite of the fact that vanpooling is intended primarily to serve a different type of trip maker, this potential problem could discourage implementation of vanpool service. Taxi and transit operators should understand that the more people who use vanpools, the greater the need should be for taxi and bus service during the day for those who desire to make shopping trips, trips to lunch, business trips, etc. In essence, vanpooling could break the "single car habit" which would be beneficial to taxi and transit operations.

Legal Problems

In the case of a private enterprise type of vanpool operation, restrictions may also be imposed due to existing city franchises, contracts, and state and Federal regulations. Legal problems are discussed in a separate report in this series entitled Legal and Institutional Issues.

An example of a vanpool system which met with regulatory problems was that of Monarch Associates, Inc. The system served several communities in the New York City metropolitan area and was quite popular with its patrons after its inception in 1964. The vanpool system regulatory problems arose out of its operation as a private interstate carrier. The initial problems were overcome because it was determined that the system served areas not serviced by common carriers. However, the system failed several years later because of financial problems encountered by the company.

Insurance Problems

Operation of vanpool service may expose vanpool drivers and their employers to additional civil liabilities which might arise from traffic accidents or loss of personal items by vanpool riders. Additional insurance will likely be needed to take care of this problem. The insurance regulations within each state or region may vary, and it is suggested that the Insurance Commission and/or an insurance company representative be contacted to determine the needs to meet local requirements. These issues are discussed in the report concerning legal and institutional issues.

SUMMARY

1. Vanpooling can produce many kinds of benefits for commuters who participate in the program, the most important of which are reduced travel costs and the convenience of door-to-door service.
2. If practiced on a wide scale, vanpooling can be an effective means of reducing travel demand during peak hours. Effective occupancy can approach that of conventional bus operations. Furthermore, vanpooling is applicable in areas not suitable for conventional transit operations.
3. Vanpooling can result in substantial savings to sponsors and users while, at the same time, helping to achieve the goals of improved mobility, air quality, and energy conservation.
4. Incentives must be built into a vanpooling program for maximum success. These incentives must include advantages to the vanpool rider, the driver, the employer, and the community.
5. The active participation and support of employers should be enlisted for organizing and promoting vanpooling (as well as carpooling, buspooling and conventional transit) for their employees.

6. The organizational form selected should be based upon the size of the employer. Generally, larger employers should organize and operate the vanpool system. Smaller employers may find it more convenient to enlist an outside agency or private organization to organize and operate the vanpool system in coordination with existing carpool, buspool, taxi, and transit programs in the community.
7. Vanpools can also be developed from an outgrowth of two or more carpools wishing to combine as one group.
8. Vans can serve multipurposes for a company, in addition to transporting employees. Such purposes may include special usage during working hours for attending outside meetings, for other motor pool purposes, transporting goods within the community, and as a back-up system for people who miss their regular vanpool.
9. Vanpools do not require the conventional van design. The definition of vanpools infers usage of vehicles to carry a range of seven to fifteen passengers.

SECTION 8

BUSPOOLS

BUSPOOLS

INTRODUCTION

The basic response to a goal for decreased fuel consumption is to increase the number of passengers per vehicle. In order to achieve an increase in the number of people utilizing each vehicle, individual transportation needs must be matched. This matching (regardless of who performs the matching function or how matching is effected) results in the pooling of transportation resources.

In what may be called a hierarchy of carpool/vanpool/buspool, the buspool potentially represents a high level of efficiency and low cost operation. In this context, "pooling" is the method whereby the users of service determine the routes, schedules, origins, and destinations. The most elementary level of pooling is carpooling. A carpool can be formed by as few as two people with common travel desires who wish to pool their respective transportation resources. When the number of matched poolers exceeds the capacity of an automobile, a vanpool may result, whereby a van-type vehicle is used with resulting lower per passenger operating cost. If the travel demand exceeds the capacity of a van, the next logical choice in the pooling hierarchy is the buspool.

The buspool, frequently called Bus Club or Subscription Bus, represents transit service where the riders determine the operating parameters of the service (routes, headway, origins, destination, and in some instances, fare). This service does not only apply to commuter work trips, but it can also apply to shopping trips, social/cultural trips, and others established on a daily, weekly or monthly basis.

The potential for a premium service at low relative cost is quite high with buspooling since per passenger costs can be minimized due to higher vehicle capacity. It must be noted, however, that from an energy conservation standpoint, buspools may not be the most efficient pooling option. The energy efficiency of a buspool is dependent upon the use of the vehicle after the pooled trip has taken place. Single direction use of a buspool with deadheading may result in an operation that would most effectively use autos or vans without the deadheading problem (since autos and vans can be parked at the end of the trip).

Another caution in the consideration of buspools is the necessity for available buses. With growing demand for transit service and resulting purchases of new buses, the buspool option can be considered for near-

term use only if surplus buses are available locally. In many areas, this may not be the case; therefore local availability of buses must be examined. For example, many transit operators may not be willing to charter buses since they already have a peak-hour demand problem. Possibly sightseeing, school, or church bus operators could be contacted should this occur.

Existing buspools were often established in response to voiced desires of a group of potential users. Any bus service that developed in response to user desires on a regular basis can be described as a buspool. Any bus service that is contracted on a regular basis with origins, destinations, and schedules determined by the user can be defined as a buspool. Traditional charter service is the best example of pre-buspool; the only factor missing is the regularity of the service.

The projects noted below indicate factors leading to successful buspooling and should be considered within the unique local situation as one tool in the endeavor to decrease fuel consumption. When the matching process is undertaken, buspools should be considered from the start as one means of providing service to the matched poolers.

SUCCESSFUL BUSPOOLS

Buspools, as defined above, are not new in the realm of urban transportation. Successful buspools can be found in several states from Virginia to California. Recent interest in buspooling, spurred by the energy crisis, has brought this travel option to light as a potentially efficient means of moving people with similar travel needs. If maximum efficiency is to be realized in new buspooling endeavors, the experience of past buspools must be counted on to minimize future problems. Documented examples of buspool experience can be found in the following cities:

Reston, Virginia	Rochester, New York
Mantua, Virginia	Tuxedo, Maryland
Columbia, Maryland	Palo Alto, California
Los Angeles, California	Southglenn, Colorado
St. Louis, Missouri	Fredericksburg, Virginia
Meriden, Connecticut	Detroit, Michigan
Pittsburgh, Pennsylvania	Omaha, Nebraska
San Francisco, California	

The best known buspooling endeavor has taken place in Reston, Virginia. By examining this experience, much can be learned about the potential for buspooling in other urban areas.

The Reston Experience ^{1/}

Reston, Virginia, is a planned community located 24 miles west of downtown Washington, D. C. In 1968, when the first buspool was started in Reston, the community contained a population of 3,000 residents. By 1980, this community is expected to cover a land area of 11.5 square miles and have a population of 70,000. Prior to 1968, commuter service between Reston and Washington, D. C., consisted of the private auto and one bus route located nearby, which served the area once per hour with a travel time of one and one-half hours. The operator had tried to schedule buses through Reston but was convinced that the affluent families would not utilize bus service.

In 1968, the Reston Community Association organized a committee to charter a bus and determine the schedule, pickup routes, and destination points for Reston's first buspool. Passenger costs were computed, based upon the charter rates charged by the operator; a breakeven operation of 35 passengers for a 51-seat bus was utilized.

The breakeven point in buspool ridership occurred in Reston after six weeks of operation. At that time, the decision was made to increase service and to add other buses as each breakeven point was reached. Schedules, routes, and other service factors were constantly refined, based upon ridership surveys, to insure that the service provided reflected the needs and desires of the buspoolers.

In 1969, a 7:00 p. m. straggler bus was added which covered the downtown areas served by the seven regular buspool routes. This service, while not paying for itself on a per-ride basis, provided sufficient service improvement and flexibility to induce 80 additional riders to the system.

As the operation increased in size and scope of service, it became evident that a separate organization was necessary, so in 1971, Reston Commuter Bus was incorporated under the laws of Virginia. This is a non-profit organization run by a volunteer Board of Directors and 11 volunteer officers.

^{1/}"Commuter Bus Clubs Serve the Suburbanite", Ervin Poka and Donald Morin, Urban Planning Division, Federal Highway Administration.

The Board of Directors for RCB, Inc., is responsible for preparing and distributing schedules, printing tickets (paid for by the sale of advertising space), surveying riders as to their preferences for service changes and quality of existing service, and handling all negotiations with the bus operator. The Board elects one rider on each bus to serve as the busmeister, who rides the bus free in return for his services. The busmeisters are automatically Board members and perform the following duties:

- Insure that the driver follows the correct route
- Sell ticket books
- Punch individual tickets
- Make weekly deposits in a special bank account from which the monthly bill would be paid to the bus company
- Coordinate passenger exchanges at bus connection locations
- Provide routing and schedule information to passengers

Busmeisters, in addition, make every effort to insure personalized service. They are the first ones to stand when buses are crowded, they redirect buses onto alternate routes when the regular route is congested due to accidents or bad weather; they personally relay passenger complaints to the system's ombudsman; and they supervise special bus festivities to make certain everybody has a comfortable and congenial ride.

The cost per ride (1972-73) for Reston buspoolers was \$1.20 with the purchase of a 10-trip ticket and \$1.50 for a single trip cash fare. A token fare of 25 cents is charged for senior citizens, and children under 12 ride free. The computed costs are based upon the total costs of operating the buspool. These costs include bus charter and operating overhead for RCB, Inc., whose only paid employees are an office manager and a secretary. During the off-peak hours, approximately one-half the buses are used for regular route service.

In 1973, Reston Commuter Bus, Inc., obtained permission to use the Dulles Airport Access Road to commute to and from Reston. This road is dedicated to the exclusive use of airport traffic; vehicles cannot exit prior to reaching the airport nor enter at any place but the airport on the return trip. The Reston buses have cards which activate gates at special Reston entrance and exit ramps (and use of the access road cuts commuting time significantly for the buspoolers).

Since the Dulles Airport Access Road splits the Reston community into two sectors, buses having collected passengers each morning in each sector meet at the Dulles ramps to exchange passengers and pool those with common destination. This, in effect, means that the buses act as two kinds of buspools: local circulation buspools and line haul express buspools. Operating in groups of two or three buses, they provide collection/distribution service. After rendezvousing at the Dulles ramps, where passengers change on the basis of destination, they begin a line-haul express function to employment hubs in Washington, D. C. In the evening, the process is reversed at a point in Rosslyn, Virginia, just outside Washington, D. C. The exchanges are performed at both the Dulles ramps and Rosslyn in just a few minutes. For more information, call Reston Commuter Bus, (703) 437-7800.

Case Studies of Other Successful Buspools

While the Reston experience shows what interested and dedicated commuters can do in a unique situation, the following examples of other successful buspools indicate the breadth of organizations, situations, and economics that lend themselves to buspooling.

Allegheny County, Pennsylvania (Pittsburgh) - There are currently five commuter-type bus operations in Allegheny County. Three were formed as early as 1950 when some major companies relocated to downtown Pittsburgh and service was necessary to provide employee transportation. These operations are highly institutionalized. The service is provided on a charter basis, with the Port Authority of Allegheny County providing the buses. Elected bus club officials make all arrangements monthly with the Port Authority and are billed monthly at current charter rates.

A unique bus club arrangement was instigated by a local citizen, and it resulted in service beginning January 2, 1974. The citizen not only assembled the necessary number of riders desired by the Port Authority (30 the first month, 35 the second, and 40 thereafter), but also arranged for a 100-space parking lot to be used for a park-and-ride facility. The service involves a 20-mile one-way trip between suburban Murrysville and downtown Pittsburgh. The fare is \$40 per month, payable in advance. Club members specify arrival and departure times. Working with the Port Authority, they also establish routing, downtown stops, and even short-cuts. The Murrysville service is unique because of the local initiative required. The service users all live in Murrysville but have different places of employment in Pittsburgh.

The local contact is Gary Lingnen, (412) 231-3600, with the Port Authority of Allegheny County.

Columbia, Maryland - The Columbia Association, acting as an agent for interested citizens, put up \$2,300 to start bus service between Columbia and downtown Washington, D. C., (30 miles one-way) in 1970. Originally, the Columbia Association chartered two buses from Eyre's Bus Service of Woodburn, Maryland. Service has now expanded to ten 39- to 49- passenger buses, depending on what is available. From the very beginning, sufficient revenue was generated so that the initial \$2,300 was never depleted. Service is provided on a 10-ride ticket or single-ride basis. Fares are \$2 per one-way trip or 10 rides for \$15. Fares were formerly \$1.75, but charter fares were increased; consequently, a fare increase was necessary.

A resident committee handles day-to-day scheduling and necessary changes. The Columbia Association arranges for the services, monitors the charter contract, and certifies the bills. The service is provided between various collection points in Columbia to 17 points in downtown Washington, D. C. Each bus has a bus captain similar to Reston's busmeister. Some buses collect on the east side of Columbia and others on the west side each morning. An interesting feature of the service is the fact that the buses, upon reaching Washington, D. C., each morning, do not return to Columbia. The buses are parked during the day at a lot in Wheaton, Maryland (suburban Washington, D. C.) until the return trips in the evening. The drivers use one bus to return to the Eyres office from the Wheaton parking lot. There have been no regulatory or insurance problems.

Through the Columbia Association, two additional commuter routes have been added. There has been service between Columbia and Baltimore, Maryland, (provided by Eyres) for one year, utilizing two buses with a one-way fare of \$1.25, or 10 rides for \$10; service is provided on a cash basis and costs are covered by fare box revenue. Also, a commuter service was started in January, 1974, between Columbia and the National Institute of Health; Carter Bus Service provides one bus with a flat fare of \$1.25 for a one-way trip. In each case, the Columbia residents have expressed interest in commuter service, and the Columbia Association has been the facilitator.

In addition to aiding with commuter service, the Columbia Association, with a staff of three, also operates 10 buses exclusively within Columbia. Dial-a-ride service is offered between 6:30 - 8:30 a. m. and 7:30 - 11:00 p. m., with a fixed route service during intervening hours. Five routes are served at one-hour headways. The morning call-ride

service provides some residents with connecting service with downtown Washington, D. C., bus service.

For more information, call William Burton, Columbia Association, (301) 730-4288.

Omaha, Nebraska - The public transit system in Omaha has promoted buspooling to the point where three buses are utilized for peak-hour commuter service between suburban areas and downtown Omaha. Two buses operate between suburban park-and-ride lots and downtown Omaha (one, 12 miles and another, 18 miles). A third bus circulates in the vicinity of the park-and-ride lots and then travels downtown. The buses are operated by union drivers. The current buspool service is approximately five weeks old, and ridership is satisfactory.

The fare for this service is 40 cents per ride or 35 cents per ride using a punched ticket; transfers are free. Service is essentially express to the downtown area. When this point is reached, stops are frequent. Park-and-ride lot utilization was negotiated by officials of the public transit system. Officials of the Western Electric Company and two suburban communities (Millard with a population of 6,000, and Bellevue with a population of 25,000) have expressed interest in similar service. Expanded service is anticipated.

For more information, contact J. W. Pospisil, Omaha Transit, (402) 341-0800.

Tuxedo, Maryland - Atwoods Goldline Service in Tuxedo, Maryland (suburban Washington, D. C.) charters buses to various groups who are responsible for determining pickup points, destinations, and schedules. Each group is responsible for its own fare collection. The amount of bus club business has expanded from one bus per day in 1968 to approximately 15 buses per day at the present time. Groups using the service are varied, with rider clubs and employer-sponsored service being represented:

- National Geographic Society - 8 buses per day
- Washington Bus Riders, Fort Meade - 1 bus per day
- Congressional Secretaries Club - 2 buses per day
- EPA employees - 1 bus per day
- Atomic Energy Commission - 3 buses per day

Service varies by commuter group. The EPA group commutes between a suburban shopping center and downtown Washington, D. C., (approximately

a 30-mile one-way trip). The AEC group commutes between Germantown, Maryland, and downtown Washington, D. C., (a one-way distance of 40 miles). Revenue is remitted by the bus clubs at mutually agreed intervals. The operation is managed and controlled by Atwood Goldline Service. The services all originated from telephone inquiries by interested parties.

Two problems of significance involved (1) the bus operators who consider the jobs rather undesirable because of the long distance trips, and (2) an insufficient number of buses. There have been no regulatory or insurance problems. Atwood will continue to seek this type of business so long as equipment is available, and operators can be found to drive the buses.

For more information, contact L. F. Hanson, President Atwood Goldline Service, (301) 773-7100.

STATAR (Steps Toward Automated Transportation Around Rochester) -
STATAR, a non-profit, non-incorporated organization, began in 1965 as a carpool group, dedicated to getting people to and from work in downtown Rochester. The service administered by STATAR grew to three chartered buses with three others under organization when a bus strike curtailed further growth. The three chartered buses, which served Eastman Kodak and other employers, stayed in operation, but recent events have reduced STATAR's service to one chartered bus. This occurred when one bus route was eliminated because it was too competitive with a route operated by a recently formed transit authority, and the other was eliminated because Eastman Kodak work schedules were changed. The only remaining STATAR route operates 20-25 miles between Pennfield (a suburb of Rochester) and downtown Rochester, and then to Kodak Park. An informal STATAR group dictates the bus route and schedule, collects fares, and designates stops. There are three principal pickup points. STATAR uses park-and-ride lots for which the group made their own arrangements.

A 45- to 53-passenger bus is rented from the public transit authority. A full range of fares has been established by STATAR.

- Annual fee is \$215
- Semi-annual fee is \$125
- One-way cash fare trip is \$1
- One book of ten rides is \$8

Other fare plans oriented to Eastman Kodak employees are also available. While more buses could possibly be added even though Eastman

Kodak has decided on staggered work hours, this would create more work for STATAR, which would prefer to stay an informal group.

The local contact is Bob Tuite, c/o Eastman Kodak Research Laboratory, Building 59, Rochester, New York 14650.

Golden Gate Bridge Highway and Transportation District - This public agency in San Francisco leases equipment and drivers to Commuter Clubs. Beginning in February 1971, with one club and one bus, the operation has grown to five clubs and 11 buses. The clubs principally operate between Marin and Sonoma Counties and downtown San Francisco. Buses are obtained from sightseeing or charter bus companies by the District through a competitive bidding process, based on a desired level of service for a zone of operation. District officials, by meeting with interested citizens representing employment concentrations or resident groups, will start a club for 30-35 persons.

The Commuter Club members set the routes and schedules in cooperation with the District. It is intended that when the buses are 100 percent full, the Club bus should be self-supporting; the District will, if necessary, subsidize the operation to the limit of \$500 per bus per month; the average subsidy per bus per month has been approximately \$350. The subsidy process extends over a three-month period because of discrepancies between the per diem bills submitted by the charter bus company to the District and the monthly payments by the clubs. The District encourages all clubs to be self-supporting, but this is quite difficult to achieve. Each club solicits its own members, collects its own dues, and makes a monthly payment to the District. The District leases the equipment and drivers to operate the Commuter buses. Since the District is the instigator of the service, they carry separate insurance to cover their liability. Each commuter bus has free passage over the Golden Gate Bridge and use of an exclusive bus lane. The longest bus run to downtown San Francisco covers a distance of 55 miles. The least cost per bus varies depending upon the zone of operation. The District advises the clubs regarding Commuter Club activities and also performs the bookkeeping. The District has assumed this responsibility for two reasons: (1) they wish to increase bus ridership, and (2) private bus companies prefer to contract with an agency rather than citizen groups. Sightseeing buses have been considered as the best source of Commuter Club buses, because they are usually idle during weekday peak hours but utilized at midday and on weekends. It is important to note that, while the District already operates 188 buses of its own, in the past funds were not available to obtain additional buses for regular service. Therefore, arrangements were made to lease club buses.

For further information, contact Tito Sasaki, Engineering Department, Golden Gate Bridge, Highway and Transportation District, (415) 346-5858, extension 37.

COM-BUS - Long Beach, California - For the last six years, COM-BUS, recently incorporated as Southern California Commuter Bus Service, Inc., has been organizing, coordinating, and providing commuter bus service in the Los Angeles area. The current level of service involves 47 buses transporting workers between their homes and places of work. Two basic routes are between Orange County and the Los Angeles airport area, and the San Fernando Valley and the Los Angeles airport area. COM-BUS has just applied to the California Public Utilities Commission (PUC) for authority to serve government employees at the Civic Center from all areas of Los Angeles and Orange County.

COM-BUS handles every aspect of developing and managing a successful commuter bus system. This includes:

- Surveying employees to define optimum routes, stops and schedules
- Establishing route and schedules
- Obtaining late model, air-conditioned, reclining coaches with professional drivers
- Coordinating with passengers
- Collecting fares
- Establishing and enforcing bus rules
- Handling passenger complaints
- Supervising entire commuter operations
- Obtaining Certificates of Convenience and Necessity from Public Utilities Commission

Buses are obtained from many well-established charter bus companies which include:

- Leisure Lines
- Mark IV Charter Lines
- Siesta Coach
- Great Western Stage Lines
- International Sightseeing Tours

- Pink Bus Lines
- Kingsmay Transportation, Inc.
- YMT Tours

Commuter bus routes vary between 20-65 miles, with the average commuter bus trip being approximately 30 miles. A typical fare for a 35-mile, one-way trip (70 miles round trip) is \$10 per week. COM-BUS leases the buses for commuter use only. From 8:00 - 4:00 p. m., the charter bus companies can utilize the buses for other purposes.

An interesting aspect of the COM-BUS operation concerns driver assignments. By carefully matching professional drivers to commuter bus routes, the commuter buses are often taken home at night. For example, if a driver happens to live in Orange County, he is assigned to a commuter route leaving Orange County. This arrangement is often so convenient that the drivers use the bus instead of commuting to the busyard in their own personal car.

For information, contact Ron Hoffman at COM-BUS, (213) 438-3407.

Government Employees Insurance Company (GEICO) - GEICO, located in Chevy Chase, Maryland (a suburb of Washington, D. C.), responded to a parking shortage with a carpooling and buspooling program. The company provided buspools from park-and-ride lots at outlying shopping centers to the GEICO office. This employer-instituted program indicates the potential for organizing buspools at this level. The employer can provide one of the most efficient catalysts for buspooling. The necessary factors of location of residence and work hours are known by the employer, therefore allowing the employer to effectively institute buspooling service for employees.

Oregon - Another example of employer-generated interest in buspools is shown by the program established by Governor McCall in Oregon. The Governor directed that a feasibility study be performed for providing bus service for state employees commuting to work between Portland and Salem. Buses would pick up state employees at strategic points and transport them to their place of work by 8:00 a. m., and depart for the original pickup points after 5:00 p. m. The cost of the service would be financed through user charges. The Governor has indicated that he would like to see such a service in operation by early 1974.

Specialized Buspools - Other even more specialized buspools are being established throughout the country. Ski-area buspools are being established to transport ski enthusiasts from metropolitan areas to the ski

regions. Other buspooling efforts for sports events have been in existence for years, but the interest in and use of these services has grown dramatically and can provide even greater opportunities for increased transportation efficiency.

CRITERIA FOR BUSPOOL OPPORTUNITIES

Much can be learned from the buspooling examples described above. The Reston experience points out several factors required for successful buspooling.

First, a number of people with similar travel desires were found to patronize the service. Similar origins (Reston) and destinations (Washington, D. C.) for a large number of people (over 1,000 passengers per day) exist in the Reston experience.

Second, while the out-of-pocket cost (\$1.20 per trip) may be higher than carpool costs, the buspool provides a high level of service without the traditional tension of commuter driving (on a total cost basis, however--comparing the buspool's cost with owning a second car--the buspool can be less expensive). A survey of 500 Reston express riders, answering a questionnaire in November 1971, indicated that 21 percent had actually reduced the number of automobiles owned as a direct result of the subscription bus service. Another 8.4 percent said they would probably reduce the number in the future, and 43.4 percent said they would probably not increase the number. In addition, 49.4 percent mentioned that they would have owned more automobiles if the bus were not available. Also, 43.6 percent said that they would not have moved to Reston if the bus were not available. The use of the Dulles Access Road, which significantly reduces the commuting times, provides even greater potential for the Reston service.

Third, an interested group of commuters, with initial support from the Reston Community Association, provided the catalyst for initiating the service.

Fourth, a transit carrier (WV&M) existed and had equipment available for charter.

Finally, Reston residents in the beginning were no more amenable to bus service than other suburban communities, but they were attracted as a high level of service developed.

Motives for Reston residents were to "decrease the number of private vehicles in use, promote traffic safety, reduce traffic, noise, and environmental pollution." To these motives is now added the energy crisis and the resulting necessity for increased travel efficiency which buspools can provide.

Buspools have grown from the citizen's interest (as in Reston), from employer interest (GEICO), from transit operator interest (as in Omaha), and from joint efforts. The organizations, fare collection, strategies, and responsibilities for buspooling are as varied as the number of buspools. Commonality exists, however, in the following factors:

- Relatively high density destination--central business district, large employer, large industrial/office complex, etc.
- Relatively high volume collection points--park-and-ride lots, new town centers/apartment complexes, high density residential areas. The high volume indicates the necessity for a limited number of stops which is required for successful buspool service
- Transit equipment available for charter
- Line haul distances great enough to allow competition between transit and auto service (travel times below 15-20 minutes are served far better by the private auto due to scheduling flexibility, thereby making buspools much worse on a level of service comparison)
- A group or organization providing a catalyst for initiation of service (employers can provide an excellent catalyst)
- High level of service (for example, reclining seats available for everyone)

Other factors, while not being absolutely necessary, will provide even greater opportunity for buspools:

- Preferential treatment of buses on the roadway (e. g. , exclusive lanes, preferential traffic signals)
- Preferential treatment of buses at destinations (more convenient discharge and pickup points, earlier plant dismissal, etc.)
- Provision of bus shelters
- Provision of a late bus to pick up those returning late from work

Perhaps the most valuable lesson to be learned from the existing bus-pool experiments is that the users, having decided upon the level of service desired and destination points, took the initiative to create and continue direct communication between themselves and the transit operators. This has resulted in transit service which provides exactly what the user desires, paying for itself out of the fare box. The convenience of the buspool, the lack of auto commuter frustration, and the elimination of the necessity for a second car have all provided incentives for buspool usage. The energy shortage and the resulting high cost/unavailability of gasoline should provide an even greater incentive for the development of buspools.

DETERMINING BUSPOOL DEMAND

For the private citizen, citizen group, employer, transit operator or other organization to implement a buspool, several questions must be answered. These questions form the steps in a decision process that proceeds from the general to the specific:

1. To pool or not to pool?
2. Where?
3. When?
4. How?

1. To Pool or Not to Pool?

The pooling concept is one means to reduce energy consumption by matching people with similar travel needs and desires. Within the total context of improved transportation efficiencies, this matching procedure can allow higher productivity per vehicle. The decision to pool transportation resources has been made by many people through the United States. The reasons are many, and each points to the desirability of the pooling concept.

Economically - The higher the number of passengers per vehicle, the lower the per passenger mile operating cost. From a private business viewpoint, reduced parking facilities at suburban offices and manufacturing facilities could result in significant savings in land use and reduced costs to the employer for providing parking spaces.

Ecologically - The pollution levels per commuter go down as the occupancy goes up; two people per car cause less pollution per passenger than one person per car; 15 people in a van cause even less pollution per passenger; with 50 people per bus providing the lowest pollution level per passenger.

Safetywise - The accident rate per passenger mile is lower for buses than for autos, hence the greater use of buses can substantially reduce the total accident rate per passenger mile of travel.

Tensionwise - The slogan "Leave the Driving to Us" is pertinent to the pooling issues; a commuting trip where one can read, sleep, talk or relax is a much more pleasant and tension-free experience than the traditional self-drive commuter trip.

2. Where?

Once a person or group has decided to pool transportation resources by matching people with similar travel needs, the next question is Where? Where will pickup points be (home, park-and-ride lots, shopping centers, community centers, schools, etc.)? Where will the destination points be (central business district, industrial park, shopping centers, commercial office complex, etc.)? The determination of these locations will be entirely dependent upon the expressed needs and desires of those wishing to use the service and will also depend upon the answers to the next question of When? The answer to this initial question will merely be a list of possible service locations. This list should be refined and revised as the process gets more specific.

3. When?

The time of service will also be dependent upon the expressed desires of those wishing to use the service. Is service desired only for the work trip (a. m. and p. m.)? Is service desired for midday travel (shopping, etc.)? Is nighttime service needed (for recreational or shift work trips)? Based upon the expressed desires of more than one person desiring to make a trip on a regular basis, a demand matrix can be established. This matrix is merely a preliminary matched list of those people desiring to make trips to and from similar locations at similar times. This preliminary list is invaluable in answering the next question of How?

4. How?

Once the preliminary matched list of people with similar travel desires has been determined, the next question is: How can this service be provided? This provokes several related questions.

What type of equipment is required? - If it is found that only two to five people have similar travel desires, then the logical choice is a pool

that takes the form of a carpool. By increasing the occupancy of an auto three to five passengers per trip, efficiencies can result as noted previously. If, however, more than five people are matched (have similar travel desires) on a regular basis, a vanpool can be considered.

While the main criteria for choosing equipment type will be the number of matched passengers per pooled trip, other factors must be considered (these considerations will vary based upon the local situation). If the required number of miles per passenger does not increase significantly between the two cars versus one van alternative, and if the operating situation (driver's pay, volunteer drivers versus hired drivers, etc.) does not change significantly, then a van can be the most effective pooling vehicle. If utilizing a van would require the purchase of a special vehicle (assuming that the alternative two cars are already owned) or hiring a driver (assuming the auto drivers are volunteers), then two auto pools may be more efficient than one van. When the number of people per pooled trip exceeds the traditional auto capacity (five people) however, a van should be considered, based upon the unique situation at hand.

When the number of people with similar travel desires exceeds the traditional capacity of a van (10-15 depending upon configuration), then more vans or a bus can be considered as an alternative. Similar factors affect the choice between vans and a bus as affect the autos versus van decision. Will the number of miles per passenger go up significantly? Will a different labor situation make a bus more costly than two or three vans? Are buses available locally for pooling? These questions must be answered on a local basis to consider the buspooling alternative. Based upon the answers to the above questions, the next questions can be addressed.

What type of organization is required? - While the requirements for implementing a buspool will be unique for each local situation, several general questions must be answered. The organizational aspects of pooling are discussed elsewhere in this report and are also covered under the carpool and vanpool discussions. For buspools, the following organizational questions are pertinent to deciding what, if any, organization is required.

- Does the local transit property have buses available for pooling?
- Is the local transit property willing to organize the service?

- If so, will they handle fare collection also?
- If not, will they charter the bus for pooling?
- If the local transit property desires a charter situation, will they handle fare or must the pooling organization do this?
- What will be the charter/pool fare? (If the local operating property runs the service, they would determine the required fare; if a charter situation occurs, the pooling organization must compute the required fare based upon costs).

If the local transit operator handles the service, determines fare, and provides the equipment, an organization consisting only of an ad hoc pooling committee will suffice. This committee can provide liaison between the users of the service and the operator. This liaison function should include an expression of the service desired and aids for determining the exact routes and schedules. If the local transit operator wishes to charter the buses, then a more formalized organizational structure must be initiated. In this case, the pooling organization determines routes, schedules, fares, fare collection procedure, and must publicize the service.

The size of the buspooling endeavor dictates the size and degree of formality (e. g. , incorporation) of the pooling organization. The Reston experience provides a perfect example of this situation. The amount of fare charged is based upon the actual costs of providing the service (charter plus overhead of actual costs as determined by the operator). Since this service is premium, the costs are higher than traditional transit service (most buspools charge approximately \$1.00 per ride); but the convenience of the service, elimination of the need for second car, lack of available gasoline for unlimited auto use, and several other factors have made buspools a success even at relatively high fare levels. If the local transit operator does not desire either a charter operation or full responsibility for a buspool, a lease option can be considered. When dealing with any transit operator, a legal analysis must be performed to determine buspool feasibility.

What Will Be The Fare Collection Procedures? - Once the organizational structure and amount of required fare have been determined, the fare collection procedure must then be organized. The type of pooling organization will determine the fare collection to some extent but most buspooling operations, regardless of organization structure, have opted for weekly or monthly commutation tickets. This procedure provides a basis (weekly or monthly) for advanced planning of the service, simplifies fare collection and allows "pay by mail" which commuters find convenient.

Once the above questions have been answered for the unique situation at hand, the exact routes and schedules of the buspool can be determined and riders can be signed up. When the initial service has begun and ridership developed, other amenities can be considered. Bus shelters, straggler bus, service additions and expansion of service hours are all improvements that can be considered within the context of the above analysis techniques.

Interested people, be they a community, group employer, transit operator or public agency can provide the catalyst for initiating a buspool. By answering the above questions for the unique situation and by communicating with the transit operator, this efficient pooling method can become a reality.

SECTION 9

POOLING FOR THE DISADVANTAGED

POOLING FOR THE DISADVANTAGED

INTRODUCTION

The explicit intent of a nationwide carpooling program is, of course, to reduce fuel consumption by increasing vehicle occupancy. Although not exclusively so, the principal concern is with the work trip of the employed. For decades now, commuters motivated by desires for privacy, convenience and autonomy, and abetted by widespread availability of cars, expanding highway systems, and inadequate transit alternatives, have increasingly chosen to make their work trips as lone occupants in private autos.

A serious commitment to carpooling on the national level would have a significant impact on many Americans. It seems only reasonable then to examine carpooling from the point of view of the problems and opportunities it may present for subsets of the populace with special transportation needs. The purpose of this report is to explore how carpooling activities might be used as opportunities for helping the "transportation disadvantaged" -- those with special mobility problems. In particular, attention is directed herein to the transportation problems of the elderly, the handicapped, and the urban poor.

Federal, state and local agencies have been devoting increasing attention to the transportation disadvantaged in recent years. The role that inadequate transportation service plays in reducing the quality of life for these people has been widely recognized.

Most proposed solutions to the problems of the transportation disadvantaged have emphasized modifying or expanding transit services. A major carpooling program may provide new ways to alleviate these serious and chronic difficulties.

In the text to follow, the discussion begins by defining who are the transportation disadvantaged. Following this is a brief summary of what actions are now being taken to meet the problem. Opportunities for application or expansion of pooling activity to aid each of the three special mobility groups are then suggested. Finally, action opportunities are identified along with steps that may be taken by individuals, business, social service agencies, and government.

WHO ARE THE TRANSPORTATION DISADVANTAGED?

Although definitions of the transportation disadvantaged vary considerably, three groups repeatedly and invariably appear in the literature devoted to the topic, and they will provide the central focus for this discussion:

- The elderly
- The handicapped
- The urban poor

The scope of this discussion purposely avoids consideration of the rural transportation disadvantaged. The rural problems are substantial ones and, in numerical terms, are just about as important as the urban special mobility problems.

For example, nearly half of the nation's poor live outside of metropolitan areas. This series of carpooling reports, however, is oriented mainly toward urban transportation actions. Therefore, the scope of this report is likewise limited to urban concerns.

The transportation disadvantaged are often viewed as those who cannot afford cars or those who are unable to drive because of age and/or physical disability. However, an additional group of elderly, handicapped, and poor who own automobiles should also be considered as transportation disadvantaged if their household budgets are stretched thin, and the cost of auto ownership and operation is a real hardship. The energy crisis, with sharply rising automotive fuel prices, will place a further burden on these marginal owners of autos who have little slack in their household budgets.

The transportation disadvantaged face several problems, among which are:

- They frequently have low incomes.
- They frequently live in places poorly served by public transit.
- They frequently have problems using the public transit system. Specifically, in cities where only conventional transit services are provided, the elderly and handicapped often have trouble getting to the transit stops and stations, and frequently have physical difficulty in boarding the transit vehicle.

Determining the number of persons in each transportation-disadvantaged class -- elderly, handicapped, and urban poor -- is complicated, because there is substantial overlapping of groups. For example, many elderly persons are also handicapped and/or poor. However, the discussions below give an indication of the magnitude of the problems.

The Elderly

There are more than 20 million elderly persons in the U.S. today (i. e., persons over 65 years of age), and 28 million are projected by the year 2000. As a group, their income level is low with at least one out of four being below the poverty level (as subsequently defined). Transportation is their third largest regular expense, exceeded only by housing and food costs. They are often transit dependent but frequently encounter physical difficulties in utilizing existing transit services.

The Handicapped

For our purposes, it is most meaningful to consider those who are chronically handicapped; i. e., those that the National Center for Health Statistics defines as having one or more long-term diseases or conditions for a period in excess of three months. Currently, this group constitutes approximately 3 percent of the population, or in excess of 6 million people between the ages of 16 and 64. Another interesting statistic is that there are about 6 million persons of all ages who have physical disabilities of the type which cause mobility limitations. The most frequently found conditions which limit mobility are arthritis and rheumatism, visual impairments, paralysis, impairment of lower extremities, impairments of the back or spine, and other diseases of muscles, bones and joints. Roughly 30 to 40 percent of the persons with mobility impairing handicaps are able to work.

A lack of transportation facilities, which are physically feasible to use, deprives large numbers of handicapped persons the same level of access to employment, shopping, and recreational pursuits enjoyed by most other Americans. Furthermore, transportation for the essential purposes of receiving medical and social services is also very difficult. It is estimated that the handicapped travel only about half as much as their non-handicapped counterparts, with the discrepancies being most noticeable in the areas of social-recreational and work trips. A handicapped citizen makes only about a third as many of these latter types of trips as do others.

The Urban Poor

The American people, taken as a whole, enjoy the world's highest standard of living. Nevertheless, more than 10 percent of our population, or in excess of 25 million people, are officially defined as poor. (The Social Security Administration defines a household as poor if its annual income is less than 3 times the cost of a minimal diet for the persons in the household. In 1968, the poverty level was \$3,553 annual income for a four-person household.) Many others who do not officially classify as being poor live by very limited means. The national median family income in 1968 was \$8,362 annually, whereas the Bureau of Labor Statistics considered that a four-person household needed \$9,600 to maintain a "moderate" standard of living.

More than half, or almost 13 million of the poor live in metropolitan areas and, of these, close to 8 million reside in the central cities. Two-thirds of the poor in urban areas are white, but only 8 percent of whites are poor compared with 25 percent of non-whites. More than three-fourths of the poor non-whites live in central city locations within the metropolitan area.

The urban poor can be further described as follows:

- 5.4 million or 42 percent are children (under 18)
- 2.4 million or 18 percent are elderly
- 2.3 million or 17 percent are adults in households headed by females under 65 (and this group is growing fast)
- 1.5 million or 12 percent are adults in male-headed households

Greatest attention has been devoted to the difficulty of the inner city resident's trip to suburban job locations (so-called reverse commuting), but trips made for a wide variety of essential purposes are difficult for the urban poor.

WHAT IS BEING DONE?

A wide variety of transportation programs are ongoing designed to improve service to those with special mobility problems. All levels of government, as well as public service organizations and citizen volunteer and self help groups, have been engaged in such activities. A representative sampling of special mobility programs are discussed below.

UMTA Efforts

At the Federal level, the Department of Transportation's Urban Mass Transportation Administration has conducted research and development projects in subjects related to special mobility problems and has provided grants to state and local agencies to support demonstration projects involving special services to the transportation disadvantaged. The main focus of UMTA's special mobility work has been on transit route and schedule flexibility, fare structures, and equipment modification and utilization. Starting in 1968, for example, UMTA engaged in a service development grant program to help individual cities conduct public transit experiments designed to connect the inner city jobless with suburban jobs. Reverse commute lines in 14 cities were developed and tested in this \$7 million demonstration program. Although the results of the demonstrations were mixed (i. e., the successes slightly outweighed the failures), it was clearly demonstrated that the social benefits of reverse commute services are substantial. One major problem encountered was the difficulty of finding developable reverse commute routes where demand was sufficient to justify conventional fixed-route, fixed-schedule transit service. The need, therefore, became clear for greater attention to non-conventional service development, such as demand-activated systems and jitney operations.

More recently UMTA has been actively supporting demonstrations of innovative transportation services for the elderly and handicapped. There are literally hundreds of such projects in progress and UMTA has played a role in many of them.

Other Federal Agencies

Agencies outside of the Department of Transportation have also concerned themselves with special mobility problems. Many transportation projects for the elderly have been financed by the Department of Health, Education and Welfare's Administration on Aging under Title III of the Older Americans Act. The Office of Economic Opportunity, currently undergoing phase-out, provided funding for a large number of rural transit projects directed especially at the poor and the elderly. Substantial funding for urban area transportation projects has been provided through the Department of Housing and Urban Development's Model Cities program. The Model Cities efforts have been devoted primarily to the organization and support of community-operated transportation services specifically oriented to Model Neighborhood areas.

State and Local Agencies

All of the Federal grant programs related to special mobility problems depend on state or local agencies for detailed planning and execution, as well as a share of the funding. A complex mix of agencies has been involved, including transportation departments and transit authorities, various types of social service agencies, health departments, educational institutions, entities such as Community Action Agencies, and local Model Cities Agencies formed in direct response to Federal programs, and innumerable other agencies. A frequent observation is that government action in the special mobility field suffers from a lack of coordination and integration.

Community Service Efforts

Even more individually tailored services are being offered to the transportation disadvantaged, particularly the elderly and handicapped, through voluntary and public service efforts at the local level. These are largely being handled on an unilateral basis, typically by nonprofit public service organizations in conjunction with private citizens acting as volunteers. Although many of these activities are supported in part by government, no agency, public or private, acts as a central register for these activities at the national level. Consequently, no hard data on the breadth and scope of the services being offered is available. Nevertheless, the selected examples which follow are illustrative of the variety of services underway in many cities throughout the country.

Special Red Cross Transportation Services - In some cities, the Red Cross is engaged in special transportation services for the elderly and handicapped. For example, after successfully training students from the University of Chicago to drive Red Cross buses for use in their work with children who are psychiatric patients at the Chicago State Hospital, the Red Cross decided to extend this service to other organizations. Requesting organizations are asked to recruit persons from their own ranks, who will then be given Red Cross motor transportation training and authorization to use Red Cross vehicles. Thus far, Illinois State Psychiatric Institute has recruited drivers to use Red Cross vehicles to transport outpatients to and from the clinic; MacNeal Hospital has instituted a similar program for their outpatients; other welfare organizations are invited to initiate similar programs when they have excess transportation needs.

Other transportation services of the Red Cross include a winter-long program by the Heart Association wherein the Red Cross transported volunteers and machinery to and from schools to help in early detection of heart ailments. Many similar short-term efforts have been mobilized through the Red Cross transportation service in cooperation with various organizations.

Wheels for Welfare, Inc. - In 1962, Wheels for Welfare, Inc. was established in Philadelphia as an independent, nonprofit agency to transport the handicapped. Today, the agency has a paid staff of 3 full-time and 2 part-time personnel, and 175 volunteer drivers. Workload has necessitated some paid driving.

Volunteers use their own cars, receive no reimbursement, and donate as much time as they choose, based on schedules planned by the office to meet requests by social workers of over 100 health agencies. Volunteers are recruited by word-of-mouth, at community and hospital fairs, through news media and publications, through presentations at club meetings, etc. They are screened by office staff, recruiting committee, or Board members, and are given the opportunity to accompany an experienced driver on a day's run.

The program has been successful in that 12,600 patient-trips were run in one year. Service is available on the basis of economic need, except where it would represent duplication of service (some welfare department recipients receive a transportation allowance). Effectiveness of the program has been measured by evaluation from the agencies served.

Transportation for Center Attendance - This transportation program for senior citizens in Springfield, Vermont, is conducted entirely by volunteers. Four permanent transportation chairmen and 35 volunteer drivers participate. Every Monday, the Transportation Chairmen call senior citizens to determine who requires a ride and subsequently contact drivers to arrange rides. Every Wednesday, approximately 25 senior citizens are transported to the senior center. They are driven home at 4:00 p.m.

The provision of the volunteer carpools enables senior citizens, who don't drive and are unable to afford cab fares, to take advantage of center activities and enjoy a day away from home. The program owes its success to the rotation of volunteer drivers so that no one is overburdened. Three of the program chairmen are reimbursed at the rate of 8 cents a mile; all other drivers provide their services free.

SST - Social Service Transport - In Titusville, Florida, an area without a public mass transit system, the crucial need for transportation for the economically disadvantaged was recognized by an active volunteer churchwomen's group. The result was the SST, a three-element program developed in July 1969, by the North Brevard Transportation Committee, formed under the auspices of the Community Services Council. The plan includes a scheduled vehicle system, an expansion of the already-organized volunteer driving program, and a central referral office with a staff to direct and coordinate the system. Volunteer recruitment and training of churchwomen's groups continues to be carried out by original volunteers. A central referral operation is manned by trained volunteers from a service league. They, in turn, train volunteer target-area residents to take over. A paid staff is called for in a later stage.

Presently, a ten-passenger minibus runs a scheduled route through the target areas, carrying its passengers to health clinics and other services. Other cities and areas in the county are looking toward establishing a similar system.

Helping Wheels - A unique carpooling program for the elderly was operated in Raleigh, North Carolina. Project "Helping Wheels" was initially funded by the Administration on Aging (HEW) and implemented by North Carolina State University. Drivers were themselves senior citizens and were reimbursed at 10 cents per mile for driving other senior citizens to go shopping, visiting, to church, to medical appointments, clubs, and similar activities.

Drivers and riders contacted each other at senior citizen clubs with coordination assistance provided by other senior volunteers. This was significant to the operation of the program and allowed both parties flexibility in scheduling. It also precluded the vehicle from being considered a taxi or livery service, and this conforms to North Carolina insurance laws. In addition, a blanket excess liability insurance policy was purchased so that all drivers were covered in excess of the state minimum liability coverage.

Shopping Pools - In a number of communities, a bus or other vehicle may be provided by a public agency or private sources to transport elderly citizens from a senior housing area to a shopping center or grocery store. For example, housing authorities in such diverse areas as Manchester, New Hampshire, and Chicago, Illinois, provides such service weekly; in other communities, such as Richmond, Virginia, a similar service is provided by a nearby food market.

Cranston Transvan - In Cranston, Rhode Island, a special subscription bus operation for elderly and handicapped residents of public housing is sponsored by the city, funded in part by an UMTA grant. Bus service is provided between the public housing facilities and three shopping centers in the area. Approximately 800 passengers are served per week by three small buses (15 to 19-passenger capacity). Riders pay \$3.00 for a 3-month subscription to the service.

Richmond Courtesy Car - A medium to high income apartment complex of about 800 senior citizens in Richmond, Virginia, is served by a courtesy car operated by the management. It makes five daily trips to the downtown area and five daily trips to a nearby shopping mall. Reservations are required, and there is usually a waiting list. A full-time driver operates the vehicle 40 hours during the weekdays.

WHAT ARE THE OPPORTUNITIES?

Opportunities for benefiting the transportation disadvantaged through pooling activities center upon either fostering the effective inclusion of these groups in pooling operations through priority treatment and information dissemination, or increasing vehicle availability, and then utilizing the vehicles as nuclei for pooling. Variations in opportunities among the groups of disadvantaged are largely a function of the relative importance of their various trip purposes.

Pooling for the Elderly

Like other groups in society, the vast majority of elderly persons in the United States rely on the private automobile for travel. Those that do not own automobiles or drive themselves depend upon friends, relatives, or volunteer services to make what are mostly essential trips (i. e. health care, shopping, and recreation). Without special consideration, the elderly could be particularly hard hit by either substantial increases in gasoline costs and/or fuel rationing. Thus, a National Carpool/Buspool Program should, as a first step, attempt to preserve as much as possible the existing travel resources of the elderly. With present travel resources largely intact, the program can then begin to capitalize on the opportunities which are available to increase the mobility of the elderly.

Before discussing particular pooling programs by category which might assist or improve the mobility of the elderly, a number of characteristics of the elderly should be noted. These characteristics, all of which are related to the mobility problems of the elderly, include:

- The elderly typically require some special assistance with all travel. Handicapped elderly persons may require special equipment while others may simply need more time to board a vehicle safely.
- The elderly often have relatively low access to transportation. As a consequence, substantial effort must be devoted to the information dissemination aspects of any new program.
- The elderly frequently have limited transportation alternatives. Many are transit captives. Thus, the reliability of the system they use may be more critically perceived by them.
- Although the elderly make mostly essential trips, individual trips have importance beyond merely satisfying particular travel needs. Trips are often a primary form of diversionary and, in effect, recreational activity.
- The elderly generally participate actively in virtually all phases of programs designed to assist them.

Carpooling for the Elderly - Carpooling offers the elderly the potential for door-to-door service, flexible routing, and use of a vehicle with more intimate (and consequently less forbidding) character. The elderly, many of whom rely on others to drive them about, are already heavy users of carpools. The emphasis is not only to create new carpools among the elderly but also to preserve and make better use of existing carpools. Special actions may be required to prevent volunteer driving from drying up as a result of fuel scarcity and high prices.

Carpooling for the elderly can be classified and discussed on the basis of vehicle ownership since this determines in part the necessary program elements.

- Elderly-owned -- Many elderly persons do own and operate automobiles. Such individuals should be encouraged to form their own carpools for other elderly persons who do not have their own automobiles. Organizations, such as the local chapters of the American Association of Retired Persons, could form referral and volunteer carpool programs which utilize elderly persons as drivers. Programs of this nature would have the

elements of self-help and independence which are often difficult to provide in other mobility programs for the elderly.

- Owned by friends or relatives -- It is quite common for elderly persons who do not have automobiles or cannot drive to depend upon friends or relatives for travel. If fuel rationing does occur and this travel resource is to remain available, it may be appropriate for the elderly persons, with or without driver's licenses and automobiles of their own, to receive fuel allotments. Even with special consideration for the elderly, however, it will be more difficult for friends and relatives to provide transportation for the elderly during a fuel crisis. This situation could be alleviated by encouraging persons transporting a single elderly person to transport others at the same time. Encouragement of such expanded uses of carpools might be organized by senior citizen centers, social clubs, and churches. Government could help these groups establish matching and referral services.
- Volunteer or agency owned -- Throughout the country, there are many volunteer or agency-sponsored programs to provide transportation for the elderly. Often, the programs provide transportation for special-purpose trips such as to health care facilities. Mechanisms should be established to allow these programs to continue and expand during a fuel shortage period. Volunteer drivers, for example, may require special fuel allotments or fuel cost rebates. Owners of automobiles not in full use might be requested to allow various agencies or institutions use of their automobiles during the day. Social service and health care agencies, who are engaged in provision of transportation to the elderly recipients of their services, could give greater attention to better scheduling of appointments aimed at more efficient use of carpools. Centralized referral services, preferably operated by organized groups of elderly persons, could be established to coordinate volunteer and agency activities. Generally speaking, the elderly are quite well organized, and there is good potential for them to pursue various carpool programs through group action.

Vanpooling for the Elderly - Because of the difficulty of finding individuals who own vans and/or are willing to use them on a volunteer basis, vanpooling for the elderly is most appropriate for agency-sponsored transportation services. The principal advantage of vanpooling over carpooling for the elderly lies in the greater capacity of the vehicles. Fewer drivers can serve more people using vans. Additionally, the van offers a potential for installation of special features to aid access to the vehicle and the possibility of multiple use. Because many institutions or agencies, private and public, which might use vans, do not have the available funds for vehicle purchase, local, state, and Federal programs should be considered which would provide the necessary assistance. For the immediate future, joint use or sharing of vehicles by various agencies would be useful since many agencies which have vans do not use them on a full-time basis.

Buspooling for the Elderly - The concentration of some elderly people in subsidized housing and in older high density neighborhoods represents a possibility for effective application of buspooling. Typical services have been organized to take people to shopping locations such as suburban regional shopping centers and to regular recreation activities.

The need for vehicles and drivers is the principal obstacle to such service. The use of school buses for adults presents both safety and legal problems, and funding for such special service with regular transit vehicles is generally difficult to find. There is the implied need for an institutional sponsor for such service.

The sponsor need not always be a public or community service organization. In certain instances, commercial sponsors may be an alternative. In Hemet, California, for example, the elderly living in this retirement-oriented community can avail themselves of free bus service to the town center offered by a well-established savings and loan company. The drop off point is the centrally located savings and loan company itself, and thus, the company provides the service largely as a marketing tool.

An additional problem for the elderly is the psychological one of fear associated with bus usage. While this is often exaggerated, a significant portion of the elderly group to be served may experience fear with respect to the vehicle itself or the larger group of strangers with which one must ride. One significant problem with buspooling is that buses have greater difficulty than cars and vans circulating through neighborhoods to provide door-to-door service. Congregating

riders at collection points may be necessary in some situations, whereupon the door-to-door service advantages, which are vital to some elderly persons, will be lost.

Pooling for the Handicapped

Many of the transport problems of the elderly are shared by handicapped persons. There are, however, significant differences. In developing pooling activities for the handicapped, a number of factors should be taken into consideration including the following:

- Unlike the elderly, many handicapped persons are employed and require transport to and from work
- Many handicapped individuals require transportation services which are tailored to their specific needs because of physical disabilities and limitations
- Despite the need of handicapped persons for very specialized transport services, there are also persons with functional disabilities (for example, the deaf) who require very little special or unique assistance. As noted previously, however, there are some 6 million persons in the U.S. with handicaps which cause mobility limitations.
- Handicapped persons, unlike the elderly, are not easily organized. Difficulties in organizing the handicapped may be traced to several causes, including the strong psychological resistance to being grouped with others, and the wide variety of types of disabilities and the consequent lack of a common basis for organizing.

Before discussing the particular pooling activities which may be appropriate for the handicapped, it should be noted that the program elements proposed for the elderly are generally applicable to the handicapped as well, particularly the non-employed handicapped. Special equipment, however, is often required. Emphasis in the following discussions will be placed on pooling activities which serve employed, handicapped persons or which serve handicapped individuals requiring specially equipped vehicles.

Carpooling for the Handicapped - The door-to-door service afforded by carpools is a particularly valuable asset with respect to handicapped persons. To maintain the present level of participation of the handicapped in carpools and encourage greater participation, it may be

appropriate to provide handicapped persons, drivers and non-drivers alike, with special fuel allotments in the event of fuel rationing. A special feature of carpooling for the handicapped is that some handicapped individuals drive specially-equipped vehicles. The owner of such a vehicle would possibly have a greater incentive to form carpools, acting as the driver, in order to maintain the mobility which this special vehicle permits. Other non-handicapped persons who are drivers of carpools may find that handicapped persons, who have limited transportation alternatives, are the most reliable, longest lasting, and therefore highly desirable carpool partners.

Firms which are sponsoring carpool programs for their employees should be encouraged to give handicapped workers priority and special consideration in the formation of carpools. Furthermore, it is desirable for organizations involved in providing social and medical services for the handicapped to develop their own carpool coordination activities.

Vanpooling for the Handicapped - The principal advantage of vanpooling over carpooling for the handicapped is that vans may be fitted with special equipment such as lifts, ramps, or fittings to accommodate wheelchairs. Institutions, such as rehabilitation centers, which serve non-ambulatory-handicapped individuals on a regular basis are logical sponsors of transport services employing specially equipped vans. Because of the high cost of specially equipped vans, institutions and agencies should be encouraged to form consortiums for the joint purchase and usage of specially-equipped vans. In the cases of very large employers and those with an especially large number of handicapped workers, it may be possible to foster vanpooling by acquisition of such specially equipped vehicles. As noted previously, handicapped persons are likely to be dependable and long lasting pool riders. In vanpooling, their inability to share the driving would not constitute the problem that it might in carpooling.

Public service agencies with adequate funding or other access to van-type vehicles may set up special transportation services. Merchants, joining together in a business district or shopping center, might sponsor a vanpool for handicapped customers. This would require aggressive solicitation and advertising on the part of the merchants to capture individual riders since the handicapped, unlike the elderly, are not typically found concentrated in groups.

Buspooling for the Handicapped - The lack of uniformity of problems and travel patterns among the diverse members of the handicapped group hinders an attempt to describe generally applicable alternatives.

The transport of handicapped children for special education purposes is the principal current application of pooling for the handicapped, and in many cases these services use vans instead of buses.

When an institution can sponsor and operate buspooling for the handicapped, special equipment may be installed in the vehicle to assist the handicapped. In some communities, special equipment has been introduced through the initiative of the public transit system. In most cases, however, local transit agencies are reluctant to make such expenditures unless prodded by Federal or state agencies or special interest groups. Generally, the funding for such services is difficult to obtain, as many programs which support transportation will not cover the special costs of equipment and trained personnel.

The greater difficulty of providing door-to-door service with buses, as discussed previously, is a real problem. For many handicapped persons, door-to-door service is essential.

Pooling for the Urban Poor

The ever increasing reliance of the American public on the privately-owned automobile has had a pervasive impact on the quality and character of life for all people, irrespective of their socioeconomic standing. Orientation toward the automobile influences the way American cities develop and decay, their physical layout, and the style of life they afford their residents.

There would seem to be justification for suggesting that the transportation problems of the poor have paradoxically been exacerbated by the increased mobility of the non-poor. Virtually every family in America that has the means to do so owns at least one automobile. Statistically, only 10 percent of the country's non-poor families are without a car, compared with more than two carless households out of five - or more than 40 percent - for those families with incomes below \$3,000 per year. However, the situation of the poor is far more desperate than even these figures indicate. Some two-thirds of the cars they own are six years old or more, with a sizeable proportion of these vehicles being highly unreliable or unusable. Barred from purchasing and maintaining adequate automobile transportation by economic condition, the economically disadvantaged are forced to use public transportation to meet their needs -- forced to do so when these transit services are generally inadequate and sometimes grossly so.

Nassau and Suffolk counties, suburban areas of the New York City metropolitan region, has numerous pockets of low-income residents. These counties also have many large industrial parks employing a wide range of skill levels, including semi-skilled and unskilled workers. Transit service linking the residence end of the trip to the job site is poor. A study of four of the low-income residential zones showed strong interrelationships between frequency of tripmaking, auto ownership, income, and job availability and accessibility. The low-income families had trip production rates that were only half those of average-income suburbanites. The low-income family was more likely to have more than one employed family member but was least likely to have more than one car. Consequently, the use of transit (and carpooling) was a necessity rather than a choice.

The urban poor make fewer trips of all kinds than do others. Their restricted mobility to shopping, for example, often means paying higher prices for lower quality merchandise, because they are, in effect, captive customers of neighborhood stores. Essential trips to receive social services, medical care, education, and recreation present significant problems for the poor in terms of travel cost, travel time, and convenience.

Those who are fortunate enough to find suburban employment as inner-city residents face a unique transportation problem, the reverse commute. Given a sufficient number of openings for their skill levels, more of the central city economically disadvantaged could become reverse commuters. To commute in the opposite direction of the major flow of traffic, however, is no easy task for these individuals. Transit systems are not geared for this need, and the private auto is often the only reasonable, if unattainable, alternative. Moreover, the problem is growing in scope. The service industry, which has more jobs at the unskilled and semi-skilled levels, accounts for a growing percentage of the employment of lower income groups and is, ironically, among the leaders in the flight to the suburbs.

The energy crisis will potentially affect the urban poor in different ways depending on whether pricing or rationing is the ultimate mechanism used to hold down fuel consumption. High fuel prices may cause extreme hardships on the urban poor in two ways: (1) low-income auto-owning families simply may not be able to afford the gas they need and (2) the urban poor who depend on voluntarily or institutionally-provided transportation may find these services drying up due to the higher fuel costs.

Fuel rationing on the other hand, could have a less severe impact and may even be a benefit to the urban poor, depending on the exact allocation method used. A disadvantaged person with ration coupons in his pocket may find it easier to get a ride from others, or if a free market is permitted, might raise cash by selling unused coupons. Whether such benefits actually materialize could depend on whether the urban poor receive fuel rations even though they may not own a car or have a drivers license.

Carpooling for the Urban Poor - More carpooling already takes place among the economically disadvantaged than among other members of society for the simple reason that it may be the only available and affordable means of transportation. Most of this carpooling among the disadvantaged comes about in an informal manner, and no external incentives or rewards have been offered for participation. As more formally organized efforts move forward, opportunities clearly exist for including -- and in fact, giving highest priority to serving -- the inner-city poor in carpool promotion activities.

Carpool matching activities may reach the poor, to expand and improve efficiency of pooling, if efforts are made to utilize employment agencies as a means of matching jobs and access to them with possible employees. Provision of additional fuel rations or fuel price reductions to the low-income worker would make him a potentially desirable addition to a carpool and thus aid the task of incorporating him into the system. This form of incentive might also encourage volunteer drivers to provide service for non-work trips.

The formation of transportation cooperatives by groups of individual urban poor is one way they can expand their level of vehicle ownership by sharing the cost of ownership and operation among several individuals. Carpool cooperatives, in particular, are probably within the economic reach of many groups of individual poor persons. The problems are to make widely known how to form a transportation cooperative and to make sure that institutional boundaries, such as insurance and vehicle registration practices, are relaxed to facilitate the formation of cooperatives. Government can help by legislating away counterproductive institutional barriers, by actively assisting the poor with the technical and administrative details of setting up a cooperative, and possibly, by providing low interest loans for the cooperative vehicle purchase. The private sector, particularly employers, can help in similar ways with technical/administrative assistance, backing of loans, and leasing of vehicles for use by a cooperative.

Another way that employers can serve positively is to assist individual low-income employees with the purchase or lease of a vehicle, with the stipulation that the vehicle be used as a high occupancy carpool. Furthermore, if these private vehicles were allowed to be used for taxi or jitney type of service, an opportunity would be opened for the owner to augment his income.

Vanpooling for the Urban Poor - The advantages that vanpooling can offer to the urban poor vary by the type of trip involved. The principal advantage is simply the higher level of efficiency that can be achieved in comparison to the carpool. In some cities, public service and government agencies have focused upon the poor by providing weekly trips to shopping opportunities. Expansion of these services and increased information regarding their availability could prove of considerable value. Placing a high priority on providing vehicles to such activities as day care centers and social service agencies could increase the range of possibilities for mobility and employment by making it easier for the potential working mother to leave the household.

An outstanding potential utilization of vanpools for the economically disadvantaged is in serving their work trips, especially the reverse commute problem cited previously. A problem previously encountered with conventional bus service for reverse commuters is the relatively low trip densities along any given line. The smaller vanpool, operating on a more flexible route, is a potential solution.

Vanpooling can, of course, prove to be a significant aid to those of this group who are currently employed and commuting out to the suburbs. It can ensure that they can, in fact, maintain these jobs in the light of fuel rationing, and/or sharply rising gasoline costs. Pooling for domestic workers, for example, could be fostered through the leasing or cooperative purchase of vehicles, as suggested in relation to carpooling.

Where employment is concentrated, and in conjunction with job training programs, giving high priority to low income workers as vanpool drivers would provide additional mobility benefits. The company may gain advantages in hiring by offering vanpooling as a means of giving the low income employee access to the company. The worker is in turn motivated to select riders who will be dependable and thus will serve as an added recruitment mechanism.

The concept of a transportation cooperative, discussed above in connection with carpools, might also be utilized with van-type vehicles as well. The higher cost of the vans, compared with cars, means that more members would be required in the cooperative group. This may present difficulties for groups of private individuals. Perhaps the greater potential for vanpool cooperatives for the urban poor lies in the involvement of larger, more formalized organizations. Groups, such as neighborhood associations, churches, and the like, could not only provide the cooperative ownership entity but also take charge of management and coordination of the vanpool operation to most effectively serve its members.

Buspooling for the Urban Poor - If buspools are viewed in terms of a service developed to meet the needs of users on a regular basis, demand-actuated service would not qualify as a buspool. The non-work oriented trips of the economically disadvantaged (i. e. shopping trips, trips to public service agencies, etc.) are most amenable to demand-actuated approach, as exemplified in the dial-a-ride programs now underway in many cities. Generally, demands are not sufficiently high to justify full-size buses. A possible exception to this situation might be in the transport of residents of sizeable subsidized housing developments to shopping locations. However, overall it would seem that formalized buspools do not offer a significant advantage to the poor in terms of their non-employment oriented travel needs.

Buspools may, however, be appropriate for the economically-disadvantaged commuter, again with special reference to those having the reverse commute problem. For the same reasons cited in the case of the vanpool, the buspool can most effectively be sponsored by an employer. Obviously, to generate sufficient demand to fill a buspool, the potential employer sponsors would have to be reasonably large firms or a group of firms located in close proximity in an industrial park. The employees using the system would have to be fairly well concentrated in the inner city.

In cases such as that of the domestic worker, charter buses might be a useful pooling mechanism. Public information may be the principal missing element in current development of special reverse flow transit routes.

WHAT ACTIONS MAY BE TAKEN?

Based upon the above discussion of pooling opportunities for the transportation disadvantaged, it is possible to suggest a variety of action opportunities. The following sections propose what might be

done by individuals, business, social service agencies, and government to serve the needs of the elderly, handicapped, and economically disadvantaged.

By the Individual

For the Elderly - There is much that individual elderly persons can do to promote and implement pooling programs directed at the elderly. The elderly population should be recognized as a valuable resource of individuals who are capable and willing to work on virtually all phases of pooling activities. Elderly persons are often well organized at the local level and there are many specific actions that individual elderly persons can take, working through the groups of which they are members.

- Encourage organizations and clubs representing the elderly to establish pooling programs
- Participate in volunteer referral and matching services run by their organization
- Serve as a volunteer driver, if feasible
- Disseminate information concerning on-going pooling activities for elderly persons
- Schedule trips with friends and other elderly persons to promote ride sharing
- Write to community leaders and politicians to express opinions regarding government actions needed to facilitate pooling among the elderly

Of course, individuals need not be elderly to play a role in promoting pooling programs for the elderly. Individuals of all ages can perform many of the actions listed above. Volunteers will be needed to drive and work at referral and matching services. Because many elderly persons are somewhat insulated from normal promotional and informational mechanisms, it is especially important that persons who know elderly individuals assist them in determining what activities are available and learning how to use them.

For the Handicapped - Unlike the elderly, the handicapped are not well organized into self help groups. Therefore, the handicapped person's actions in carpooling would likely have to be more individualistic. A significant fraction of the handicapped are employed. They can, as individuals, try to inform their employers regarding their unique

mobility limitations with the aim of receiving high priority treatment in any pooling programs. The handicapped person who can drive, for example, may be in special need of the closest in parking space available. Whether he drives or not he also may need assistance getting in and out of his auto and, therefore, would benefit greatly by having a carpool partner to assist him. Bringing these factors to his employers attention, the handicapped person could feasibly convince his employer to recruit reliable fellow employees as carpool partners. Personal communication and persuasion of this type could feasibly result in the employer being sold on the idea of offering substantial incentives to potential carpool partners of the handicapped employee.

Non-handicapped individuals also have significant roles to play in programs for the handicapped as volunteers, organizers, and promoters.

For the Urban Poor - The productive individual actions that the urban poor can pursue productively are similar to those of the elderly. The urban poor can work through groups, such as store-front neighborhood centers, to promote pooling. They can encourage the leaders and members of such groups to undertake pooling projects as a worthwhile group function. Once such projects are underway, individuals can actively engage in them, both as users of the facilities and services provided, and as volunteer workers on the project.

Individuals can band together in small groups to form carpool or vanpool cooperatives and take the initiative in seeking institutional assistance in the formation and management of such cooperatives.

Low-income persons who reside in the inner city and either work or train for work in the suburbs, can individually, or in small groups with fellow employees or trainees, seek to inform management of their transportation problems and solicit priority treatment in pooling projects sponsored by their employers.

Individual low-income employees can volunteer for the role as driver of company-owned carpools and vanpools and seek extra pay as consideration for such service.

By Business

For the Elderly - Merchants and businesses have two areas of potential involvement in pooling programs for the elderly. First, they can actively sponsor, individually or collectively, pooling programs for the elderly. Shopping-oriented bus or vanpools are good examples of this. Second, individual businesses and business organizations (such as Chambers of Commerce) can promote pooling activities sponsored by other organizations. In this regard they may be able to lend vehicles for use in such programs and encourage their employees to serve as volunteers.

For the Handicapped - To assist handicapped individuals to satisfy non-work transport needs, merchants and businesses can perform for the handicapped what the above recommendation indicates they can do for the elderly. To a large extent, such activities for the handicapped and elderly can be highly coordinated or provided as a single program. For handicapped individuals who are employed, major employers can set up pooling programs for all employees with special emphasis on the handicapped. Sponsorship of equipment and services represents a major contribution which can be made here. The employer who is subsidizing vanpooling may assist the handicapped by setting a high priority on making the van available to handicapped employees and by equipping the van with special features. Making employer-owned vans which are used for commuter vanpooling available during the day to service agencies or volunteer groups who are helping the handicapped meet their mid-day travel needs is another potential service.

For the Economically Disadvantaged - Relative concentrations of residential locations of the economically disadvantaged make possible a fairly broad range of options for business action. For shopping trips particularly, merchant-sponsored vanpools and buspools may be set up, giving the merchant benefits in the form of advertising, business potential, and possibly tax advantages. Fuel incentives would encourage this activity, which could possibly utilize vehicles generally used for goods delivery and other business purposes. Such incentives could also encourage the lending of vehicles to volunteer drivers or public service agencies for use in serving day care centers and other activities where timing matches well with typical business needs.

Employers may do a great deal to insure the participation of the economically disadvantaged in pooling programs. One obvious way of accomplishing this is in terms of the priorities that employers set

in establishing their employer vanpool systems. For example, vanpools for the economically disadvantaged could be made the first order priority - rather than extending primary efforts to encouraging vanpooling among the economically secure employees, (e.g., the executive). The first vanpools organized could be initiated specifically for the benefit of the company's low income reverse commuting personnel. Only after the major portion of the low income groups needs are met, should efforts be spent on sponsoring vanpools for other employees. Such action would be especially valuable in conjunction with job training programs and might justifiably be made eligible for government subsidies.

An extension of this priority concept would be employer sponsorship of pooling cooperatives or leasing of vehicles to workers. A company might put up the capital for purchase of vehicles and then sell them to the disadvantaged employee on a long-term payment schedule, assisting him with the payments by matching riders and perhaps payment of a driver's wage for transport of other employees.

Another approach would be to provide the low income employee with a vehicle and with a certain flexibility in work schedule, such as late arrival and early departure, to permit him to operate as a taxi-type of service. He would be on call to pick up other employees of the company and charge them, at a company specified rate, for service.

The employer may provide incentives to other workers to include the low income employee in pooling groups. Preferential parking or parking subsidy are perhaps the most promising of such incentives.

Coordination with employment services and social service agencies would help to spread information on the employer's programs. Further, vehicle use efficiency might be increased by making services available to these agencies. Companies with fleet vehicles could loan them to social service organizations in conjunction with volunteer or ration incentive driver programs.

By Social Service Agencies

For the Elderly - Social service agencies and institutions which serve the elderly are primary candidates to serve as program sponsors or play other major roles in pooling activities for the elderly. Specified actions which public and private social agencies can take include:

- Organize and manage pooling programs for the elderly
- Provide centralized referral services
- Coordinate existing pooling activities as an umbrella agency
- Sponsor vans and buses for use by other organizations in pooling
- Join with other agencies and institutions to form a demand base of sufficient size to justify new vehicle purchases for pooling programs
- Disseminate information concerning on-going pooling programs to make elderly persons not only aware of existing services, but also of how to use them. This action is of critical importance since no pooling program will be successful without adequate promotion.

Information dissemination to the elderly population is a difficult process requiring extraordinary measures, such as door-to-door campaigns, to get the message across effectively. The Social Security Administration is especially concerned with these problems and is aware that many elderly persons fail to receive the full benefits to which they are entitled simply because they are not aware of their eligibility or the application process.

Beginning January 1, 1974, some 2.5 million elderly persons will become eligible for benefits under the new Federal Supplemental Security Income (SSI) program. A national effort, Project SSI-Alert, to alert older persons to these new benefits is being undertaken. The Department of Health, Education, and Welfare's Administration on Aging is guiding and funding this effort which will involve governmental and private voluntary organizations at the local community level. The major purpose of Project SSI-Alert is to find those persons who are eligible for new benefits and to help them apply for their income supplement.

The organizations and volunteer groups engaged in Project SSI-Alert could provide valuable assistance in disseminating information to the elderly concerning special transportation projects designed for their benefit.

For the Handicapped - With respect to programs for the handicapped, social service agencies can perform the same actions listed above in relation to the elderly. Additionally, they can assist organizations to obtain special equipment to perform pooling activities; and they can develop techniques to assist employers to form pooling programs for their handicapped employees. To assist handicapped individuals seeking employment, a special volunteer or referral program can be established to provide transportation.

For the Economically Disadvantaged - For non-work trips, a conscious effort to include this group in pooling services may improve vehicle use efficiency. Agencies with vehicles might utilize the economically disadvantaged as drivers, providing incentive to the driver by permitting personal use of the vehicle at other times.

As with other groups to be served, the greatest contribution is in coordination and promulgation of information on pooling activities. Workshops and seminars might be sponsored to educate business and encourage participation in services. Contact with business or government sources of vehicles might provide a basis for matching to employment, child care facilities, and other points of focus for vehicle use.

By Transit Operators and Other Government Agencies

For the Elderly - Transit operators can play a significant role in pooling activities for the elderly by acting as the focus of all information dissemination activity. This is a logical role since they are already providing information concerning public transportation services. With regard to buspools, transit operators can provide favorable charter rates and technical assistance to encourage their development.

A primary contribution of other public agencies may be in the provision of vehicles through direct subsidy of purchase and operating cost, matching or other sharing of funds to cover special costs of providing additional services to the elderly and handicapped, or loaning of available vehicles for special use. The various possibilities might best be utilized in conjunction with public service agencies which would undertake the administrative functions. Another major area of governmental activity might be in the provision of incentives for pooling activities. If there is rationing, fuel allocations should be given to elderly individuals regardless of whether or not they have a driver's license or an automobile. Furthermore, special allotments to institutions and agencies serving the elderly should be considered along with special fuel tax rebates or reductions.

For the Handicapped - In general, the actions which transit operators and government agencies can take with respect to pooling programs for the handicapped parallel those which can be taken for the elderly. In areas of special vehicle needs for the handicapped, transit operators may be able to assist various organizations in the selection of appropriate vehicles and special equipment. In addition, special vehicles for the handicapped could be added to the transit operator's fleet for use on special charter work.

For the Economically Disadvantaged - Funding and subsidization incentives are especially useful for this group. In working with employers, government can subsidize both the purchase and operation of vanpooling vehicles that can be used for pooling by inner city reverse commuters. Priorities and levels of support could be important. Larger financial subsidies should be offered in a vanpooling program to the economically disadvantaged sector. For example, vanpools that are developed to bring new trainees from the inner city out to the suburban employer organization should receive higher levels of support from those which provide vanpooling opportunities for existing low income employees.

Financial incentives could also be offered to the various public and private carpool organizations which are springing up across the nation. These organizations could be encouraged to make special efforts to provide matching opportunities for disadvantaged persons, both with regard to work trips for the employed and job trainee, as well as non-work trips. Incentives might take the form of a special tax consideration or outright grants. Transportation cooperatives might similarly be encouraged. Special fuel rations or price reductions might be granted to the low income individual to increase his value as a member of a carpool, thus providing incentives to make pool operations available to this group.

Finally, government can take an active posture striving to ensure that the unemployed among the economically disadvantaged can be integrated into public and private matching programs. The best means of achieving this objective would be for the government to work closer with state and commercial employment agencies, as well as with welfare departments, to provide them with lists of employers and other agencies undertaking commuter-matching programs.

SUMMARY

The purpose of this report has been to present practical opportunities for utilizing a national commitment to carpooling as a means of at least maintaining and potentially improving mobility for the transportation disadvantaged--the elderly, the handicapped, and the urban poor. If conscious efforts are made to transform the problems of a fuel shortage into such opportunities, then these opportunities may be realized.

In general, the transportation disadvantaged should be given high priority in pooling organization and matching programs. Some ways in which priority can be given include: preferential treatment of these persons in ongoing programs; technical, administrative, and financial assistance in self-help programs; inclusion of special mobility problem subjects in public information programs; provision of special considerations in the event gas rationing is instituted; and more concerted efforts in the consolidation of ongoing special mobility action projects for better management and increased efficiency.



SECTION 10
CARPOOL BACKUP SYSTEMS

CARPOOL BACKUP SYSTEMS

INTRODUCTION

Background

A common difficulty experienced by carpoolers is the problem of finding an alternative means of transport when, for one reason or another, there is an occasional need for travel beyond the scope of the carpool. A daily, work-related carpool may be envisioned as a form of transit service with a fairly tightly defined geographic orientation (areas of origin and destination) and essentially a 24-hour service frequency. When irregular and usually unexpected needs for travel arise which are outside these basic constraints, a "backup" method of travel is required to meet this need. Perhaps one of the most important reasons for the failure of carpools to continue for extended periods of time is the restricted flexibility imposed on carpoolers through the lack of (or lack of information concerning) backup or alternative travel means. Thus, the provision of backup systems where they are required and the provision of adequate information about them on a convenient and timely basis may equal or exceed the importance of the initial formation of carpools in a successful carpool program.

In terms of historical perspective, there appears to be little in the way of organized backup systems for present known carpooling activities. In Nassau County, New York, carpool staging areas have been established adjacent to several freeways in that area, primarily to serve as carpool assembly points but which could incidentally serve as points where backup rides could be solicited. Such staging areas were common in urban areas when gasoline was rationed in World War II and also undoubtedly served as incidental backup points. There have been several recent efforts to set up downtown circulation bus routes which may meet midday backup needs but are primarily formed to provide shopping and lunch travel opportunities to areas of concentrated employment. Examples of such service exist in Washington, D. C., suburban McLean, Virginia, Minneapolis, Minnesota, and a department store-sponsored program in Fort Worth, Texas.

Purpose of Paper

The purpose of this technical memorandum is to identify the kinds of carpooler problems requiring backup systems, and to identify the kinds of solutions which are or could be made available to serve as backup systems based on a generalized context and set of circumstances. As will be seen, each problem requiring backup will have several potential solutions, with the appropriateness of each solution in a specific situation varying according to local conditions, available or easily developable facilities, and other local circumstances.

For purposes of this memo, carpools are limited to those organized for daily travel to and from work. Carpools organized for other purposes, such as shopping, health care, social or other, are assumed to be sufficiently infrequent or erratic to not usually lend themselves to formal backup solutions, and therefore are excluded.

IDENTIFICATION OF PROBLEMS REQUIRING BACKUP

To provide a framework within which alternative backup solutions can be considered, it is useful to enumerate the basic occurrences which can lead to backup requirements. For convenience they are lettered for later referral.

<u>Type</u>	<u>Description</u>
A	Persons missing carpool into work in the morning
B	Persons having unexpected midday travel needs, but who return to original work place before end of work day
C	Persons having unexpected midday travel needs, and who do not return to original work place
D	Persons missing carpool back home in the evening
E ^{1/}	Persons desiring an intermediate stop on the way to or from work for a reason not shared by other carpool members (e.g., dropping off or picking up a student, personal business, shopping, social or recreational, etc.).

^{1/} Studies elsewhere indicate this as one of the frequently mentioned reasons for carpool abandonment.

No data were found concerning the relative frequency of occurrence of these problem types. Such data would be valuable in narrowing the problem types to avoid concentrating on trivialities.

By categorizing carpool members as to their role on a specific day (driver/non-driver), their ability to drive, and their access to an auto, it is possible to assess the impact of each occurrence and begin to define possible backup solutions.

Kinds of Carpool Members on a Specific Travel Day

<u>Type</u>	<u>Description</u>
I	Carpool Driver
II	Passenger, able to drive with access to auto
III	Passenger, able to drive without access to auto
IV	Passenger, unable to drive

Thus a carpool driver who for some reason misses his trip in the morning disrupts all those he fails to pick up, although an obvious solution is for a "reciprocating" driver to take over that role. If the driver misses in the evening, again all other members are affected and their solution is less obvious. A non-driver (Type IV) who misses his carpool is clearly faced with more restricted solution possibilities than the others.

A framework element within which possible solutions may have differing utility is a classification of carpools themselves in accordance with basic locational criteria:

<u>Kinds of Carpools</u>		
<u>Residential Location</u>	<u>Employment Location</u>	<u>Category Name</u>
Central City/Near Suburbs	In or near CBD	Short-Central
Central City/Near Suburbs	Outlying	Reverse-Commute
Distant Suburbs	In or near CBD	Long-Central
Distant Suburbs	Outlying	Tangential

RELATING BACKUP SOLUTIONS TO SPECIFIC PROBLEMS

Table 1 is a matrix relating the previously established occurrence types to carpool member roles on a given travel day. In each matrix

TABLE 1. CARPOOL PROBLEM MATRIX

Occurrence Type	Member Type			
	I (Carpool) Driver	II Passenger, Access to Auto	III Passenger, No Access to Auto	IV Passenger, Unable to Drive
A Miss pool in morning	All others affected both ways Normal solution is for other member to drive	No others affected Person needs backup in-bound service which could be use of own car	No others affected Person needs independent backup in-bound service which could not be use of own car	No others affected Person needs independent backup in-bound service not requiring driving
B Errand with return during day	No problem, driver simply uses own car No impact on others	No others affected Person could borrow driver's car or use other backup service	(same) ←	Could not borrow driver's car or use backup method requiring driving No others affected
C Open-ended unexpected errand	All others denied trip home All need independent backup solution	No others affected Person needs independent backup service	(same) ←	(Same except backup method cannot require driving)
D Miss pool at night	All others denied trip home or at least delayed All need independent backup solution or accept delay	No others affected Person needs independent backup service	(same) ←	(Same except backup method cannot require driving)
E Errand on the way	All others delayed All need independent backup solution or accept delay	All others delayed Person needs independent backup solution or impose delay on others	(same) ←	(Same except backup method cannot require driving)

cell are brief comments concerning the nature of the problem which arises. Some of the observations which can be made in reviewing this matrix are the following:

- Cell B-I of the matrix poses no problem whatever. A car-pool driver needing incidental use of his car during the day is in precisely the same position as if he had driven alone.
- Under most circumstances, the solutions to problems arising in Cells A-I, A-II, B-II and B-III are obvious, involving role shifting among carpool members or use of an available car to meet an unexpected need.
- The problems arising from all cells in Row E are not trivial, since this is an oft-stated reason for the dissolution of carpools. However, such problems basically constitute delays imposed by one carpool member on the others. People's willingness to impose or accept such delays depends on many factors, not the least of which are prevailing pressures for and general attitudes toward carpooling. Also, pool riders who don't drive or who don't have access to a car may have no choice in accepting the delay. These problems fall mainly in the area of interpersonal relationships and compatibility among carpool members. It is difficult to conceive of backup solutions to this problem which will consistently provide relief to it, since it normally involves a third location which is neither the regular origin nor destination of the carpool and which can vary by incident.
- The remaining eleven cells of the matrix all pose problems requiring backup systems which are independent of the carpool itself. These can range from employer-sponsored systems, to use of public carriers, to use of other carpools and other private agreements among individuals. These are set forth in the following section.

POTENTIAL BACKUP SYSTEMS OR METHODS

Legal and institutional issues are important in considering alternative backup systems. This is so because many of the backup solutions of which one can conceive depend on the existence of some system of incentives to motivate potential providers of backup transportation service (e.g., other carpool drivers) to, in fact, provide such service. The most obvious of incentive systems, the payment of a fee of greater than a rider's pro rata share of bare auto operating costs,

can serve to translate the recipient of that fee from a private traveler to a public carrier, and thereby bring him under public utility regulations, cause him to assume liability for the rider's safety and simultaneously render his insurance ineffective for this purpose, and make him legally liable for the payment of income taxes on the profits from such fees. This legal and institutional aspect is the subject of another report in this series and is not reported here.

Therefore, it seems appropriate to organize possible backup system solutions as follows:

- Employer-sponsored solutions -- This group of solutions appears to be one of the most promising based on analyses elsewhere in this project. Since most employers carry employee liability insurance, it appears that additional insurance to cover liabilities resulting from carpooling activities would be far less proportionately than would be the case for private individuals. Also, since employees of a common employer are considered an affinity group, it appears that employee sponsorship of this activity would not bring the employer into a public carrier status. Finally, adequate employer accounting of any fees or other compensation paid to employees under carpooling activities would simplify tax procedures. Thus, many of the legal and institutional difficulties would be eased or eliminated under this category.
- Existing Public Carriers -- Existing public carriers such as taxi companies and public transit companies and agencies are, of course, already under public utility regulation and, therefore, solutions based on regular services provided by such companies present none of the legal and institutional difficulties stated.
- Private Arrangements Among Individuals -- It is in this category that legal and institutional difficulties can arise if the solution is based on the payment of a fee to a private individual over and above the pro rata operating cost of the vehicle. However, some possible solutions in this category do not depend on such fee payments.

A stranded carpooler arranging a backup ride needs to go through basically the same steps that he went through in the original formation of his carpool, i. e., he must either find or arrange for a vehicle with an available seat traveling between a known origin and destination at an acceptable time of the day. A principal difference between arranging the backup and arranging the original carpool is the short time available (urgency) for arranging the ride and the brevity of association

(duration) of the backup ride. One can envision a continuum of these two factors, urgency of arrangement and duration of association, in which at one extreme would be the continuing carpool (less urgency of arrangement, greater duration of association) and at the other extreme would be the single taxi ride (greater urgency of arrangement, brief duration of association). Between these two extremes, but tending toward the taxi end of the continuum, would be the arrangement of the backup ride.

Employer Sponsored Backup Systems

It is envisioned that one of the most effective ways of increasing carpooling is through specific carpool promotion programs of employers or neighboring groups of employers. Such programs might include assistance in manual or automated carpool member matching; provision of reduced parking costs, improved parking locations and other benefits for carpools; various levels of sponsorship of vanpools; and others. An essential element of a well conceived employer-sponsored carpool program would be the provision of a backup system. Components of such a backup system might include:

Central On-Line Information System -- Provision of a central backup information and assistance service within the employer or employer group which could be contacted by telephone to provide assistance in meeting specific backup needs. Such a service could assist in contacting taxi companies, dispense current knowledge of bus routes and schedules, and arrange for other company-sponsored backup service. Depending on the size of the company, this might be the part-time duty of assigned personnel or may require full-time staff.

Vanpools -- Allocation of a small proportion of the company sponsored vanpools, if any, to providing late morning and late evening service for backup purposes. In the absence of vanpools, other company vehicles might be made available for this service or a vehicle specifically purchased for it.

Paid Employee Drivers -- Providing direct remuneration to one or more volunteer employees to serve as backup carpool drivers. Such remuneration could be direct cash payments, subsidy of insurance, maintenance or other auto operating costs, or the provision of a company vehicle which could be used by the backup driver for his own purposes on evenings and weekends. One scheme might be for such

designated drivers to be assigned specific residential sectors, to come to work and return home somewhat later than normal business hours, and to check with a central information service within the company or agency concerning the location and needs of stranded poolers before traveling to and from work.

Company Cars -- Providing access for licensed driver employees to company-owned vehicles for emergency midday use. This might extend to company sponsored vanpools. Once again, the services of a central information service for coordination and control would be required.

Pre-Matching -- In the initial carpool matching process each carpooler could be given a list of potential backup poolers. Then in the time of an unforeseen trip need the carpooler might already have a master list to use in seeking out a trip.

Existing Public Carriers

The use of existing public carriers as backup systems to carpoolers is an obvious solution where applicable. One of the principal difficulties experienced by stranded poolers seeking such service is a lack of information concerning them. Possible solutions to this need include:

Readily Available Information -- Providing transit schedules, taxicab company phone numbers, rates and other information; auto rental outlet locations and rates; and any other data on public carriers as part of the mailout from carpooler matching services sponsored by employers or carpool sponsoring agencies.

Central On-Line Information System -- Providing a central information service from which information on the use of public carriers as backup could be solicited on a case-by-case basis. Such a service could be either sponsored by employers or by the areawide carpool sponsoring agency. It is estimated that a staff of seven would be required for servicing 10,000 carpooler-employees assuming one percent of these would require backup assistance on a given day.^{1/}

^{1/} Based on experience indicating the requirement of seven dispatchers per 100 dispatched taxi rides per day (see Dwight Bauman).

Transit Marketing -- Encouraging public carriers to orient in part their marketing and promotional campaigns to their utility as backup services to carpoolers.

Public carrier services which are candidates for backup services include:

Regular Scheduled Transit Service -- Although perhaps not sufficiently convenient or attractive for regular commuter use, regular bus or rail service might provide an acceptable backup service to normal carpoolers. This would probably be most suitable for short-central commuters with decreasing applicability to long-central, reverse commute, and finally tangential carpoolers.

Special "Downtown"-Type Bus Service -- There have been several successful efforts to establish low fare special bus loops connecting downtowns with nearby employment concentrations, mainly to provide shopping and lunch opportunities. These also can serve certain carpool backup needs.

Regular Taxi Service -- Individual or shared ride.

Contract Taxi Service -- Might be arranged in various ways with cab company depending on frequency of need, number of employees, etc.

Rented Cars -- The limited distribution of car rental outlets and the comparatively high cost of rented cars would probably restrict their use as a backup system to only the most urgent cases.

Jitneys -- Line taxis or jitneys have largely been legislated out of existence in the United States to prevent their competing with regular scheduled transit service to the detriment of the latter. The use of jitneys in specific circumstances is being reconsidered by many, and if they come back into existence they could clearly perform backup service to certain carpooler needs.

Subscription Buses -- Subscription buses for work commuting (e.g., Reston, Va.) are essentially large carpools. It would appear likely that a carpool candidate from an area of sufficient demand to warrant such service would be a regular user of it. However, this might provide a backup possibility under certain circumstances. This would require the ability to pay one-way or daily "fares" in lieu of a regular subscription fee and it would seem appropriate that such a "fare" be substantially in excess of the prorated subscription fee.

Dial-a-Ride -- There has been much interest on and study and experimentation with demand-actuated or "dial-a-ride" transit systems in recent years. Experience to date has indicated that these systems appear best suited for serving travel needs in fairly limited communities or as a feeder service to a regional public transportation system. Clearly such a system could serve as a backup to carpoolers where it exists, although it would not appear to be economically viable to develop such a system for that purpose only.

Private Arrangement with Non-Public Carriers

Into this category fall all potential backup solutions which do not involve public carriers and which are not based on employer or other affinity-group sponsorship. As stated earlier, a problem arises when solutions in this category depend on the payment of a fee, since such payment can cause the recipient to become a legally-defined public carrier, with attendant regulatory, liability and tax problems. However, some solutions may be based on a "reciprocity" motivation, i. e., a private driver may be willing to give a stranded pooler a ride if he can look forward to the possibility of receiving similar backup service when required. Furthermore, it may be possible to eliminate the public carrier problem through local legislation, i. e., provide legally for unregulated incidental or infrequent "for hire" transportation services. Also falling under this category is the possible assistance of individual drivers who require their car every day. While not candidates for carpools, such persons might provide a backup service to stranded poolers on either a voluntary or incentive basis. Such persons might be requested to submit their names and normal travel habits as part of a carpool matching program, even though not carpool candidates, if they would like to provide this service.

The principal solution for stranded carpoolers falling into this category is the use of other carpools. A major problem in implementing this solution is identifying other carpools from which to solicit a ride. Possible solutions to this include:

- (a) Providing carpool members with lists of other carpool members having generally similar origins and destinations. A source for such lists might be data from carpool matching efforts sponsored by individual employers, groups of employers or metropolitan agencies. Minimum information on such a list would be person name, place of work and place residence phone numbers, and normal working hours.

- (b) A refinement to (a) above would be to provide lists of formed carpools. This implies some central record keeping of carpools and, further, requires providing an incentive for carpoolers to "register" their carpool. One incentive might be to make the registration of carpools a prerequisite for obtaining such a list. Another would be the payment of a flat fee (say \$5.00) for incidental users of carpools, payable to the carpool driver for use in defraying fuel or parking costs. Under both (a) and (b), relatively frequent updates of lists would have to be provided, perhaps monthly or quarterly, since such lists would likely be quite perishable.

Comment: Problems with (a) and (b) would include the security risks associated with disseminating names and regular travel habits of carpool members. This would be somewhat ameliorated (but not eliminated) by restricting information to phone contacts only. Another problem is the possibility of fully loaded carpools, requiring perhaps several calls by a stranded pooler before finding an available pool with space. The lists would have to be "tailored" to include only poolers or pools having similar origins and destinations.

- (c) Providing carpool "staging" areas at both residential and employment "focal" points. Residential focal points might be shopping centers, churches, schools, parks, etc., while employment area focal points might be central plazas, parks, railroad stations, or simply established block faces. General destination areas from each focal point might be segregated and signed (e.g., West Side, Downtown, XYZ Industrial Park, etc.) so that waiting poolers can seek out likely rides. It appears that the principal incentive for use of such staging areas would have to be the payment of a fee, varying somewhat, perhaps, for each basic O-D pair but firmly established for each such pair. This fee would be payable to the driver and would be of sufficient size to encourage a number of drivers to "cruise" such areas looking for riders.

Comment: A basic disadvantage to this solution is the need for fee payments to private drivers for the reasons stated previously. Another problem concerns security related to having carpools formed among strangers. Essentially, such staging areas are legalized hitchhiking points. For these reasons it appears that this potential solution can be rejected from further consideration.

CONCLUSIONS

This brief explanation has attempted to identify the types of problems carpoolers encounter that require backup transportation, and some potential concepts for overcoming the problems. A vastly more thorough study is required to screen and select a reasonable number of backup concepts and to then develop and evaluate in detail their merits. Additional work is needed to relate specific solutions to specific problem types.

