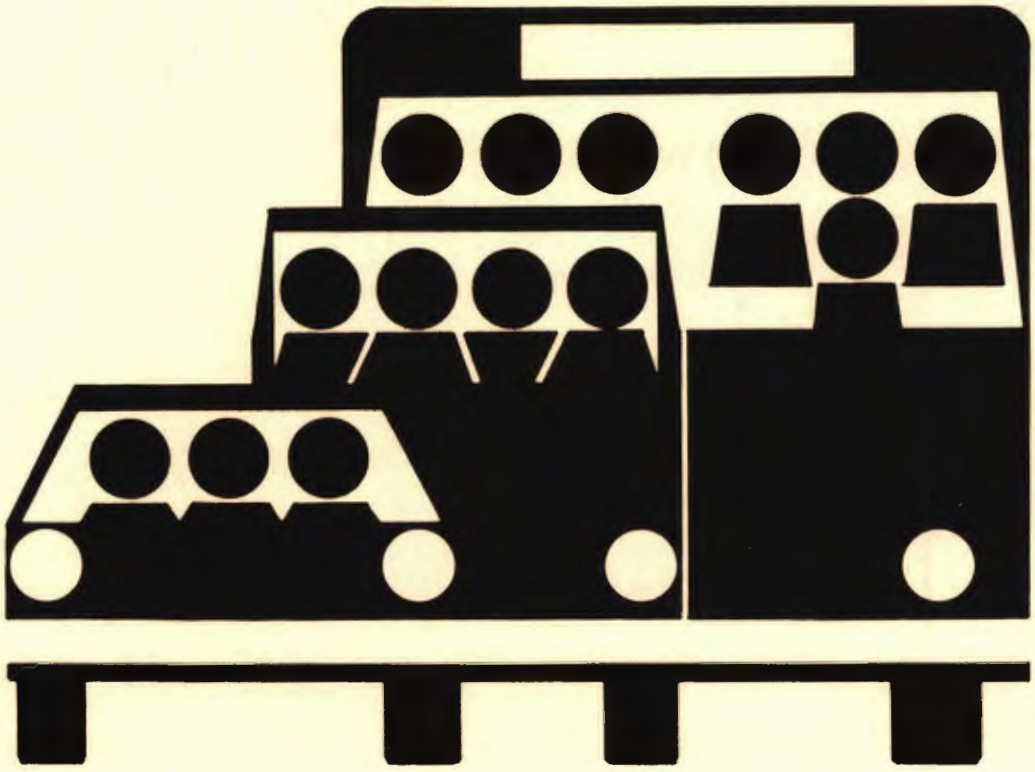
Manual Carpool Matching Methods



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PREFACE

This report is one of a series dealing with various necessary ingredients for a successful Carpool/Buspool Program. It was developed by Alan M. Voorhees and Associates, Inc. for the United States Department of Transportation.

The goal of a Carpool/Buspool Program should be 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.

The other reports prepared as part of this series, as well as other important documents concerning carpooling and buspooling can be obtained from the U.S. Department of Transportation.

TABLE OF CONTENTS

LIST OF FIGURES

MANUAL CARPOOL MATCHING METHODS

INTRODUCTION

Carpool and buspool matching has been done in a variety of ways. Some situations require the use of computer methods, but many others can employ simple manual methods to great advantage. This report discusses manual matching methods and instructs interested users in how to initiate, organize and manage a manual matching activity. The report is aimed primarily at small and medium size employers with 100 to 1,000 personnel. Some employers in the upper end of this size range, and even larger ones, may wish to use manual matching as an interim step to the use of computerized matching methods. Groups desiring to begin the carpool matching process with least possible delay can start by using manual matching methods and then shift to automated methods as the size or complexity of the job warrants.

The report first describes three basic types of matching methods: Centralized Matching Techniques, Locator Board Methods, and Roster Techniques. General system elements -- maps, grid configuration, and questionnaires -- common to all the techniques are then detailed. Applications of manual matching methods in home-based and employment based systems are outlined. The Appendix presents examples of existing applications of the manual matching methods.

While the report is designed more for work-based user groups than for home-based groups, most aspects of the manual matching processes described are just as applicable to neighborhood groups. The greatest difficulty in home-based matching is the establishment of the organization which can serve as a long-lasting focal point for carpool and buspool matching.

Success of carpool and buspool matching is based on the hypothesis that a significant deterrent to the use of these high occupancy modes is a lack of knowledge that other persons travel to the same places at the same time as oneself. Giving people better information about those who have similar travel desires in time and space closes the knowledge gap and leads to increased pooling, especially when other substantive incentives to pooling are present.

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, whicn 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 acquaintence. 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 ☐ NASSIF BLDG. ☐ FOB 10A ☐ OUTDOOR			
COMMERCIAL PARKING LOT *(Location)*	STREET PARKING *(General Location)*		
NOTES *(i.e., Driver/rider wanted; irregular schedule, etc.)*			
When vacancy is filled, remove this card from board.			

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)*			
When arrangements have been completed, remove this card from board.			

Form DOT F 1700.13 (11-71) CAR POOL APPLICATION

(COLOR - RED)

FIGURE 1. LOCATOR BOARD QUESTIONNAIRES

FIGURE 2. NASA LOCATOR BOARD

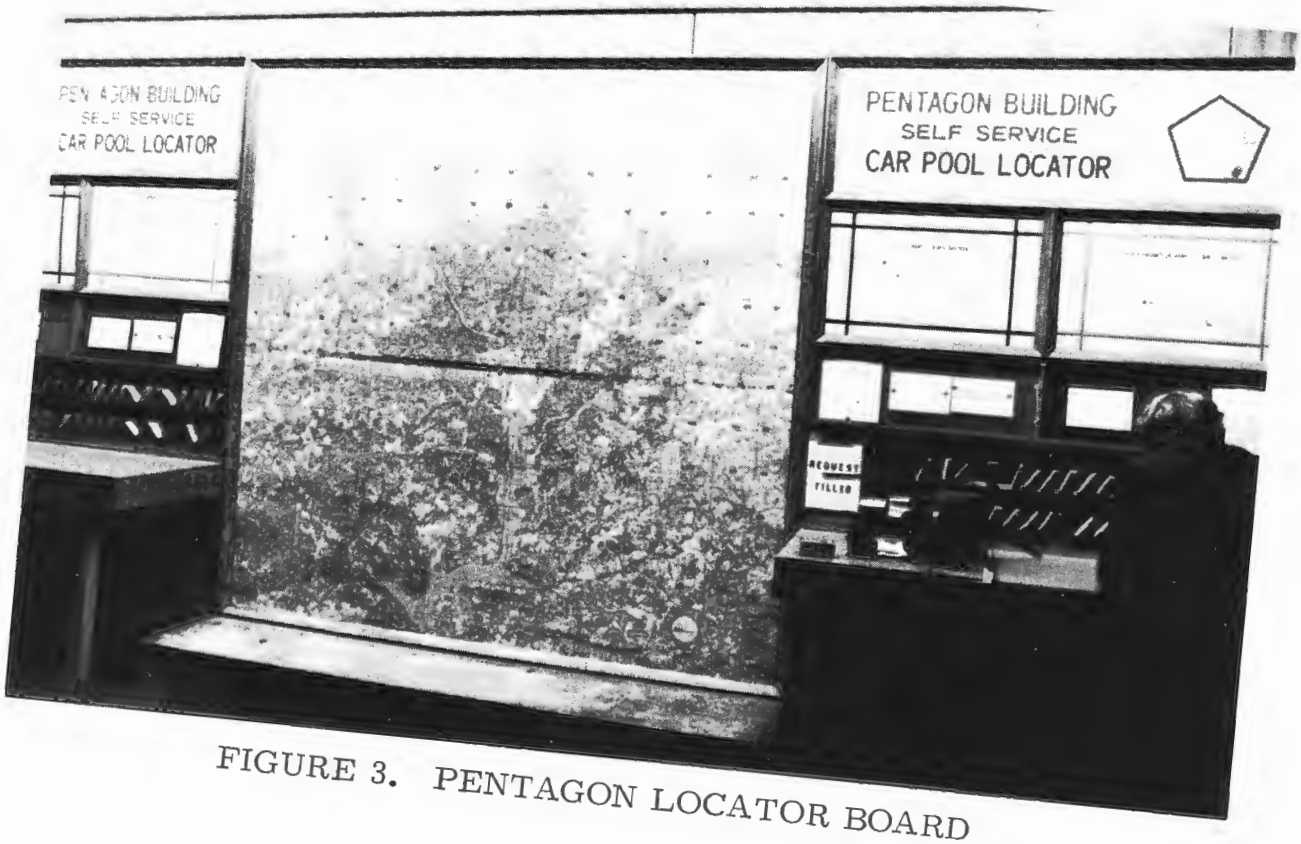

FIGURE 3. PENTAGON LOCATOR BOARD

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 carpools.

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.

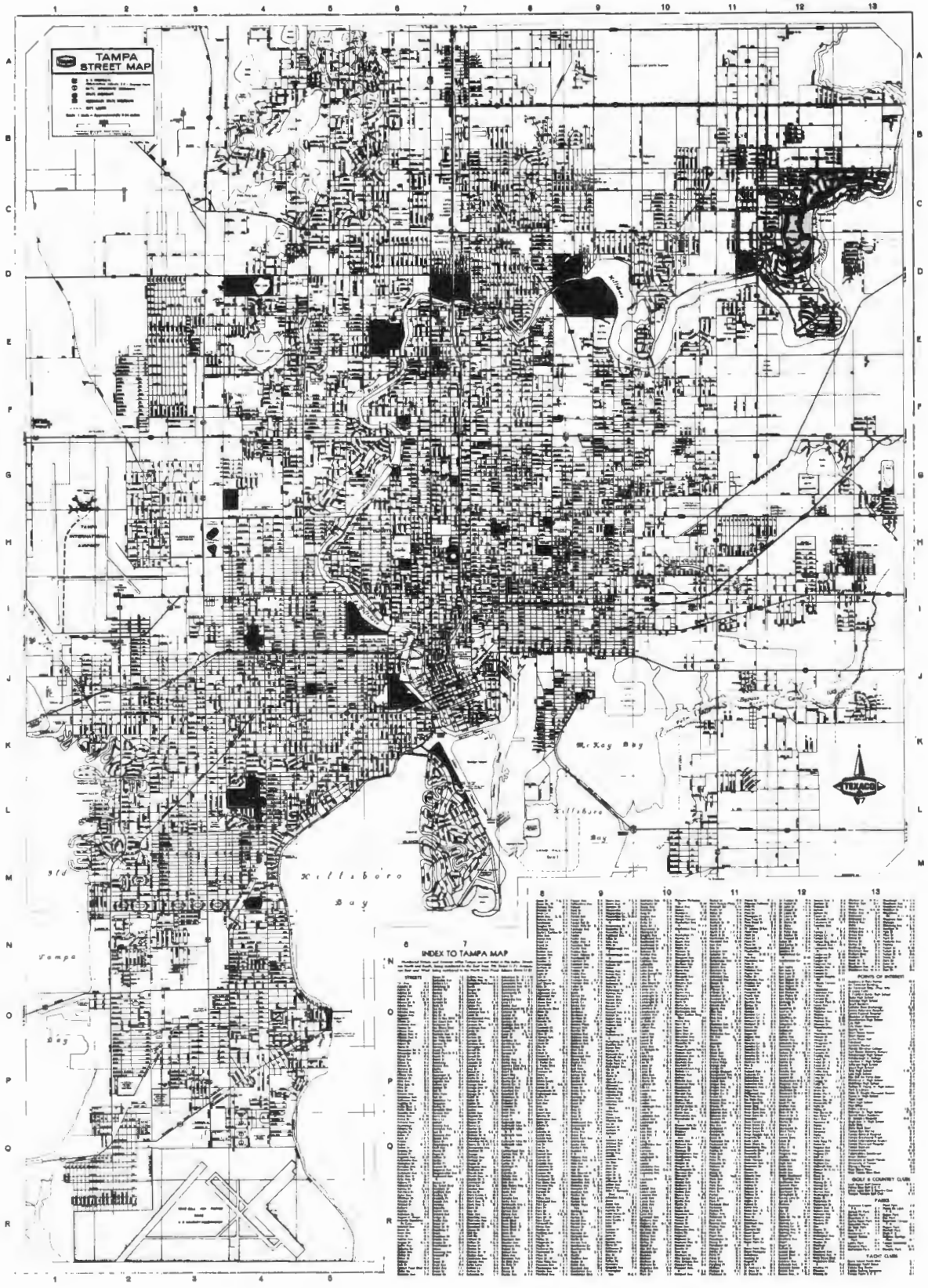

FIGURE 4. TYPICAL OIL COMPANY MAP

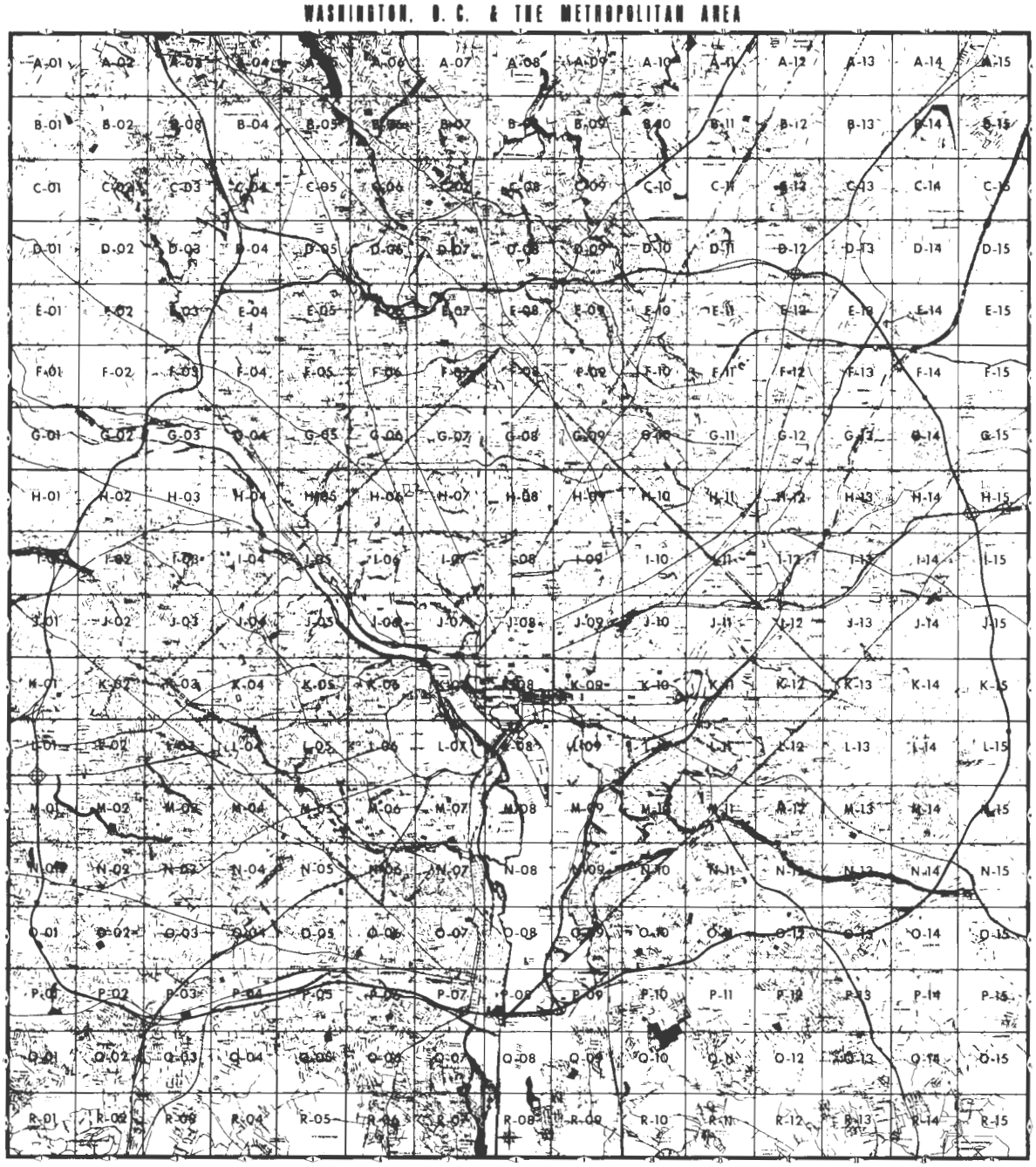

FIGURE 5. MAP SHOWING GRID CELL DESIGNATIONS

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)

CAR/BUS POOL SURVEY QUESTIONNAIRE

MAP TACK NO.

8. WORK HOME
GRID CELL NUMBERS

INITIALS

1. FIRST MIDDLE LAST NAME

2. WORK TELEPHONE

3. HOME ADDRESS: STREET NUMBER AND NAME

APT. NO.

TOWN OR CITY

ZIP CODE

4. EMPLOYER'S BLDG. NAME

WORK ADDRESS: STREET NO. AND NAME

TOWN OR CITY STATE ZIP CODE

5. WORKING HOURS BEGIN M END M

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

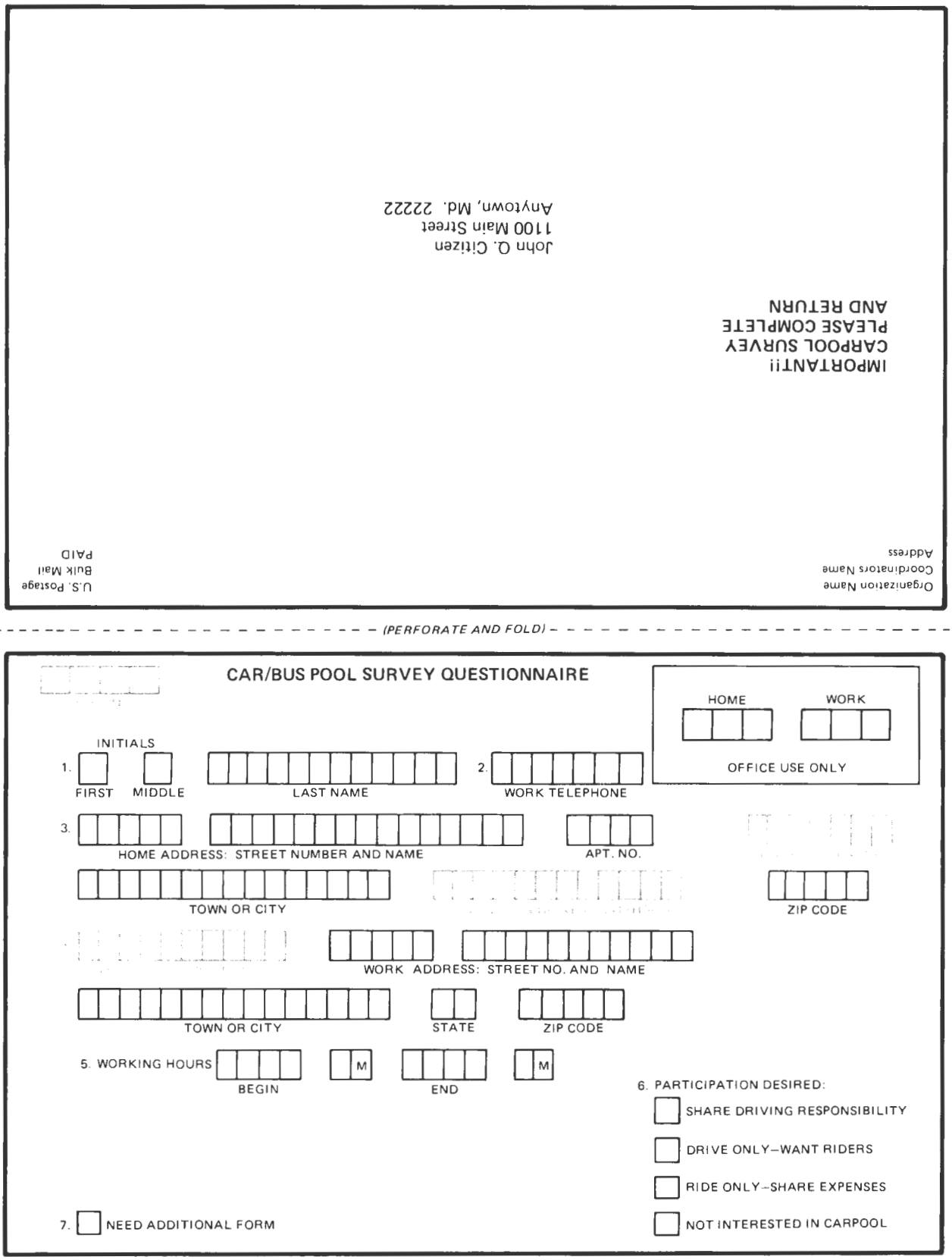

FIGURE 7A. TYPICAL HOME-BASED QUESTIONNAIRE

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

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 Personnal (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.

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 chosen for smaller group sizes, for example ones with fewer than 1,000 or so potential carpoolers.

Three basic types of manual matching methods are described in this report: Centralized Matching Technique, Locator Board Method, and Roster Technique. The Roster Technique is simplest and least expensive to implement and is applicable to the smaller group sizes

of 100 or so persons. The Locator Board Method, basically a self-service type of system is widely used in government offices in Washington, D.C. It works best for larger groups and should be selected of the sponsor wishes to minimize administrative effort. Locator Boards can be used effectively in an office building housing many small to medium sized employers. The Centralized Matching Technique should be used if the plan is to switch later from manual to computerized matching. It requires more administrative effort but, if agressively managed, can result in the highest degree of carpool formation. The Centralized Technique can be coupled with carpool incentives record keeping.

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 carpoolers 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 carpoolers 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

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 $8\frac{1}{2}$" 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

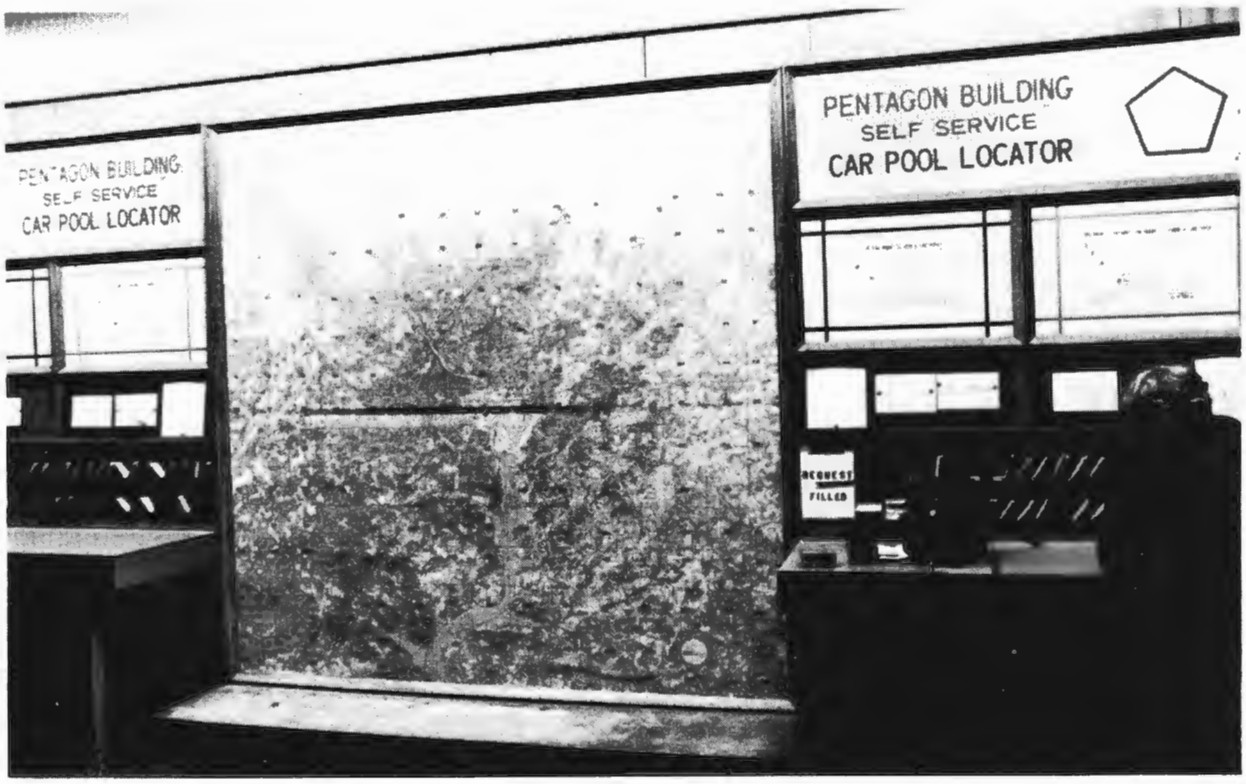

FIGURE 8. PENTAGON LOCATOR BOARD

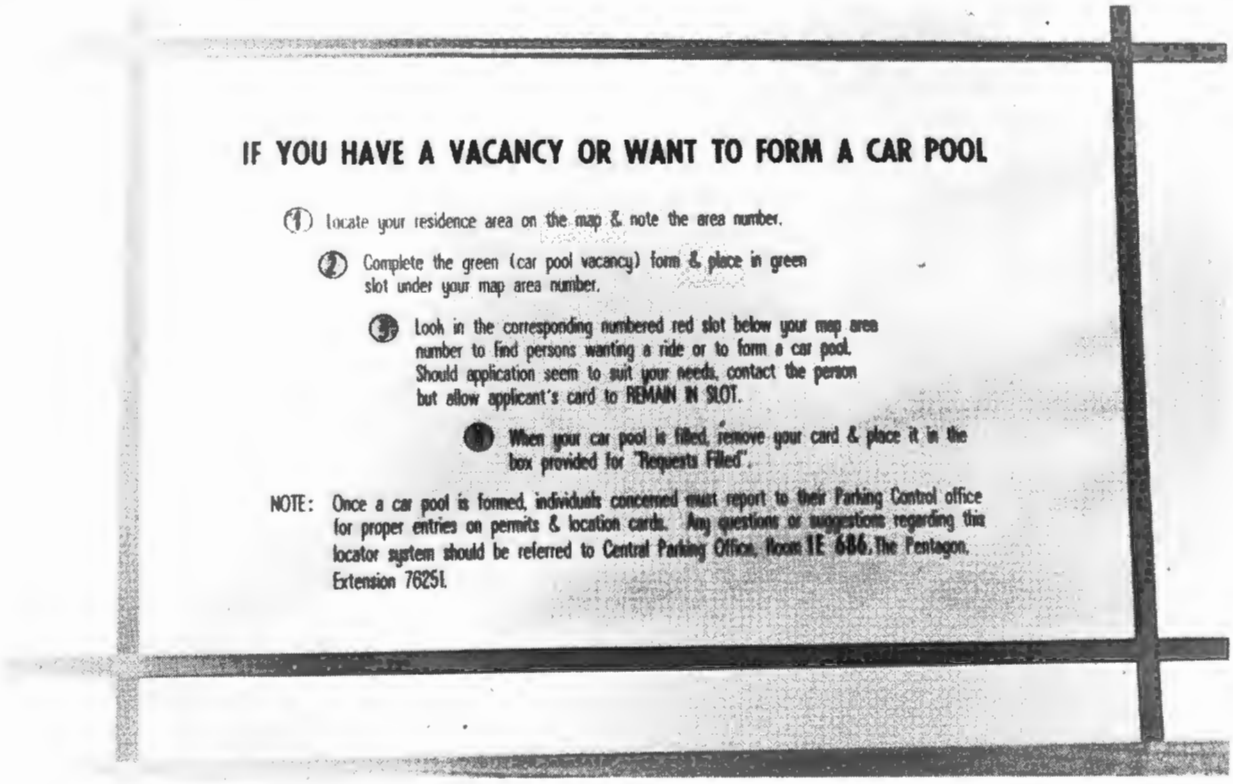

FIGURE 9. CLOSE-UP INSTRUCTIONS

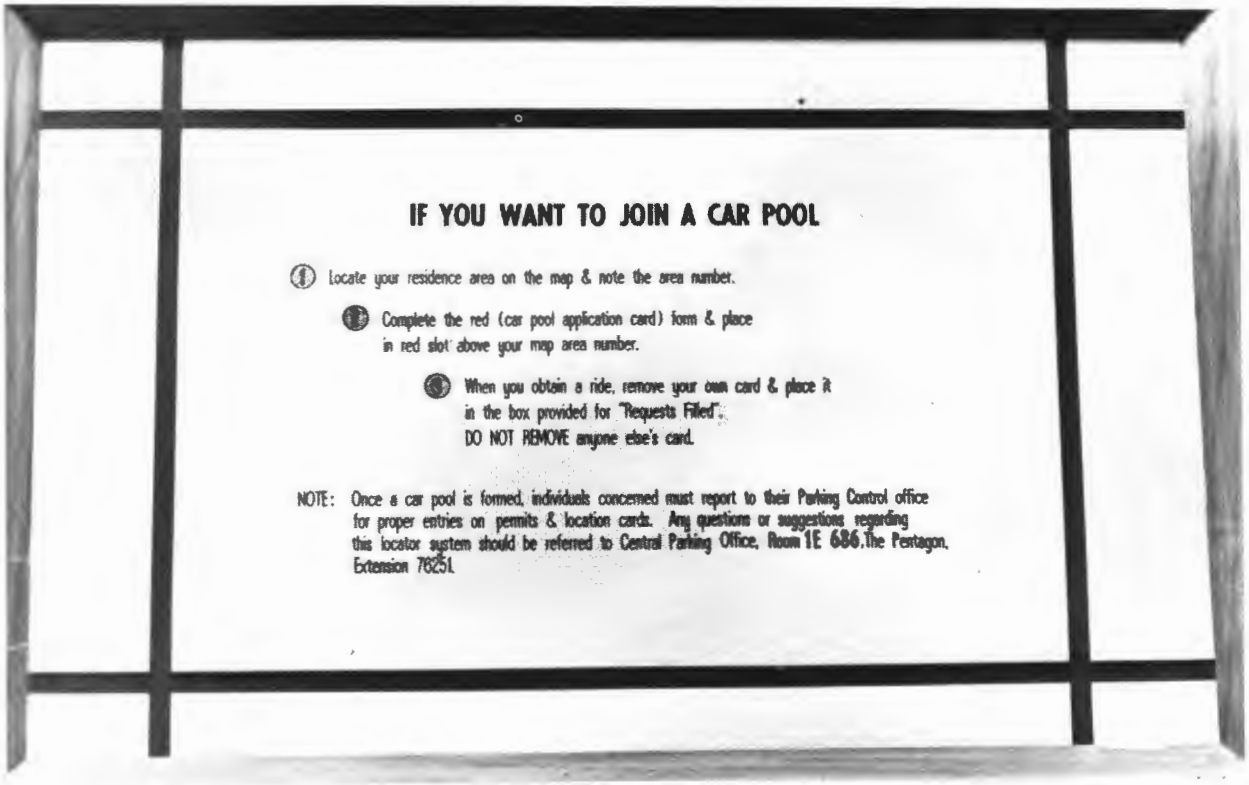

FIGURE 10. CLOSE-UP INSTRUCTIONS

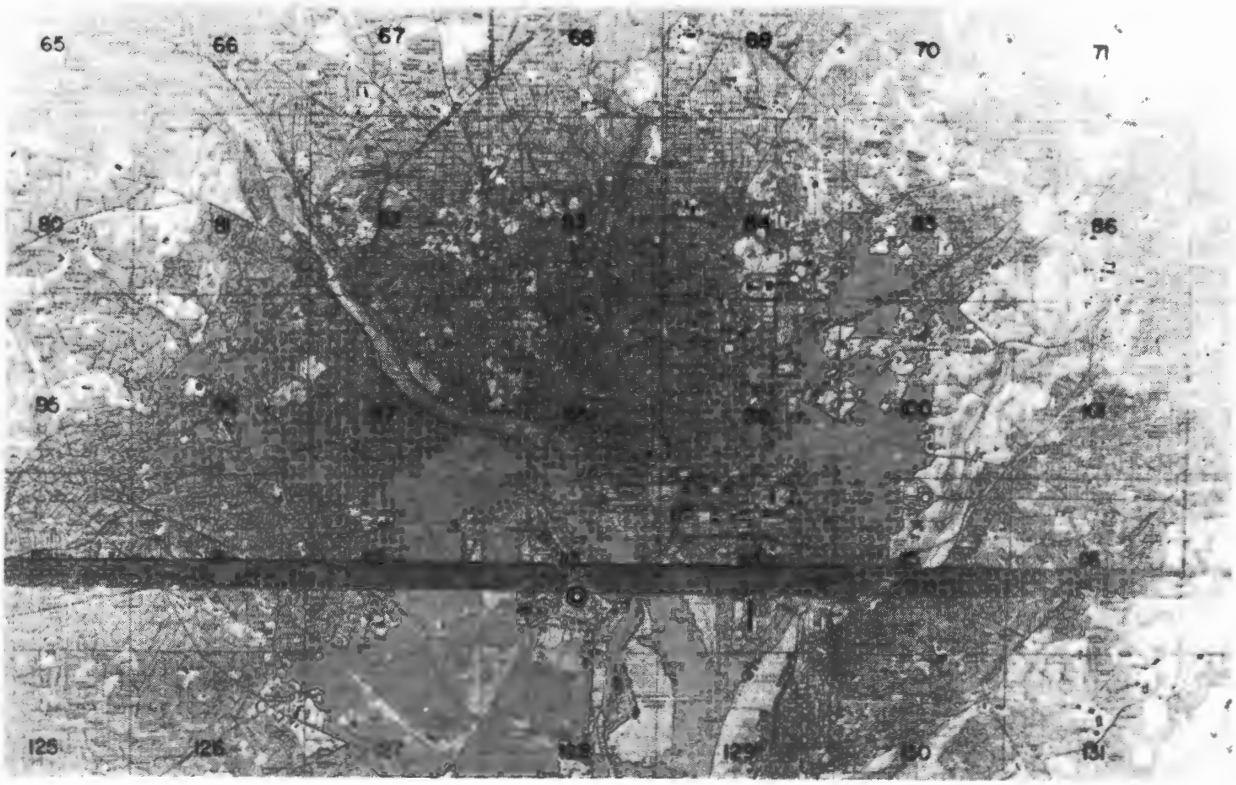

FIGURE 11. PENTAGON MAP

FIGURE 12. PENTAGON MAP-CLOSE-UP

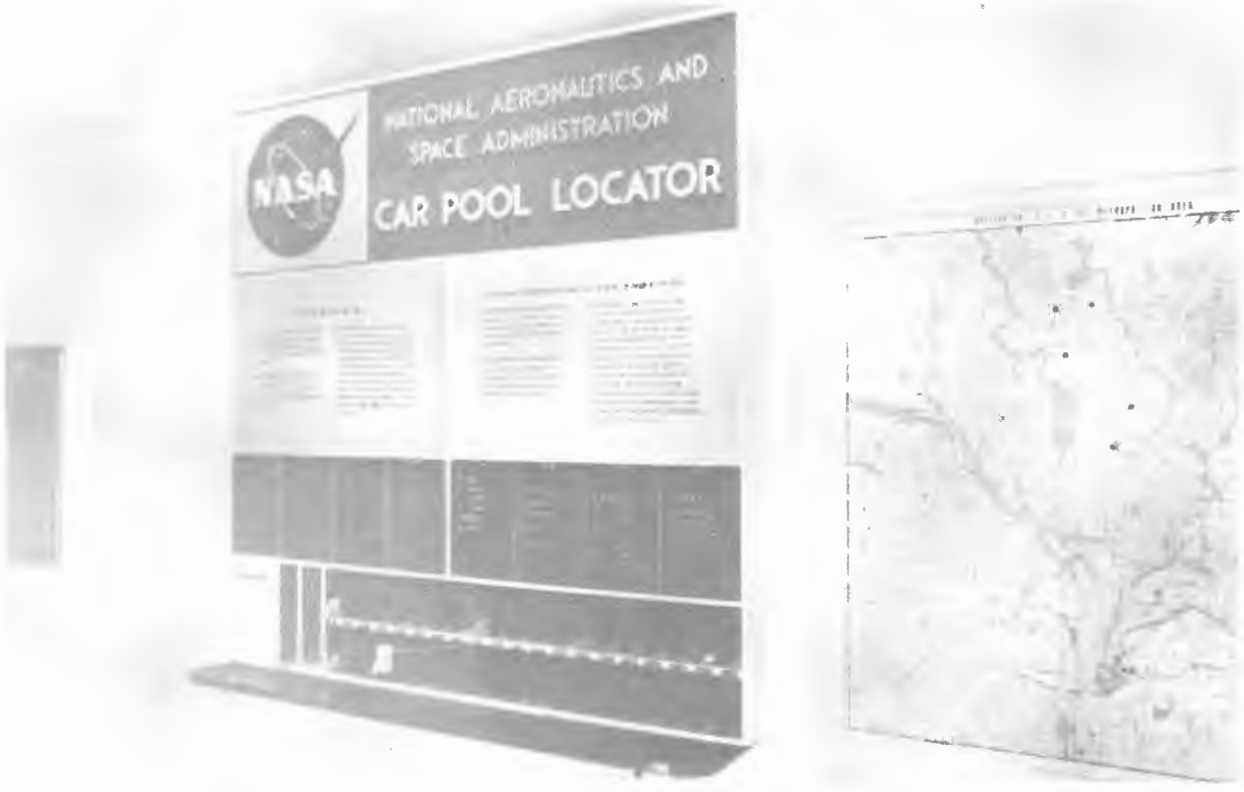

FIGURE 13. NASA LOCATOR BOARD AND MAP

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 super-imposed 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 overlayed 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 illuminted 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 designated 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.

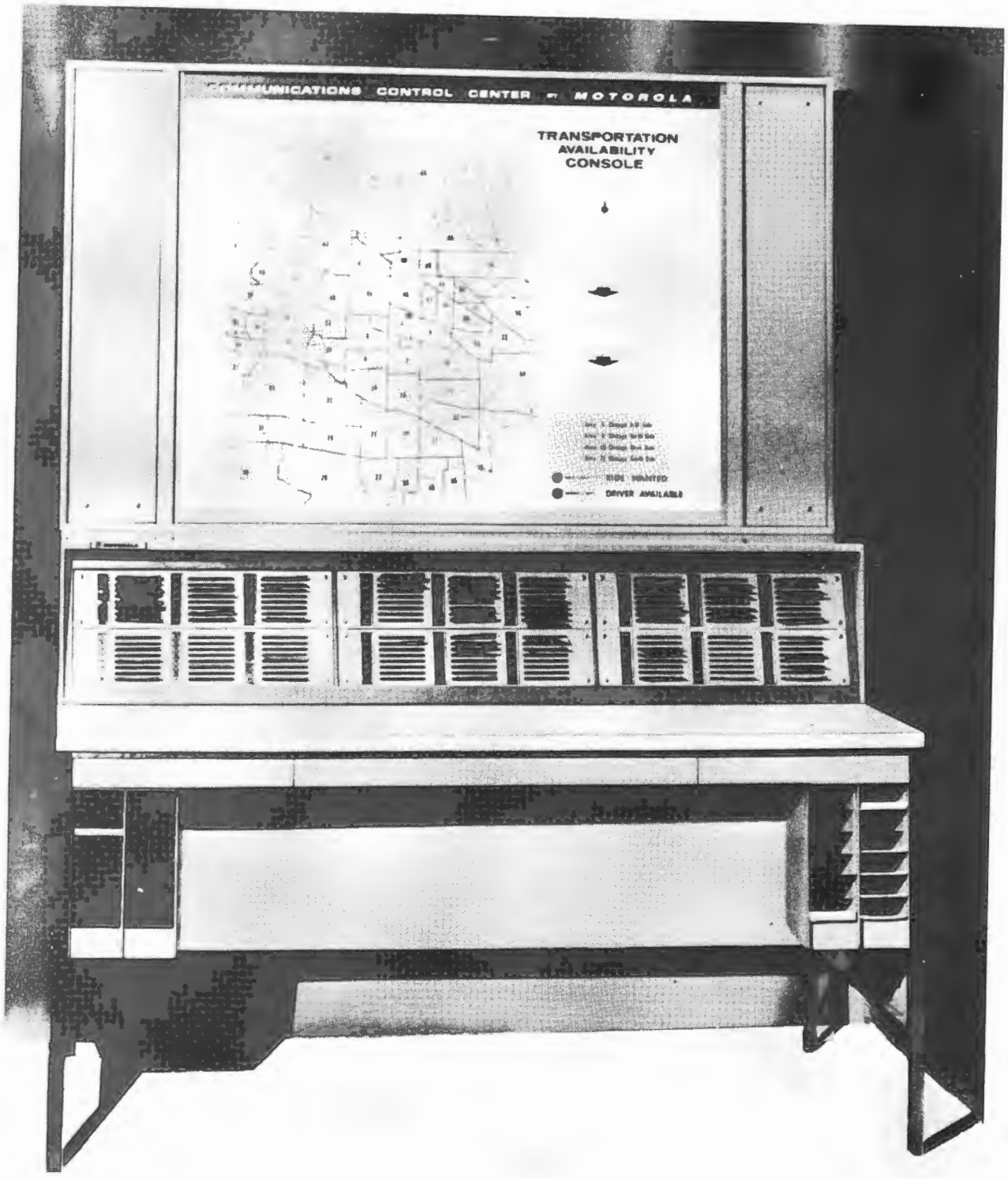

FIGURE 14. MOTOROLA LOCATOR BOARD

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