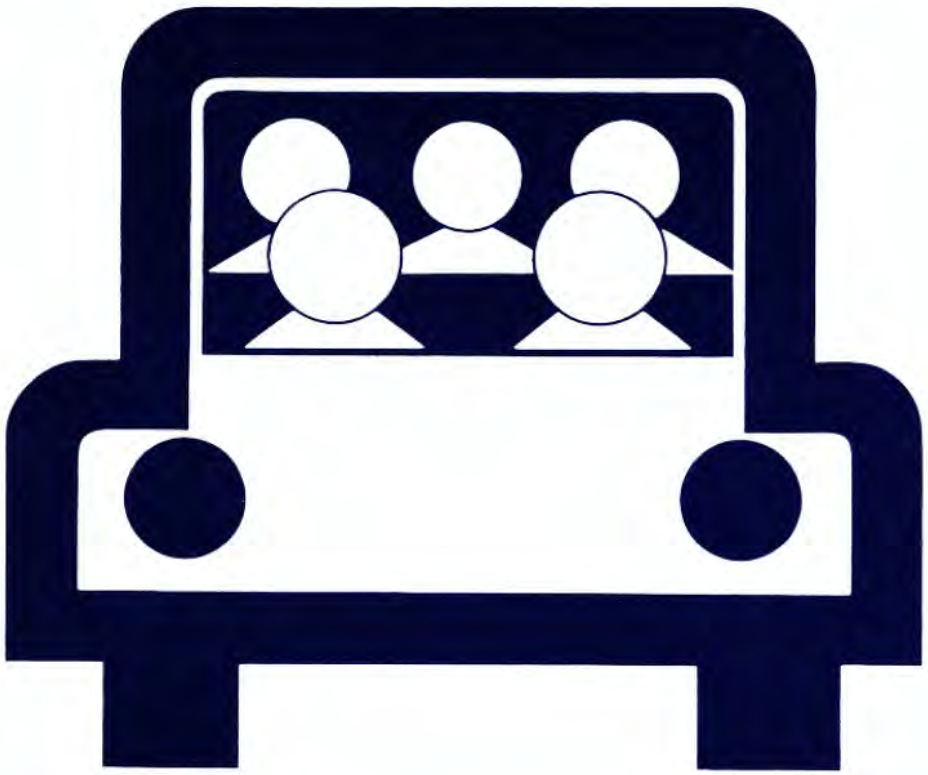
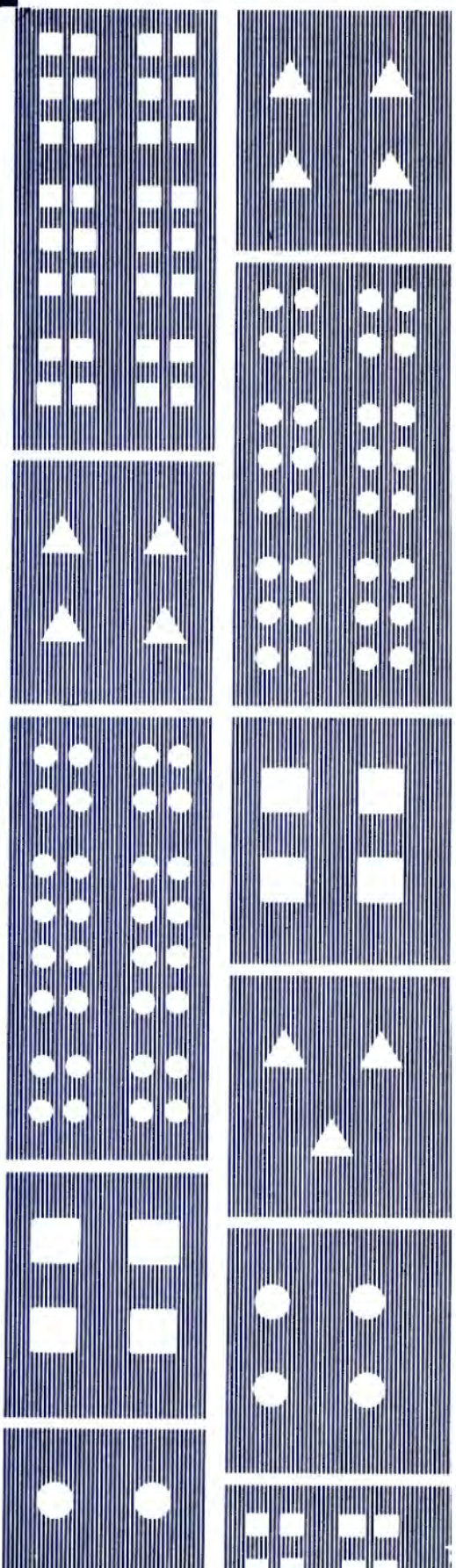
CARPOOL & BUSPOOL

MATCHING GUIDE

FOURTH EDITION





U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION/JANUARY 1975

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
Washington, D.C. 20590

CARPOOL AND BUSPOOL MATCHING GUIDE
(Fourth Edition)

By

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TRANSIT AND TRAFFIC ENGINEERING BRANCH
URBAN PLANNING DIVISION

January 1975

ACKNOWLEDGEMENTS

Contributions by Mr. Donald A. Morin, Mr. Robert Redmond, and Mr. Edward Fleischman of the Transit and Traffic Engineering Branch and by the Computer Services Division of the Federal Highway Administration are gratefully acknowledged.

Special recognition is due: Mr. Jack Novack of Operation Oxygen, Pasadena, California; Mr. Thomas Jourdan, President, Specialty Transit Company, Inc., Wentzville, Missouri; Mr. Charles Gudaidis, Connecticut Department of Transportation; Mr. Ron Hoffman, President, Com-Bus, Long Beach, California; Mr. Bob Owens, 3M Company, St. Paul, Minnesota; Mr. DeWayne Cuthbertson, Government Employees Insurance Company, Chevy Chase, Maryland; Mr. Joseph Kozlowski, Hallmark Cards, Kansas City, Missouri; Dr. Frank Davis, Jr., University of Tennessee, Knoxville, Tennessee; Mr. Leon R. Bush, The Aerospace Corporation, Los Angeles, California; Mr. Mike Tucker, Northern Natural Gas, Omaha, Nebraska; Mr. Ken Moody, Texas Instruments, Dallas, Texas; Mr. Don Smith, Jantzen, Inc., Portland, Oregon; Mr. Dennis Chessir, General Dynamics, Fort Worth, Texas; Mr. John Gluch, Pentagon, Washington, D.C.; Ms. Sybyl Brown, Newlett Packard, Colorado Springs, Colorado; Mr. Richard Gepela, NASA, Washington, D.C.; Mr. Elmer Biggs, Federal Highway Administration, Baltimore, Maryland; Ms. Kay Deshler, General Mills, Inc., Minneapolis, Minnesota; Mr. Ervin Poka, Reston Commuter Bus, Reston, Virginia; and Mr. Roy Coughlin, Southern New England Telephone, New Haven, Connecticut, for their excellent cooperation.

CARPOOL AND BUSPOOL MATCHING GUIDE

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I. INTRODUCTION

Currently, most of the congestion experienced on the urban highway network occurs during "rush hours." These travel peaks, which rarely total 20 hours per week, are largely attributed to the concentration of the individually driven commuting vehicle--the automobile. As a result, greater public attention is being focused on the environmental disadvantages of the automobile en masse and the question of the highway's ability to serve future urban needs.

Although the highway's vehicular capacity is often near saturation at rush hours, the highway's person carrying capacity via carpools and buses has barely been tapped. For example, increasing auto occupancy from 1.2 persons/car (common for Los Angeles during rush hours) to 1.5 persons/car (common for Washington, D.C., during rush hours) would be a 20 percent reduction in the number of commuting vehicles on the highway. In addition, buses are capable of moving 50,000-60,000 seated passengers per hour on an exclusive bus lane, far in excess of typical United States corridor demands. Combined efforts to increase the use of carpools and buses can result in minimizing congestion today, while accommodating significant growth tomorrow.

To achieve better utilization of our highways, alternatives comparable to the individually driven automobile in terms of convenience, cost, and door-to-door traveltime must be offered. A cross-section of comprehensive carpool matching activities sponsored in 1973-74 (most initiated during the energy crisis) show spectacular results. Auto usage decreased 23.5 percent among the 197,000 auto commuters where followup data are available. As a result, there are 33,200 fewer cars on the road. Twenty-nine thousand, four hundred more commuters are now carpooling, 800 are in vanpools and 3,000 are riding express buses. During the summer of 1974, carpool sponsors report that the gains accomplished during the energy crisis have not lessened. In many instances, programs have yet to peak. Ride sharers like their new commuting habits and are continually selling the idea to their co-workers. This report briefly describes these programs and summarizes the successful ingredients.

A comprehensive carpool, vanpool, or buspool program (various forms of ride sharing or pooling programs) requires an information service which matches commuters' travel needs. Generally, if the thought of carpooling occurs to a commuter, it is difficult to establish an acceptable carpool among associates due to their widespread random residences. Thus, by enlarging the universe of potential matches to include virtually all employees at a specific location, the carpool information service can bring together commuters sharing similar travel needs. In

fact, a classic comment of an employee receiving a computer list of others in his neighborhood was, "I had no idea someone lives in my apartment complex and works my hours here."

In addition to a carpool locator service, three other facets of a comprehensive carpool service have emerged: public information, to inform the commuter of the benefits of carpools and buspools: incentives, to establish parking priorities for carpools and where feasible, priority lanes; and continuing programs, to provide carpool locator assistance for new and moving employees.

The individually driven automobile with its affordable, convenient, fast, door-to-door service has become our number one commuting vehicle. However, millions of commuters have accepted ride sharing with these amenities while contributing significantly to the reduction of highway transportation costs, congestion, pollution, and energy consumption.

II. SUCCESSFUL PROGRAMS

Various successful approaches have been used to encourage automobile commuters to share a ride. They all feature convenient, door-to-door service in which the total traveltime is comparable to that of the privately driven automobile. These include carpools, vanpools, and truly express buspool service. The following represents a cross section of programs ranging from public and private carpool programs to commuter bus operations showing dramatic increases in bus patronages. Many were sponsored by employers, some by third parties, and an increasingly greater percentage by urbanwide ride sharing campaigns.

A. Carpool Programs

Carpools are one of the most effective ways to increase the productivity of existing transportation facilities immediately and economically. In contrast, other approaches require years of time and billions of additional dollars.

Contrary to public opinion, carpooling has been "big business" for a long time. Even before the energy crisis in the winter of 1973-74, more commuters traveled in carpools than all other forms of mass transit combined.

Hallmark Cards

In Kansas City, Missouri, Hallmark Cards with 4,000 employees embarked on a carpool matching program in early 1973. Initially, a survey of existing auto occupancies found 132 cars carrying 460 Hallmarkers in carpools with at least three members. With apparent room for improvement, a low-key program of carpool matching and parking priorities was established. Without the aid of a carpool computer program, Hallmark collected data from 2,500 employees, hand matched the employees, and distributed a personalized list to each participant. While this approach was adequate, a more efficient computerized matching system was developed. Upon joining Hallmark, each new employee is offered the option of entering the computerized carpool matching system and upon leaving the information is deleted.

Priority parking spaces are reserved for carpools of three or more at the most desirable locations. Management, not in three-man carpools now park immediately behind the carpoolers in the next best spaces. These efforts have proved fruitful as the three-man carpools doubled to 258 carrying 907 employees. The above figure, based on an estimate of two-man carpools, indicates there are over one-third of all Hallmark employees currently pooling to work in private autos.

Jantzen, Inc.

In April 1973, Jantzen, Inc., in the apparel industry, decided to make an effort toward reducing pollution. Realizing there was little or no direct industrial pollution from its facilities, the thrust was established to aid employees in forming carpools at all Jantzen facilities. At each site, the Jantzen supervisors distributed and collected carpool data forms resulting in an 80 percent response. With 3,360 employees at seven sites in four States, carpools increased by an estimated 30 percent to a current total of 45 percent. The employment at these sites varies. For example, 48 percent of the 207 employees in Los Angeles, and 35 percent of the 1,568 employees in Portland, Oregon, are carpooling. In July 1974, 90 percent of all new carpools were still operating.

The company believes that the individual's self-motivation is the key to success. Their objective is to make it convenient for employees who are interested in carpooling to get together. Excellent matching services were provided along with posters for bulletin boards, a few buttons, and a pamphlet titled "What's All This Talk About Carpooling." Jantzen used a map board with pins representing residential location of employees instead of computer listings as many locations had only a few hundred employees. Because of plentiful parking, incentives such as preferential locations were not established.

General Dynamics

About 10 miles west of Fort Worth, Texas, the auto occupancy of 6,600 General Dynamics employees increased from 1.2 to 1.87 by June 1974. The continuous growth in auto occupancy beginning in December 1973 has yet to peak and may exceed an average of two persons after summer vacations are completed.

General Dynamics developed a grid-based carpool computer program modeled after the Federal Highway Administration (FHWA) program. One square-mile grids were superimposed on maps and distributed to employees along with a questionnaire and memorandum explaining the program. The matching process was believed to be extremely important to the success of the program. General Dynamics obtained a 96 percent return rate on the questionnaires. To aid in forming carpools, four starting shifts were consolidated into two shifts, one at 7 a.m. and one at 8 a.m. Since parking is convenient and plentiful, parking priorities were not established.

NASA

In Washington, D.C., the National Aeronautics and Space Administration (NASA), responding to Government energy conservation guidelines, now allocates 90 percent of their parking permits to carpools ranking highest on their point system. To assist new or moving employees, NASA maintains a pigeonhole grid map for matching potential carpools along with a listing of active carpools. New employees are briefed on NASA's carpool program. This continuing well-managed program, initiated in 1964, now commands an average of 3.85 persons per car for over 1,000 of the 1,600 employees.

McDonnell Douglas Corporation

In St. Louis, Missouri, the McDonnell Douglas Corporation promoted carpooling among their 47,000 employees when parking availability became critical. A carpool grid map was established and special well-located parking areas for cars containing three or more persons were set aside in existing lots. These priority parking areas were a big incentive since in their large congested parking lots a short walk to a car can permit a commuter to "beat the evening rush." The result was an average of 2.8 persons per car, double the typical rate.

Hewlett Packard

With 2,000 employees on flexible work hours, Hewlett Packard in Colorado Springs, Colorado, launched an innovative comprehensive pooling program. As a result, 40 percent of all employees including strong representation from both management and production are carpooling. With enthusiastic top management support, the employees are confident that carpools are "in."

Contending with flexible work hours (employees can change arrival times daily between 6:30 and 8:30 a.m.), the approach for matching carpool riders shifted from a purely mechanical matching of employees residence and desired time of arrival to a more personal approach after data on employee residential patterns were collected. Extended "coffee breaks" for employees from predetermined residential locations were held. Employees were personally informed of their "coffee break" by a phone call, flyer, and announcement over the public address system of all persons eligible to attend the meetings that day.

Some meetings with up to 200 persons required 1 1/2 hours. After a "game" of "musical chairs" was completed, smaller groups of around 12 discussed desired arrival times and possible routes for carpools. Employees found it easy to compromise on starting times. For example, it was common to find 6:30 and 7:30 starting times modified to arrive at 7 a.m. The opportunity to meet face to face was considered a major reason for the success of this program. It would have been hard to match flexible hours by computer and mediate the differences in a fashion acceptable to potential carpoolers.

The carpool questionnaire included a number of questions on bus transit. All but one person wanted two or three pick up locations to reduce traveltime, not door-to-door service as this is recognized as too time consuming. Only one express bus was established, (30 miles one way) as no additional buses were available. To maintain excellent bus service, the ride sharing coordinator periodically rides the bus seeking suggestions for improvements. In addition, Hewlett Packard has helped form a number of vanpools owned and operated by employees. All ride sharing employees are assured of close in parking spaces.

Burroughs Corporation

In Pasadena, California, the Burroughs Corporation and Operation Oxygen Pasadena, a local environmental organization, established a carpool program in 1972 to assist in the abatement of air pollution and traffic congestion. Backed by top management at a Burroughs' facility, the program was well received by employees. As a result of the carpool program, the parking demand at the Burroughs' facility was reduced by 35 percent, from 659 to 427 cars. Spurred by the recent energy crisis, eight companies with a total of 5,000 employees in the nearby Pasadena area combined efforts in a pooling program.

Connecticut Statewide Efforts

In 1972, the Connecticut Department of Transportation (DOT) developed a computer program for carpool matching and provides carpool matching services to any public or private employer in the State who desires to participate.

Initially, over 7,000 employees from 45 State agencies in Hartford submitted data forms for matching. Subsequently, over 1,000 employees ride in carpools, most parking in spaces reserved for carpools with three or more. Joining the spirit of Connecticut DOT in conserving energy, about 100 companies

from across the State also sponsored programs. With around 80 percent to 90 percent of the employees participating, many through use of personnel records, some 70,000 questionnaires were returned by the first 31 firms.

In addition, Connecticut DOT has an accelerated statewide construction program for carpool commuter parking lots located primarily at key highway intersections. As of September 1974, 11 permanent lots, which are paved, landscaped, and illuminated and 62 new gravel-covered temporary facilities have been constructed. "Even though the energy crisis appears to have subsided, our carpool commuter lots are holding their own and in many instances are experiencing increased usage," said State Transportation Commissioner Joseph B. Burns.

Federal Highway Administration (FHWA)

On a small group basis, carpooling was actively promoted among 72 FHWA employees arriving in Washington, D.C., in November 1971. The employees were informed of an official U.S. Department of Transportation (DOT) policy requiring carpools with three or more participants as a parking permit prerequisite. Within a month, 55 percent selected carpools averaging 4.1 persons per car. Of the remaining; six walked to work, five could not be matched, and 26 took the bus. This is an example of matching a small sample in a large metropolitan area.

Also, in Washington, D.C., the FHWA completed its first computerized carpool matching program in August 1972 by distributing a personalized computer listing to over 600 participating employees. To determine the program's impact, a comprehensive followup questionnaire was distributed in October 1972. The results indicated an average auto occupancy of 3.8 among carpoolers and an overall occupancy of 2.34 for all FHWA employees. The latter figure increased to 2.45 after the carpool matching effort. The unusually high before occupancy can be largely attributed to a DOT policy requiring most employees to be in a carpool to obtain a parking permit. Even with extensive ride sharing, many employees indicated that the carpool lists helped improve their existing carpools by allowing them to switch members, thus making the carpools more convenient. Over 90 percent indicated a desire to see the matching service run periodically every 6 or 12 months.

Washington, D.C.

In the Washington, D.C., metropolitan area, the Washington Metropolitan Council of Governments, the Board of Trade, and the Washington D.C. Department of Highways and Traffic

sponsored an areawide carpool program. Recognizing the low occupancy rate of the automobile for commuter purposes (1.2 persons per vehicle for work trips from suburb to suburb and 1.5 from the suburb to Washington, D.C.), carpooling is one of the primary measures proposed to implement the National Air Quality standards for carbon monoxide, hydrocarbons, and photochemical oxidants. Many advantages for carpooling as a technique for reducing air pollution were noted:

1. A carpool program requires virtually no capital investment.

2. There are no major legal or institutional barriers to overcome.

3. The impact of a successful program can be immediate and dramatic.

4. A successful areawide carpool program can reduce the need for new construction of transportation facilities.

5. Fuel savings will lessen the impact of shortened fuel supplies.

Increased carpooling resulting from a public service campaign, carpool matching at over 100 employment sites, and the energy crisis is incalcuable. Determining the increase in carpools through matching or those motivated to carpool by advertising has yet to be accomplished. However, one aspect is certain, downward auto occupancy trends in Washington, D.C., have been broken. Auto occupancy on the Potomac River Bridges in May 1974 was up by 8 percent over May 1972 figures.

Baltimore Federal Employees

Federal employees from various agencies in Baltimore were asked to participate in a pilot testing of the FHWA Carpool Matching Program. Initially, listings were produced and distributed to over 600 participating Federal employees in July 1973.

In November 1973, the effort was expanded to include additional Federal agencies in nearby buildings. Of 6,000 employees in the survey group, 3,600 returned carpool matching questionnaires.

In March, a followup survey of commuting habits was completed. Carpooling was up 7 percent from the previous July to a total of 36 percent of employees. A breakdown of other modes shows 42 percent riding the bus, 18 percent driving alone, and the remaining 4 percent driving by other means.

Boeing Company

Boeing, with 52,000 employees at five sites in the Seattle, Washington metropolitan area, has encouraged carpools for its employees for years. Organized efforts date back to the 1940's and continued to some degree until January 1974 when a major new campaign was waged to conserve fuel. During these years when employment varied from 34,000 to 105,000 employees, Boeing offered incentives such as reserved parking areas and flexible hours for carpoolers. The January 24, 1974, issue of the Boeing News was devoted largely to ride sharing and the overall transportation problems facing the Nation. Reaction to the issue was believed to have stimulated the excellent response to a carpool survey card included in each payroll envelope. Of the 29,000 respondents, over 20,000 were interested in carpooling while approximately 6,000 had alternate preferences for commuting.

The computer carpool matching program designed by Boeing utilized the zip code. Rather than giving each applicant a computer listing of potential carpoolers, Boeing established 115 "Share the Ride" centers on the Plant billboards. These information centers were located within easy access to all employees. At these "Share the Ride" centers all employees at that plant site are listed by zip code and time of arrival. The beauty of Boeing's zip code matching is that employees can check adjacent zip codes for the best match.

In January 1974, a survey showed that 29 percent of all employees were carpooling with an average occupancy of 1.26. In May, after the "energy crisis" had subsided, the average occupancy was 1.38, about 10 percent above the January survey. In addition, six charter buses operate between Seattle and another plant in Everett, Washington, 60 miles away.

The Pentagon

The Pentagon, in Washington, D.C., with 25,000 employees has consistently suffered from a parking shortage. Formerly, spaces were issued according to rank and grade with no priority for carpools. Even so, due to the huge parking lots (some requiring a 12-minute walk to the building), informal carpooling occurred as commuters carpooled with high ranking officials to obtain the "close in" parking advantage.

The first priority parking lot for carpools was established in December 1970. In December 1973, to optimize the use of the 10,000 plus parking spaces and reduce congestion and energy consumption, 18,000 employees participated in computerized carpool matching. The computer lists were distributed in

March 1974, along with information on obtaining a "close in" space for carpools of three plus. The program was an instant success with nearly 4,000 permits issued in the first 3 months.

As of June 1974, 4,962 registered carpools with an average of 2.6 persons have taken over 2,000 cars off the highways. With many empty parking spaces, parking on curbs and access streets was eliminated.

In addition to the carpooling activities, there are about 22 buspools in operation and about 8,000 conventional bus riders.

Omaha, Nebraska

In Omaha, Nebraska, a program labeled Energy Conservation Carpool Operation (ECCO) was conceived by an energy committee of Northern Natural Gas Company. After receiving company approval for use of its computer, Northern's energy committee, which included two Jaycees, obtained full support of the Omaha Jaycees. In September 1973, ECCO became an authorized Omaha Jaycee project.

The main goal of the Omaha Jaycees is to make data available to commuters to aid carpool formation and increase ridership of mass transit. Vital to the success of the effort, a promotional campaign was launched (although limited in scope so as not to swamp the volunteer effort) at both the public and company levels. The active support and aid of key business and public personalities was obtained and the ECCO promotion was coordinated with Metro Area Transit expansion and development. The Jaycees contacted companies, explained the details of ECCO program, and enlisted their participation. Upon a company's involvement, an effective program of training was launched to guide their program.

By April 1974, the success and popularity of ECCO was evident as 130 companies had completed surveying their employees. Of the 1,190 Northern employees who received the questionnaire, 65 percent returned the completed form. This subsequently led to the formation of 130 more carpools bringing the total number to 281. While parking is not critical at Northern, emergency car kits were offered as an incentive.

Union Pacific Railroad had over a 75 percent return from its 5,000 employees, and the company is investigating the adoption of this ECCO format for some of its other locations. Mutual of Omaha, an insurance company with about 3,600 employees, began its own carpool promotion in early 1973. Through the use of attractive incentives - preferred parking, free breakfasts, and drawings - more than 1,000 employees were already commuting

by carpools when ECCO started. The company has worked hard to encourage the smaller businesses in its immediate area to participate in pooling programs. It made its data processing and keypunching services available to them, and now matches the employees from these 29 concerns with its own employees.

As of May 1974, approximately 15,000 of a potential 27,000 employees, mostly in downtown Omaha, had submitted data forms to ECCO. In addition, ECCO assisted employers with an estimated 10,000 employees to initiate their own company programs in Omaha.

B. Vanpool Programs

Use of employer-sponsored vanpools has increased dramatically since May 1973. At that time, the 3M Company launched a pilot program with six vans. As demand grew, 3M periodically purchased additional vans and as of September 1974 had 67 in use. Likewise, other corporations such as General Mills, Texas Instruments, and Cenex Corporation obtained vans the second or third time to meet surging demand.

In addition, privately owned vanpools exceed the employer-sponsored vans in use. An excellent example of privately owned vans is at the Norfolk, Virginia, industrial military complex where at least 30 vans are known to be in operation. Interestingly, most of these vans travel in excess of 40 miles one way, eliminating a much greater share of the vehicle miles of travel than their numbers would indicate.

3M Company

The 3M Company in suburban St. Paul, Minnesota, established a "commute-a-van" pilot program in April 1973 with six 12-passenger vans. By September 1974, the well-received program expanded to 67 vans serving nearly 8 percent of all employees in St. Paul, one in Los Angeles, and one in the New York metropolitan area. With as many as 1,000 people on waiting lists, continued expansion of the program at 3M installations is assured.

In the pilot program, six areas exhibiting slightly different trip characteristics were selected. The number of employees residing in these areas range from 67 to 277 with distances varying from 5 to 32 miles respectively. In January 1973, a special employee survey was conducted to determine interest in each of the selected pilot areas. In one area, 12 miles from the 3M Center, 50 of the 178 persons applied for the use of the van.

The vanpools consist of the "Pool Coordinators" or drivers with at least one backup driver and a minimum of eight paying passengers. The drivers must have chauffeurs licenses and are carefully screened to determine reliability. Drivers are responsible for the vans and ride free in return for driving and collecting monthly fares. Monthly fares, figured on a "break even" basis of eight riders, range from $19.50 to $39 depending on distance. The $39 fare serves a round trip distance of 135 miles. As an incentive to the pool coordinator to keep the van full, the driver pockets the fare of the 10, 11, and 12th riders.

Possibly the best indication of the program's acceptance is its tremendous growth and continued acceptance.

In April 1974, 80 percent of the 437 vanpoolers returned questionnaires on the program. Ninety-one percent of the participants expressed a desire to continue using the commute-a-van for commuting. The convenience level of the vans scored amazingly high as exactly 80 percent of the respondents found the vanpool more convenient than their former method of commuting.

With convenient residential pick-up areas and priority parking at the 3M center, one "pool coordinator" stated that the extra minutes required to pick up riders at their front door and travel to and from work is "offset by the pleasure of his riders' company." In addition, he expects to save the costs of a $15 monthly parking fee and an estimated $75 per month on auto expenses.

By any measure the 3M commute-a-van program has been an outstanding success. The average van carries 11.36 persons for a monthly fare of $23.72 and a round trip distance of 49 miles. The shift to vans saves over 1.4 million vehicle miles of travel and 108,300 gallons of gas per year. The vanpool project reduced the size of a planned 3M parking structure from 1,500 to 775 spaces saving 2 1/2 million dollars. In addition, carpooling employees have expanded three-fold to approximately 3,000 since the energy crisis began. Overall, 40 percent of all employees are participating in ride sharing, certainly one of the highest in the country.

General Mills, Inc.

Following 3M's example, General Mills, Inc., in neighboring Minneapolis launched a pilot commuter van program among its 1,800 employees. Begun in January 1974, with five vans, the program doubled in just 3 months and in September 1974 had 16 vans. In order to lower fares in some areas and

maximize use of the vans, arrangements have been made to use a van for shuttle service between buildings during the day. Free transportation is available to commuter van passengers for doctor appointments and emergencies. The vans are used for these purposes by employees with a chauffeur's driver's license while company cars are provided for other passengers. In addition to the van program, reserved parking close to the building for carpools of three or more is offered to more than 50 carpools transporting over 180 employees. More requests for reserved parking assignments are continuously made as new carpools are formed with the aid of a "Pool It" ride board from which employees find others to pool with.

C. Buspool Programs

One outstanding feature of a buspool is its fast, point-to-point, convenient service. The buspool concept can include various approaches such as; charter, contract, subscription, and user-owned buses. Typically, buspools originate at a limited number of stops, usually two or three fringe parking areas to minimize collection time and riders are guaranteed a seat. Then the buspools travel non-stop to the destination, frequently a single employer, dropping all riders off in one or two stops. This approach allows the buses to travel at virtually the same speed as the automobiles, thus the traveltimes are excellent.

Buspool growth has been rapid in the past 6 years. In fact, operations in the metropolitan areas of Washington, D.C.; Los Angeles, California; New York, New York; Norfolk, Virginia; New Haven, Connecticut; Dallas, Texas; and Knoxville, Tennessee, have added approximately 200 buses in the past 3 years.

Specialty Transit Co.

In the greater St. Louis area, a private bus company providing express bus service has grown from 1 to 22 buses in 15 years. Financed 100 percent from the farebox, the company provides service from semi-rural towns 25 to 50 miles from the passenger's suburban employer, the McDonnell Douglas Corporation. When passengers were interviewed, their number one concern was travel-time with cost an important second. If either of these were excessive, they would return to carpools. By minimizing the service stops (the loading and discharging of passengers) to an average of three per bus through well-located fringe parking areas, not only is the total traveltime reduced but the passengers appreciated the smooth, virtually non-stop service. This non-stop service in combination with headrests allowed the passengers to sleep, which was a big favorite. This private bus company has grown not by accident but by a sincere effort to serve the commuters' desires.

Com-Bus

In the Los Angeles metropolitan area, Com-Bus, a private bus operation, serves over 2,500 commuters traveling to work each day. With typical routes 18 to 65 miles one way, Com-Bus acts essentially as a middleman, coordinating route scheduling with riders needs, adding new routes (currently accommodating eight separate employment locations), and obtaining buses primarily from private charter firms. By utilizing the idle buses of private charter firms at rush hour, this commuter program has expanded in 7 years to 47 buses each way. The charter buses (late model, air conditioned, reclining seat coaches) provide the maximum in riding comfort. Com-Bus management points to the personalized service their passengers receive in a high-quality commuter bus service. Included in their amenities are: the same bus driver each day, a refreshment bar in the afternoon, weekly payments without tickets, route flexibility (not restricted by regulatory restraints), economy (about 2¢ per mile), traveltime (about the same as driving a car), and some buses with AM/FM stereo music.

The commuter has received many benefits, as much of this commuting time formerly lost while fighting freeway traffic is now recovered. Riders have extra time to relax, read, play cards, talk, or just plain sleep. One rider commented, "I get to work relaxed and I've discovered reading again," while another rider observed, "The bus was surprisingly comfortable. Each bus carries about 40 people, and after talking with some of them, I'd say there are probably at least 40 reasons why they prefer commuting by bus." Again, the concept of personalized service has been instrumental in increasing bus patronage. In December 1973, the first of 20 17-passenger "widened" vans were put into service.

Reston Commuter Bus

Over 7 years ago, Reston, a growing new planned suburban community with a population of only 3,000, initiated its first express commuter bus to Washington, D.C., 25 miles away. Today, with a population of 23,500, commuters are served daily by approximately 48 bus runs financed entirely by fares. The typical passenger is a middle-class suburbanite who supposedly will use only his private automobile. There are various reasons for the success of the program, but the major one is relatively fast, convenient service. According to a November 1971 survey, 56 percent of the passengers ranked the reduction of traveltime first in importance for increasing ridership.

While the Reston program has proved to be an outstanding success, it began only after residents had tried in vain to have scheduled express bus service started to their area. Actually, the bus company's refusal to provide scheduled service was a blessing in disguise as it led to a flexible user-controlled contract or "buspool" operation. Routes can be improved at will without the time-consuming scrutiny of a regulatory body, payment is generally made by check, and the routes to and from Reston can be varied allowing the bus to adapt to traffic conditions.

A new service by Common Ground Foundation (CGF), a nonprofit service organization run by a local church group provides shuttle service from Reston's outlying areas not served by RCB buses to transfer points with RCB buses. The buses make four loops in the mornings and five loops in the evenings, at a cost of $100/week to RCB. This particular service is free to passengers showing RCB tickets.

An RCB Mini-Bus service for commuters began in February 1974 with one 12-passenger van. The 60-mile roundtrip to Rockville costs $43 per month per passenger and riders are picked up at four Reston locations. The van has a State Corporation Commission common carrier certificate in order to operate. By September 1974, a total of three vans were in operation.

Southern New England Telephone

The desire among the 4,000 Southern New England Telephone (SNET) employees in New Haven, Connecticut (137,000 population) to share a ride emerged in January 1973 with a "Superbus" program. The first two "Superbuses" (chartered monthly with a private operator) serve commuters between a bedroom community and New Haven (about 25 miles away). This success guided expansion to eight charter "Superbuses" and three new transit routes. The transit authority had "first crack" at running new routes. "Superbuses" or charter buses were established when the transit authority elected not to provide service. The nucleus of bus riders are SNET employees but anyone, regardless of employer, can ride. The eight chartered "Superbuses" drive 350 employees an average of 25 miles each way with seats guaranteed.

To start a new "Superbus" and to minimize origins, one or two convenient pick-up areas are proposed, then the State searches State property adjacent to a highway and will build a park and ride lot acceptable to bus riders. Many new lots

serve less than 30 cars, allowing more convenient locations which have a distinct advantage of remaining congestion free.

SNET has established free priority parking for four-person carpools. Over 200 carpools beat the parking crunch by using nearly half of the company's 450 spaces. Formerly, competition for one of the 450 free parking spaces required arriving one hour early. Sufficient spaces for qualifying carpools are reserved as a block of spaces rather than assigning each carpool a specific space. During the morning rush to park, cars can systematically "park" in the nearest space rather than locating a specifically numbered space. Commercial parking nearby costs about $20-$30 per month.

Two options to assist employees in forming carpools have been established. A company organ "Classified-Ad" section is available for advertising a person's needs. The other approach utilizes a computer printout for all 14,000 employees in the State from personnel lists. The personnel office maintains lists by office and zip codes.

An Office of Environmental Affairs has been organized by SNET to serve a number of functions including the company's ride-sharing program. The carpool program is promoted by parking priorities and energy and cost-saving analysis. A computer analysis of commuting costs by make of car is available to each employee. To reduce fuel consumption further, the company has drastically cut the availability of company cars from 11 a.m. to 1 p.m. to insure their use for official purposes only and requires employees to share the use of a company car for business trips to other cities.

D. Combination Car, Van, and Buspool Programs

Since it is inconceivable that one mode of transportation can serve all commuters' desires, many programs stress all options. The Knoxville, Tennessee, program, while encompassing all forms of available ride sharing, places emphasis on the optimum use of each vehicle type, i.e., cars, vans, and buses. While many programs relate to one mode, the following programs are known to place major emphasis on two or more of the pooling modes.

Government Employees Insurance Company (GEICO)

In a Washington, D.C., suburb, GEICO, with 3,900 employees, and only 1,100 parking spaces faced a parking shortage in 1972. Zoning was denied for the construction of additional

parking facilities. GEICO's solution was to establish priority parking spaces for carpools of three or more, provide a carpool matching service, and a buspool program. As a result, over 343 parking permits serving 1,036 employees were issued, raising the overall average auto occupancy to around two persons per car, 40 percent above the local occupancies. Eight free buspools originating at three shopping center fringe parking areas serve 300 GEICO employees. Another 200 employees ride GEICO subsidized buses from more distant origins. With an estimated 500 employees traveling on regularly scheduled buses over half of all employees now "share a ride." GEICO management, elated over the corporate headquarters program has distributed a "How-to-do-it" package to regional offices. As a result, two offices have sponsored their first carpool campaigns.

Aerospace Corporation and the Air Force SAMSO Installation

The 3,700 employees at Aerospace Corporation, in El Segundo, California, participated in a joint ride sharing program with the 2,100 employees at the Air Force's Space and Missile Systems Organization (SAMSO installation). This ride sharing concept began in June 1972 for Aerospace employees who were transferred from San Bernardino to El Segundo, California, 80 miles away. Rather than relocate their residences, a "charter" bus was initiated. It was so successful that it served as a model for establishing other routes. What started as a commuter service for transferees has now grown into eight buses carrying approximately 250 employees.

Upgraded from standard transit buses, these comfortable buses are outfitted with air conditioning, reclining seats, and music. For each rider, the trip means from 1 to 2 hours a day for reading, relaxing, or just quiet conversation (and even work!). While cutting air pollution, it is estimated that these buses save 250,000 gallons of gasoline annually.

The buses were initiated by individual groups of employees and run as bus clubs. Various charter companies provide buses with the average weekly fare of $8 to $12. Because of the frequent business trips of the riders, commitment to weekly or monthly use is not required and rebates are given. Employees of nearby companies are permitted to use these buses. The bus clubs are self sustaining requiring no employer guarantee. However, the company aid in soliciting members for the bus clubs has been vital to their success.

A fully computerized carpool matching system was developed and initiated at SAMSO Aerospace. A total of 1,226 employees were processed in the initial January 1974 run. New and revised applications are updated and added to the master file weekly expanding the data base to 1,450 employees. A followup survey found that approximately 60 percent of those participating in the program had actually joined a carpool. A later survey found about 15 percent left their carpools. Prime reasons were that someone had moved or work hours or jobs had changed. This distinctly shows the need for a continuing matching effort to aid those with changing travel needs.

During March 1974, 37 percent of the employees were ride sharing. Interestingly, these ride sharers represented at least 47 percent of vehicle miles of travel. The actual decrease in vehicle miles of travel exceeds the decrease in auto use as travelers commuting greater distances tend to carpool more often, since they benefit the most.

Texas Instruments, Incorporated

A major Texas Instruments complex in Dallas, Texas, which employs in excess of 20,000 people, initiated a comprehensive ride sharing program in the fall of 1973. The program was designed to meet the Environmental Protection Agency's (EPA) transportation requirements for the region. The proposed regulations require employers with 1,000 or more employees in one location to provide incentives encouraging employees to share a ride. While EPA regulations apply to only four company facilities, the corporate policy is to aid all "domestic sites" in pooling programs. The effort is viewed as a corporate moral commitment to locate the best commuting opportunities for employees and to conserve energy and reduce air pollution.

With a carpool matching effort and parking priorities for three or more per car or a "full car" such as a two-seater sports car carrying two people, the average occupancy has increased from 1.20 in October 1973 to 1.64 in April 1974. A pilot TRANS-I-VAN program started in March 1974, with five vans, expanded to 10 in July 1974, and is similar to the 3M Company operation. In addition, seven new express bus routes, five from downtown Dallas and two from suburban Dallas, provide exclusive service to Texas Instruments with other bus routes under discussion. Texas Instruments determines the routes, stops, and times and guarantees the Dallas Transit Authority or private transit company 40 paid riders for a trial 2-week period to test a potential route.

In addition, Texas Instruments contracted with the Dallas Transit Authority to allow all Texas Instruments employees to ride any Dallas transit bus free for the 8 days prior to Christmas 1973 by displaying their employee pass.

Knoxville, Tennessee

Starting months before the energy crunch of Fall 1973, the city of Knoxville, Knoxville Transit Authority, various homeowner's associations, the University of Tennessee, and major employers all pioneered a comprehensive urbanwide pooling program. Encompassing all forms of available ride sharing, the emphasis is on the optimum use of each vehicle type, i.e., cars, vans, and buses.

This urbanwide carpooling program was not viewed as a reaction to the energy crisis but as a positive response for urban transportation needs involving:

1. Declining transit ridership and rapidly increasing transit deficits.

2. Increasing peak hour traffic congestion.

3. Current development patterns which stress densities too sparse to allow economical use of traditional transit.

4. The construction of peripheral activity centers, shopping centers, industrial parks and office complexes are vastly changing the travel patterns and dominance of the downtown Knoxville area.

The car/buspool concept was, therefore, viewed as a low-cost method of identifying commuter demands to allow (a) more effective scheduling of buses to generate higher load factors and multiple peak hour trips through selective scheduling, promotion, and selling; (b) alternatives for areas which cannot economically support traditional transit service; (c) measures for evaluating changing origin destination patterns for both highway and transit planning.

Knoxville's ride sharing achievements are largely the result of an all volunteer effort operating on a shoestring budget. By the end of the energy crisis, 12,000 employees at 12 firms received carpool matching lists, hundreds of carpools were established, a vanpool pilot program was initiated, and nine new express bus routes were established.

In September 1974, the second phase of Knoxville's ride sharing program was launched, emerging from a volunteer effort to a federally funded campaign.

Preliminary findings of the first phase suggest:

1. In Knoxville where transit has very low utilization, the importance of carpooling cannot be overemphasized.

2. The car/buspool matching program can increase carpooling by 5 percent of the work force with little other effort than a good carpool matching service.

3. The car/buspool matching program is a very effective predictor of express bus service and can accurately predict riders for a direct marketing approach. Riders readily pay double fare for genuine express service.

4. Firms do not grasp the actual cost of commuter associated expenses for land, parking lots, multiple shift work schedules, and uneconomical expansion of parking facilities.

5. Highly visible radio or TV carpool programs are less effective because of the lack of association between respondents.

6. A highly committed individual in each firm is essential for the success of a program.

7. Employer vanpools or charter buses are very appealing to many businesses.

8. A successful program should probably consist of a strong promotional and training program directed to the employer plus a strong appeal to the employees so that pooling implies benefits instead of imposition.

9. The propensity of employees of a given firm to live in the same neighborheed appears to be far greater than expected. This may have major implications for transportation planning and schedulings.

Extensive cooperation and marketing (bus demand established from carpool matching data) between Tennessee Valley Authority (TVA), suburban employers, Levi Strauss, and Camel Manufacturing, the transit authority, University of Tennessee, employees and home owners associations resulted in nine new express bus routes. These genuine express bus runs virtually equal the door-to-door traveltime of a privately driven automobile. With only three or

four pick-up stops at fringe parking areas (churches and shopping centers) the buses travel express to a single employment destination (one major stop) arriving 10 minutes before work. This enables fast trips for the commuters and quick turnaround for the buses.

The initial express bus was established in December 1973 and was an instant success. Within a month a second bus was initiated to alleviate crowding and had eight standees the first day. A few weeks later, three more buses serving six routes were added. These three express buses take workers to suburban employers, Levi Strauss and Camel manufacturing, at 6:50 a.m. and return downtown at 7:50 a.m. with primarily TVA employees who live in the suburbs. When additional demand data are available in Fall 1974, it is anticipated that these same buses will serve shopping mall employees starting work at 9 a.m.

By summer, all nine new premium fare buspools using five buses were carrying more riders than in March. In addition, TVA added two special charter buses to serve overtime employees. These buses cover full operating costs as riders pay premium fares of $.50 and $.60 for premium fast service as compared with $.30 for conventional locals. With 10-16 standees on some buses, larger 53-passenger buses were considered but an informal survey determined that riders would rather commute in the smaller 45-passenger air conditioned buses than the larger 53-passenger buses without air conditioning. The desire by riders "to stand in air than sit in heat" was very clear. The fast service results in standing less than 20 minutes.

Overall, TVA increased their employees ride sharing from 30 to 50 percent. To continue this program, a permanent full time position of transportation coordinator has been established to aid all TVA employment centers.

Mayor Kyle C. Testerman sums up the program by stating, "Substantial evidence has been gathered that the car/buspool plan can do more to save energy, reduce congestion and pollution, reduce parking problems, and increase access to the downtown area than any other program which we might be able to implement within the city. The car/buspool system is also working to reduce the tax burden caused by a previously ineffective mass transit system as well as providing a fast and reliable method for getting to work. Frankly, our bus system for the first time has become consumer oriented."

III. CARPOOL AND BUSPOOL CONSIDERATIONS

All carpool and buspool programs require a basic ingredient--match commuters sharing common Time-Origin-Destination (TOD) needs into potential carpools and, as demand permits, van and buspools. Expanding the universe of potential matches from carpools developed between friends and associates by word of mouth to all employees aids in locating more convenient carpools. The proximity of carpool members is a significant factor in attaining a level of door-to-door carpool service comparable to driving alone. Although the importance of matching TOD needs is paramount, a comprehensive carpool and buspool program should include the following phases:

A. Public information
B. Incentives
C. Data processing
D. Continuing service

A. Public Information

A critical portion of a carpool program is proper promotion of the public information phase. Through a public relations campaign, the advantages to both the individual and society should become clear to the potential ride sharer. Not only can many commuters be matched with conveniently located trsvel partners, but amenities frequently superior to driving alone are possible. Some considerations to stress in a public information program to employees are:

1. Acceptable Traveltime

   The single most important factor in a commuter's selection of a travel mode is traveltime. Commuters demand fast door-to-door service tailored to their working hours. Through well matched car, van and buspools, acceptable door-to-door traveltimes are common as their pickup time is brief and pools are tailored to working hours. A moderate increase of 10 percent in auto occupancy can significantly reduce traffic congestion resulting in shorter traveltimes for everyone during rush hour. For example, during the height of the energy crisis, Los Angeles reported a 7 percent reduction in rush hour traffic from the preceding year. As a result, 40 percent of traffic delays were eliminated.

2. Low Costs

   Naturally, dollar savings is especially prominent in times of inflation. By doubling up the employee can save up to 50 percent. With five persons per car an employee can save

up to 80 percent. This, savings to each pooling employee of $250 to $1,000 could be equivalent to awarding employees a free dishwasher, a cash bonus, a paid vacation, or contribute towards a college education for a child. Overall pooling is the least expensive mode when considering alternatives to the individual and society.

3. High Levels of Convenience

Pooling can provide door-to-door service; avoid the problems of inclement weather; provide a guaranteed comfortable seat; require fewer driving days; and provide service to the handicapped and non-drivers.

4. Improvement of Environment

Pooling presents an excellent opportunity for commuters to "do their part" in reducing air pollution while actually saving money. A case in point is Washington, D.C., where 35 percent of total peak hour travel occurred on congested arterial streets operating below 15 mph. If a comprehensive pooling program reduced arterial vehicle travel by 20 percent, average arterial speeds could jump to 27 mph. for an 80 percent increase. By combining the benefits of the increased speed and the reduced number of vehicles on the road, the total drop in emissions is 52 percent and 38 percent for carbon monoxide (CO) and hydrocarbons (HC) respectively.

5. Conservation of Energy

Pooling represents one of the best opportunities to conserve fuel while not restricting mobility. Evaluating the energy consumption per person mile of travel at peak periods, the carpool is competitive with the commuter bus. Considering a reasonable level of transit service and necessary dead-heading, the bus carries about 20 passengers per bus mile. At 4 miles per gallon, this equals 80 passenger miles per gallon. This compares with 48 passenger miles per gallon for a carpool (four passengers at 12 miles per gallon) and 100 passenger miles for a vanpool (10 passengers at 10 miles per gallon).

For the Nation as a whole, transit buses are estimated to produce only six passenger-miles per bus-mile traveled owing to extensive deadheading and low occupancy travel at off-peak hours. At 4 miles per gallon, the fuel efficiency of such a bus is about equivalent to a passenger car with a fuel consumption rate of 14 miles per gallon and an average occupancy per vehicle mile of 2.0.

Some concern has been expressed on automobile insurance coverage for carpools. Policies vary with insurance companies, ranging from carpool coverage under regular policies to lower rates for carpools. While carpoolers should carry higher liability coverage, any rate increase should be offset by savings due to less commuter driving and therefore lower rates. If in question, the individual should verify the situation by writing to the insurer.

Ride sharing concepts must be marketed, as any new product, to stimulate demand. Inexpensive promotional techniques to sell some of the aforementioned ideas include combinations of the following: timely company announcements; bumper stickers; management letters of support to all employees; and endorsement by news media, politicians, local merchants, unions, and anti-pollution groups. An effective method utilized by one employer was a combination of "breakfast and coffee hours" where employees were briefed on the program's objectives followed by a question and answer session. Later, ride sharing lists were distributed at another "coffee hour" which was held primarily to allow potential carpoolers, many unknown to each other, to meet and make arrangements for carpools.

The U.S. Department of Transportation is working with the National Advertising Council in sponsoring a national carpool campaign. The Advertising Council is producing campaign materials and promotional items and is distributing this material to the mass media for presentation.

The Advertising Council is a private, non-profit organization which conducts public service advertising campaigns in the public interest. The Council material is used in space and time donated by the mass media. Material is being distributed to 5,000 radio stations, 750 television stations, 700 consumer magazines, 2,500 business publications, and 10,000 newspapers. The theme of the campaign is "Double-Up America."

The U.S. Department of Transportation has produced a 10-minute movie for the campaign. The movie is aimed at employers and will be available on a free loan basis. Posters, radio, and TV spots, etc., are also being produced and will be available at cost.

B. Incentives

In combination with the public information phase, special incentives should be provided where feasible. To date, the most successful incentives have been special parking privileges for carpoolers and priority use of highways. Parking incentives generally take two forms: (1) where parking is

limited, the parking permits are issued to the largest carpools; and (2) where parking is plentiful, priority carpool parking areas are designated. The first technique is self-explanatory while the second can be applied in various ways. In a large industrial parking lot, priority parking areas can be established at the best locations, close to gates, etc., which can save carpoolers 5 to 10 minutes a day by "beating the rush." Inside parking facilities are a distinct advantage over less convenient outside parking areas. By utilizing one of the two techniques illustrated above, employers can simultaneously promote carpooling as an employee service while increasing the productivity of their parking facilities.

In December 1971, at the congested toll plaza area approaching the San Francisco-Oakland Bay Bridge, two priority lanes for carpools with three or more persons were added to the already successful bus priority lane. In addition to the priority lanes, the 50 cent toll was eliminated for carpools and a $1 fee per month charged. Anticipating this change, all cars passing the toll booths were given carpool postcard application forms for carpool matching. About 10 percent returned the post cards and within 2 weeks after the priority lane opened, the number of cars with three or more persons doubled from 1,000 to 2,000 during the morning rush period. During a bus strike in summer 1974, carpools doubled again to 4,400 carpools per peak.

In the Washington, D.C., metropolitan area, a two-lane reversible busway was established in 1969 on the Shirley Highway (I-95). By 1974, bus ridership increased almost 400 percent as more commuters traveled by bus than by automobile during the rush periods. The time saved by the buses on the line-haul portion of the trip frequently results in a door-to-door traveltime comparable to the automobile and is believed to be a major factor in improved bus patronage.

Initially, a portion of the reversible bus lane passed through a major highway reconstruction project and was restricted to buses only. In December 1973, the completed portions of the reversible lanes were opened to carpools with four or more persons. Within a month, an average of 272 carpools used the lanes in the morning peak period and by May 1974 this total increased to 700 carpools.

In the Los Angeles area of the San Diego Freeway (I-405), a metered entrance ramp (Lakewood Boulevard) was adjusted to allow carpools to bypass the metering. This provided carpools a time saving of about 7 to 9 minutes. As a result, the daily average number of carpools expanded from 125 before to 460 per

p.m. peak. Due to this success, a second high occupancy priority ramp has been opened and has experienced a similar growth in carpools from 150 to 370. A survey at these two ramps discovered that 300 of these carpools are new as a result of the incentive. Other ramp locations are under consideration for similar ramp metering. Carpool lanes have also been established recently on major commuting highways in Miami and Honolulu.

Highway departments have an incentive to encourage high occupancy vehicular use to demonstrate the highway's flexibility in meeting the rush hour demands. Priority freeway lanes for buses and carpools can provide a distinct incentive for ride sharing. The highway's productivity could double by increasing the 1.4 persons per car (which is a common rush hour automobile occupancy) to 2.8 per car. Furthermore, virtually unlimited capacity is available with bus rapid transit on an exclusive right-of-way or reserved lanes in combination with proper terminal facilities.

C. Data Processing

The data processing phase closes the information gap now existing between potential ride sharers by making time-origin-destination (TOD) information readily available. It consists essentially of three parts:

1. Collecting TOD information
2. Matching TOD information
   (a) Manual
   (b) Computer
3. Distributing suggested pool combinations

The approaches to these phases will vary widely according to local needs and the program's size.

1. Collecting TOD information

   Each employee should receive an application form with a cover letter briefly describing the matching program, priority parking, if any, and managements' endorsement. Every employee's response should be sought with the understanding that the application does not commit the employee. With a higher percentage of returns, the universe is larger and more acceptable matches are possible. Many programs have obtained a 90 percent response from employees, certainly an excellent goal.

The necessary TOD data will be dependent on the extent of the program. Where the program serves one major parking and employment area, the essential data may be limited to the name, home address, and business phone numbers. Usually, the desired time of arrival and departure is included only where the pooling program includes staggered starting times. A few additional questions may be included, such as the person's desire to drive only, ride only, or share driving, and information on the present mode of travel to work. However, an easy to understand, short data form is necessary. The Connecticut DOT and FHWA data forms (Figures 1 and 2) are typical examples.

2. Matching TOD Data

A number of options are available for matching the TOD data. The transition between hand matching and use of a computer varies with accessibility to a computer, number of applicants, and intentions of maintaining a continuing program. Where the potential applications number fewer than 300, a hand matching or manual technique is easy and inexpensive. From this level a computer program based on a grid system overlay on a metropolitan map or automatic address coding and DIME reference file system such as the one developed by the Bureau of the Census should be considered. The latter approach is under development and could conceivably serve an entire metropolitan area.

A critical variable in a matching system is the correct size of grid or land area for grouping suggested pools. Few criteria are available, although the total door-to-door traveltime is significant in an acceptable pool. When this total traveltime for all ride sharers falls within a 25 percent increase of the fastest alternative, it generally constitutes an acceptable pool.

Although it will be difficult to estimate door-to-door traveltime, experience indicates that 1-square-mile areas are acceptable for gathering carpools in higher density regions while areas ranging to 4 or more square miles are acceptable in less dense regions. Also, distance from employment source should be considered. On longer commutes, possibly in excess of 45 minutes, many people accept driving to a specific residence or predetermined parking area where the carpools or buspools originate. The potential combinations are many and any reasonable grouping should be suggested, allowing the individual to make the final selection.

CONNECTICUT DEPARTMENT OF TRANSPORTATION
GREATER HARTFORD COMMUTER PROGRAM

PLEASE DO NOT WRITE IN THIS SPACE

Please Print

NAME 1 (Last) (First) (Init.)

ADDRESS 25 (Street No.) (Street Name)

42 (City) (State) (Zip Code)

TELEPHONE 66 (Number) 73

EMPLOYER 1 (Company Name)

EMPLOYER'S ADDRESS 21 (Street No.) (Street Name)

DEPARTMENT 38 (Number) BUSINESS PHONE 43 (Number) (Extension) 55

TIME YOU LEAVE HOME FOR WORK _____am_____pm 59

TIME WORK BEGINS _____am_____pm 63

TIME YOU LEAVE WORK FOR HOME _____am_____pm 67

PRESENT MODE OF TRAVEL TO WORK: (check one)

1. Auto - Drive Alone _____ 3. Bus _____ 71
2. Auto - Part of Carpool _____ 4. Other (specify) _____ 72

How many in carpool including driver _____

73

Figure 1
Typical Carpool Data Form

RETURN TO: HHP - 26
ROOM 3301

FEDERAL HIGHWAY ADMINISTRATION

Data Form For Carpool/Bus Commuter Program

INSTRUCTIONS: PLEASE COMPLETE ALL QUESTIONS AND RETURN ONLY THIS PAGE WITHIN ONE WEEK THROUGH INTEROFFICE MAILS. PLEASE CALL 60210 IF YOU HAVE ANY QUESTIONS.

CARD NO. 1

1 [1][A]

3 [ ][ ][ ][ ][ ][ ][ ][ ][ ] 11
SOCIAL SECURITY NUMBER

NAME 12 [ ] 35
(FIRST AND LAST)

ADDRESS 36 [ ] 58
(NUMBER AND STREET NAME)

59 [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ] 73
(CITY)

74 [ ][ ]
(STATE)

76 [ ][ ][ ][ ][ ] 80
(ZIP)

CARD NO. 2

1 [2][A]

X 12 [ ][ ] Y 14 [ ][ ]
HOME GRID NUMBER (See Maps)

PLEASE LOCATE YOUR RESIDENCE CAREFULLY ON THE CORRECT MAP AND PLACE THE GRID NUMBERS HERE.

X 16 [ ][ ] Y 18 [ ][ ]
WORK GRID NUMBER (See Maps)

PLEASE LOCATE YOUR WORK GRID CAREFULLY ON THE CORRECT MAP AND PLACE THE GRID NUMBERS HERE.

REPORTING TIME 20 [ ][ ] Hrs. : 22 [ ][ ] Min. 24 [ ] A/P

DEPARTING TIME 25 [ ][ ] Hrs. : 27 [ ][ ] Min. 29 [ ] A/P

(Example: Show 8:00 A.M. as [0][8] : [0][0] [A] and 4:30 P.M. as [0][4] : [3][0] [P])

DO YOU DESIRE TO BE INCLUDED FOR CARPOOL MATCHING? (30)

YES [ ] NO [ ]

(REMEMBER THAT A "YES" ANSWER PLACES YOU UNDER NO OBLIGATION)

35 [ ][ ][ ][ ] 39
OFFICE PHONE

45 [ ][ ][ ][ ][ ] 50
ROOM NUMBER

56 [ ][ ][ ][ ][ ][ ] 61
ROUTING SYMBOL

Sample Data Collection Form

Figure 2

The FHWA carpool computer listing is an example of ample data allowing the user to select carpool members (Figure 3). Each participant receives his own personalized list including the names, addresses, and phone numbers of all others in his home grid. When there are less than eight prospective carpoolers in the home grid, the adjacent eight home grids are listed giving the applicant ample information on others sharing TOD needs. An introduction to the FHWA carpool matching program is listed in Appendix A. This gives a brief description of the capabilities and limitations of the FHWA computer program.

(a) Manual matching

The manual matching program approach is simple and requires essentially the TOD data as shown in Figure 1. It is suggested that an areawide map (approximate scale of 1 inch equals 1/2 mile) with a street index be utilized. The street index allows the unknown location of some addresses to be quickly identified. After assigning a unique number to each application, the numbers are plotted on the map at the approximate residential location. Visual inspection will suggest acceptable carpools based essentially on traveltime accessibility of group members.

(b) Computer Matching

The computerized approach to successful carpool matching is usually based on either a grid system, census tracts, or traffic analysis zones. The home and work locations of participants can be input into the program by manual identification from grid maps or through automatic address coding.

A computerized program based on a duel density grid system such as the one developed by FHWA provides a comprehensive approach to carpool and buspool matching. The input typically requires an applicant's name, address, home and work locations, and his working hours. An example of a typical applicant data form appears in Figure 2. This type of program can handle multiple work locations simultaneously, but separately and multiple work times (additional details on the FHWA Carpool Matching Program are described in Appendix A).

CARPOOL LOCATOR INDIVIDUAL LIST

SEND TO:
D-31
757
MCEVOY JOHANNA
745 ARLINGTON BLVD FAIRFAX VA 22399

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

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

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

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

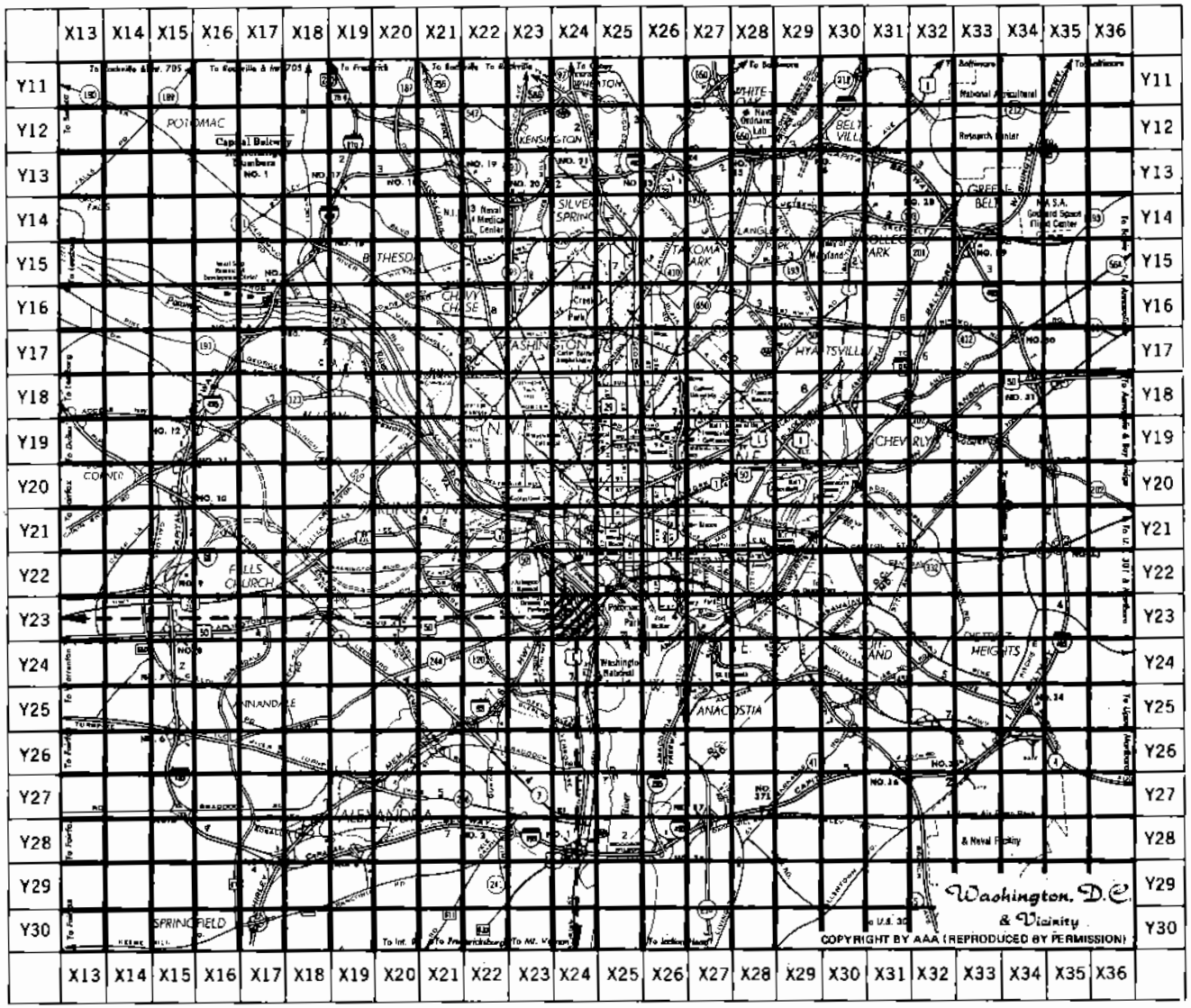
Figure 3
Carpool Locator Individual List

To serve the developed urban area and the surrounding semi-rural region, a provision in a computerized matching system for two grid sizes is very useful. This technique provides a smaller grid in the well developed areas (Figure 4) and a larger area grid in the less developed surrounding areas (Figure 5). The semi-rural surrounding areas should be included in the matching process since commuters living 20 or more miles from work rarely have access to public transportation and due to the time, boredom, and cost in driving individually, they represent a group very favorable to pooling.

The density matrix uses a matrix to list only the number of persons in all grids sharing the same TOD needs. By visual review, closely grouped grids with 40 or more sharing similar TOD needs can be identified for potential buspools. Smaller groupings can be identified for potential vanpools. An example of this matrix is shown in Figure 6. A prorated estimate of data from a small pilot test of the FHWA Carpool Matching Program showed that several 1-square-mile grid cells have up to 150 persons coming to the southwest Washington, D.C., employment area (less than 1/2 square mile) within a 15-minute period.

Certainly some of these areas can support new buspools. By minimizing stops at each end, the collection and distribution time can be drastically reduced as the buspool would stop only at a limited number of pre-designated points. This contrasts with conventional bus runs which consume considerable traveltime, stopping at virtually every bus stop along the route. The ultimate in personalized bus service is filling a bus to capacity in four to six residential stops, traveling express to work, and discharging all passengers at one stop, their employer's doorstep, 5 minutes before work. By simultaneously lowering the commuters traveltime, the productivity of the bus and driver is increased.

The Connecticut Department of Transportation's computer program for carpooling utilizes the planning department's automatic address coding program in locating addresses in statewide traffic analysis zones. The address coding capability automatically assigns an address to a specific area eliminating the manual assignment of an address by either the applicant or a central office staff. In theory, the traffic analysis zone is a natural for carpool and buspool matching, as its size



Washington, D.C. Two Density Grid System
Map 1
(2/3 actual size)

Figure 4

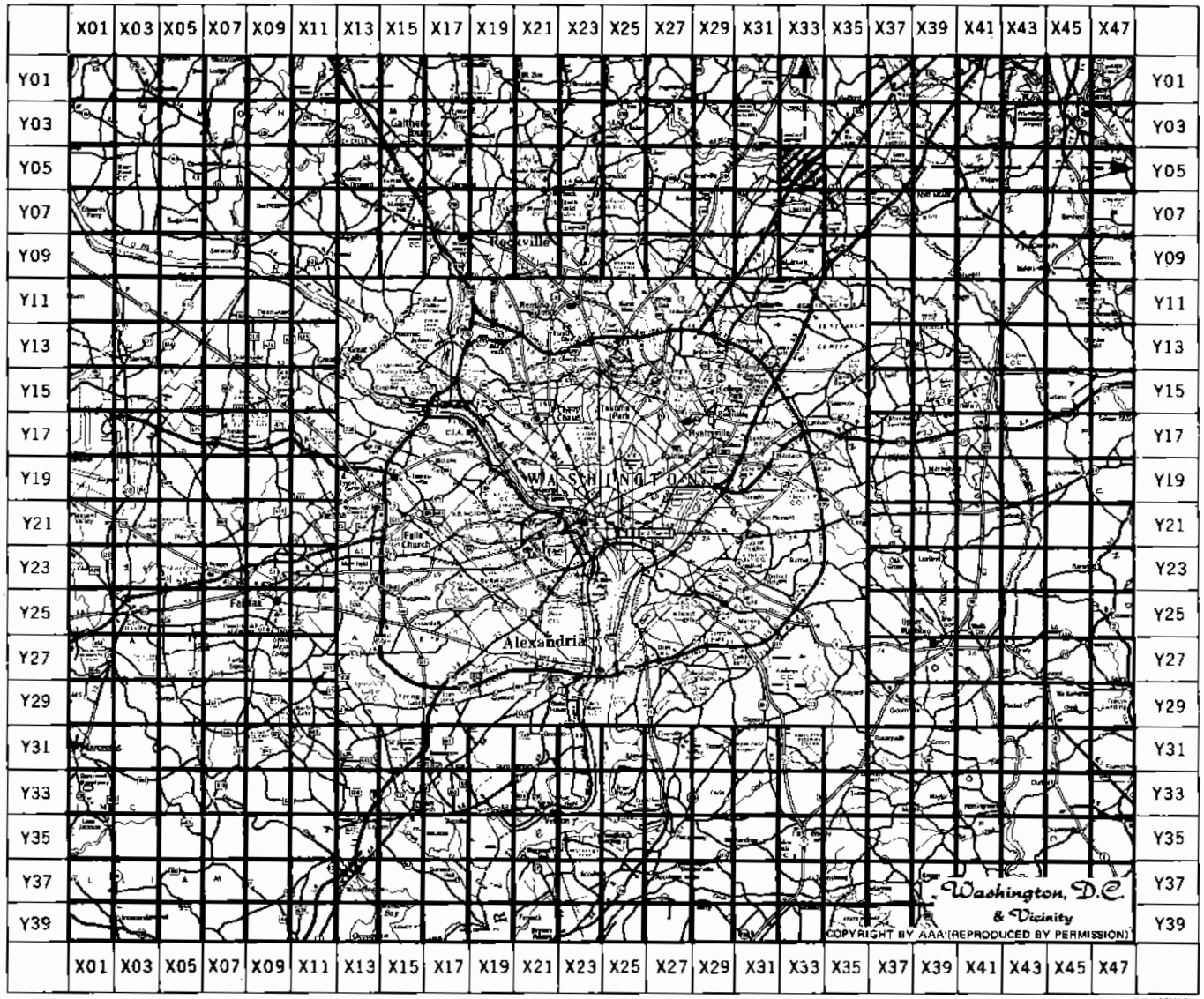
MAP 1

THIS SERIES OF TWO MAPS WILL PERMIT YOU TO SELECT THE GRID YOU RESIDE IN.

PLEASE DETERMINE YOUR HOME GRID AND PRINT THE X & Y GRID NUMBERS IN THE APPROPRIATE BLOCKS ON THE DATA FORM.

MAP NO. 1 INCLUDES THE ENTIRE METROPOLITAN AREA WITHIN THE CAPITAL BELTWAY & APPROXIMATELY 2 MILES BEYOND THE CAPITAL BELTWAY.

EXAMPLE MAP 1
IF YOU LIVED AT THE PENTAGON (SEE SHADED AREA) YOUR GRID WOULD BE X24 -Y23



Washington, D.C. Two Density Grid System
Map 2
(2/3 actual size)

Figure 5

MAP 2

MAP NO. 2 INCLUDES A CONSIDERABLY LARGER AREA FOR PERSONS LIVING BEYOND THE LIMITS OF MAP 1.

IF YOU LIVE BEYOND THE APPROXIMATE 20 - 25 MILE LIMITS OF MAP 2, SELECT THE GRID AT WHICH YOU TYPICALLY ENTER THIS MAP WHEN COMMUTING TO WORK.

EXAMPLE MAP 2
IF YOU LIVE IN LAUREL MD. (SEE SHADED AREA) YOUR GRID WOULD BE X33 - Y05.

IF YOU ARE UNABLE TO DETERMINE YOUR HOME GRID, LEAVE IT BLANK ON THE FORM AND IT WILL BE ADDED.

NUMBER OF PERSONS IN EACH HOME GRID REPORTING TO GRID X24Y21 AT 8:15 A.M.

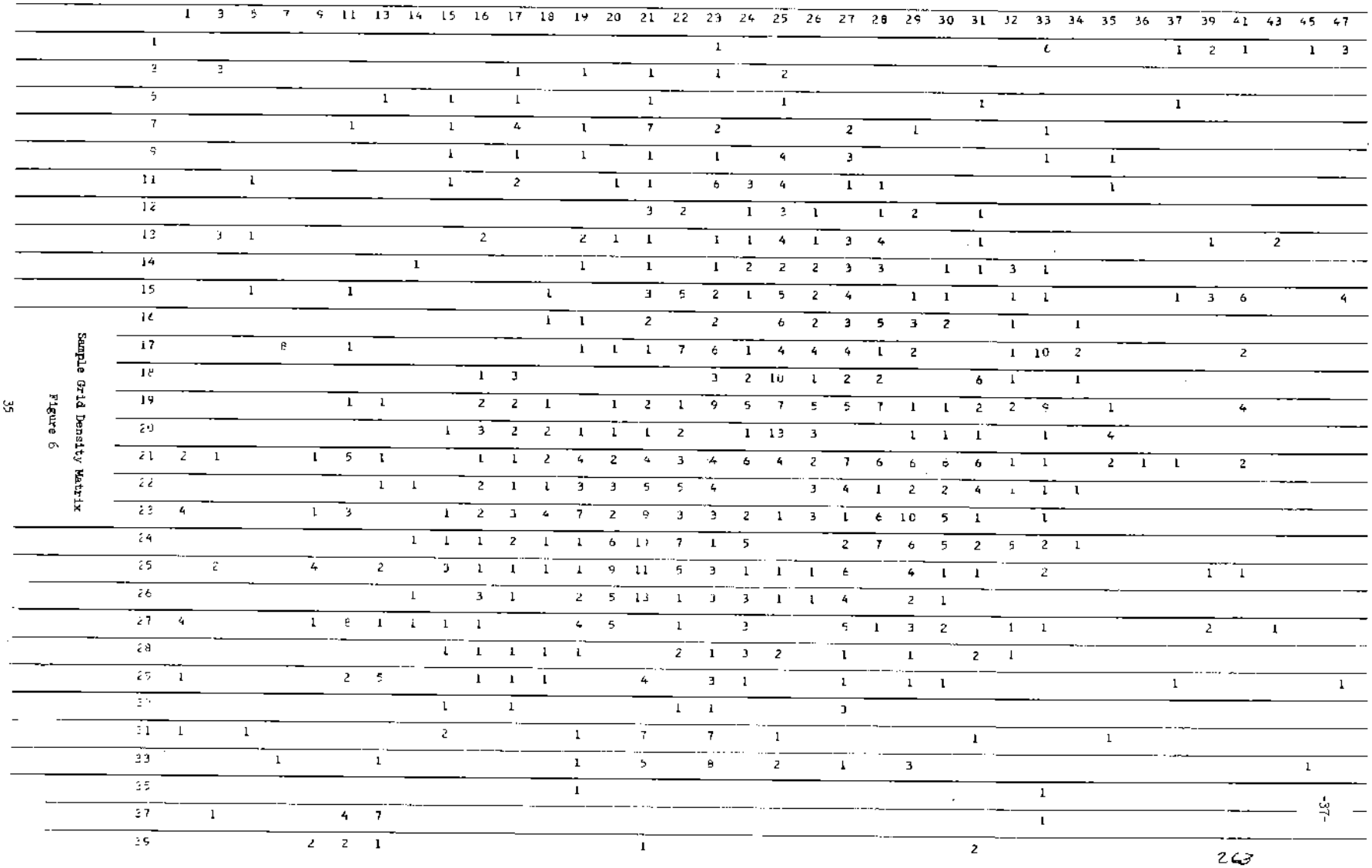


Figure 6
Sample Grid Density Matrix

varies with the number of trips it generates. Also, the travel analysis zone generally does not cross major barriers, such as rivers, parks, and major freeways.

The Bureau of the Census matching program is an example of a program based on census tracts. Through the use of automatic address coding, participants are assigned to census tracts. Matches are made by a search of a participant's home census tract and surrounding tracts if necessary for a minimum number of matches.

The choice of type of computerized program to use will depend to a large extent on the availability and accessibility of certain factors such as Census DIME/GBF reference files, computer capability and degree of matching sophistication required. Another point to keep in mind is that the most sophisticated matching process need not be the best solution for every situation. A very simple process can be extremely effective, if carried out within an ambitious and comprehensive overall carpool/buspool program.

3. Distributing suggested pool combinations

After the potential matches are selected by either the manual or computer process, the emphasis turns to distribution of this information. Distribution techniques vary with the program's size and with suggested approaches including personal contact, mail, and master lists.

The personal contact technique is believed to be the most successful. It brings together 50 to 100 potential carpool members of a part of the region for a "coffee hour." This coffee hour is simply an extended regular coffee break allowing the potential carpool partners to discuss special arrangements in forming new carpools. The informal coffee hour may start with a pep talk on the carpool program followed by questions. The carpool listings may be distributed before or during the meeting and a master list maintained at selected points for further references. Mailing or internal routing systems should be utilized along with or where the personal contact method is not feasible.

D. Continuing Service

The continuing service phase is extremely important in maintaining or increasing the occupancy rates derived from the initial matching effort. Vacancies will still exist in carpools and others will

develop quickly due to personnel turnover and changing living patterns. Such changes represent a source of empty seats available for meeting the employee's ever changing commuting needs. This last phase in a comprehensive carpool program serves changing commuting needs by providing readily available master lists, which are periodically updated.

These master lists should include a high percent of all employees' TOD needs whether carpooling or not. To be effective, the availability of this service must be well recognized by all employees.

The effort required to update the master lists depends on factors such as: the rate of employee turnover; parking permit requirements; number of employees; and percent of employees under a parking management control plan. Essentially, there are two basic approaches:

1. Use of existing data sources
2. Resurvey of all employees

Use of existing data sources such as personnel records and parking permit applications should be fully explored. The information required is the same as that on the master list for each individual. It may be possible to have each new employee indicate his willingness to participate by filling out one of the initial matching forms at the time of personnel processing. Arrangements to obtain changes in employee addresses and phone numbers should be explored.

Where virtually all persons within a given matching program park under a centrally controlled parking management plan, the information on parking permit applications should be used. Sufficient information is frequently available where carpool size is required for parking priorities, as each application must identify all carpool partners (Figure 7). As new applications are received, all names can be compared and corrections made as well as including new names. No name should be eliminated unless it is clear that an employee has moved from the area as he may have switched modes.

When a sufficient number of changes are obtained from the above sources, the original computer card deck can be updated and the entire computer matching program run to produce a new master listing.

The use of existing data sources may not be possible due to problems with obtaining the information from personnel offices, or a parking situation where employees utilize private and public parking at many locations. The approach then to maintain an up-to-date master listing involves periodic resurveying of all employees in a manner similar to the initial effort. While this approach

1. PERMIT NO.	2. DATE SUBMITTED	3. APPLICATION TYPE A ☐ NEW C ☐ WITHDRAWN B ☐ CHANGE D ☐ LOST	4. PARKING LOCATION (Number in order of preference) A___DOT HQ B___FOB 10A C___BUZ PT	5. NO CAR POOL MEM (Incl applicant)
6. PRIORITY GROUP (Check one) A ☐ PHYSICAL HANDICAP C ☐ OVERTIME E ☐ CAR POOL B ☐ SUPERGRADE/EQUIV D ☐ SHIFT WORK F ☐ INDIVIDUAL			7. GRADE/RANK	8. DATE PERMIT ISSUED

9. APPLICANT NAME (Last, First and MI)	10. ADM	11. RTE SYM	12. EXT	13. EMPL NO*	14. COMPLETE ADDRESS (No. and St., City, State and Zip Code)

15. CAR POOL MEMBER INFORMATION (DO NOT INCLUDE APPLICANT) ADDITIONAL SPACE ON REVERSE

	A. CAR POOL MEMBER NAME (Last, First, MI) AND SIGNATURE (See Caution Below)	B. ADM	C. RTE SYM	D. EXT	E. EMPL NO*	F. COMPLETE ADDRESS (No. and St., City, State and Zip Code)
1						
2						
3						

16. AUTHORIZING OFFICIAL	A. DURATION OF CERTIFICATION	17. APPLICANT—I CERTIFY THAT ALL STATEMENTS ABOVE ARE TRUE. (See Caution Below Before Signing)	
B. SIGNATURE	C. DATE	A. SIGNATURE OF APPLICANT	B. DATE

NAME OF APPLICANT (Last, First and MI)	OFFICE EXTENSION	FOR DOT USE	PERMIT NUMBER

PLEASE TYPE (SEE INSTRUCTIONS ON REVERSE SIDE) SHADED AREAS FOR DOT USE (DO NOT COMPLETE)

CAUTION: Falsification of information or signature, or inclusion of employees not participating as regular members of this car pool will result in revocation of parking privileges and may be grounds for disciplinary action as provided for in DOT 1700.19B. Regular members are those employees who ride to and from work each day in this car pool and do not include part-time or casual riders.

Form DOT F 1700.9.1 (3-73) Supersedes previous edition **OFFICIAL PARKING APPLICATION—CAR POOL**

REMARKS/VIOLATION RECORD:

VALIDATION TIME/DATE STAMP

	A. CAR POOL MEMBER NAME (Last, First, MI) AND SIGNATURE (See Caution)	B. ADM	C. RTE SYM	D. EXT	E. EMPL NO.*	F. COMPLETE ADDRESS (No. and St., City, State and Zip Code)
4						
5						
6						
7						
8						

INSTRUCTIONS

1. Please type application. Complete fully—incomplete applications will be returned.
2. New or change application:

Items 3 thru 7, 9 thru 14 and 17 completed by applicant.
Item 15 completed by car pool members.
Item 16 leave blank.

3. Withdrawal application or certification of lost permit: Items 3, 9 and 17 only are to be completed.

* Military applicants use Social Security Number, all others use payroll employee number.

Figure 7
Parking Permit Application

certainly involves more effort in terms of distributing and collecting survey forms and keypunching data, it has the advantage of providing an opportunity to show management's continuing support of the program to employees. It also provides the opportunity to refine the initial effort to better serve the needs based on the experience gained.

IV. CONCLUSION

There is no magic combination and success will be dependent upon sincere efforts to adopt these general concepts. Independence of the commuter, that is the desire of driving alone, is difficult to assess, but appears to be less important than many believe. The necessity for taking steps to alleviate the "energy crunch" makes this still less important. Based on successful examples, the commuter will leave the automobile at home more often when convenient door-to-door alternatives are available. Generally, the acceptable carpool and buspool serves as an alternative to the individually driven automobile.

A comprehensive carpool-buspool program, in addition to matching commuters with similar time-origin-destination needs, should include public information, incentive, and continuing service phases. Successful programs effectively utilizing these phases have demonstrated the commuter's acceptance in pooling where the amenities are comparable to the best alternative. In fact, successful carpool programs in various large metropolitan areas average around three persons per car, double the typical averages, and buspool programs sport phenomenal growth rates.

Larger employment areas should be able to employ both carpool and buspool concepts simultaneously. By reviewing carpool matching programs for employee concentrations in specific residential areas, valuable information may be provided to bus companies or citizen groups for establishing buspool routes. Implementation of these programs requires relatively short lead time and is low in cost as it essentially utilizes existing facilities more effectively.

APPENDIX A

Introduction to the FHWA Computer Program for Carpool Matching

The following discussion is intended to afford persons interested in computerized carpool/buspool matching programs a brief description of the FHWA matching program. A complete user and program documentation, as well as the program itself, is available.

The FHWA program is written in American National Standard COBOL and thus should be readily transferable to environments other than the IBM 360/65 (O.S.) under which it has been developed and tested. The version now available is considered the first generation in what is expected to be a rapidly evolving program area. The matching logic is quite simple and some potential users may find that it is not applicable to their situation. One should be cautioned, however, against placing unwarranted importance on having a sophisticated matching process. A very simple process can be extremely effective if carried out within an ambitious and comprehensive overall carpool/buspool program.

A. The Grid System

The matching process is based on a grid system overlaid on urban area maps to which home and work locations are manually coded, usually by the applicant himself. The X and Y numbers of the home and work grids are used in the matching process. An example of such a grid system is shown in Figure A-1. Note the following with respect to this system.

1. Overall boundaries must be rectangular and grid cells should be square for optimum use in the program, but they can be rectangular.

2. Only integer values may be used for X and Y coordinates.

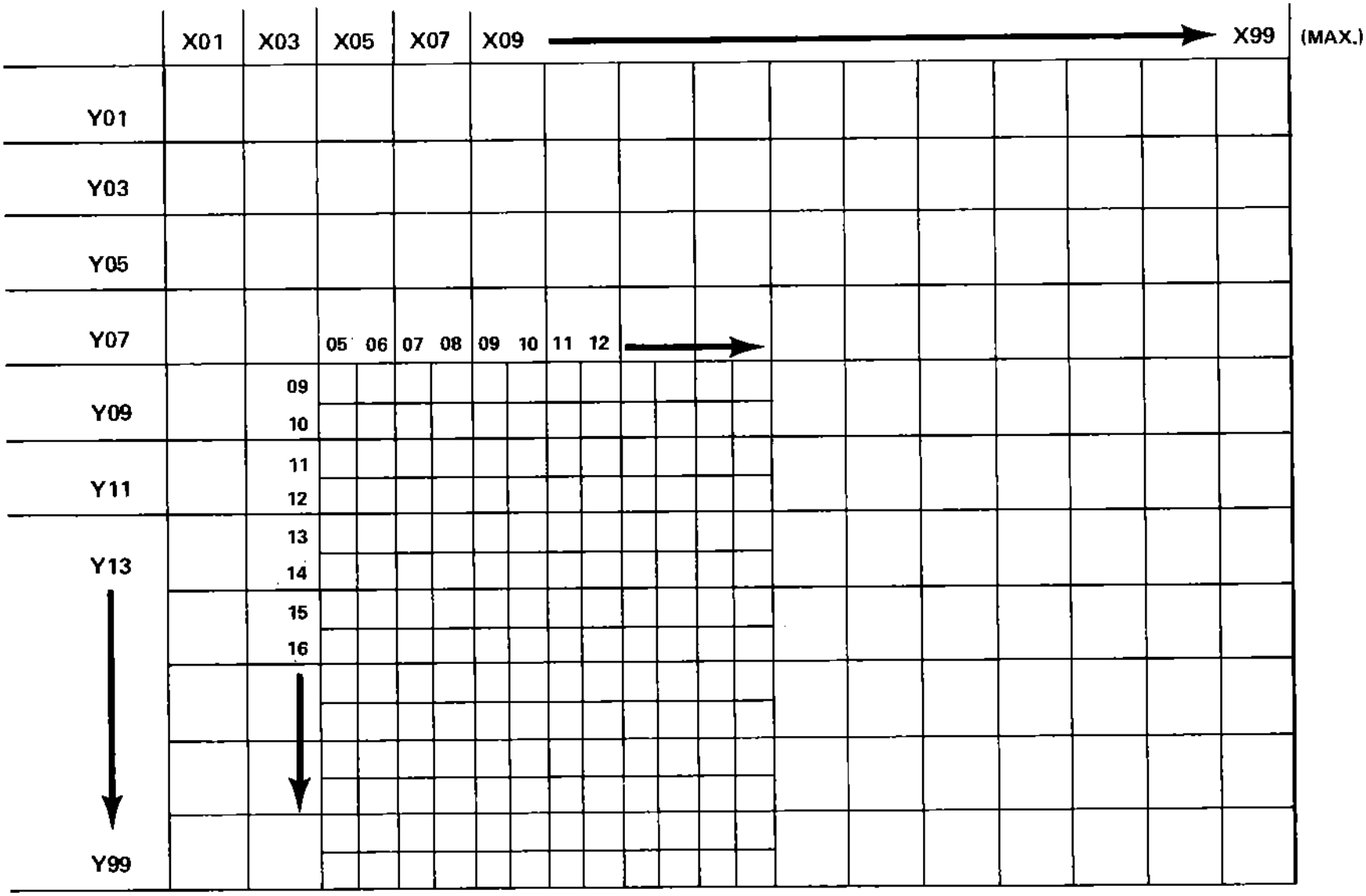
3. For 1 Density Grid System:

   X and Y coordinates are numbered consecutively from 01 to a possible maximum of 99, although the maximum coordinates must be odd integers.

4. For 2 Density Grid System:

   a. Two grid densities may be used, but the cells in the outer grid system must be twice the dimensions of the inner grid system, as in the example in Figure A-1. This affects a density ratio of 4:1.1/

1/ The inner grid, (for instance, 1 sq. mile) is intended to allow for higher density areas, such as downtown, and completely developed residential areas while the outer grid (for instance, 4 sq. miles) is applicable to sparsely developed or rural areas.



EXAMPLE OF GRID SYSTEM

Figure A-1

b. The inner grid system may be placed anywhere within the outer system, not necessarily as shown in the example.

c. The lowest X and Y inner-grid coordinate values must be odd numbers.

d. The highest X and Y inner-grid coordinate values must be even numbers.

e. The X and Y outer-grid coordinate values must be odd numbers with a possible maximum of 99.

Within these limitations, the user can adapt the grid system to the local situation as desired.2/

B. The Program Package

There are four segments in the program, any or all of which may be called for by the user in any one run. These are called:

1. "Update" - Builds or updates a basic sequential file of participants in the matching program. Edits and prints list of rejected data cards.

2. "Process" - Processes the basic sequential file into files specially indexed to facilitate the operations called for in the remaining two segments.

3. "Lists" - Produces the matched output under any one of three options:

   a. "Master" - Produces a master matched listing of all participants for retention and use of the operating office.

   b. "Mail" - Produces individual listings for all participants, showing their potential carpool mates, to be "mailed out."

   c. "Requests" - Produces individual listings for selected participants as requested by the user. This option would most frequently be used to produce a listing for a newcomer without having to use the "Mail" option which would produce lists for all participants.

2/ When selecting the orientation of the grid system, the user should consider any benefits that could be derived from conformance with the major axis of existing coordinate systems. For example, the possibility of using automatic address coding in the future may make it desirable to aline the grid system with one of the coordinate systems used in the CENSUS DIME (Dual Independent Map Encoding) files. These systems are: (1) State Plane, (2) Mapset Miles, and (3) Latitude and Longitude.

This can also be used to produce a list of potential carpool mates along the route of a participant rather than near his home grid. This is done by specifying each grid cell that his route passes through.3/

4. "Density" - Produces graphical home grid printouts, selected according to reporting or departing time and work grid, showing total participants in each home grid cell. This indicates visually the distribution of trip beginnings and their densities. It is primarily useful for examining possible "vanpools" and "buspools" or as an aid to study conventional bus routing and scheduling.

C. The Matching Logic

This section describes the logic used under the "Lists" segment, "Mail" option, which is the major matching operation. The "Requests" option uses a similar matching logic in the normal case where a newcomer is being processed.

For each participant, a listing is produced which is determined according to the following process:

All participants who live in the same home cell, work in the same work cell, and arrive and depart within a specific range of time are identified. If there are less than eight participants in a home cell4/ all participants in adjacent home cells (usually eight cells) who work at the same work cell are added to the list. Otherwise, only the basic home cell with at least eight participants is listed.

With respect to this process, the following should be noted:

1. Multiple work places are recognized and matched separately.

2. Multiple work times are recognized in the matching process. The user can specify a range (e.g., plus or minus 15 minutes) and listings produced will include matches within this range for each person. Specific times can be matched separately by maintaining separate files.

3. The search at the home end extends only to the adjacent cells (usually eight) and all adjacent cells are taken at once if the minimum number is not reached in the home cell. There is no graduated expansion. There is no expansion beyond the immediate adjacent cells.

3/ This would be a fairly cumbersome process to apply to a large number (or all) participants since each grid cell on the route must be externally determined and input.

4/ This number is set at eight in the current program version. It is not an input parameter but could be changed by a substitution of approximately 10 cards in the program deck.

4. There is no search at the work end. Each work place cell is matched as an independent unit.

D. Planned Improvements

In the near future, the present carpool matching capabilities of the program will be expanded to produce a carpool and transit information system. The carpool section of the new program will include as a minimum, the following improvements.

1. Adaptation of computerized address coding using the Census Bureau DIME files and ADMATCH program to eliminate the manual coding to cells required in the present program. It should, however, have a user option to bypass the automatic coding feature so that manually coded input can also be used.

2. Inclusion of an "along-the-route" matching option that is more highly automated than is possible in the present program.

3. Inclusion of a work end-search similar to the home end-search.

4. Improvement of the home end-search to expand first to participants in adjacent cells having the same work time, then to consider earlier and later work times if a minimum number of matches is not met.

5. The ability of the "mail" option to be run only for selected times, employers, and/or work cells, instead of all times, employees, and work cells as in the present program.

6. A change from a sequential listing of the carpool master file to an alphabetical listing by first and last name.

7. The ability of the "mail" option to sort and group by agency, department, or division code before printing the individual lists.

8. The ability of the "master" option to print the adjacent grid cells for empty grid cells as a reference for newcomers to use when checking the master list. This ability should be provided as a secondary option.

9. The ability of the "density" option to produce matrices at user-set time intervals.

The transit information section of the program will provide the commuter with route numbers, boarding and alighting points, scheduling and other identification information. This new program is intended to provide a commuter with as much information as possible about available ride sharing opportunities.

Input Description

The input into this program consists of two data cards per participant and seven parameter cards. The data cards require such information as the participant's name, address, social security or employee number, home and work grid coordinates, reporting and departing times, desire to carpool, and an optional area where additional data such as home or office telephone number, office room number, and mail routing code can be included for use in the output listings.

The parameter cards permit the user to select program options that will be applicable to particular situations. Such decisions as to the size of the grid system, whether to use the one or two density system, the type of output list (master, mail, or requests), and the output format are programed with these seven parameter cards.

Output Description

The output from this program can take two forms; grid lists and a grid density matrix. The grid lists include a master list, mail list, and request list. Each list serves a different function and thus the information is output in a slightly different format.

For each designated work cell, the master list option will print the following information for all participants having this common destination: name, address (including city, State, zip code), home grid coordinates, arrival and departure times, and any information appearing in the optional input field. The output will be sorted according to work and home grid cells, and arrival and departure times.

The mail list contains the same information as the master list, except that participants will be matched according to arrival and departure times. A participant will be matched with all other participants in his home grid cell having a common work cell and an arrival and departure time within a predetermined range. An address block will be printed on the top of each participant's list, giving his name, address, and any other requested information, such as an office mail routing code, that has been recorded in the optional input field. A message area can also be added at the end of each individual's listing to convey special instructions or messages (Figure 3). The output can be made to sort on any item(s) in the optional area.

The request list is identical in form to the mail list. This option is used to obtain either additional mail list copies for certain participants (e.g., newcomers) or "along the route" listings as described earlier.

If, during the printing of any of these three types of lists, there are any home grid cells with less than eight participants residing within them, the information on the participants residing in the adjacent grid cells (usually eight) will also be printed. This will give a participant in a low density area a suitable size list of participants living near him.

The other output form, the grid density matrix, will give a visual representation of the number of participants residing in each home grid cell who have a common work grid and reporting or departing time (all times are rounded off to nearest 15-minute interval). An example of a density matrix appears on page 35. (Figure 6).

The user and program documentations, along with the computer program itself are available from the:

Chief, Urban Planning Division
Federal Highway Administration
Attention: HHP-26
Washington, D.C. 20590

Anyone interested in obtaining the FHWA Carpool Matching Program should send a magnetic tape of at least 300 feet. The program load module and source deck can be copied onto a 9-track tape with 800 or 1600 bpi. The source deck can be copied onto a 7-track tape with 556 or 800 bpi. Please specify the track size and number of bpi.

The new Urban Transportation Planning Battery also contains the latest version of the FHWA Carpool Matching Program. It is recommended that anyone in the transportation planning field request the entire BACKPAC tape, which contains other useful programs. A 2400 foot magnetic tape is needed for the BACKPAC programs.

There is no charge for this service to either public or private agencies or groups who will use the program as a nonprofit public service, since this is in the public interest. All others must pay a $40 labor and computer time charge to reimburse the government for copying each tape.

APPENDIX B

Biliography of Related Carpool/Buspool Publications

The following publications can be obtained free from:

Federal Highway Administration
Attention: HHP-26
Washington, D.C. 20590

1. Carpooling Case Studies: Computerized Carpool Matching at FHWA Headquarters and Baltimore Federal Executive Board Carpooling Pilot Project, Federal Highway Administration, January 1974

2. Incentives to Carpooling, U.S. Department of Transportation, January 1974

3. Preferential Treatment for High Occupancy Vehicles, Federal Highway Administration, April 1974

4. Highway Users Federation, Carpools and Buses, Washington, D.C., 1973

5. Guidelines on the Operation of Subscription Bus Services, Urban Mass Transportation Administration, August 1974

6. Owens, Robert D., and Sever; The 3M Company Commute-A-Van Program, St. Paul, Minnesota, May 1974

7. Manual Carpooling Matching Methods, U.S. Department of Transportation, January 1974

8. Review of Matching Software and Procedures, U.S. Department of Transportation, January 1974

9. User Documentation for the FHWA Carpool Matching Program, Federal Highway Administration, January 1974

10. Program Documentation for the FHWA Carpool Matching Program, Federal Highway Administration, January 1974

11. Transit/Taxi Coordination, U.S. Department of Transportation, January 1974

12. Vanpools, U.S. Department of Transportation, January 1974

13. Buspools, U.S. Department of Transportation, January 1974

14. Organization for Carpooling, U.S. Department of Transportation, January 1974

15. Legal and Institutional Issues of Carpooling, U.S. Department of Transportation, January 1974

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