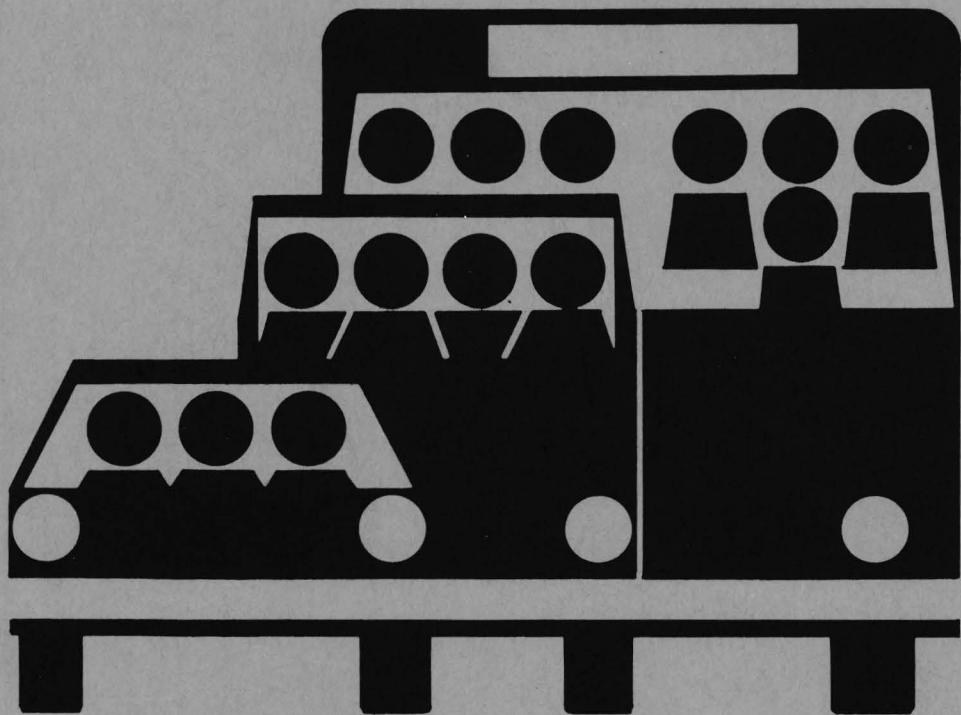# Review of Matching Software and Procedures

U.S. Department of Transportation

January 1974

PREFACE

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

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

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

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

DISCLAIMER

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

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

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REVIEW OF MATCHING SOFTWARE AND PROCEDURES

INTRODUCTION

Over the past several years there has been a growing interest in organized carpooling as a technique to take maximum advantage of the people moving capacity of our streets and highways and to reduce auto emissions. With the advent of the energy crisis this interest has been stimulated with carpooling seen as a method to assist in conserving fuel supplies and reducing travel costs while maintaining mobility.

Successful carpooling operations have many aspects including employer organization and encouragement, public information, public and private incentives and techniques for making individuals aware of potential carpool mates. One matching technique applicable to larger groups (say, 500 or more) is the use of computerized automated matching programs.

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

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

This report attempts to fill this gap. The inventory included in the report represents the status of carpool software as of January 1, 1974. It discusses the range of applicability of the various programs, the status and scope of program documentation, the extent to which each program has been used, the language in which each is written, the computer facilities required, an estimate of program run-times, and the types of reports produced. In addition, the name of a contact

individual is given so that more detailed and current information may be obtained if desired.

DESCRIPTIVE PARAMETERS

During the process of contacting the various users and developers of carpool matching software it quickly became evident that while all the software performed basically the same function, the techniques for performing carpool matching were sometimes quite unique. In order to standardize the cataloging of the software it was decided to group the data concerning each program into five categories: software status, capability summary, documentation, system management, and limitations. Some of these categories are in turn subdivided into various subtopics where appropriate. In addition to these categories the name, address and phone number of a primary contact are included.

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

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

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

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

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

RESULTS

During the data collection phase of this task as many identifiable users of carpooling software and other informed persons as practical were contacted. There have been some duplications of development effort as some organizations have or are currently developing their own software. Since most of these individual efforts are unique to a particular situation they do not have broad enough appeal to be considered as candidates for wide distribution. There are, however, some rather unique ongoing efforts that deserve to be singled out for closer examination because of a strong capability in one or more areas. These programs are operational in one or more installations.

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

Since this document will require constant updating to accommodate new software, the revision to existing software, and to correct errors in the existing information, please feel free to contact the Department of Transportation with your information.

TABLE 1 - STATUS AND SYSTEM SUMMARY

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

-- Unknown or missing information
*These data are not necessarily comparable

TABLE 1 - CONTINUED

Organization	Language	Host Computer	Core Required	Disk/ Tape	Time Matches	Documentation
Connecticut Commuter Program	ANSI FORTRAN	UNIVAC 1108	32K (Words)	-/-	--	Very limited
WBZ/ALA	RPG	IBM 360/70	20K	0/0	--	User Guide

TABLE 2 - CAPABILITIES SUMMARY

| Organization | Geo coding | Matching | | Reporting | | | File Maintenance |
		Geographic	Compatability	Master List	Match List	Van or Buspool	
FHWA	49 x 49 bi-level grid	Many-to-one grid cluster at O	Time	All or nothing	All or nothing	Yes	Reformat of files required for adds, deletes and changes
Census	Address match to census tracts	Many-to-one tract cluster at O	Time and driver/pass.	All or nothing	All or nothing	No	None furnished
AAT-Detroit	Machine read X-Y coordinates	Many-to-one coordinate cluster at O	--	Yes	Yes	Yes	--
Operation Energy	99 x 99 grid 99 work sites	Many-to-one cluster at O	Time	Selected	Selected	Yes	Complete
UCLA	Looked-up box-and-page	Many-to-one clusters of box and page	Time	Selected	Selected	Yes	Clumsy
Washington COG	50 x 50 grid	Many-to-one grid cluster at O	Time and Drive/Pass.	All or nothing	All or nothing	Yes	Clumsy
Denver GWHS	Scaled X-Y coordinates	Many-to-one coordinate cluster at O	None	All or nothing	All or nothing	None furnished	Complete

-- indicates missing information   O = origin end of trip   D = destination end

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TABLE 2 - CONTINUED

| Organization | Geo-coding | Matching | | Reporting | | | File Maintenance |
		Geographic	Compatability	Master List	Match List	Van or Buspool	
Connecticut Commuter Program	Hand coded to traffic zones	Many-to-one	Time	Yes	Form letter	None	Manually (sort utility required)
WBZ/ALA	ZIP codes	Many-to-one	Time Rider/Driver	Yes	Form letter	None	Deletes and adds required for changes

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Organization/Name	U. S. Department of Transportation FHWA/Carpool Matching Program	

Contact

Bob Redmond
Federal Highway Administration
Urban Planning Division

Washington, D. C. 20590
Phone: (202) 426-0210

Software Status

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

Capability Summary

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

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

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

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

Documentation

Full documentation is available for both user and program.

System Management

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

Limitations

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

Some of these limitations have been circumvented by various users:

(1)   The University of Tennessee has implemented a 100 x 100 grid system

(2)   The City of Los Angeles has reduced the volume of the printouts and is looking at making some of them optional

(3)   Utah has implemented the program on a Honeywell computer.

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

Contact   Ron Crellin
                     Bureau of the Census
                     Washington, D. C.
                     Phone: (301) 761-7533

Software Status   Inquiry Date: 1/3/74
                     First Used: 1973
                     Current Version: 1973
                     Installed at: Los Angeles County Board of
                                        Supervisors
                     Language: COBOL
                                        FORTRAN
                                        PL/1
                                        ALC
                     Computer: IBM 360/65
                     Core Required: 110K
                     Tape Required: 2
                     Disk Required: --
                     Time Required: 40 minutes
                     Test Case: 5000 matches
                     Note: This system makes maximum
                                        use of the IBM utility program
                                        SORT/MERGE

Capability Summary

Geo-coding--Geo-coding of the carpool candidates' origin requires
a two-step process. First, the candidate file (containing the
addresses) are combined with the DIME/GBF Reference File to
obtain a new Candidate File with candidates matched to census tract.
Second, the center-point coordinates of all census tracts are placed
in a Center-Point File.

Matching--The many-to-one, location/time matching of candidate
poolmates is a four-step process. First, the number of candidates
for each census tract is determined from the Candidate File and the
Center-Point File. If the minimum number of candidates (an input
parameter) falls within any census tract it is placed in the Domain
File; if not, the surrounding tracts are combined with the original
tract until the minimum number is reached. This cluster of tracts
is then added to the Domain File. This Domain File contains
matched sets of domain numbers and census tracts. Third, the

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Domain File is matched to the tracts in the Candidate File to form a Candidate Domain File by assigning domain numbers to each candidate in the file. Finally, on a domain-by-domain basis a series of non-geographic matches (e.g., temporal) are isolated and the results written on the Matched Candidate File.

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

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

Documentation

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

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

System Management

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

Limitations

Any area that has not been tracted or does not have an up-to-date GBF/DIME file cannot use the program. It would be difficult to transport the software to another IBM 360/370 installation, much less to another computer, due to the intricate JCL required and the reliance upon IBM utility routines.

Organization/Name   American Academy of Transportation/AAT Detroit

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

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

Capability Summary

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

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

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

File Maintenance--The file maintenance capabilities are unknown.

Documentation

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

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

System Management

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

Limitations

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

Organization/Name   Operation Energy

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

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

Capability Summary

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

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

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

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

Documentation

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

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

System Management

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

Limitations

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

Organization/Name   UCLA

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

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

Capability Summary

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

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

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

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

Documentation

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

<u>Programmer documentation</u>--We assume that the program documen-
tation is sparce since this appears to have been a student project
without much outside financial support.

System Management

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

Limitations

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

Organization/Name   Washington COG/Carpool Program

Contact   Jack Barrett
Washington Council of Governments
1225 Connecticut Avenue, N.W.
Washington, D. C. 20036
Phone: (202) 223-6800 x248

Software Status

Inquiry Date:	1/3/74
First Used:	August 1973
Current Version:	1973
Installed at:	Washington Council of Governments
Language:	COBOL Utility Sorts
Computer:	IBM 370/158
Core Required:	Approximately 100K
Tape Required:	Several
Disk Required:	Presently disk sort (no-random access needed)
Time Required:	17 minutes
Test Case:	1300 people

Capability Summary

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

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

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

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

Documentation

User documentation-- In preparation

Program documentation--Insufficient

System Management

Requires someone with a fair knowledge of systems to initially run the carpooling program.

Limitations

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

Organization/Name   Denver GWHS/Carpool Program

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

Software Status   Inquiry Date: 12/20/73
                    First Used: 1973
                    Current Version: 1/74
                    Installed at: George Washington High School
                    Language: FORTRAN
                    Computer: UNIVAC 1106 (Time Sharing)
                    Core Required: 32K words/2000 people
                    Tapes Required: None
                    Disk Required: Program Residence
                    Time Required: 1 second per match
                    Test Case: 1800 matches

Capability Summary

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

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

1. Reads and sorts all data in core

2. Searches for all possible destinations in increments
    of one tenth of a mile until it finds four matches (2-mile
    maximum)

3. If it cannot find four possible riders it will go into a
    "radar search" where it will search in one degree
    increments up to five degrees all people along the path
    to the point of destination

4. It then prints all selected carpoolers.

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

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

Documentation

None

System Management

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

Limitations

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

Organization/Name   Connecticut Commuter Program

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

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

Capability Summary

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

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

1.   Questionnaires are distributed to employees at the same
      time promotional efforts are initiated

2.   Coding procedures are applied to identify the town of
      origin, location of employment, working hours, existing
      mode of transportation and coder's unique number

3.   Data is sorted onto a master file and edited for errors

4.   Errors are corrected and updated master file is created

5.   The master file is sorted and matched for origin, desti-
      nation and time of day and a page of printed output is
      generated for each employee in the form of a letter

6.   The letter is distributed to each employee

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

Documentation

Program and user documentation is very limited and not explicit.

System Management

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

Limitations

The program has an updating process if corrections or more people are added to the data base file. However, if new people are added to the master file the data base must be sorted again and so on through the entire process of matching all people rather than matching a selected few. The system data base file contains 200 characters per record for each person and is maintained throughout the entire matching process. This generates an excessive amount of I/O time. Because the zones are on a very large scale, perhaps the program could be used for "park and ride" bus- or vanpool service as opposed to carpooling. There is a large amount of coding involved when processing employees.

Organization/Name WBZ/ALA Commuter Computer Campaign

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

Software Status

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

Capability Summary

Geo-coding--The program uses ZIP codes for the home end of the trip and there are 36 possible "desired" destinations.

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

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

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

Documentation

User documentation--complete

Program documentation--unknown

System Management

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

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Limitations

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

TABLE 3 - OTHER CARPOOL SOFTWARE DEVELOPMENT EFFORT AND USERS

ORGANIZATION	CONTACT/DATE	COMPUTER/ PROGRAM STATUS	REMARKS
Michigan DOT Lansing, Mich.	Larry Britton (517) 373-2316 12/28/73	Burroughs/5700 Development	Couldn't get FHWA Program running. Are developing their own program. Many to one match. Uses grid squares.
New York State Dept. of Transportation Albany, N.Y. 12226	Fred Genero (518) 474-8232 12/28/73	Burroughs/5700 Completed	Modified FHWA Program. Developed sort to list utility programs.
American Automotive Association Philadelphia, Penna	Bertrand Clotheir (215) 864-5000 12/28/73	IBM 360/40 (128K) Not Finished	FHWA Program too large. Are developing own programs on many to many match.
Management Information Systems Penn. DOT Harrisburg, Penna.	Terry Mosser (717) 787-3307 12/28/73	Burroughs/6700 Completed	Running FHWA Program. No No modifications. Also wrote own programs
University of Tennessee Knoxville, Tenn.	Tom Bennett (615) 974-5311 12/28/73	UNIVAC 1106/ Completed	Make several changes to FHWA Program.
Dept. of Traffic City of Los Angeles Los Angeles, Calif.	Ed Rowe (213) 485-2788 12/28/73	IBM 360	Modified FHWA Program.
Northern Virginia Transportation Commission		Wash. COG's Computer	Served as test case for COG's areawide program. Test results unknown.

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TABLE 3 - CONTINUED

ORGANIZATION	CONTACT	COMPUTER	REMARKS
Aerojet Los Angeles	I. Doshey 12/28/73	IBM 360, 300K FORTRAN	Does grid system, matched pool listing, van pool data, space documentation
Automatic Data Processing (Los Angeles)	B. Shaw 12/28/73	IBM 360, 64K COBOL 1,000 matches	Uses grid for destination, ZIP for origin, matched pool listing, sparce documentation
CALTRANS	J. Kenen (213) 620-4815 12/28/73	IBM 360, 60K FORTRAN	Uses coordinates for matching, matched pool listings, sparce documentation
COMPUTRANSIT	B. Goldstine (213) 922-3998 12/28/73	IBM 360, 128K PL/1 2000 matches	Uses grid system, matched pool listings, sparce documentation
Operation Oxygen	J. Novack (213) 351-3551 12/28/73	Burroughs, 24K COBOL 1000 matches	Uses grid system, matched pool listing, sparce documentation
U.S. Bureau of Standards, Md.	Judy Gilsinn (301) 921-3481 12/28/73	Univac 1108 FORTRAN	Uses coordinates, matched pool listings, sparce documentation

*Data obtained from an evaluation performed by the City of Los Angeles