FINAL REPORT

EVALUATION OF MICROCOMPUTER APPLICATIONS IN TRANSPORTATION ENGINEERING

by

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(The opinions, findings, and conclusions expressed in this report are those of the author and not necessarily those of the sponsoring agencies.)

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SUMMARY

This study investigated areas where microcomputers can aid in the effectiveness of transportation engineering at state and local levels. A survey of the microcomputer needs of transportation professionals in state and local agencies in Virginia was conducted. Overall, traffic engineers, public transit operators, and transportation planners indicated a strong interest in programs associated with their specialties and, in some cases, an interest in related areas. Sources of and information on software are described. Specific programs that address the needs cited in the responses to the survey of transportation agencies are described. Programs were first sought through the DOT support centers and then comparable privately developed programs and additional applications were considered. The potential for in-house software is addressed. The study recommends that a microcomputer support organization be established at the state level to assist transportation professionals in securing software for engineering problems.

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INTRODUCTION

Background

As solid-state technology reduced the physical size of the microprocessor, its computing power increased, and its purchase price plummeted. In the past, only the largest agencies could have their own computer systems; now small and middle size agencies can own and operate their own microcomputers.

These machines bring remarkable computational power to an individual in a very personal way. They are easy to program, easy to operate, and low in cost. Although they lack the capacity of the mainframe, they are adequate for application to many problems in transportation engineering.(1) This is one profession where microcomputers exhibit considerable potential for enhancing productivity.

User Considerations

Although microcomputers do offer significant advantages over both manual methods and mainframe computers, they also have certain limitations. The following are some pro and con issues related to the use of microcomputers in engineering practice.

Advantages

The major advantages of the microcomputer to transportation professionals are associated with their making the individual more productive and creative in problem solving by their ease of use and cost-effectiveness. They provide a means to easily propose and evaluate alternative plans and designs and to select the best strategy for a particular problem. This permits the engineer to become more creative as he works on concepts and the computer on numbers. The improved means of data storage and retrieval is another productive feature of micros. Because microcomputers have low initial cost and negligible maintenance

costs, time savings can quickly be costed to offset the initial cost of the system.

It is really the way the user and the computer integrate that makes this relationship work so well. Most available software programs do not require that the user have programming experience, and they are very simple to run. The user communicates with the computer interactively. Most programs use "menus" to prompt the user for certain options or input. These menus describe each option to be selected, thereby directing the user through virtually each step of the process. Input of data is in free-format, as contrasted to the fixed column requirements of the past.

Disadvantages

The disadvantages of the microcomputer are in many cases stated in terms relative to mainframes and are not really disadvantages in themselves. For example, micros have lower speeds and capacities than mainframes so that they are not yet applicable to large-scale analyses such as required for large traffic networks -- but they are ideally suited for analysis of an isolated intersection.

Other disadvantages include incompatibility among the different systems that have evolved. Disks written by one microcomputer generally cannot be read by another. Also, the increased use of microcomputers may lead to the so-called black-box syndrome; i.e., to the user not understanding the theory of the analysis.

Trends in Microcomputers

The technology of the microcomputer is continually improving and new developments are offsetting many of the current disadvantages. For example, the latest computers show larger word size and more memory. Hard disks and data base management systems provide for increased on-line storage of information. Compared to early days, higher level languages are becoming more common. Microcomputers are becoming part of large networks with macros via new communications packages. Thus, agencies using micros to their maximum potential must be continually alert to technological and institutional changes affecting their deployment.

PURPOSE OF RESEARCH COUNCIL PROJECT

The purpose of this study was to investigate areas where microcomputers can aid in the effectiveness of transportation engineering at state and local levels. The primary objectives were --

1. to identify day-to-day engineering and planning functions in state and local agencies that can potentially be performed on micros,

2. to evaluate the effectiveness of available software for addressing selected engineering problems on microcomputers,

3. to modify selected software to meet specific needs,

4. to design and recommend a program to assist agencies in obtaining and using the recommended software packages, and

5. to recommend applications that warrant new software development.

AREAS OF APPLICATION

Although much of the literature alludes to the major office uses of microcomputer technology such as word processors, electronic spread sheets, data base managers, graphics and statistical packages in the general sense, this project focused on more specific technical applications such as timing traffic signals and forecasting transportation demand. The selection of a computer for transportation engineering uses is quite different from the selection of a computer for general office applications. This is so because in the latter case, general software is available for accounting and file management purposes for most computers. It is when the applications become specialized that the type of machine becomes extremely critical.(2,3)

Under such circumstances, the needs of the transportation engineering community became subverted to the rationale of the organization when decisions concerning the type of machine are taken from the user.

Why is this so? The standard way for selecting a microcomputer is (1) decide on what you need to do, (2) then locate software (programs) that accomplish those tasks, and (3) finally, go look for hardware (microcomputer) to run the software you need. When the needs of an

agency are very generally defined, this approach is not necessary; however, when programs are not widely used and distributed it becomes imperative to follow the proper selection process.Under those circumstances where the hardware is defined first, strategies for obtaining the software must be evaluated.

SURVEY OF NEEDS FOR MICROCOMPUTERS AND THEIR USES

A survey of needs of transportation professionals in state and local agencies of Virginia for microcomputers and how the micros would be used was made during September and October 1983. Seventy-two questionnaires were mailed and 38 returned. The response rates for specific professional groups are given in Table 1.

Overall, the results indicate that the most interest lies in traffic engineering applications, but this is attributed to the high representation (29 of 72) of that group in the survey. The results show that city traffic engineers and district traffic engineers are highly interested in traffic engineering applications and that local engineers are peripherally concerned with demand forecasting and systems analysis while the district engineers are not. Public transit operators are interested only in public transportation operations and management.

Table 1

Response Rates for Survey

Agency/Division	Mailed	Returned	%
Virginia Department of Highways and Transportation Divisions	4	3	75
District Traffic Engineers	8	4	50
Local Traffic Engineers	21	14	67
Public Transit Operators	17	7	41
Metropolitan Planning Organizations (MPOs)	9	5	56
Local Planners	13	5	38
TOTALS	72	38	

Response = 53%

The remaining groups -- MPOs and local planners -- are interested primarily in data base management for travel, transportation system, and land use data, with some interest in the Quick Response Planning package. Some city planners also noted an interest in the traffic engineering category.

This survey confirmed the classification of applications relative to the planning, management, and operation of highway and public transportation systems into three primary groups:

1. Traffic engineering applications

2. Public transportation applications

3. Transportation planning applications (4)

Without overanalyzing these data, what can be concluded? The data show that transportation professionals do perceive the microcomputer as beneficial to their area of specialization. That is, overall, traffic engineers, public transit operators, and transportation planners indicate a strong interest in programs associated with their specialities and, in some cases, an interest in related areas. The survey results have been interpreted to show program applications that will potentially attract the associated interest groups. These preferences are summarized in Tables 2 through 4 as applications for traffic engineering, public transportation, and transportation planning, respectively.

Table 2

Traffic Engineering Applications

Primary Interest Groups

City Traffic Engineers
District Traffic Engineers

Applications

1. Traffic data analyses

   Turning movement analysis
   Traffic counter data analysis

2. Inventory/Record Systems

   Traffic signal maintenance needs
   ADT summary
   Pavement marking schedule
   Sign inventory

3. Traffic Engineering and Design

   Intersection capacity
   Isolated signal optimization
   Signal progression analysis
   Traffic network analysis

4. Traffic Accident Records & Analysis

Table 3

Public Transportation Applications

Primary Interest Group

Public Transportation Operators

Applications

1. Transit Ridership

   Forecasting transit ridership impacts of changes in level of service

2. Revenues and Costs

   Fare revenue projections
   Cost forecasts

3. Route Performance

   Scheduling
   Route development
   Run-cutting strategies

4. Transit Surveys

   Ridership reporting
   Survey processing

Table 4

Transportation Planning Applications

Interest Groups

City Planners
Metropolitan Planning Organizations

Applications

1. Forecasting Model Systems

   Quick response methods (NCHRP #187)

2. Data Base Management

   Travel data
   Land use data
   Network data
   Census data

SEARCH FOR SOFTWARE

Public vs. Private Software

Software for transportation engineering purposes is available from both public and private sources. The difference is considerable with respect to cost and freedom of distribution. Public domain software has been developed with government funds and the proven programs are distributed without significant cost by the DOT support centers. Once an agency obtains a copy for its use, it can make unlimited copies for individuals and agencies.

Software available from private vendors is much more costly and tightly controlled by copyright laws. Programs are sold to individuals or agencies for their sole use unless otherwise specified by contract.

The only support available is from the provider and at present the support centers do not deal with private programs. Technical assistance is provided by the supplier and, in many instances, at a cost.

As will be shown, there are cases where similar programs such as SOAP and Intersection Capacity Analysis are available from both sources, and the alert user will select the publicly available program.

At a recent American Society of Civil Engineers conference session on microcomputers (May 1984) a need was voiced for a consumer type review of private software for transportation engineering such as those the major micro magazines provide for the more widely used software packages. At present the FHWA is reviewing some of these programs and it is hoped that their findings will be published soon.

U. S. DOT Microcomputer Support Centers

The categories of transportation engineering applications for microcomputers stated above relate directly to user groups for micros that have been established nationwide by the U.S. DOT. These user groups include the following:

1. TIME Support Center (Transit Industry Microcomputer Exchange), Rensselaer Polytechnic Institute, Troy, N.Y. (310) 266-6227

2. MTP Support Center (Microcomputers in Transportation Planning), TSC, Cambridge, Mass. (617) 494-2247

3. STEAM Support Center (Safety and Traffic Engineering Applications for Microcomputers), TSC, Cambridge, Mass. (617) 494-2247

4. MAHP Support Center (Microcomputer Applications in Highway Projects), Cambridge, Mass. (617) 494-2247

The purpose and functions of the support centers include --

- publication of technical bulletins,
- operation of a software clearing house,
- maintenance of software,
- provision of a technical advisory service, and
- development of microcomputer user/product directories

Publications

In addition to the newsletters that the user support centers publish and the assistance provided by individuals and peer agencies, updated published reports are available to alert users of software availability in transportation engineering. These resources include

Microcomputers in Transportation Software and Source Book, U.S. DOT, UMTA & FHWA, March 1984 (eriodically updated), and Microcomputer Applications in Transportation Engineering, ITE, 1983.

PROGRAMS

A wide range of programs have been developed and are available to transportation professionals in the public and private domains. Tables 5, 6, and 7 describe programs that address the needs cited in the responses to the survey of transportation agencies. These programs are examples of the types of software that are available and are in no way to be interpreted as exhaustive. Programs were first sought through the DOT support centers and then comparable programs and additional application areas were considered in privately developed programs. Appendix A includes descriptions of the programs identified in Tables 5, 6, and 7, and Appendix B provides an example of one program from each of the applications groups.

Table 5. Traffic Engineering Applications Programs

APPLICATION	PROGRAM	DESCRIPTION	MICRO SYSTEM REQUIREMENTS M-Computer	OP. System	Memory	DEVELOPER
A. Traffic Engineering and Design						
1. Intersection Capacity	CMA*	Identifies critical movements at an intersection, adjustment factors, degree of saturation, LOS.	Apple II+	DOS 3.3	48k	Univ. of Fla.
	ICAPACITY	Computes signalized intersection capacity according to the HCM Method.	Various	CP/M	64k	Bather, Belrose Boje, Inc.
	CAPCALC	Intersection analysis based on TRB Circular #212.	Apple, IBM, TRS	UCSD P-System	64k	Roger Creighton
	CAL SAT	Intersection capacity based on the NCHRP Method.	Apple II+	DOS 3.3	64k	Inst. of Tras. Studies
2. Isolated Signal Optimization	SOAP/M*	Optimization program for isolated intersections.	Apple II+	DOS 3.3	48k	Univ. of Fla.
	WEBSTER	Optimum cycle length and splits.	Various	CP/M	64k	Bather, Belrose Boje, Inc.
3. Signal Progression Analysis	SPAN*	Displays time-location diagram for arterials. Simple offset optimization, produces time-space diagram.	Apple II+	DOS 3.3	48k	Univ. of Fla.

*Software secured for this project.

Table 5. Cont'd.

APPLICATION	PROGRAM	DESCRIPTION	MICRO SYSTEM REQUIREMENTS M-Computer	OP. System	Memory	DEVELOPER
	AAP/M*	A scaled down version of a mainframe program that acts as an intelligent terminal to the mainframe.	Apple II+	DOS 3.3	48k	Univ. of Fla.
	PASSER II PASSER II-Data Loader	Microcomputer version of the TTI arterial optimization program Passer II	Various	CP/M	64k	Bather, Belrose Boje, Inc.
4. Traffic Network Analysis	TRANSYT/7	Microcomputer version of TRANSYT/7	Various	CP/M	64k	Bather, Belrose Boje, Inc.
B. Data Collection and Analysis						
1. Turning Movement Analysis	TMC/48	Analyzes counts from TimeLapse electronic counter	Various	DOS 3.3 CPM	64k	TIMELAPSE, Inc.
	TMC*	Analyzes counts from TimeLapse electronic counter	Apple II+	DOS 3.3	48k	Univ. of Fla.
2. Volume Counts	COUNTS PLUS][*	Processes 24-hour mechanical traffic counts with 15-minute subtotals	Apple II*	DOS 3.3	48k	Univ. of Fla.

*Software secured for this project.

Table 5. Cont'd.

APPLICATION	PROGRAM	DESCRIPTION	MICRO SYSTEM REQUIREMENTS M-Computer	OP. System	Memory	DEVELOPER
	SCAN*	Analyzes speed and volume data obtained from road tubes. (TRAFFICOMP equipment)	Apple II+	DOS 3.3	48k	Univ. of Fla.
	VOLTAPE VOLPLOT	Analyzes road type traffic counts 15 min, AM,PM highest volume, graphs.	Various	CP/M	64k	Bather, Belrose Boje, Inc.
3. Inventory Data	INVENTORY	Inventories of signs, pavement markings, etc.	Various	CP/M	64k	Bather, Belrose Boje, Inc.
C. Traffic Accident Records and Analysis	TARP TAAP TARPLOT	Traffic accident analysis and collision diagrams.	Various	CP/M	64k	ATEMS Computer Systems

*Software secured for this project.

Table 6. Transportation Planning Programs

APPLICATION	PROGRAM	DESCRIPTION	MICRO SYSTEM REQUIREMENTS M-Computer	OP. System	Memory	DEVELOPER
A. Forecasting Model System						
1. Quick Response Technique	QRS*	Software to assist in transportation sketch planning (Quick Response System from NCHRP Report No. 187)	Apple II+ IBM PC	UCSD Pascal Version IV	64k 256k	COMSIS Corp. (MTP Support CTR)
2. UTPS Type Package	MICROTRIPS	A comprehensive package paralleling UTPS in functional capability for systems up to 150 zones, 2000 links.	Various	CP/M	64k	PRC Voorhees
	MINUTP	Complete transportation planning system similar in operation to UTPS, PLANPAC, etc.	IBM PC Various	CP/M	Varies with size of network 64-320k	COMSIS Corp.
	DODOTRANS II*	Software which provide a flexible framework for transportation analysis of modeling.	Apple II+	UCSD II.1	64k	M.I.T. (MTP Support Center)
B. Impact Analysis	ROADWAY AQ*	Analysis of air quality impacts of alternative highway designs.	Apple II+	DOS 3.3	64k	Cambridge Systematics

*Software secured for this project.

Table 7. Transit Operations Programs

APPLICATION	PROGRAM	DESCRIPTION	MICRO SYSTEM REQUIREMENTS M-Computer	OP. System	Memory	DEVELOPER
A. Financial Management						
1. Cash Flow	CASHFLOW*	Calculates forecasts of cash on hand from passenger and non-passenger revenues.	Apple II+	DOS 3.3 (VisiCalc)	64k	(TIME Support CTR)
2. Budget2. VC	BUDGET2. VC*	Develops a budget estimate of fuel cost and operator wages.	Apple II+	DOS 3.3 (VisiCalc)	64k	(TIME Support CTR)
3. Budget Calculator	BUDGET*	Estimates future revenues and expenses	Apple II+	DOS 3.3 (VisiCalc)	64k	(TIME Support CTR)
B. Transit Trip Schedules	Chapel Hill Scheduler	Builds schedule using route and start time data.	Apple II+	UCSD II.1	64k	Chapel Hill Transit (TIME Support CTR)
C. Route Performance and Cost Analysis	Service Monitoring Package*		Apple II+			(TIME Support CTR)
D. Optimal Route Design	FRACAS*	Designed to optimize fares, routing, and headways for radial routes	Apple II+	UCSD II-1	64k	MIT (TIME Support CTR)

*Software secured for this project.

Table 7. Cont'd.

APPLICATION	PROGRAM	DESCRIPTION	MICRO SYSTEM REQUIREMENTS M-Computer	OP. System	Memory	DEVELOPER
E. Ridership Analysis						
1. Data Exhibits	HISTOGRAM*	Preprints a ride check sheet, computes total passenger miles and average trip length and prepares a histogram of passenger loads on a bus trip.	Apple II+	DOS 3.3 (VisiCalc)	64k	(TIME Support CTR)
2. Ridership Sampling	STAT 1.0*	An optimal sampling plan program and a random date selection program.	Apple II+	DOS 3.3	64k	(TIME Support Center)
F. Comparative Data	Section 15*	Summarizes financial and operating data submitted annually to UMTA by the Nation's public transportation agencies.	IBM PC Apple II Apple III			(MTP Support CTR)

*Software secured for this project.

SOFTWARE DEVELOPMENT

In addition to the application programs that were identified in the previous section, applications for which no pertinent software exists were cited by people who were contacted in the course of this study. One such need was the use of the TimeLapse traffic counter for applications other than that for which it was developed -- turning movement analysis.

The Virginia Highway and Transportation Research Council modified the TMC software that was developed by the University of Florida to analyze data from the TMC/48 box in cases where the buttons are used for counting categories other than intersection volumes. These additional applications of the TMC/48 are vehicle classification counts and vehicle occupancy studies. The programs are illustrated in Appendix C.

CONCLUSIONS

The preceding observations on current microcomputer applications in transportation engineering strongly indicate that there is potential for improving the productivity of a transportation agency (i.e., an MPO, city traffic engineering department, or public transit provider). This potential can be met only if the managers of these agencies obtain the support of upper management to become micro users.

The reference here is to engineering applications on micros -- not office management uses. It is also noted that there may be different needs among traffic engineers, transportation planners, and transit operators regarding microcomputers. Why? Because their problems are different. Hence the software needs vary among such users, and ultimately the hardware needs among the three may not be compatible. For example, the study revealed a variety of traffic engineering programs in the public domain for the Apple Computer and the IBM-PC. For computers that use the CP/M operating system, similar programs must be obtained from private vendors at a significantly higher cost. When an agency is considering this problem of matching software with hardware, cost can be a most important difference among alternatives. That is, one may wish to know the total cost difference for a system using computer A which is purchased at a lower price than computer B, but requires private vendor software for its CP/M operating system, while computer B can take advantage of the software in the public domain. The detail necessary for such a cost analysis can be identified only by the potential user because only he knows his specific needs. It is possible that a compromise computer may serve no one.

RECOMMENDATIONS

The Virginia Department of Highways and Transportation has recently authorized its divisions to purchase the Zenith Z-150 PC microcomputer under an exclusive state contract. In order to take advantage of the cited applications of micros in transportation engineering, a microcomputer support organization should be established at the state level to assist transportation professionals in securing software for engineering applications. The problem should be addressed from both a statewide perspective and a local point of view. For example, the option of writing or purchasing a particular program for use by all units of state government as compared with an exclusive local purchase should be considered. Strategically optimal solutions need to be approached for distribution strategies for different software packages. In order to reach this goal, certain steps must be undertaken.

The two primary functions of this support center would be communications and technical effort. The former includes newsletters, surveys, demonstrations, short courses and site level assistance. The primary technical tasks comprise the identification of appropriate software needs of the supported groups and source of programs, evaluation of alternative strategies for obtaining/developing software, supplementary documentation, and case study data sets for aiding users to become familiar with the software.

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3. "Selecting a Single User System: Selected Readings Volume 2," Urban Mass Transportation Administration, Washington, D.C., April 1983.

4. "Microcomputers in Transportation," Transportation Research Record 932, Transportation Research Board, Washington, D.C., 1983.

APPENDIX A

SOFTWARE DESCRIPTIONS

The following format is used to describe available transportation engineering programs in this section.

Program Name

(Brief Description)

Operating System

Computer

Language

Memory Requirements

Public or Private Availability

Vendor

1. TRAFFIC ENGINEERING APPLICATION PROGRAMS

CMA

Identifies the critical traffic movements at an intersection, performs adjustments for lane width, trucks, pedestrians, left turns, etc. Determines the degree of saturation and level of service for a signalized intersection. The inputs include intersection geometrics, traffic volumes, phasing and adjustment factors. Outputs include data files and the level of service.

DOS 3.3

Apple II+

Applesoft BASIC

48k

Public

University of Florida Transportation Center

ICAPACITY

This set of programs is based upon mathematical procedures which consider approach geometry, traffic demands and traffic signal operation to determine approach performance. Results are based on the Highway Capacity Manual procedures. These interactive programs include procedures for approach and turn evaluation analysis.

CP/M 80, PC DOS, MS DOS

Various Computers

BASIC

128k

Private

Bather, Belrose, Boje, Inc.

CAPCALC

Evaluates intersection performance, follows TRB Circular 212 procedures for signalized intersections (both planning and operations/design) and unsignalized intersections. Calculates intersection levels of service for signalized intersections and approach levels of service for unsignalized intersections. Provides for user control of cycle length and intersection approach phasing. Calculates average delay on each approach using Webster's equation.

UCSD P-System

Apple II, IBM-PC, PC/XT, TRS 80II/12/16

Pascal

64k

Private

Roger Creighton Associates

CAL SAT

Intersection Capacity based on the NCHRP method

DOS 3.3

Apple IIe

BASIC

64k

Public

Institute of Transportation Studies

SOAP/M

This program optimizes and evaluates the operation of a multiphase traffic signal. Capabilities include: menu-driven input routines for all traffic data input, optimization of cycle lengths and splits, and estimation of delay, stops, fuel consumption and annual operating costs. Graphical display of the degree of saturation on all movements is available. A summary report is printed showing all inputs and outputs. The inputs include volume, capacity, % trucks, PHF, lost time, phasing and minimum green times. Outputs focus on optimal cycle lengths and splits, estimates of delay, stops, pool consumption, and annual operating costs.

DOS 3.3

Apple II+

Applesoft BASIC

48k

Public

University of Florida Transportation Center

WEBSTER

An interactive program which considers intersection geometry, operation and traffic signal operation in the determination of intersection performance based on the analytical research performed by F. V. Webster of the TRRL.

CP/M 80

Various Computers

CBASIC2

64k

Private

Bather, Belrose, Boje, Inc.

SPAN

Displays a time-location diagram on the screen for an arterial signal system. Prints a time-space diagram showing the characteristics of signal progression. Provides simple optimization of offsets for progression. Provides for manual adjustment of offsets.

DOS 3.3

Apple II+

Applesoft BASIC

48k

Public

University of Florida Transportation Center

AAP/M

Communicates as an intelligent terminal with the miniframe version of AAP/M. The capabilities of this program include preparation of AAP deck to run Passer II or TRANSYT on an arterial signal system. Transmits the input deck to a host computer. A SPAN file is prepared as output.

DOS 3.3

Apple II+

Applesoft BASIC

48k

Public

University of Florida Transportation Center

PASSER DATA LOADER/PASSER II-80

PASSER DATA LOADER is a stand alone intersective program used for construction, entry, editing and management of input data sets. PASSER II-80 is a signal timing program which permits convenient arterial timing development based upon maximized through-band geometry and alternate phasing analysis for multiphase intersection systems. PASSER II-80 considers speeds, traffic volumes and saturation capacities for up to 20 intersections to generate a single optimum through-band solution. Results include measures of effectiveness and a time-space diagram.

CP/M, PC DOS, MS DOS

Various Computers

BASIC

64k, 128k

Private

Bather, Belrose, Boje, Inc.

TRANSYT/7

A signal timing plan development and evaluation program. As an offset and split analysis and development tool, TRAYSYT uses a traffic model and hill climb optimizing procedure to generate new timing plans for arterials and grids. It also produces a full set of link and network measures of effectiveness.

CP/M-80, PC DOS, MS, DOS

Various Computers

BASIC

128k

Private

Bather, Belrose, Boje, Inc.

TMC/48

Facilitates the analysis of data from the TMC/48, a microprocessor-based turning movement counter. The TMC program totals volumes by 5- or 15-minute intervals for 16 distinct movements. This program examines and edits data from the TMC/48, merges data records, saves and retrieves data to disc files and prints turning movement reports. For data recorded by 15-minute intervals, a peak period analysis can be performed which includes calculating peak hour factors and percentage of turning vehicles.

CP/M, MS DOS

Various Computers

BASIC

64k

Private

TimeLapse, Inc.

TMC

Automates the analysis of turning movement count data from a TimeLapse counter. Capabilities include retrieval of data from the intersection counter; examination, editing and merging of data; summary printout, peak period analysis.

DOS 3.3

Apple II+

Applesoft BASIC

48k

Public

University of Florida Transportation Center

COUNTS PLUS] [

Counts Plus] [is designed to process 24-hour mechanical traffic counts with 15-minute subtotals (which may be cumulative). These counts may be input manually or from disk data files created by machine reader programs.

DOS 3.3

Apple II+

Applesoft BASIC

48k

Public

University of Florida

SCAN

The SCAN program automates the process of collecting and analyzing spot speed data. Capabilities include --

1. reading data from a TRAFFICOMP traffic study device with the "speed" (2000 series) data collection program, and

2. editing the data to change values, add a study description, compute multiday averages, etc.

DOS 3.3

Apple II+

Applesoft BASIC

48k

Public

University of Florida

VOLTAPE/VOLPLOT

VOLTAPE is an interactive program used to enter, edit and manage traffic volume road tube counts. VOLTAPE supports paper tape reader and manual data input, 15-minute and 60-minute count tape formats, single and dual channel tape reader formats, count summation by channel and manual data entry.

VOLPLOT processes and evaluates volume counts for up to 4 approaches for as many as 4 days. Outputs include a summary report of the counts and count averages on a 15-minute basis, volume statistics, highest 8-hour volume and graphs for each count approach. VOLPLOT also includes a signal warrants package and an experimental pedestrian crossing gap determination feature.

CPM/80, MS-DOS, PC-DOS

Various

BASIC

128k

Private

Bather, Belrose, Boje, Inc.

INVENTORY

An interactive, menu-driven, expandable traffic sign inventory system. Its primary function is the management of traffic sign information. The program features on-line data entry, easy data reviews and editing, user-accessible data element dictionaries, extensive error checking and a highly flexible report generator. The program can be expanded by the addition of optimal modules to also manage pavement marking data and other traffic information.

CP/M-80, MS-DOS, PC-DOS

Various

BASIC

128k

Private

Bather, Belorse, Boje, Inc.

TARP/TAAP/TARPLOT

This program consists of three main elements: accident record file management, accident record and rate analyses, and intersection collision diagram plotting. The use of the program starts by abstracting 21 individual items of information from the police traffic accident report form directly by keyboard into the microcomputer system. The second part of the record data base concerns traffic volumes, both intersection turning movement counts and midblock volumes. The final portion of the accident record system is the plotting of intersection collision diagrams.

CP/M

Various

BASIC

64k

Private

ATEMS Computer Systems

2. TRANSPORTATION PLANNING PROGRAMS

QRS

The Quick Response System (QRS) software implements the techniques described in NCHRP Report No. 187 on the computer. Only those techniques involved with the traditional four-step planning process (trip generation, distribution, mode split and assignment) have been implemented. Other techniques (traffic smoothing, corridor diversion, intersection capacity analyses, incremental mode split, etc.) will be added later. Local data or default rates may be used.

USCD p-system Version IV

Apple II, IBM-PC

Pascal

64k

Public

MTP Support Center

MICROTRIPS

MICROTRIPS includes programs for travel demand modeling, matrix manipulation, highway and transit network analysis and network planning.

CP/M; MS-DOS, PC-DOS

Various

BASIC

64k; 128k

Private

PRC Voorhees

MINUTP

Similar in nature and function to the larger, more complicated systems such as UTPS, PLANPAC, and TRANPLAN. Includes modules for network building, impedance matrix development, trip generation, trip distribution, matrix conversion, traffic assignment, report generation.

PC-DOS

IBM-PC

FORTRAN

128k-320k

Private

COMSIS Corporation

DODOTRANS II

DODOTRANS II is a software system for a microcomputer in which managers, engineers, and planners can conduct analyses using models and other procedures appropriate to their own areas of interest. It provides a library environment containing data files. Utility capabilities are provided in the system for inputting and editing data, for defining data structures, for moving data around between files, and for input and output (in both report and graphic forms). "Application modules," or functional procedures such as models or submodels, are provided either by the user or by some application developer. The environment allows the user to define a very large number of "analysis sequences," which string together models and utilities in any desired way to do analysis, including producing graphic and tabular outputs and entering data as needed, and which are executed (the analysis sequences) by user-defined commands.

UCSD p-system

Apple II

Pascal

64k

Public

MTP Support Center

ROADWAY AQ

ROADWAY AQ is a VisiCale Template which provides predictions of vehicular emissions (carbon monoxide, hydrocarbons, and nitrogen oxides) for roadway segments before and after various levels of improvement. Predictions are provided for a base year and for two future years which are of interest to air quality planners. Both existing roadways and proposed improvements are specified in terms of the number and width of travel lanes, vehicle volumes, roadside characteristics (obstruction and shoulder width), and roadway type.

DOS 3.3, PC DOS

Apple II, IBM PC

VisiCale

64k

Public

MTP Support Center

3. TRANSIT OPERATIONS PROGRAMS

CASHFLOW

This program calculates forecasts of cash on hand given the expectation of the level and timing of transit system passenger and non-passenger researcher. Financial entries include cash on hand at the beginning of the period, system passenger revenues, system expenses, federal aid, state aid, local aid and loans and repayments.

DOS 3.3

Apple II

VisiCale

64k

Public

TIME Support Center

BUDGET2. VC

This program develops budget estimates of fuel cost and operator wages given a schedule of number of miles and hours and assumption of fuel economy, driver productivity (pay hours/platform hours) and unit prices of fuel and wage rates. Budget changes as a function of service levels, driver productivity, fuel prices, wage rates and fuel economy are calculated.

DOS 3.3

Apple II

VisiCale

64k

Public

TIME Support Center

BUDGET CALCULATOR

The BUDGET CALCULATOR is a tool for estimating future revenues and expenses. Its first function helps the user allocate current expenses, as reported on the Section 15 form 301, for each of four functional categories to three level of service variables: weekday vehicles, revenue vehicle miles, and revenue vehicle hours. After calculating system level unit costs for the current year (using service supplied data from form 406), the program estimates future year unit and total costs based on the user's estimate of price changes for labor, services, and materials and the expected level of service parameters. The second function is used to estimate future revenues and bring expenses and revenues into balance. The user enters current revenue data from Section 15 forms 201 and 203 and an estimate of future year changes. Changes in service levels and average fares are used together with systemwide service and fare elasticities to estimate future year passenger fare revenue.

Apple II

VisiCale

64k

Time Support Center

CHAPEL HILL SCHEDULER

The CHAPEL HILL SCHEDULER is a transit schedule writing and editing program which allows transit schedulers to build, edit and print bus timetables on a trip-by-trip or multiple-trip basis. Schedulers will find the program relieves the laborous tasks of calculating schedule times and making corrections.

UCSD p-system

Apple II+

Pascal

64k

Public

TIME Support Center

SERVICE MONITORING PACKAGE

Two programs are included. The first is a passenger count program which is used to enter counts taken by bus drivers eight days per month, and to provide averages for a selected time period by route for weekday, Saturday and Sunday service. The second program performs route analyses. Costs, revenues and margins (revenues minus costs) are computed and used to determine a number of performance indicators.

UCSD p-system

Apple II+

Pascal

64k

Public

TIME Support Center

FRACAS

FRACAS stands for Fare and Route Analysis Computer Aided Systems. It accepts inputs and system objectives, operating parameters, existing service and market sensitivities, all drawn from readily available data. It outputs the best routes, fares and headways to achieve system goals in the time periods and areas analyzed.

UCSD p-system

Apple II+

Pascal

64k

Public

TIME Support Center

HISTOGRAM

This program preprints a ride check sheet, computes total passenger miles and average trip length, and prepares a histogram of passenger loads on a bus trip. The inputs include the route, date, day, direction and start time of the trip, a bid of bus stops, the distance from the terminal to each stop, boardings and alightings by stop and the time for the terminal. The program computes the distance between stops, cumulative boardings and alightings, load by stop, passenger miles between stops, passenger minutes between stops, summary statistics and a histogram of the load.

DOS 3.3

Apple II

VisiCale

64k

Public

TIME Support Center

STAT 1.0

This program determines which vehicle trips should be sampled to obtain statistically valid volume for route ridership, fare levels, etc. The initial program identifies alternate sampling plans, and consisting of the number of days and number of trips per day to sample. Subsequent programs randomly select the actual days and trips to sample.

DOS 3.3

Apple II+

BASIC

48k

Public

TIME Support Center

SECTION 15 DATA (1981)

The Section 15 Report summarizes financial and operating data submitted annually to the Urban Mass Transportation Administration by the nation's public transit agencies. The 1981 Section 15 tables containing financial and operating data on individual transit agencies are now available on three 1/4" diskettes for IBM PC, Apple III and Apple II microcomputers. The files are in the data interchange format (DIF-format) developed by Software Arts, Inc. to allow the interchange of data among a wide variety of programs. DIF-format files are loadable into VisiCalc, VisiFile, 1-2-3 and many other microcomputer application programs. Additionally, Sorcim's SuperData Interchange (SDI) utility can convert a DIF-format file into a SuperCalc-loadable ".CAL" file.

MTP Support Center

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APPENDIX B

EXAMPLE PROGRAMS

1. TRAFFIC ENGINEERING
   SOAP/M

2. TRANSPORTATION PLANNING
   QRS

3. TRANSIT OPERATIONS
   CHAPEL HILL SCHEDULER

The purpose of this Appendix is to illustrate the ease in using a menu-driven program as is typical of those prepared for microcomputers. The comments on the right-hand side highlight program features.

1. TRAFFIC OPERATIONS

The example traffic engineering program is SOAP/M. Elements of the program prompts and select output are given. This demonstrates an actual user experience. The reader is encouraged to note how he is led through the analysis by the program.

```
]RUN SOAP
              ****************
              *   S.O.A.P.   *
              *      IS      *
              *   LOADING    *
              ****************

 VERSION JANUARY 1983


       **********************
         SOAP/M DATA ENTRY
       **********************


   0 CLEAR MEMORY
   1 ENTER NEW TRAFFIC DATA
   2 ENTER CONTROL DATA
   3 PERFORM TIMING COMPUTATION
   4 DISPLAY INPUT DATA



  90 DISK DATA TRANSFER
  99 EXIT THIS MENU

 ENTER CHOICE  90
     (DISK DATA TRANSFER)

   1 READ DATA FROM DISK
   2 SAVE DATA ON DISK
   3 DELETE FILE FROM DISK



   99 EXIT THIS MENU

 ENTER CHOICE1
       READ FROM DISK DRIVE # 1
**  PLEASE INSERT A DISK **

 ENTER FILENAME OR
 'C' FOR CATALOG
 HIT RETURN TO CANCEL
 ?EXAMPLE#1

     EXAMPLE#1           .SOAP
          HAS BEEN FETCHED
```

MAIN MENU
(BASIC USER OPTIONS)

LOAD EXAMPLE DATA
FROM DISK (FILENAME: EXAMPLE #1)

```
VERSION JANUARY 1983

      **********************
        SOAP/M DATA ENTRY
      **********************


  0 CLEAR MEMORY
  1 ENTER NEW TRAFFIC DATA
  2 ENTER CONTROL DATA                                  RETURN TO MAIN MENU
  3 PERFORM TIMING COMPUTATION
  4 DISPLAY INPUT DATA



 90 DISK DATA TRANSFER                                  SELECT OPTION #1:
 99 EXIT THIS MENU                                      ENTER NEW TRAFFIC DATA


ENTER CHOICE  1

TRAFFIC DATA
      1 VOLUME
      2 HEADWAY
      3 CAPACITY                                        MENU FOR OPTION #1
      4 LOST TIME
      5 LEFT TURNS/CYCLE ON CLEARANCE
      6 TRUCKS
      7 PEAK HOUR FACTOR
      8 GROWTH FACTOR
      9 APPROACH DISTANCES
     10 SPEED

 90 DISK DATA TRANSFER
 99 EXIT THIS MENU

ENTER CHOICE  1                                         CHOICE 1 FROM OPTION #1 MENU
      TRAFFIC VOLUME (VOL/PERIOD)

PARAMETER            VALUE
-----------------------------------------NBT.................800
NBL.................125
SBT.................750
SBL.................100
EBT.................700
EBL.................225
WBT.................500
WBL.................100
-----------------------------------------PRESS <RETURN> TO RETAIN VALUE
ENTER <CTRL-E><RETURN> TO EXIT
```

NOTE: VALUES GIVEN FOR PARAMETERS WERE LOADED AS EXAMPLE #1. USER CAN CHANGE ANY OR ALL AT THIS POINT.

```
ENTER CHOICE  2                                    CHOICE 2 FROM OPTION #1 MENU
          HEADWAY (SEC/VEC)

PARAMETER              VALUE
-----------------------------------------NBT.................2.2
NBL.................:.2.5
SBT.................2.2
SBL.................2.5
EBT.................2.2
EBL.................2.5
WBT.................2.2
WBL.................2.5
-----------------------------------------PRESS <RETURN> TO RETAIN VALUE
ENTER <CTRL-E><RETURN> TO EXIT
NBT.................
    SAVING DATA

TRAFFIC DATA
     1 VOLUME
     2 HEADWAY
     3 CAPACITY
     4 LOST TIME
     5 LEFT TURNS/CYCLE ON CLEARANCE
     6 TRUCKS
     7 PEAK HOUR FACTOR
     8 GROWTH FACTOR
     9 APPROACH DISTANCES
    10 SPEED

 90 DISK DATA TRANSFER
 99 EXIT THIS MENU
```

```
ENTER CHOICE  3
        SATURATION FLOW (V/HG)

PARAMETER             VALUE
-----------------------------------------NBT.................2
NBL.................1
SBT.................2
SBL.................1
EBT.................2
EBL.................1
WBT.................2
WBL.................1
-----------------------------------------PRESS <RETURN> TO RETAIN VALUE
ENTER <CTRL-E><RETURN> TO EXIT



ENTER CHOICE  4


  ---------------------
 ! ENTER NEW LOST TIME !
 !   OR <RETURN> TO    !
 ! RETAIN CURRENT VALUE!
  ---------------------


CURRENT VALUE 3.5
ENTER NEW VALUE ?




 ENTER CHOICE  5
            LEFT TURNS/CYCLE

 PARAMETER             VALUE
 -----------------------------------------NBL.................1
 SBL.................1
 EBL.................1
 WBL.................1
 -----------------------------------------PRESS <RETURN> TO RETAIN VALUE
 ENTER <CTRL-E><RETURN> TO EXIT
```

```
ENTER CHOICE  6
                % TRUCKS

PARAMETER             VALUE
-----------------------------------------NBT.................0
NBL.................0
SBT.................0
SBL.................0
EBT.................0
EBL.................0
WBT.................0
WBL.................0
-----------------------------------------PRESS <RETURN> TO RETAIN VALUE
ENTER <CTRL-E><RETURN> TO EXIT
NBT.................6
                    6
NBL.................4
                    4
SBT.................1
                    1
SBL.................4
                    4
EBT.................5
                    5
EBL.................5
                    5
WBT.................4
                    4
WBL.................4
                    4
NBT.................
    SAVING DATA



ENTER CHOICE  7
THE HOURLY VOLUMES WILL BE DIVIDED
BY THE PEAK HOUR FACTOR

THE CURRENT VALUE IS .95

ENTER NEW VALUE: .9
```

```
ENTER CHOICE  8
          ENTER GROWTH FACTOR
          -------------------
         RETURN TO RETAIN VALUE

          CURRENT VALUE NBT - 1
             NEW VALUE -1.3

          CURRENT VALUE SBT - 1
             NEW VALUE -1.25

          CURRENT VALUE EBT - 1
             NEW VALUE -

          CURRENT VALUE WBT - 1
             NEW VALUE -1.4

TRAFFIC DATA
      1 VOLUME
      2 HEADWAY
      3 CAPACITY
      4 LOST TIME
      5 LEFT TURNS/CYCLE ON CLEARANCE
      6 TRUCKS
      7 PEAK HOUR FACTOR
      8 GROWTH FACTOR
      9 APPROACH DISTANCES
     10 SPEED

 90 DISK DATA TRANSFER
 99 EXIT THIS MENU

ENTER CHOICE  9

TRAFFIC DATA
      1 VOLUME
      2 HEADWAY
      3 CAPACITY
      4 LOST TIME
      5 LEFT TURNS/CYCLE ON CLEARANCE
      6 TRUCKS
      7 PEAK HOUR FACTOR
      8 GROWTH FACTOR
      9 APPROACH DISTANCES
     10 SPEED

 90 DISK DATA TRANSFER
 99 EXIT THIS MENU
```

CHOICES 9 AND 10 ARE NOT INCLUDED IN THIS ISSUE OF THE PROGRAM. THEY CANNOT BE USED.

RETURN TO MAIN MENU AND SELECT OPTION #2

```
ENTER CHOICE  2

        CONTROL DATA


    1 CYCLE LENGTH
    2 CONTROLLER TYPE
    3 PHASING
    4 GREEN TIME BY MOVEMENT
    5 ALL RED TIME

 90 DISK DATA TRANSFER
 99 EXIT THIS MENU

ENTER CHOICE  1

CURRENT CYCLE LENGTH IS 100 SEC
ENTER NEW VALUE<RETURN FOR NO CHANGE ?

        CONTROL DATA


    1 CYCLE LENGTH
    2 CONTROLLER TYPE
    3 PHASING
    4 GREEN TIME BY MOVEMENT
    5 ALL RED TIME

 90 DISK DATA TRANSFER
 99 EXIT THIS MENU

ENTER CHOICE  2

 CURRENT TYPE OF CONTROLLER <P>

PRESS -P- FOR PRETIMED CONTROL
PRESS -A- FOR ACTUATED CONTROL?A
COORDINATED? <Y/N>N

        CONTROL DATA


    1 CYCLE LENGTH
    2 CONTROLLER TYPE
    3 PHASING
    4 GREEN TIME BY MOVEMENT
    5 ALL RED TIME

 90 DISK DATA TRANSFER
 99 EXIT THIS MENU
```

MENU FOR OPTION #2

CHOICE 1 FROM OPTION 2

```
ENTER CHOICE  3
          CURRENT PHASING

              NB      SB      EB      WB

PROTECTION PERM    PERM    PERM    PERM

SEQUENCE         L-T             L-T

PHASE CODE       6               6
-----------------------------------------          PHASING ALTERNATIVES

     1 NEITHER LT PROTECTED
     2 NB LEFT PROTECTED
     3 SB LEFT PROTECTED
     4 EB LEFT PROTECTED
     5 WB LEFT PROTECTED
     6 BOTH TURNS PROTECTED(W/O OVERLAP)
     7 BOTH TURNS PROTECTED(W/ OVERLAP)
     8 FULL DIRECTIONAL SEPARATION
-----------------------------------------
N/S PHASING OK? (Y/N) E/W PHASING OK? (Y / N)
          CONTROL DATA


     1 CYCLE LENGTH
     2 CONTROLLER TYPE
     3 PHASING
     4 GREEN TIME BY MOVEMENT
     5 ALL RED TIME

  90 DISK DATA TRANSFER
  99 EXIT THIS MENU

ENTER CHOICE  4
          GREEN TIMES / MOV'T

PARAMETER              VALUE
-----------------------------------------NBT.................15
NBL.................10
SBT.................15
SBL.................10
EBT.................15
EBL.................10
WBT.................15
WBL.................10
-----------------------------------------PRESS <RETURN> TO RETAIN VALUE
ENTER <CTRL-E><RETURN> TO EXIT
NBT.................
     SAVING DATA


ARE THESE MINIMUM OR ACTUAL GREEN TIMES      (M/A)?M  MUST SPECIFY "MINIMUM"
                                                      FOR PROGRAM TO COMPUTE
          CONTROL DATA                                GREEN TIMES UNDER OPTION 3


     1 CYCLE LENGTH
```

```
    2 CONTROLLER TYPE
    3 PHASING
    4 GREEN TIME BY MOVEMENT
    5 ALL RED TIME

 90 DISK DATA TRANSFER
 99 EXIT THIS MENU

ENTER CHOICE  5
          TOTAL ALL RED TIME:
          (SECONDS PER CYCLE)


          CURRENT VALUE - 0

       ENTER NEW VALUE -

         CONTROL DATA


    1 CYCLE LENGTH
    2 CONTROLLER TYPE
    3 PHASING
    4 GREEN TIME BY MOVEMENT
    5 ALL RED TIME

 90 DISK DATA TRANSFER
 99 EXIT THIS MENU

ENTER CHOICE  99
VERSION JANUARY 1983


       **********************
         SOAP/M DATA ENTRY
       **********************


  0 CLEAR MEMORY
  1 ENTER NEW TRAFFIC DATA
  2 ENTER CONTROL DATA
  3 PERFORM TIMING COMPUTATION
  4 DISPLAY INPUT DATA



 90 DISK DATA TRANSFER
 99 EXIT THIS MENU
```

AFTER ENTERING DATA FOR OPTION #2
RETURN TO MAIN MENU (99)

```
ENTER CHOICE  3

VERSION  JANUARY 1983


COMPUTATIONS IN PROGRESS ... PLEASE WAIT
SPECIFIED CYCLE: 100

          (Y/N)?


   GREEN TIME...SEC PER MOVEMENT

MOVEMENT    CALC       REQ.       MIN.     OK
=======================================
1 NBT       36.9       29.2       15.0   YES
2 NBL       11.2        9.4       10.0   YES
3 SBT       36.9       27.6       15.0   YES
4 SBL       11.2        7.8       10.0   YES
5 EBT       32.7       26.0       15.0   YES
6 EBL       19.2       15.6       10.0   YES
7 WBT       32.7       19.5       15.0   YES
8 WBL       19.2        7.8       10.0   YES
```

PERFORM TIMING COMPUTATIONS OPTION #3

PROGRAM CALCULATES GREEN TIMES FOR EACH PHASE.

```
CYCLE LENGTH: 100 SEC
FLOW RATIO: 66 %
VOL/CAP: 76 %
ALL RED TIME: 0 SEC
        HIT SPACE BAR TO CONTINUE
           OR RETURN TO EXIT

INITIAL TIMING CALCULATIONS ARE COMPLETE

 1 REPEAT TIMING CALCULATIONS
 2 ENTER GREEN TIMES
 3 EVALUATE INITIAL TIMINGS
 4 COMPUTE FINAL TIMINGS

99 EXIT

 ENTER CHOICE ?2
ENTER PHASE TIMES IN SECONDS
HIT RETURN TO RETAIN CURRENT VALUE

TIMES MUST INCLUDE YELLOW CLEARANCE

 PHASE        CURRENT      NEW

=========================================
 NB&SB THRU       36.9     ?37
 NB&SB LEFT       11.2     ?12
 EB&WB THRU       32.7     ?32
 EB&WB LEFT       19.2     ?19

    TOTAL           100

ARE THESE TIMES OK?(Y/N)


   GREEN TIME...SEC PER MOVEMENT

MOVEMENT    CALC       REQ.       MIN.     OK
=========================================
1 NBT       37.0       29.2       15.0   YES
2 NBL       12.0        9.4       10.0   YES
3 SBT       37.0       27.6       15.0   YES
4 SBL       12.0        7.8       10.0   YES
5 EBT       32.0       26.0       15.0   YES
6 EBL       19.0       15.6       10.0   YES
7 WBT       32.0       19.5       15.0   YES
8 WBL       19.0        7.8       10.0   YES
```

"DESIGN COMMAND" MENU NOW APPEARS. THIS MENU PERMITS THE USER TO REPEAT THE DESIGN PROCEDURE, ANALYZE THE PRESENT SET OF TIMINGS, OR OPTIMIZE THE SPLITS TO MINIMIZE THE DELAY OF THE INTERSECTION.

ENTER NEW GREEN TIMES FOR ANALYSIS

```
CYCLE LENGTH: 100 SEC
THESE ARE SPECIFIED GREEN TIMES
ALL RED TIME: 0 SEC
        HIT SPACE BAR TO CONTINUE
           OR RETURN TO EXIT

INITIAL TIMING CALCULATIONS ARE COMPLETE

 1 REPEAT TIMING CALCULATIONS
 2 ENTER GREEN TIMES
 3 EVALUATE INITIAL TIMINGS
 4 COMPUTE FINAL TIMINGS

99 EXIT

 ENTER CHOICE ?3
SAVING VARIABLES
```

"DESIGN COMMAND" MENU
WITH CHOICE 3 TABLES NOW ARE PROVIDED
TO SHOW IN DEPTH ANALYSIS OF GREEN
TIMES SPECIFIED LAST.

ADDITIONAL TABLES ARE NOT INCLUDED HERE

```
      ****************************
      * PERFORMING CALCULATIONS *
      ****************************
         * LEFT TURN CHECK *
```

	NBL	SBL	EBL	WBL
VOLUME	125	100	225	100
PROTECTION	PERM	PERM	PERM	PERM
CAPACITY:				
PROTECTED	122	122	223	223
UNPROTECTED	79	71	118	54
CLEARANCE	36	36	36	36
TOTAL	237	229	377	313
EXCESS LT'S	0	0	0	0

```
      HIT SPACE BAR TO CONTINUE
         OR RETURN TO EXIT

ERSION: JANUARY 1983

                  EVALUATION
                  ----------


    1 RERUN EVALUATION
    2 PRINT REPORT
    3 DISPLAY DEGREE OF SATURATION

90 DISK DATA TRANSFER
99 EXIT THIS MENU
```

AFTER THE REPORTS FOR CHOICE 3 UNDER "DESIGN COMMAND MENU" ARE GIVEN A NEW MENU APPEARS. IF CHOICE 2 IS MADE, THE FOLLOWING FORMAL REPORT IS PRINTED (IN NORMAL USE THIS IS ON ALL THE OUTPUT THAT GOES TO THE PRINTER).

```
NTER CHOICE  2
NTER COMMENT - EXAMPLE APPLICATION
     ********************************
     *PROCESSING INPUT PARAMETERS*
     ********************************

          ************************
          * PROCESSING SIGNAL *
          * TIMING PARAMETERS *
          ************************


           ******************
           * DESIGN REPORT *
           ******************
```

TRANSPORTATION RESEARCH CENTER
SOAP/M SIGNAL TIMING DESIGN
OAK & POKE

EXAMPLE APPLICATION

!INPUT!

	(NB)		(SB)		(EB)		(WB)	
	THRU	LEFT	THRU	LEFT	THRU	LEFT	THRU	LEFT
VOLUMES (VPH)	800	125	750	100	700	225	500	100
SAT FLOW (VPHG OR #LANES)	2	1	2	1	2	1	2	1
HEADWAY (SEC)	2.2	2.5	2.2	2.5	2.2	2.5	2.2	2.5
PCF (#-RED/TOTAL)	0	0	0	0	0	0	0	0
GREEN/MOV (SEC)	15	10	15	10	15	10	15	10
TRUCKS (%)	0	0	0	0	0	0	0	0
LEFT TURNS (LEFT/CYCLE)		1		1		1		1

LEFT TURN PROTECTION:	PERM	PERM	PERM	PERM
SEQUENCE:	L-T		L-T	

PHF: .95
CONTROLLER TYPE: ACTUATED
CYCLE LENGTH: 100.0 SECONDS
LOST TIME: 3.5 SEC/PHASE CHANGE

!SIGNAL TIMING CALCULATIONS!

		(NB)		(SB)		(EB)		(WB)	
		THRU	LEFT	THRU	LEFT	THRU	LEFT	THRU	LEFT
VOLUME/CAPACITY		.26	.06	.24	.04	.22	.12	.16	.04
VOLUME:	(VPH)	800	125	750	100	700	225	500	100
SAT FLOW:	(VPHG)	3273	1440	3273	1440	3273	1440	3273	1440
LEFT TURN SATURATION:	(VPHG)		500		500		700		500
GREEN TIME/MOVEMENT									
AVAILABLE:	(SEC)	37	12	37	12	32	19	32	19
SPECIFIED MINIMUM:	(SEC)	15	10	15	10	15	10	15	10
REQUIRED:	(SEC)	29.2	9.4	27.6	7.8	26	15.6	19.5	7.8

4 PHASE OPERATION	(SEC)	(%)
NB&SB THRU :	37.0	37.0
NB&SB LEFT :	12.0	12.0
EB&WB THRU :	32.0	32.0
EB&WB LEFT :	19.0	19.0
:		
:		

DEGREE OF SATURATION
NORTH/SOUTH: 31.6 %
EAST/WEST: 34.5 %
TOTAL: 66.1 %

TOTAL LOST TIME: 14.0 (SEC)
CYCLE LENGTH: 100.0 (SEC)
ALL RED TIME: 0.0 (SEC)

TRANSPORTATION RESEARCH CENTER
SOAP/M SIGNAL TIMING EVALUATION

OAK & POKE

EXAMPLE APPLICATION

!LEFT TURN CHECK!	(NB) LEFT	(SB) LEFT	(EB) LEFT	(WB) LEFT
VOLUME:	125	100	225	100
PROTECTION (TYPE):	PERM	PERM	PERM	PERM
CAPACITY (PROTECTED):	122	122	223	223
CAPACITY (UNPROTECTED):	79	71	118	54
CAPACITY (CLEARANCE) :	36	36	36	36
TOTAL:	237	229	377	313
EXCESS LT'S:	0	0	0	0

!MEASURES OF EFFECTIVENESS!	(NB) THRU	(NB) LEFT	(SB) THRU	(SB) LEFT	(EB) THRU	(EB) LEFT	(WB) THRU	(WB) LEFT
DEGREE OF SATURATION: (%)	71	53	66	44	72	60	51	32
OVERSATURATED?	NO	NO	NO	NO	NO	NO	NO	NO
AVERAGE DELAY: (SEC/VEH)	29.3	38.2	28.7	38	32.5	32.3	30.2	32.9
TOTAL DELAY: (HOURS)	6.5	1.3	6.0	1.1	6.3	2.0	4.2	0.9
GRAND TOTAL: (VEH-HRS/HR)	<< 28 >>							
STOPS PER MOVEMENT: (%)	0	0	0	0	0	0	0	0
FUEL CONSUMPTION: (GAL/HR)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GRAND TOTAL: (GAL/HR)	<< 46 >>							
LEFT TURN CONFLICTS: (/HR)	0		0		0		0	

2. TRANSPORTATION PLANNING

As an example of a user friendly transportation planning program, the trip generation program from the QRS package is used. This appended material is taken from the QRS Documentation (January 1984) which users receive with the diskettes.

TRIP GENERATION

Boot up Quick Response with "QRS1" diskette in drive 1 and "WORK" diskette in drive 2. When you see the QRS signon, press any key to get the first menu.

WELCOME TO THE QUICK RESPONSE PLANNING SYSTEM

THE FOLLOWING FUNCTIONS ARE AVAILABLE:

0) HELP
1) TRIP GENERATION
2) TRIP DISTRIBUTION
9) EXIT SYSTEM

ENTER ONE OF THE ABOVE FUNCTIONS ... 1

Press key "1" to select the trip generation function.

YOU HAVE ELECTED TO DEVELOP TRIP PRODUCTIONS AND ATTRACTIONS BY ZONE. THE FOLLOWING ARE THE STEPS OF THIS PROCESS.

0) HELP
1) ESTABLISH PRODUCTION RATES
2) ESTABLISH ATTRACTION EQUATIONS
3) PROVIDE ZONAL DATA
4) PROVIDE EXTERNAL STATIONS-- P"S AND A"S
5) CALCULATE PRODUCTIONS AND ATTRACTIONS
9) EXIT TRIP GENERATION FUNCTION

THE NEXT LOGICAL STEP IS 1

ENTER ONE OF THE ABOVE OPTIONS ... 1

Press key "1" to select Production Rate function.

DEFAULT PRODUCTION RATES ARE AVAILABLE FOR
THE POPULATION GROUPS SHOWN BELOW.

0) HELP
1) 50-100,000
2) 100-250,000
3) 250-750,000
4) 750-2,000,000
5) PREVIOUSLY DEFINED TABLE
6) DIRECT INPUT
9) EXIT THIS SECTION

ENTER ONE OF THE ABOVE OPTIONS ... 1

Press key "1" for default table for areas with a population between 50,000 - 100,000.

ELECT ONE OF THE FOLLOWING WAYS TO COMPUTE
TRIP PRODUCTIONS.

0) HELP
1) INCOME RANGE AND AVERAGE DAILY PERSON TRIPS PER H.H.
2) AVERAGE AUTOS PER H.H. AND AVERAGE DAILY PERSON TRIPS PER H.H.
9) EXIT THIS SECTION

ENTER ONE OF THE ABOVE OPTIONS ... 2

Press key "2" to obtain default values by average autos per H.H.

	< 1 > AVG AUTOS PER HH	< 2 > AVERAGE DAILY PERSON TRIPS/HH	< 3 > PERCENT HBW	< 4 > TRIPS BY PURPOSE HBNW	< 5 > NNB
1>	0.56	4.5	21	57	22
2>	0.81	6.8	21	57	22
3>	0.88	8.4	21	57	22
4>	0.99	10.2	18	59	23
5>	1.07	11.9	18	59	23
6>	1.17	13.2	16	61	23
7>	1.25	14.4	16	61	23
8>	1.31	15.1	16	61	23
9>	1.47	16.4	15	62	23
10>	1.69	17.7	14	62	24

MORE... <V> TO SCROLL DOWN

OPTIONS: <E> EDIT <R> REVIEW <S> SAVE <X> EXIT <P> PRINT

For this example, you will modify some entries in this table as follows:

- change Line 3 to read:

  0.88 8.50 22.00 56.00 22.00

- change Line 8 to read:

  1.31 15.50 15.00 62.00 23.00

Press key "E" for EDIT

EDIT/ROW = 3<CR>

ENTER <C> COLUMN--OR---<A> ALL COLUMNS

Press key "A" to enter data for ALL COLUMNS.

ENTER VALUES FOR ROW 3 SEPARATED BY A SPACE

ENTER 0.88<SP> 8.50<SP> 22.00<SP> 56.00<SP> 22.00<SP>

Note: <SP> means space bar throughout this documentation. For typing in a decimal number less than one, the "0" must be typed prior to decimal point. You can not back space to an error of this kind. You may re-edit the column for correcting the error.

	< 1 > AVG AUTOS PER HH	< 2 > AVERAGE DAILY PERSON TRIPS/HH	< 3 > PERCENT HBW	< 4 > TRIPS BY PURPOSE HBNW	< 5 > NNB
1>	0.56	4.5	21	57	22
2>	0.81	6.8	21	57	22
3>	0.88	8.5	22	56	22
4>	0.99	10.2	18	59	23
5>	1.07	11.9	18	59	23
6>	1.17	13.2	16	61	23
7>	1.25	14.4	16	61	23
8>	1.31	15.1	16	61	23
9>	1.47	16.4	15	62	23
10>	1.69	17.7	14	62	24

MORE... <V> TO SCROLL DOWN
OPTIONS: <E> EDIT <R> REVIEW <S> SAVE <X> EXIT <P> PRINT

Press key "E" for EDIT

EDIT/ROW = 8<CR>

ENTER <C> COLUMN--OR---<A> ALL COLUMNS

Press key "C" to enter data for a Single Column.

COLUMN # = 2<CR>

NEW VALUE = 15.50<CR>

Note: See changes in table as done previously. Screen not repeated here.

Select "S" to SAVE the changed default table.

Note: This must always be done if a rate table is updated or an entire table entered.

ENTER FILE NAME: RATETAB<CR>

ENTER YOUR TITLE UP TO 25 CHARACTERS:
*UPDATED TRIP PROD. RATES<CR>

RATETAB. FILE SAVED
<PRESS RETURN> <CR>

Select "P" to PRINT updated Production Rate table.

Note: The printer must be on prior to entering the Print option.

ENTER REPORT TITLE: First Updated Rates-Productions <CR>

ENTER TODAYS DATE: 12/10/82<CR>

Press key "X" EXIT to proceed with trip generation.

YOU HAVE ELECTED TO DEVELOP TRIP PRODUCTIONS AND ATTRACTIONS BY ZONE. THE FOLLOWING ARE THE STEPS OF THIS PROCESS.

0) HELP
1) ESTABLISH PRODUCTION RATES
2) ESTABLISH ATTRACTION EQUATIONS
3) PROVIDE ZONAL DATA
4) PROVIDE EXTERNAL STATIONS-- P"S AND A"S
5) CALCULATE PRODUCTIONS AND ATTRACTIONS
9) EXIT TRIP GENERATION FUNCTION

THE NEXT LOGICAL STEP IS 2

ENTER ONE OF THE ABOVE OPTIONS ... 2

Press key "2" to establish attraction equations.

DEFAULT ATTRACTION EQUATIONS ARE AVAILABLE FOR THE FOLLOWING PURPOSES:

1) HOME-BASED WORK
2) HOME-BASED NON-WORK
3) NON-HOME-BASED
9) EXIT THIS SECTION

ENTER ONE OF THE ABOVE OPTIONS ...2

Press key "2" to review the "Home Based Non-Work" purpose equation.

HBNW=Ax(RETAIL EMPLOYMENT)+Bx(NON-RETAIL EMPLOYMENT)+Cx(DWELLING UNIT)

A = 10.00 B = 0.50 C= 1.00
O.K. ? (Y/N)

If the equation parameters shown as A=10.00 B=0.50 C=1.00 are to be changed, Press key "N".

O.K. ? <Y/N> N

ENTER A, B, OR C B

We wish to change B from 0.50 to 1.00

B= 1.00 <CR>

A=10.0 B=1.00 C=1.00

O.K. ? <Y/N> Y

Press key "Y" if no further changes.

DEFAULT ATTRACTION EQUATIONS ARE AVAILABLE FOR THE FOLLOWING PURPOSES:

1) HOME-BASED WORK
2) HOME-BASED NON-WORK
3) NON-HOME-BASED
9) EXIT THIS SECTION

ENTER ONE OF THE ABOVE OPTIONS ... 9

Press key "9" to proceed assuming equations for home-based work and non-home based are acceptable.

YOU HAVE ELECTED TO DEVELOP TRIP PRODUCTIONS AND ATTRACTIONS BY ZONE. THE FOLLOWING ARE THE STEPS OF THIS PROCESS.

0) HELP
1) ESTABLISH PRODUCTION RATES
2) ESTABLISH ATTRACTION EQUATIONS
3) PROVIDE ZONAL DATA
4) PROVIDE EXTERNAL STATIONS-- P"S AND A"S
5) CALCULATE PRODUCTIONS AND ATTRACTIONS
9) EXIT TRIP GENERATION FUNCTION

THE NEXT LOGICAL STEP IS 3

ENTER ONE OF THE ABOVE OPTIONS ... 3

Press key "3" to Provide Zonal Data.

THIS STEP REQUIRES THE ZONAL DATA.
SELECT ONE OF THE FOLLOWING:

0) HELP
1) PREVIOUSLY CREATED ZONAL DATA FILE
2) EMPTY ZONAL DATA TABLE
9) EXIT THIS SECTION

ENTER ONE OF THE ABOVE OPTIONS ... 1

Press key "1" to recall a previously created zonal data file from the WORK diskette.

*** ENTER FILE NAME ...TEST.ZONAL.DATA <CR>**
FILE: TEST.ZONAL.DATA

SAMPLE TUTORIAL DATA

ZONE	< 1 > AVG AUTOS PER HH	< 2 > EMPLOYMENT RETAIL	< 3 > EMPLOYMENT NON-RETAIL	< 4 > DU"S
1>	0.8	1000.0	3000.0	50.0
2>	1.5	10.0	20.0	4000.0
3>	1.8	500.0	10.0	2000.0

OPTIONS: <E> EDIT <R> REVIEW <S> SAVE <X> EXIT <P> PRINT

The user may edit, review , and save the table as previously described.

Press "X" to exit this section.

Note: If you edited this table you will get the following message:

IMPORTANT! SAVE THIS STEP IF YOU HAVE NOT DONE IT ALREADY.

SAVE ? (Y/N) N

Press key "N" to exit this section without resaving.

YOU HAVE ELECTED TO DEVELOP TRIP PRODUCTIONS AND ATTRACTIONS BY ZONE. THE FOLLOWING ARE THE STEPS OF THIS PROCESS.

0) HELP
1) ESTABLISH PRODUCTION RATES
2) ESTABLISH ATTRACTION EQUATIONS
3) PROVIDE ZONAL DATA
4) PROVIDE EXTERNAL STATIONS-- P"S AND A"S
5) CALCULATE PRODUCTIONS AND ATTRACTIONS
9) EXIT TRIP GENERATION FUNCTION

THE NEXT LOGICAL STEP IS 4

ENTER ONE OF THE ABOVE OPTIONS ... 5

Note: In this example the external stations are not provided.

Press key "5" to calculate productions and attractions.

WARNING: EXTERNAL STATIONS ARE NOT PROVIDED.
<PRESS RETURN> <CR>

SUMMARY

PRODUCTION RATES USING DATA FILE .... ratetab
ZONAL DATA USING DATA FILE ... test.zonal.data
O.K. ? (Y/N) Y

Press key "Y", if you have accessed correct data files.

TRIP PRODUCTIONS AND ATTRACTIONS COMPLETED?
<PRESS RETURN>

	<1>	<2>	<3>	<4>	<5>	<6>
	H B W		H B N W		N H B	
ZONE	**P**	**A**	**P**	**A**	**P**	**A**
1>	70.0	6800.0	191.0	13050.0	74.0	9525.0
2>	9856.0	51.0	41112.0	4120.0	15342.0	2070.0
3>	4768.0	867.0	22204.0	7010.0	8841.0	2025.0
	14694.0	7718.0	63507.0	24180.0	24257.0	13620.0

OPTIONS: <G> SPECIAL GENERATORS <B> BALANCE P"S AND A"S
<P> PRINT <E> EDIT <R> REVIEW <S> SAVE <H> HELP <X> EXIT

If there are special generators they can be entered now using the edit feature. As an example, say zone 3 has a special generator. We wish to estimate trips attracted to the shopping center located in Zone 3 directly. The estimates for attraction are as follows:

HBW	4200
HBNW	2400

Press key "E" to EDIT the P and A table.

EDIT/ZONE= 3<CR>

Enter <C> Column--or--<A> All Columns

Press "C"

COLUMN # = 2<CR> **NEW VALUE =** 4200<CR>

Press key "E" to ENTER data for HBNW.

EDIT/ZONE = 3<CR>

ENTER <C> Column--or--<A> All Columns

COLUMN # = 4<CR> **NEW VALUE =** 2400<CR>

Note: Complete entry for NHB in a similar fashion

If you wish to maintain the values entered for special generator attractions during the balancing, the zones to be held constant must be specified. The <G> "Special Generators" function should be called. Also, values entered for external stations are usually held constant and therefore must be identified as special generators.

For this problem we will hold productions constant for Zone 3.

Press key "G"

Enter zones to be held constant terminated by 999

ZONE = 3<CR> **ZONE** = 999<CR>

Special generators:

ZONE = 3

O.K. ? (Y/N) Y

Select key "Y", if your special generators were chosen correctly.

	<1> H B W		<2>		<3> H B N W		<4>		<5> N H B		<6>
ZONE	P		A		P		A		P		A
1>	70.0		6800.0		191.0		13050.0		74.0		9525.0
2>	9856.0		51.0		41112.0		4170.0		15342.0		2070.0
3>g	4768.0		4200.0		22204.0		2400.0		8841.0		2025.0
	14694.0		11051.0		63507.0		19620.0		14257.0		13620.0

OPTIONS: <G> SPECIAL GENERATORS <B> BALANCE P"S AND A"S
<P> PRINT <E> EDIT <R> REVIEW <S> SAVE <H> HELP <X> EXIT

The "g" by Zone 3 indicates Zone 3 is a special generator and will not enter the attraction balancing.

Press key "B" to Balance P's and A's.

Although not a usual case, there are times when attractions may be held constant, such as when using a shopping center as an attractor in distributing trips out to households as producers.

SELECT: <P> for Productions or <A> for attractions to be held constant

"P" selected.

	<1>	<2>	<3>	<4>	<5>	<6>
	H B W		H B N W		N H B	
ZONE	**P**	**A**	**P**	**A**	**P**	**A**
1>	70.0	10416.0	191.0	46444.0	18263.0	18263.0
2>	9856.0	78.0	41112.0	14663.0	3969.0	3969.0
3>g	4768.0	4200.0	22204.0	2400.0	2025.0	2025.0
	14694.0	14694.0	63507.0	63507.0	24257.0	24257.0

OPTIONS: <G> SPECIAL GENERATORS <B> BALANCE P"S AND A"S
<P> PRINT <E> EDIT <R> REVIEW <S> SAVE <H> HELP <X> EXIT

You will generally wish to save these results for use in trip distribution.

Press key "S" to save this information.

ENTER FILE NAME: test.tgtd.data <CR>

ENTER YOUR TITLE UP TO 25 CHARACTERS:
Zonal Productions and Att. <CR>

test.tgtd.data file saved
<PRESS RETURN> <CR>

If you wish to print the table, press "P".

ENTER REPORT TITLE: Zonal Productions and Attractions <CR>

ENTER TODAY'S DATE (mm/dd/yy) 12/11/82<CR>

Press key "X" to exit

SAVE? (Y/N) N

```
YOU HAVE ELECTED TO DEVELOP TRIP PRODUCTIONS AND ATTRACTIONS
BY ZONE.  THE FOLLOWING ARE THE STEPS OF THIS PROCESS.

          0)  HELP
          1)  ESTABLISH PRODUCTION RATES
          2)  ESTABLISH ATTRACTION EQUATIONS
          3)  PROVIDE ZONAL DATA
          4)  PROVIDE EXTERNAL STATIONS-- P"S AND A"S
          5)  CALCULATE PRODUCTIONS AND ATTRACTIONS
          9)  EXIT TRIP GENERATION FUNCTION

               THE NEXT LOGICAL STEP IS  9

          ENTER ONE OF THE ABOVE OPTIONS ...  9
```

Press key "9" to Exit trip generation function.

You have completed trip generation, both production and attraction estimation. These results are used in the trip distribution module. The results have been saved in a file named TEST.TGTD.DATA which can be used in the trip distribution function.

3. TRANSIT OPERATIONS

This program, the CHAPEL HILL SCHEDULER, is a transit schedule writing and editing program which allows transit schedulers to build, edit, and print bus timetables on a trip-by-trip or multiple trip (block) basis.

The user is first asked by the program to specify whether he wishes to

1. call a schedule file from disk, or

2. begin a new schedule file.

For this example, we select option 2, as it supercedes 1, because a schedule file must be created before it is saved on the disk.

The user must now input the number of timepoints or number of potential stopping points on the route. These are nodes which a route connects. The maximum number of timepoints is 24. For this example 16 are used.

From now on the program is run by selecting options from a main menu that provides a number of functions which allow use of its capabilities and capacities. These functions include the following:

U)ser Restart: Restarts the entire program, destroying any existing workfile at the time the function is requested. You will receive a secondary prompt designed to ensure that you wish to replace your workfile.

U)srRst is a dangerous procedure, however; use with extreme caution.

P)attern: Creates the route patterns used by the remainder of the program.

R)untimes: Allows you to specify route travel times for a specified pattern.

E)dit: Allows unlimited editing of any existing travel time set.

A)ctive: Allows users to specify and change the travel time set and pattern they wish to use with the trip and block creation functions. These functions automatically use the "active" set that you have previously specified. For block creation, two active sets are allowed, facilitating alternating route patterns and travel times within a single vehicle block.

T)rip (a single trip): Creates individual round-trips given the active travel time set, a target timepoint, and a time at that target.

B)locks (of trips): This function creates blocks of multiple-trip, single vehicle schedules given various inputs.

W)indows: This function allows you to select a limited number of timepoints for display on the video screen. This function is useful for schedules with more than 13 timepoints, as no more than 13 will fit in an 80-column format.

F)lip: Flip toggles from one window to another, allowing display of the remaining timepoints in the workfile.

X)out: Deletes a single trip from the workfile.

Z)ap: Deletes an entire block of trips from the workfile.

D)isplay, V)iew, L)ist: Allow screen display of scheduled trips in the workfile, 15 lines at a time.

D)isplay shows the entire workfile in block/trip number order; V)iew shows a single block of trips in trip number order; L)ist shows the entire workfile in chronological order.

S)ort (Chronologically): Arranges the scheduled trips in the workfile into chronological order (while maintaining block/trip order as well) based on a single timepoint, just as in a printed timetable.

O)output: Output offers a variety of output routines. One may send workfile patterns, running times, and scheduled trips to either the printer, video screen or UCSD-Pascal TEXT files on disk. The scheduled trips can be output in either block and trip number order or chronologically. The function also computes a series of statistics about scheduled trips in the workfile, including total running time, layover time, etc.

C)hange: Allows you to change block and trip numbers in the workfile on a single-trip, range-of-trips, or block basis.

S)ave: Saves the entire workfile on disk for use at a later time.

G)et: Calls and loads workfile stored on disk for further use.

I)ndex: Lists the route patterns and travel time sets available in a workfile. Also lists timepoint names created using the N)ame functions.

N)ame: Allows you to name each timepoint in the schedule for future reference.

?): Lists each program function, with a one-line description of its operation.

Q)uit: Leaves the program, returning machine control to the UCSD p-System.

Route Patterns

The creation of a route pattern and travel timer is now illustrated. In order to create route patterns, enter the P)AT function. After a pattern is entered the program shows the following listing for each specific pattern. In this case we see Pattern "A".

```
Route pattern listing for
Pattern "A":

Timepoint 1 is served.
Timepoint 2 is served.
Timepoint 3 is served.
Timepoint 4 is served.
Timepoint 5 is not served.
Timepoint 6 is served.
Timepoint 7 is served.
Timepoint 8 is a layover.
Timepoint 9 is served.
Timepoint 10 is served.
Timepoint 11 is served.
Timepoint 12 is not served.
Timepoint 13 is served.
Timepoint 14 is served.
Timepoint 15 is served.
Timepoint 16 is a layover.
```

Travel Times

Given particular route patterns, the user can next develop travel times for each route pattern using the R(untime function. R)untime will first request the existing pattern you wish to use,

PATTERN CODE < CR > (Enter A)

and then asks for a Timeset number associated with that pattern.

TIMESET NUMBER < CR >

Timeset numbers may be any valid integer number, but each timeset must have a unique combination of pattern code and timeset number. Following these two inputs, the function will request travel time between each route segment serviced by the pattern; layover segments are not included. A typical prompt line looks as follows:

TRAVEL TIME from 1 to 2 is < CR >

An example Timeset designated as A1 is shown below.

```
Travel time listing for
Pattern "A", Timeset "1":

Travel time from 1 to 2 is: 6
Travel time from 2 to 3 is: 8
Travel time from 3 to 4 is: 5
Travel time from 4 to 6 is: 4
Travel time from 6 to 7 is: 5
Travel time from 7 to 8 is: 5
Layover time from 8 to 9 is: 3
Travel time from 9 to 10 is: 5
Travel time from 10 to 11 is: 5
Travel time from 11 to 13 is: 5
Travel time from 13 to 14 is: 6
Travel time from 14 to 15 is: 9
Travel time from 15 to 16 is: 7
Layover time from 16 to 1 is: 7
Elapsed travel time, including
```

Building Scheduled Trips

If route patterns, travel timesets, and the "active" set have been created, you may start building a timetable. Schedules may be built by individual trip, or by blocks of single-vehicle trips.

You may create a single trip by selecting the T)rip option from the main program. This function will request a target timepoint, which may be any timepoint which is either served on a layover point, followed by a target time at that timepoint.

TARGET TIMEPOINT < CR >

TARGET TIME < CR >

Given this information, the function will use your active travel timeset and pattern (eq. A1) to generate a schedule for one round-trip as shown below.

Block	Trip	1	2	3	4	5	6	7	8	Time
1	1	534	540	548	553	*	557	602	607	120

Block	Trip	9	10	11	12	13	14	15	16	Time
1	1	610	615	620	*	625	631	640	647	120

Blocks of Scheduled Trips by a Vehicle

One can create vehicle blocks, or parts of blocks, using the B)lock function. Each B)Lock can be any number of continuous trips by a single vehicle. An example block is shown below.

Block	Trip	1	2	3	4	5	6	7	8	Time
1	1	534	540	548	553	*	557	602	607	120
10	1	534	540	548	553	*	557	602	607	120
10	2	654	700	708	713	*	717	722	727	120
10	3	814	820	828	833	*	837	842	847	120
10	4	934	940	948	953	*	957	1002	1007	120
10	5	1054	1100	1108	1113	*	1117	1122	1127	120
10	6	1214	1220	1228	1233	*	1237	1242	1247	120
10	7	134	140	148	153	*	157	202	207	120
10	8	254	300	308	313	*	317	322	327	120
10	9	414	420	428	433	*	437	442	447	120
10	10	534	540	548	553	*	557	602	607	120

Block	Trip	9	10	11	12	13	14	15	16	Time
1	1	610	615	620	*	625	631	640	647	120
10	1	610	615	620	*	625	631	640	647	120
10	2	730	735	740	*	745	751	800	807	120
10	3	850	855	900	*	905	911	920	927	120
10	4	1010	1015	1020	*	1025	1031	1040	1047	120
10	5	1130	1135	1140	*	1145	1151	1200	1207	120
10	6	1250	1255	100	*	105	111	120	127	120
10	7	210	215	220	*	225	231	240	247	120
10	8	330	335	340	*	345	351	400	407	120
10	9	450	455	500	*	505	511	520	527	120
10	10	610	615	620	*	625	631	640	647	120

APPENDIX C

VHTRC TMC/48 EXTENDED APPLICATIONS PROGRAMS

The VHTRC software main program, START, allows the user to enter and edit counter box data, enter and edit site information, save data on diskette or retrieve data from diskette by selecting a menu option. Its menu is shown in Figure C-1.

Choice 1 is used for transferring data from a TMC box to the microcomputer. The TMC box may be connected directly to the Apple's serial port, or it may be connected to the TMC telephone coupler to transmit the data to a telephone which is connected to a 300 baud modem, which is connected to the Apple's serial port. After the TMC box is connected and choice 1 is selected, it takes about three minutes for the data to be read and put into a usable format in the microcomputer's memory. Choice 2 allows the user to look at the data. This should be done after a box is read, to check that the data have been transmitted correctly. This menu item also allows the user to edit the data. Choice 3 is used for entering information about the particular site, such as location and weather conditions, before saving the data file on disk. If a TMC box has been read, using choice 1, the person in the field should give this information verbally, over the phone, to the person at the microcomputer. Alternatively, if the user has retrieved a previously saved data file from a disk, the user may display the site information on the screen by means of menu item 3. Choice 4 transfers the data file in microcomputer memory 8 to a disk. It transfers the site information (supplied by using menu item #3) as well as the actual counts. Choice 5 transfers a data file from a disk into the microcomputer memory. Thereafter, the user may wish to look at, or change, file information or data using options 2 or 3. Choice 6 returns control to the operating system.

At present there are two programs which print reports. One assumes that the TMC box has been used for vehicle classification counts and the other is designed for vehicle occupancy counts. Figures C-2 and C-3 show the button usage that is assumed by these report programs. Sample output is shown in Figures C-4 and C-5.

A typical use of the classification software would be as follows:

A technician in the field spends from 7 a.m. to 7 p.m. recording classifications on a TMC box, using the 15-minute recording option. That is, he pushes button 1 every time an in-state car passes in one direction, button 15 whenever an out-of-state car passes in the other direction, and other buttons similarly. The box records and saves the counts every 15 minutes. At the end of the day, the technician finds a telephone and calls the person at the microcomputer. This latter person

now runs the main program and selects option 1. The technician couples the TMC box to the telephone, and the program reads the data in the box into its memory. After this process, the program returns to the menu. The computer operator now chooses option 2 and looks at the data to see that it looks reasonable. If so, the operator returns to the menu, and selects option 3 to enter site information. The technician gives the information over the phone, and the operator enters it. Then the operator returns to the menu, selects item 4, and saves the file on a disk. After using option 6 to exit this program, the operator runs the program called "CLASSIFICATION," to print a report (Figure C-4). This program needs only to be given the name of the file when prompted.

This program was developed by Jennifer Ward, of the Virginia Highway and Transportation Research Council.

Figure C-1. Menu for program 'START'.

```
VIRGINIA TRANSPORTATION RESEARCH COUNCIL
   TURNING MOVEMENT COUNTER SYSTEM

1) READ COUNTER

2) EXAMINE OR EDIT DATA

3) LIST, ENTER, EDIT FILE INFORMATION

4) STORE DATA ON DISK

5) RETRIEVE DATA FROM DISK

6) EXIT FROM PROGRAM


PLEASE ENTER CHOICE OF OPTION >>>
```

Figure C-2. Button Designations for Vehicle Classification.

E. or N. Bound Lane		W. or S. Bound Lane	
BUTTON #	CLASSIFICATION	BUTTON #	CLASSIFICATION
1	VA. Cars	16	VA. Cars
2	Out-of-State Cars	15	Out-of-State Cars
3	2-Axle - 4 Tire Trucks	14	2 Axle - 4 Tire Trucks
4	2-Axle - 6 Tire Trucks	13	2-Axle - 6 Tire Trucks
5	3-Axle - 6-10 Tire Trucks	12	3 Axle - 6-10 Tire Trucks
6	Tractor-Trailers	11	Tractor-Trailers
7	Buses	10	Buses

Figure C-3. Button Designation for Vehicle Occupancy Rate

E. or N. Bound Lane		W. or S. Bound Lane	
BUTTON #	PERSONS PER VEHICLE	BUTTON #	PERSONS PER VEHICLE
1	1	16	1
2	2	15	2
3	3	14	3
4	4	13	4
5	5	12	5
6	5	11	5

Figure C-4. Vehicle classification output.

```
ROUTE: 153                                DATE: 6/4/84
LOCATION: LINK 3                          WEATHER: CLEAR
DISTRICT: RICHMOND                        STATION NO.: 3
COUNTY: AMELIA

                    PEAK HOUR INFORMATION:


          MORNING PEAK HOUR STARTS BETWEEN 7:00 AND 9:00.

        AFTERNOON PEAK HOUR STARTS BETWEEN 4:00 AND 6:00.


NORTHBOUND TRAFFIC
==================

          MORNING PEAK HOUR VOLUME    79 FROM 7:30 TO 8:30
        AFTERNOON PEAK HOUR VOLUME    72 FROM 4:30 TO 5:30

SOUTHBOUND TRAFFIC
==================

          MORNING PEAK HOUR VOLUME    61 FROM 8:00 TO 9:00
        AFTERNOON PEAK HOUR VOLUME   100 FROM 4:30 TO 5:30

TRAFFIC IN BOTH DIRECTIONS
==========================

          MORNING PEAK HOUR VOLUME   133 FROM 7:30 TO 8:30
        AFTERNOON PEAK HOUR VOLUME   172 FROM 4:30 TO 5:30
```

Figure C-4. Cont'd.

ROUTE: 153
LOCATION: LINK 3
DISTRICT: RICHMOND
COUNTY: AMELIA

DATE: 6/4/84
WEATHER: CLEAR
STATION NO.: 3
DIRECTION: SOUTHBOUND

PER. END	PASS. CARS VA	PASS. CARS NOT VA	TRUCKS 2A,4T	TRUCKS 2A,6T	TRUCKS 3A,6-10T	TRUCKS T-T	BUSES	TOTAL
7:15	4	0	2	0	0	0	0	6
7:30	6	0	1	1	1	1	1	11
7:45	6	0	7	1	1	2	0	17
8:00	3	0	1	0	0	0	2	6
8:15	9	0	8	1	0	1	1	20
8:30	3	1	6	1	0	0	0	11
8:45	13	0	2	1	0	0	0	16
9:00	7	1	4	0	0	2	0	14
9:15	7	0	4	1	0	0	0	12
9:30	6	0	2	1	0	2	0	11
9:45	6	0	2	0	0	0	0	8
10:00	2	0	2	0	1	2	0	7
10:15	7	0	1	1	0	0	0	9
10:30	5	0	2	0	0	2	0	9
10:45	5	0	5	1	1	0	0	12
11:00	3	0	2	0	0	0	0	5
11:15	8	2	2	1	0	0	0	13
11:30	6	1	2	0	2	2	0	13
11:45	3	0	4	1	1	1	0	10
12:00	11	1	3	1	0	0	0	16
12:15	3	0	3	2	0	3	0	11
12:30	11	0	4	0	0	1	0	16
12:45	6	0	2	3	0	2	0	13
1:00	3	0	5	0	0	2	0	10
1:15	6	0	2	0	0	0	0	8
1:30	5	0	3	1	1	0	0	10
1:45	2	0	4	0	0	2	0	8
2:00	8	1	4	2	0	1	0	16
2:15	5	1	2	1	0	1	0	10
2:30	5	1	1	1	0	1	3	12
2:45	4	1	1	0	0	3	0	9
3:00	13	1	2	2	1	1	0	20
3:15	7	3	4	1	0	2	0	17
3:30	7	1	1	0	0	3	0	12
3:45	4	4	5	0	0	2	0	15
4:00	5	1	1	1	0	2	0	10
4:15	15	0	4	0	0	2	0	21
4:30	12	1	11	3	0	3	0	30
4:45	19	2	5	1	0	1	0	28
5:00	13	2	3	1	0	0	0	19
5:15	15	2	3	2	0	1	0	23
5:30	18	2	10	0	0	0	0	30
5:45	13	2	6	0	0	0	0	21
6:00	16	0	3	1	0	0	0	20
6:15	13	0	6	0	0	0	0	19
6:30	10	0	2	0	0	0	0	12
6:45	12	0	4	0	0	0	0	16
7:00	9	0	7	0	0	0	0	16
SUBTOTAL	379	31	170	34	9	48	7	678
PCT.	55.9	4.6	25.1	5	1.3	7.1	1	100.0
TOTAL	745	56	334	73	9	83	9	1309
PCT.	56.9	4.3	25.5	5.6	.7	6.3	.7	100.0

Figure C-4. Cont'd.

ROUTE: 153
LOCATION: LINK 3
DISTRICT: RICHMOND
COUNTY: AMELIA

DATE: 6/4/84
WEATHER: CLEAR
STATION NO.: 3
DIRECTION: NORTHBOUND

PER. END	PASS. CARS VA	PASS. CARS NOT VA	TRUCKS 2A,4T	TRUCKS 2A,6T	TRUCKS 3A,6-10T	TRUCKS T-T	BUSES	TOTAL
7:15	5	0	4	0	0	0	0	9
7:30	15	0	5	0	0	1	0	21
7:45	11	0	5	0	0	0	0	16
8:00	15	0	9	0	0	0	0	24
8:15	8	2	4	0	0	2	0	16
8:30	13	0	8	1	0	1	0	23
8:45	9	0	5	1	0	0	0	15
9:00	11	0	5	0	0	1	0	17
9:15	7	1	3	2	0	1	0	14
9:30	8	0	4	1	0	1	0	14
9:45	7	0	2	0	0	0	0	9
10:00	10	0	0	1	0	0	0	11
10:15	6	0	3	0	0	0	0	9
10:30	10	0	2	0	0	2	0	14
10:45	15	0	3	0	0	2	0	20
11:00	8	0	6	1	0	0	0	15
11:15	5	1	1	0	0	1	0	8
11:30	5	0	2	0	0	1	0	8
11:45	3	0	3	2	0	2	0	10
12:00	5	2	1	1	0	1	0	10
12:15	6	1	3	0	0	0	0	10
12:30	2	0	4	1	0	0	0	7
12:45	8	0	1	2	0	4	0	15
1:00	6	0	2	2	0	1	0	11
1:15	4	0	2	0	0	0	0	6
1:30	4	0	3	0	0	0	0	7
1:45	9	1	4	2	0	0	0	16
2:00	5	1	2	1	0	0	0	9
2:15	3	0	0	3	0	0	0	6
2:30	11	2	1	1	0	0	0	15
2:45	5	0	2	1	0	1	0	9
3:00	8	2	4	0	0	2	1	17
3:15	9	0	3	1	0	2	1	16
3:30	6	0	3	0	0	0	0	9
3:45	4	1	1	2	0	1	0	9
4:00	2	1	1	1	0	1	0	6
4:15	9	1	6	1	0	0	0	17
4:30	4	1	4	1	0	1	0	11
4:45	4	0	6	1	0	1	0	12
5:00	11	3	6	2	0	0	0	22
5:15	11	1	9	3	0	0	0	24
5:30	6	0	4	1	0	3	0	14
5:45	3	0	3	0	0	1	0	7
6:00	13	2	4	0	0	0	0	19
6:15	12	0	3	1	0	1	0	17
6:30	13	1	3	0	0	0	0	17
6:45	3	1	2	1	0	0	0	7
7:00	9	0	3	1	0	0	0	13
SUBTOTAL	366	25	164	39	0	35	2	631
PCT.	58	4	26	6.2	0	5.5	.3	100.0

Figure C-5. Vehicle occupancy output.

ROUTE: 360 DATE: 6/29/84
LOCATION: LINK 271 WEATHER: HOT
DISTRICT: RICHMOND STATION NO.: T2
COUNTY: NOTTOWAY DIRECTION: NORTHBOUND

PERIOD	VEHICLES WITH FOLLOWING NUMBER OF OCCUPANTS 1	2	3	4	5	>5	TOTAL VEHICLES	OCCUPANCY RATE
7:00- 7:15	21	4	2	0	0	0	27	1.3
7:15- 7:30	23	3	3	3	0	0	32	1.56
7:30- 7:45	12	3	3	1	1	1	21	2
7:45- 8:00	22	11	5	2	0	15	55	2.85
8:00- 8:15	21	6	5	4	0	7	43	2.47
8:15- 8:30	24	5	1	0	0	0	30	1.23
8:30- 8:45	19	1	1	1	0	0	22	1.27
8:45- 9:00	22	9	4	4	0	0	39	1.74
9:00- 9:15	22	3	1	0	0	0	26	1.19
9:15- 9:30	20	5	9	6	0	0	40	2.03
9:30- 9:45	16	2	2	0	0	0	20	1.3
9:45-10:00	22	5	2	1	0	0	30	1.4
10:00-10:15	23	7	2	1	0	0	33	1.42
10:15-10:30	31	10	2	2	0	0	45	1.44
10:30-10:45	36	7	3	1	0	7	54	1.94
10:45-11:00	22	2	2	0	0	0	26	1.23
11:00-11:15	32	5	2	3	0	0	42	1.43
11:15-11:30	32	7	4	6	0	4	53	2
11:30-11:45	32	8	3	4	5	3	55	2.11
11:45-12:00	38	3	2	2	0	5	50	1.76
12:00-12:15	20	7	3	3	0	5	38	2.24
12:15-12:30	35	5	4	4	0	2	50	1.7
12:30-12:45	33	4	4	0	0	0	41	1.29
12:45- 1:00	28	9	3	3	0	0	43	1.56
1:00- 1:15	29	7	3	0	0	0	39	1.33
1:15- 1:30	29	7	3	3	0	3	45	1.82
1:30- 1:45	24	10	7	0	0	2	43	1.79
1:45- 2:00	46	14	12	2	0	5	79	1.87
2:00- 2:15	33	12	2	2	0	0	49	1.45
2:15- 2:30	36	17	1	1	0	0	55	1.4
2:30- 2:45	49	7	3	3	0	5	67	1.7
2:45- 3:00	34	10	2	0	0	1	47	1.4
3:00- 3:15	39	7	8	0	0	0	54	1.43
3:15- 3:30	38	12	8	2	0	1	61	1.64
3:30- 3:45	55	11	2	2	0	4	74	1.55
3:45- 4:00	36	7	2	2	0	0	47	1.36
4:00- 4:15	58	2	2	3	0	0	65	1.23
4:15- 4:30	45	6	2	0	0	0	53	1.19
4:30- 4:45	37	5	2	0	0	0	44	1.2
4:45- 5:00	45	7	2	2	2	0	58	1.43
5:00- 5:15	53	13	6	1	0	1	74	1.45
5:15- 5:30	48	10	19	3	0	2	82	1.82
5:30- 5:45	46	2	2	0	0	2	52	1.31
5:45- 6:00	56	2	3	0	0	1	62	1.21
6:00- 6:15	52	3	4	1	0	4	64	1.53
6:15- 6:30	42	10	12	2	0	0	66	1.61
6:30- 6:45	49	6	2	0	0	3	60	1.42
6:45- 7:00	40	11	3	0	0	0	54	1.31
SUBTOTAL	1625	329	184	80	8	83	2309	1.6
PERCENT	70.4	14.2	8	3.5	.3	3.6	100.0	

Figure C-5. Cont'd.

ROUTE: 360
LOCATION: LINK 271
DISTRICT: RICHMOND
COUNTY: NOTTOWAY

DATE: 6/29/84
WEATHER: HOT
STATION NO.: T2

PEAK PERIOD OCCUPANCY RATES

PERIOD	NORTHBOUND	SOUTHBOUND	TOTAL
7:00-9:00	1.94	2.77	2.49
4:00-6:00	1.38	2.87	2.22