Microcomputer Assistance for a Rural Transportation Operation: The Tennessee Experience

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ABSTRACT

As microcomputers become increasingly popular, rural transportation operators are anxious to know if microcomputers can improve their current bookkeeping and operational analysis techniques. Present methods used by most of these operations are typically manual or performed by a mainframe computer through timesharing or consulting contractual arrangements. A few operations have experimented with minicomputers or microcomputers. Primary objectives of a recently conducted study were to investigate and evaluate commercially available data base management software, adapt the most suitable software to a current operation in middle Tennessee, and develop a systematic and rather self-explanatory package of software and accompanying instructions to simplify management analysis procedures and generation of reports. One of the most significant contributions of this research will be the transferability of study results. The transportation management program described has contributed to the development of a more generic version that can be used by a large number of other rural transportation operations across the country.

In this paper documentation is presented on how one large rural transportation operation in middle Tennessee recognized the potential assistance to be derived from microcomputers, resisted initial pressures to buy a system immediately, and through a federally funded research project was able to gain insights and purchase recommendations concerning their unique needs. The agency subsequently obtained a complete hardware and software system and is in the process of integrating this new technology into their operational scheme. Evaluations are continuing, but the impacts of this agency's conversion to microcomputer operations and many of the lessons learned from and results of this research project will be valuable to other rural transportation facilities.

Background

The Transportation Systems Center of the U.S. Department of Transportation initiated a funded research project in 1984 to investigate the roles microcomputers could play in the operations of rural transportation operations. There were three major reasons why this research was believed to be necessary:

1. Several rural transportation operations across the country were purchasing microcomputers and experimenting with software packages in an attempt to manage their transportation operations more efficiently;
2. The experiences, both successes and failures, gained from these efforts were not being nationally disseminated; and
3. Numerous other rural transportation operators were interested in obtaining tested and widely applicable data base management software that was available in the public domain.

Theretofore, the innovative transportation pioneers experimenting with microcomputers had

1. Experienced problems with equipment,
2. Attempted to write their own programs in some instances with varying degrees of success, and
3. Often discovered after installation of a file management program that they really needed the increased flexibility and power of a data base management program.

After a search for a candidate agency among various rural transportation agencies, the Upper Cumberland Area Regional Transportation System (UCARTS) in Algood, Tennessee, was selected. This agency typically provides between 17,000 and 18,000 client trips per month with 38 vehicles serving a 14-county rural area. The 1,500 to 2,000 clients served during any month require services to many different destinations throughout middle Tennessee. In addition to the diversity of their operations, UCARTS was selected as the project research site because

1. A microcomputer system was desired (and was already being studied) to give the agency greater in-house management and reporting capabilities;
2. Existing operational data were already being compiled by a contractual arrangement with a mainframe computer company (i.e., the transition from large computer processing to a microcomputer should be easier because UCARTS was acquainted with computer data requirements and report capabilities); and
3. Experienced researchers knowledgeable about rural transportation, the specific UCARTS operation, and microcomputers were available nearby at Vanderbilt University.

The willingness to work together of researchers familiar with the UCARTS system and operators appreciative of research benefits that could be derived from their close regional proximity to one another was a definite consideration in the U.S. Department of Transportation selection of a final test site. It was believed that these factors would increase the likelihood of a successful research project.

Research Development

Two important objectives in developing the microcomputer transportation package were

1. A sufficient information dissemination and training period for personnel inexperienced with microcomputers, who would be the key daily operators and must fully understand the system; and
2. An easily understood, menu-driven, and commercially available data base management program from which various functional transportation modules could be created.

The researchers observed that the nonexistence of computer skills and experience and a general apprehension about computers by rural agency personnel appeared to be the norm. Because these premises were accepted and attempts to overcome them were made in a systematic manner, the likelihood of a rural transportation operation successfully converting from manual or contractual management operations to an in-house computerized operation was enhanced.

A training scheme to gradually familiarize agency personnel with the capabilities of a microcomputer proved to be successful. Cornerstones of the educational process were

1. Initial introduction of games, word processing, and simple basic programs to merely acquaint personnel with the power and fun of microcomputers;
2. Development of a list of simple cures for correcting those confusing situations frequently encountered by a neophyte operator; and
3. Designation of one key person who had total control and authority over the use of the microcomputer.

By starting the educational process gradually and using a variety of games and basic programs, the natural inherent fears of a person unfamiliar with and apprehensive about the microcomputer were overcome. Advancement to other more complex activities proceeded smoothly after the initial anxieties and natural inertia of resistance to change had been dispelled.

Compilation of a basic list of "what if" actions proved to be extremely helpful. This help list consisted of typical screen displays or error messages along with simple sequential descriptions, in laymen's terms, of the procedures necessary to remedy problems, or at least return the user to a recognizable restarting point. Anyone who has ever dealt with a computer of any type has experienced the frustration caused by the coldness of that inanimate collection of electronic gadgetry when it simply refused to respond to seemingly logical commands. By developing the trouble-shooting commands for agency personnel, researchers were able to minimize these anxieties and create a useful crutch or security blanket for the fledgling operator.

With regard to software development, the researchers sought to choose a good, adaptable data base manager that was widely used and readily available in the commercial marketplace. By studying the attributes of various data base managers before final selection was made, researchers hoped to more closely match program capabilities with system needs and minimize later frustrations when information from separate files could not be compatibly accessed. The selection of a popular data base management software package would increase transferability, availability, and training opportunities at other operations across the country. Researchers felt that these objectives were best satisfied by ASTON-TATE's dBASE II software. Although no single data base manager could perform every function exactly as analysts might have desired, the abilities and popularity of dBASE II appeared to most nearly satisfy the majority of the desired objectives. An IBM XT microcomputer was selected for this test project.

Careful study of UCARTS procedures and operations, along with a study of potential improvements in the current mainframe computer reports received from their computer consultant, resulted in several program development decisions. Figure 1 shows a facsimile of the main menu developed for the UCARTS microcomputer program. This main menu follows immediately after the display of two rather catchy, color graphic logos showing pictures of the State of Tennessee and a transit vehicle. The main menu in Figure 1 shows that the system user has five basic options. The user can enter trip data, modify or create various microcomputer data files, generate various reports for management decisions, post trip data to intermediate files, or terminate operations and exit the UCARTS program. Figure 2 shows three first-level menus and their associated selection possibilities. These first-level submenus are followed by other submenus asking for further clarification of desired actions such as the addition, modification, or deletion of various data (e.g., trip, vehicle, or client records). By systematically typing a one-digit number in response to menu prompts and user desires, the user can progress downward through the program to a desired task. The user then sees a screen requesting certain types of formatted data. Merely pushing the entry key on the microcomputer allows the user to return to the main menu, from which other functions can be performed depending on the action needed and the corresponding path selected.

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MAIN MENU

KEY:    FOR:

1       DATA ENTRY

2       DATA BASE MANAGEMENT

3       PRINT REPORTS

4       POST TRIP DATA TO REPORT FILES

0       TERMINATE PROGRAM OPERATION

SELECT___
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FIGURE 1 UCARTS main menu selections.

FIELD TESTING AND SYSTEM REFINEMENTS

The research project is now in the final stages of testing and refinement. Work has proceeded surprisingly smoothly. The researchers would like to think that this success is attributable to outstanding capabilities and proper planning. These traits may have helped, but expert dBASE II programming skills of computer consultants responding to transportation information desires, the luxury of redundant computer report capabilities, and no critical time constraints or deadlines probably contributed more to the overall success. The transferability of these lessons to other transit properties could be beneficial.

Rarely are transportation experts or system managers experienced computer programmers, and vice

DATA ENTRY MENU

KEY:	FOR:
1	TRIP DATA ENTRY
2	IN-KIND SERVICE DATA ENTRY
3	UNMET SERVICE DATA ENTRY

SELECT____

DATA BASE MANAGEMENT MENU

KEY:	FOR:
1	CLIENT DATA BASE
2	DESTINATION CODE DATA BASE
3	VEHICLE DATA BASE
4	FUNDING SOURCE DATA BASE
5	SYSTEM CONSTANTS
6	CLIENT AGE UPDATE
7	END OF MONTH/YEAR DATA RESET

SELECT____

REPORTING MENU

KEY:	FOR:
1	COUNTY SUMMARY DATA
2	VEHICLE SUMMARY DATA
3	FUNDING SOURCE SUMMARY DATA

SELECT____

FIGURE 2 UCARTS first-level submenu selections.

versa. Therefore, interaction and continuing feedback among all parties results in the most useful computer programs. The continuance of an existing mainframe computer contract in Algood and subsequent comparison and improvement of microcomputer reports have been beneficial. There is no immediate plan to cancel the existing computer contract until all field testing of UCARTS programs has been completed and full-scale microcomputer operations are running smoothly. In many other rural transportation operations the original technique for compiling information and generating reports is a manual one. Regardless of the existing methodology, current techniques should not be totally abandoned until an agency's microcomputer programs are refined and fully operational. Even then a backup or emergency contingency plan should be available.

A final luxury that this research has enjoyed is a freedom from major time constraints. Many government agencies find themselves in the unfortunate position of having to complete system installation in too short a time; adequate testing is not permitted; and old techniques are irreparably abandoned too soon after implementation of the new system.

Since the field tests were begun several months ago, two revisions to the original microcomputer program have improved it. Installing a default capability for the trip funding source code has saved many hours of key punching. Although UCARTS has several funding sources from which to request client trip reimbursement, the majority of all client trips are charged to the FHWA Section 18 program. The keypunch operator can now simply enter numeric trip destination codes for different clients and vehicles without repetitively entering code 018 after each Section 18 charged trip. The few trips reimbursed from other funding sources are recorded by simply overriding the 018 default value and entering 020 for Title XX or another prescribed funding code. The program has the flexibility to allow users to designate funding default values and other funding designations that correspond to their own operations.

Intermediate posting of client trips was a second improvement in the process that was warranted on the basis of field testing experiences. Although packing or updating several report files occurred rather rapidly, a disproportionate amount of the keypunch operator's total time was spent waiting while report files were updated after trip data for each client were entered. The intermediate posting allows trip data to be entered continuously until sufficient nonproductive time for posting (e.g., during lunch or at end of workday) is available. Thus, the operator requests an update when most desirable and time productivity is maximized by minimizing waiting time during normal working hours. Both improvements have greatly aided the data entry process and increased total system productivity.

A final refinement in field data collection has been the replacement of several data collection forms with a single form. Drivers have appreciated this change, which occurred only when UCARTS personnel started processing their own data. Before their analysis of data processing requirements, they were unaware of some of the repetitive and inefficient data collection procedures that were being used.

INTERIM CONCLUSIONS

The entire process of converting the data processing procedures of UCARTS to a microcomputer has been extremely successful. Previously inexperienced personnel have adapted well to microcomputer operations and enthusiasm about the derived benefits and expectations has remained high. The tailoring of commercially available data base management software to transportation management needs has been rewarding.

UCARTS personnel are even learning how to use dBASE II terminology to program and generate simplistic reports that answer site-specific management questions. These increased skills have given UCARTS personnel a useful, new management tool that allows them to compile data from numerous files in almost any imaginable format. These capabilities have been used to generate different client listings that are periodically updated by individual county dispatchers.

The last remaining major question before UCARTS converts totally to microcomputer operations has recently been answered. The question was about input time requirements. How much time is required to enter all the data for the 14-county system? Tests just recently completed have shown that one data keypuncher will be kept busy an average of 3 or 4 hours each day entering trip destinations and other updated data. Thus, other functions can be easily accommodated in the remaining 4 or 5 hours of a typical workday. Time requirements for data entry must be a serious consideration of any agency considering conversion to microcomputer operations. For example, additional personnel, equipment, or remote site entry by local dispatchers must be evaluated. Similarly, small transit agencies with few vehicles must carefully evaluate possible microcomputer time and cost savings and increased efficiencies against the total moneys and efforts required to implement these changes.

In retrospect, the decision to designate one person as having absolute control was apparently instrumental in preventing a disproportionate number of unnecessary users and computer use for word processing, recreation, experimentation, or other nonessential purposes. The addition of a microcomputer by some agencies has been followed by many people using it for word processing, even to the extent that its original intended purpose was never achieved or a second microcomputer had to be purchased. This potential problem was averted at UCARTS, primarily because the microcomputer was not viewed as the whole agency's machine but was assigned to a single individual.

ACHIEVED AND ANTICIPATED BENEFITS

The addition of the microcomputer to the UCARTS operation has had, and should continue to have, profound benefits. Benefits already received include

1. Increased availability of different management reports,
2. Practically instantaneous generation of management reports,
3. Better understanding of total operational procedures and data needs because of the internal reviews performed in connection with processing requirements, and
4. Improved data collection and monitoring procedures.

Benefits expected when the test period ends and full operation begins include

1. Financial savings,
2. Data management of other agency programs besides transportation by the UCARTS umbrella agency, the Upper Cumberland Human Resources Agency, and
3. Increased marketing and funding potentials.

The first two benefits need little explanation, but the increased marketing and funding potentials represent interesting strategies. The UCARTS transportation director anticipates that having better and more accurate records of the clients transported and trips provided in each county will enable the agency to better identify those counties that are not fully paying their share of the total transportation system costs. For example, county trip records can be used as leverage to prove to county judges or chief county executives that their constituents are being subsidized from other funding sources. Thus, any county official not willing to pay an adequate proportional share of total cost could face transportation service cutbacks to county citizens. This greater accountability and increased funding potential will greatly assist the operations of UCARTS.

FUTURE RESEARCH NEEDS

When the UCARTS software is fully operational, several additional functions could further expand program capabilities. Maintenance scheduling and routing modules should be investigated, along with any significant improvements in the recently released, updated data base management program called dBASE III. If useful maintenance scheduling or routing capabilities are available or the updated data base manager demonstrates significant improvements in capabilities or processing times, these improvements should be implemented.

As the operational procedures become routine, and if system travel demands increase, a final enhancement worthy of consideration is networking. Individual inputing of data from the busier remote county sites could become needed. Networking microcomputers present both unique opportunities and problems. Networking should be initiated cautiously and only when demand or logistics dictate multiple units at remote sites.

SUMMARY

Thus far, the entire research project has progressed efficiently and with no major problems. A more generic version of the tailored UCARTS program has been developed in conjunction with the UCARTS test project and will be available in the next few months. This program will be marketed by the U.S. Department of Transportation, Transportation Systems Center on a national basis and will be public domain software. A national training course using a test case example and the generic data base management programs is currently being put in final form. The training will introduce users to both the utility and the capabilities of these recent software developments.

The research and microcomputer programs described in this paper about Tennessee's experiences have been major contributors to the creation of widely available public domain programs that are adaptable to a variety of rural transportation operations. Subsequent papers will further document the utility of these generic programs, although their capabilities strongly resemble those tailored specifically to UCARTS operations and described in this paper.

Publication of this paper sponsored by Committee on Rural Public Transportation.