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Publication of this paper sponsored by Committee on Bus Transit Systems.

Abridgment

Assessing User Needs in Design of a Management Information System for Rural Public Transportation Services

JOHN COLLURA AND DALE FERGUSON COPE

The feasibility of designing a comprehensive management information system (MIS), which will assist in the performance of management and operations tasks involved in the provision of rural public transportation, depends on the definition and understanding of the relations among information gathering, processing, and reporting activities and those areas of administration and operations that might avail themselves of the advantages of a comprehensive MIS. The initial analysis of user needs and constraints, which is the focus of this paper, should indicate in specific terms the ways in which an MIS will contribute to the performance of information-related activities within the transportation operation. A step-by-step process is outlined to provide guidance to the initial MIS development activities and to assist in the structuring of a low-cost, comprehensive, and efficient MIS that will meet the information gathering, processing, and reporting requirements of rural public transportation authorities and operators.

The development of information gathering and processing techniques and the construction and maintenance of data sets for the purposes of administering and operating public transportation services are becoming ever more important objectives for government agencies, transportation authorities, operators, and the riding public. Current fiscal constraints, energy shortages, and the resulting emphasis on service efficiency and productivity are leading to increased dependency on the availability of appropriate and accessible information for transportation policymaking and management.

The continued viability of public transportation, particularly in rural areas where the service population is widely dispersed, where costs per trip tend to be high, and where systems are currently facing reductions in operating subsidies (Section 18 funds, Urban Mass Transportation Act of 1964, as amended) as well as other cutbacks in local, state, and human service agency budgets, rests especially on the ability of those who are responsible for the delivery of services to monitor carefully both the technical and social efficiency of these systems. The design and implementation of a comprehensive management information system (MIS), the advantages of which have long been recognized in the private sector, which will meet the data requirements of rural transportation agencies with full recognition of the limited financial and personnel resources available to such agencies, is a key factor in the maintenance of efficient and coordinated programs.

For the purposes of this paper, we have grouped the major management information needs of regional and local public transportation agencies and operators in rural areas into four general areas of activity:

1. Billing and accounting needs (1-3),
2. Monitoring and evaluating needs (4, and Section 15 of the Urban Mass Transportation Act of 1964, as amended),
3. Reporting requirements (5), and
4. Routing, scheduling, and dispatching needs (6).

Particularly in smaller transit facilities, these four broad categories encompass the minimum information-related activities that must occur to meet funding and report-filing regulations and ensure effective delivery of service.

MIS OBJECTIVES

Once the decision has been made to investigate the possibilities of designing a comprehensive MIS, and the proposal has been justified in the light of other uses for the start-up funds and time elsewhere in the operation, the process of identifying system objectives, constraints, and desirable features may begin (7). MIS objectives should be defined as specific targets that indicate how the MIS will support various aspects of the transit service and should be expressed in terms of what managers and operators will be able to do once their information requirements have been satisfied.

Thus, the basic sequential flow of the MIS development process is initiated with an analysis of existing data needs and current system capabilities and deficiencies. Participants in this first definitive step might categorize information system deficiencies as either those gaps that result from what information is lacking in the current system or as deficiencies in the structure, organization, storage, or use of information.

A review of the work tasks and schedules of each employee, including managers, bookkeepers, dispatchers, drivers, and others, and the information requirements that correlate to their tasks will reveal both the data needs and the deficiencies in the data and/or data structure that may be present in the existing system. As a result of this effort, the preliminary outlines of the MIS that might be designed to maintain and manipulate the necessary information and the specific technology and personnel required to process the information will become evident. The delineation of appropriate questions for the transit manager to ask with regard to specific goals in each category will aid in the clarification of the point along the simple-complex spectrum at which the service's MIS should be directed.

Another crucial aspect of assessing MIS needs involves the selection of an approach to the in-place information activity. An empirical approach involves the study of the in-place system slated to be replaced or improved; the idea is that the existing information system may have some good features and that the inherent deficiencies have been calibrated over time such that personnel have learned to compensate for the inadequacies of the system. In addition, the empirical approach also stresses that there may be a chance that inexpensive modifications to current methods might solve any information problems that exist (6).

Even if the decision has been made to scrap the existing information activity, an empirical examination of the information gathering and processing methods central to the present system will lead to an understanding of the volume and kinds of data needed in the new MIS, the level of accuracy and precision of current inputs, and the ways in which information currently generated is used by various personnel within the organization.

The alternative approach might be termed the logical method and may appear to be the mode of choice in a situation where the present information activities are hopelessly bound up in methods that result in wastes of time, money, and energy. The logical approach, essentially starting from scratch, may be preferable, for example, when a new manager is hired or a new service is being implemented. Under the logical approach, the information system designed will be free to experiment with various concepts of information management and, in this case, ignorance of how information-related activities have been carried out in the past may be a blessing. The end result of either approach, however, should be a general idea of the major elements of the new or redefined MIS and an understanding of how these elements are interrelated.

After the initial tasks of defining, refining, and reconciling information requirements have been completed, the user's needs assessment should result in the following outputs:

1. Statements of MIS objectives,
2. List of cost and personnel constraints and other restrictions,
3. Statements (or lists) of information requirements, and
4. Statements of what personnel should be able to do when the MIS is implemented.

The process of defining needs will have revealed data categories of essentially two dimensions: (a) a set of information-related activities that the MIS will encompass, and (b) a listing of the sources of data needed to accomplish those activities. At this point, it will be helpful for the information manager to construct a matrix of these information activities and the sources of data to aid in illustrating both the multiple uses of data gathered for the MIS and the processing steps necessary to match the activity with the source of information. Such a matrix will also illustrate the empty cells in which new activities and/or new sources of data are needed.

Each individual in the organization will contribute to the construction of the activity-source matrix a list of information-dependent tasks for which he or she presently takes responsibility for and a series of current sources of the requisite data for completion of those tasks. The conduct of this exercise, and staff discussion of the resulting matrix, will not only provide information regarding data storage locations and the full range of information-dependent activities carried out within the operation, but it will also tend to reveal certain duplicative efforts (if they exist) and any access problems encountered by particular members of the staff (7). The exercise might have several other beneficial results in pointing out areas of excess or missing information and thus lead to the reorganization of particular data on file. This streamlining of files will be especially important if the decision has been made to computerize the MIS, and it will demonstrate the true storage needs of such a system.

Figure 1 represents a slice of a matrix constructed of the information activities and data sources for a hypothetical transit service. It is assumed that the person within the organization who has taken on the role of MIS coordinator has worked up a list of information requirements and has ascertained the location of various files, card boxes, etc., where the necessary data are stored for manual or computerized processing. For the purposes of this hypothetical example, let us say that Figure 1 represents a slice of the matrix wherein an activity is specified and the data storage locations listed. The activity includes the billing of area human service agencies for transportation services provided to eligible clients under a specific funding source.

USING ACTIVITY-SOURCE MATRIX TO MODEL MIS

By examining a specific activity within the matrix and its corresponding data sources, a process for conducting that activity begins to take shape. The matrix assists in the task of converting verbal descriptions of information needs (collected from the involved personnel) into pictorial representations of work tasks and work flow. A flowchart of this activity sequence, as displayed in Figure 2, will serve as an abstract representation of the MIS components and their interrelations (6).

The flowchart illustrates inputs and their sources, a process (manual or automated), and outputs. The information and understanding collected within the framework of the activity matrix will provide assistance in the construction of a flowchart specific to the MIS activity. As mentioned above, a flowchart will prove useful for either a manual or computerized system; the differences will appear only in the processing block. At a minimum, the blocks shown in Figure 2 should be included in the graphic representation of the activity.

Figure 3 presents a flowchart that might be constructed for the carrying out of the first hypothetical activity in the matrix: Billing participating human service agencies for transportation services delivered to clients.

The input step specifies those files to be used in the activity, the location of these files, and the specific data to be retrieved from the files; coding information; and timing of the activity (monthly, annually, etc.). The processing step specifies how the data are to be sorted, what calculations are necessary, what files are to be updated with the new data, and what and where processed information is to be stored. The output step specifies what should be done with the data. In this case, an invoice for each participating agency will be prepared, mailed, and stored.

CONCLUSIONS

As demonstrated in this paper, the definition of sources and processes required to carry out the information activities of small transit services is a critical first step toward increasing the efficiency and productivity of both the transit staff

Figure 1. Matrix of information activities and sources of data.

SOURCE / ACTIVITY	CLIENT FILE(S)	VEHICLE FILE(S)	TRIP FILE(S)	AGENCY FILE(S)	REVENUE FILE(S)	PERSONNEL FILE(S)
	• ID Number • Name, Address • Handicap • Age • Eligibility • Agency Affiliation • Etc.	• Capacity • Insurance • History • Maintenance • Etc.	• OD Data • Vehicle Hours • Vehicle Miles • Purpose • Eligibility	• Rate Data • Subsidy Data • Funding Sources • Billing Proc.	• Fares • Subsidies • History • Etc.	• ID Number • Wage Data • Benefit Data • Time Data • Employment History • Etc.
BILLING HUMAN SERVICE AGENCY FOR SERVICES TO CLIENT IN MONTH	X		X	X	X	
FORM 406 UMTA SECTION 15 REPORT	X	X	X		X	X
OTHER ACTIVITIES • • • •						

Figure 2. Flowchart of theoretical input, processing, and output.

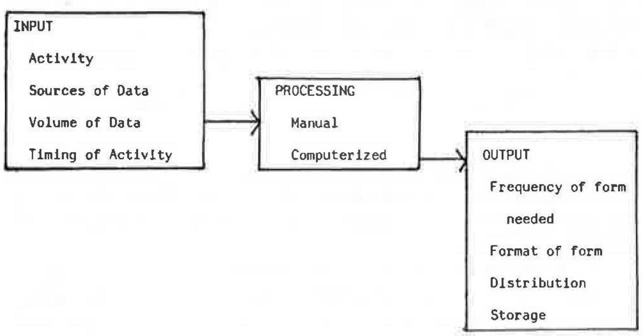
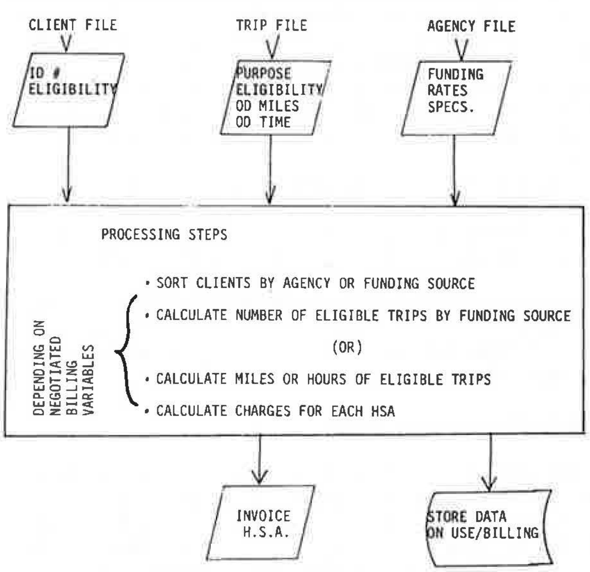


Figure 3. Sample flowchart for billing human service agencies.



and the service itself. Preparing a flowchart similar to that shown in Figure 3 for each information activity may seem an onerous task at first; however, the understanding gained through the process of defining needs, specifying activities and data sources in matrix form, and constructing a flowchart for each activity will be valuable to all participants in the service. The clarification of all the elements involved in the conduct of each information-related task will lead to more efficient procedures in the four major areas of concern.

ACKNOWLEDGMENT

This paper is part of a research project sponsored by the Office of University Research, U.S. Department of Transportation. The assistance of Theodore R. Higgs, Jr., contracting officer, and B. Paul Bushueff, Jr., contracting officer's technical representative, is gratefully acknowledged.

The overall goal of this ongoing research is to develop and test a comprehensive MIS that will be flexible enough to meet the varying data needs of rural public transportation operations. The MIS will be developed with full recognition of the limited resources available to agencies in rural areas.

The opinions and conclusions expressed or implied in this paper are ours and not necessarily those of the U.S. Department of Transportation.

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

Madison Avenue Dual-Width Bus Lane Project

SAMUEL I. SCHWARTZ, ANDREW HOLLANDER, CHARLES LOUIE, AND RAYMOND AMORUSO

On May 26, 1981, New York City implemented an exclusive dual-width bus lane on Madison Avenue in midtown Manhattan, which was funded by a one-year federal demonstration grant. The facility operates from 2:00 to 7:00 p.m. on weekdays and carries 25 000 passengers daily. It shares a roadway with three lanes of mixed traffic and is defined by pavement markings and overhead signs, accompanied by intense enforcement. Initial results indicated that (a) peak-hour bus speed was increased by 83 percent, (b) peak-hour bus reliability was increased by 57 percent, (c) peak-hour bus density was reduced by 45 percent, (d) traffic speed on Madison Avenue was increased by 10 percent, (e) average speed on parallel avenues was unchanged, and (f) average speed on eastbound cross streets was unchanged and on westbound cross streets was reduced by 6 percent. This project represents one of the most ambitious transit-priority projects for an urban arterial short of a complete ban of other traffic. The evolution and results of the project are described, and the implementation process is emphasized.

The concept of exclusive bus lanes is well established. It has been tested on expressways and urban streets throughout the United States and is now an accepted method of moving more people faster. But the institution of a dual-width bus lane on the congested streets of midtown Manhattan must be one of the severest tests of this approach.

This paper presents the rationale for selecting Madison Avenue as the locale for such a project and describes the implementation of the project and its impacts.

DUAL-WIDTH BUS LANE PROJECT

Project Background

Planning for a major surface transit improvement in midtown Manhattan began in 1979. All major avenues in midtown Manhattan were examined as possible candidates. Madison Avenue was selected because it was characterized by the following:

1. The highest bus volumes on any midtown arterial--approximately 200 buses during the peak hour (approximately 24 000 people travel by bus between 2:00 and 7:00 p.m. on Madison Avenue),
2. The lowest bus travel speeds on any midtown avenue during midday and evening periods--approximately 4 mph, and
3. The lowest automobile travel speeds on any midtown avenue during the evening period--approximately 5 mph.

These characteristics of Madison Avenue stem from its location as the central corridor for office development in midtown. Five local bus routes (with a combined headway of 53 s during the peak hour) and 32 express bus routes traverse its length. [Express buses run nonstop between the Manhattan central business district (CBD) and residential areas in each of the city's boroughs.] Subway lines flank it two blocks away on both sides. A major commuter railroad terminal (Grand Central Station) is one block away on Park Avenue at 42nd Street (see Figure 1).

The site conditions of Madison Avenue are as follows:

1. Roadway widths--Madison Avenue occupies an 80-ft right-of-way between 42nd and 60th Streets. The right-of-way consists of a 54-ft roadway and 13-ft sidewalks.
2. Traffic control devices--Madison Avenue is a one-way northbound arterial. Left turns are prohibited at the two-way cross streets in the project corridor. The remainder of the cross streets are one way. All intersections are signalized. There is a 27-mph northbound signal progression.
3. On-street parking regulations--Before implementation, the entire curb lane along the east (right) side of Madison Avenue was signed "No Standing, Bus Zone". Between 38th and 60th Streets, parking was prohibited along the west (left) curb, except for 54 spaces allocated for diplomats, 7 for the press, 11 for cars of handicapped drivers, and 5 for taxis.
4. Surface transit system--Between 42nd and 59th Streets Madison Avenue is directly served by 5 New York City Transit Authority (TA) local bus routes, 15 TA express bus routes, and 17 private express bus routes.
5. Land use--Both sides of Madison Avenue are characterized by office towers. At the time of project implementation, four major buildings were under construction.

Project Design

After consideration of several approaches, including single- and double-width contraflow lanes, a transit mall, and rerouting of buses, the dual-width concurrent-flow approach was selected as optimal. The final design consisted of the following elements:

1. Reorganization of bus stops along the right curb. The frequency of bus stops for local buses was changed from every other block, on average about every 500 ft, to every third block, about every 750