11. J.F. Engel, H.F. Fiorillo, and M.A. Cayley, eds. Market Segmentation: Concepts and Applications. Holt, Rinehart, and Winston, New York, 1972.
12. F.J. Wegmann, G.E. Byrne, A. Chatterjee, C.R. Bonilla, and K.W. Heathington. Market Opportunity Analysis for Short-Range Public Transportation Planning. NCHRP, Rept. 208, Oct. 1979.
13. Organizing the Marketing Function in Readings in Public and Nonprofit Marketing. The Scientific Press, Palo Alto, Calif., 1978, pp. 81-86.
14. K. Sinha, D. Jukins, and O. Bevilacqua. Stratification Approach to Evaluation of Urban Transit Performance. TRB, Transportation Research Record 761, 1980, pp. 20-27.
15. F. Wegmann, C. Bonilla, T. Bell, D. Dewhirst, C. Sorchen, and K. Heathington. Market Opportunity Analysis for Short-Range Public Transportation Planning. NCHRP, Rept. 210, Oct. 1979.
16. J. Attanucci, I. Burns, and N. Wilson. Bus Transit Monitoring Manual. UMTA, Rept. No. UMTA IT-09-9008-81-1, Aug. 1981.
17. E.P. Cox. Marketing Research: Information for Decisionmaking. Harper & Row, New York, 1979.
18. S. Schoeffler, R. Buzzell, and D. Heany. Impact of Strategic Planning on Profit Performance. Harvard Business Review, Volume 52, No. 2, March-April 1974, pp. 137-145.
19. M. Turnquist, A. Meyburg, and S. Ritchie. Innovative Transit Service Planning Model That Uses a Microcomputer. TRB, Transportation Research Record 854, 1982, pp. 1-6.
20. G. Kocur. Potential Impacts of Transit Service Changes Based on Analytical Service Standards. TRB, Transportation Research Record 854, 1982, pp. 60-67.
21. A.H. Savage. Another Myth Falls: Marketing Really Does Affect Transit Ridership Levels. Passenger Transport, April 1982, pp. 4-5.
22. D. Young. Davenport, Iowa: One Small System's Race Against Time. Mass Transit, Dec. 1982, p. 52.
23. P.G.W. Keen. Managing Organizational Change: The Role of MIS. Proc., Seventh Annual Conference, Society for MIS, New York City, Sept. 1975.

Publication of this paper sponsored by Committee on Public Transportation Planning and Development.

Low Cost Planning Techniques for Assessing Rural Transportation Needs

HANNAH WORTHINGTON

As many local planning departments face lower departmental budgets, hiring freezes, and consolidation of various planning functions, the creative application of traditional planning techniques specifically to small-scale rural transportation projects becomes increasingly important. It is necessary in continuing to provide the informational support needed to compete for reduced program funds against an increasing pool of fundable projects and to distribute those funds fairly throughout a large and often diverse rural population. The purpose of this study was to find low-cost ways to apply those traditional planning techniques to the specific needs of a rural community. The low-cost application presented uses secondary data that are available from published sources to rank communities in a political jurisdiction according to their transportation needs. Ranking such areas according to the proportion of the population that is transit dependent is a first step in the political decision-making process to be followed by an actual estimate of transit ridership using demand models specifically calibrated for rural areas. The technique was used in preparing the transit element of the County of Rock, Wisconsin, Transportation Study.

THE NEED FOR MODIFIED PLANNING TECHNIQUES

There are a number of conditions common to rural areas that require the adaptation of traditional planning techniques. The planning technique discussed in this paper is needs assessment. The purpose of needs assessment in this context is to establish priorities for transportation needs within a political jurisdiction. Commonly, this technique involves collection of original data on current patterns of transit use and/or citizens' predictions of their future use of a proposed service as defined broadly at the preplanning stage. This collection and analysis of original data requires a large amount of time and a large number of staff hours as well as specialized skills in survey and statistical research. Even so the technique often yields predictions of high use areas with low correlation to actual use.

Planning for the transportation needs of rural areas requires modification of the traditional technique for establishing priorities in geographical subareas to accommodate conditions common to such areas. Those conditions include population size and characteristics, geographical size and diversity, land use patterns, local administrative and legislative structure, and the area's status within a larger political jurisdication.

Size and Land Use

Size and land use are major factors in determining the planning and program resources available to the area. The small population and predominantly agricultural land use of rural communities provide a small tax base (both property and income). Local revenues, therefore, often can support only a small planning staff. Recent economic conditions have further restricted that staff.

For instance, local tax relief initiatives and federal income tax and spending reductions have reduced local revenues. Reduced revenues have been compensated for by reducing overtime, increasing the use of part-time employees, reducing positions through attrition and layoffs, and eliminating certain planning and program functions.

In addition, the Comprehensive Employment Training Act (CETA) and other sources of federal support have been curtailed. Thus, staff, members are often

performing more than one planning function or are combining planning and program functions and have little support staff to perform original data collection tasks.

Competition for Funds

The reduction in program funds--local, state, and federal--has created other dilemmas for local planning departments. At the local level there is increased competition for funds within planning departments both among the various planning functions, including transportation, and between planning and program functions. There is also competition among various programs at the regional and state levels. This increased competition for funds requires a convincing presentation of information to support the need for, and planned equitable distribution of, program funds.

Political Structure

In many instances, the structure of the local legislative body is one that requires legislators to perform administrative as well as legislative duties. Thus legislators examine and take action on the managerial details of proposed projects in addition to their legislative function of appropriating funds for specific projects. Therefore, the results of a needs assessment must be presented in a convincing and understandable form for legislators who may be unfamiliar with planning techniques.

Diverse Development Patterns

Land use and development patterns common to rural areas create a situation that must be considered in establishing priorities within a geographic area based on transportation needs. This situation is the combination of small towns or cities and large sparsely populated rural areas within a single political jurisdiction that has both centralized and decentralized services. Priorities therefore must be based on which subareas are most transit dependent (i.e., have the highest ratio of needy to the population of the subarea) as well as which areas have the highest concentrations of needy (i.e., have the highest ratio of needy to the population of the entire area). In that way, both the urban and rural areas will be considered. This method of establishing priorities is likely to be politically palatable because it ensures that both rural and urban areas will be taken into consideration.

Special Interests

These priorities must also consider a number of special interests in the region that often conflict with each other. One such issue is the preservation of decentralized services (e.g., the rural general store) while considering the practicality of providing transit to and from centralized service areas. Other conflicting special interests are the simultaneous provision of work trips, medical trips, and shopping trips--all preferred during peak hours.

USE OF MODIFIED PLANNING TECHNIQUES

The feasibility study for Rock County, Wisconsin, (1) identified and recommended a number of options for general public transportation. These options were developed on the basis of the following planning elements:

1. Data collected on population characteristics, existing service, and major trip generators;
2. Needs analysis;
3. Goals and objectives set by the advisory committee;
4. Estimates of ridership demand;
5. Cost and revenue analysis; and
6. Consideration of the effect on users and implementation issues.

The focus of this paper is on the needs analysis element. A number of aspects of the needs analysis technique used in the Rock County study accommodate the uniquely rural conditions described in the previous section and are particularly suited for use by local planning departments. These aspects are presented in detail in this section.

A New Application of a Traditional Technique

The needs assessment technique described in this paper is not new; however, this application of the technique is a useful alternative to the more typical common sense or ad hoc approach to assigning priorities to subareas within a rural jurisdiction. Its purpose is to give rural transportation planners the tools for encouraging local legislators to combine their parochial interests with more objective data when establishing priorities.

It provides more specific information than the common sense approach to politicians and administrators making decisions on transportation service delivery. It provides a low-cost, expedient basis for fair distribution of resources countywide and for presenting results to policymakers in a clear, concise form. Establishing those priorities county or regionwide becomes more and more crucial as available funds decline.

Using an extensive collection of demographic and geographical data instead of "a few statistics and some common sense" to assign priorities often gives policymakers additional insights. For example, when a subarea is described in terms of its transit dependent residents, policymakers can consider the types of funds earmarked for service to those people. Without more extensive information, funds for the elderly or poor, for example, might never be considered; or if they were considered, no data would be available to support the use of those funds for a given subarea.

Methodology

The needs analysis used in the Rock County study is based on predictions of high transit use as implied by the proportion of transit dependent in each geographical subarea. Identifying needs is not the same as estimating demand or documenting community interest in public transit. It is used to describe gaps in service and identify geographical areas that are most likely to generate ridership based on the characteristics and size and density of the population in those areas.

Demand was estimated later by using models calibrated with data from hundreds of rural systems nationwide specifically for a number of transit options. Community interest was not specifically addressed by this study, but several surveys of county residents were included as appendix material. They indicated a perceived lack of transportation opportunities in areas outside the two major cities of Janesville and Beloit.

Assessing Relative Need

The method of needs assessment used for this study began with developing a measurement of each subarea's relative need for transportation in terms of

geographical area, type of user, and trip purpose. The relative need was analyzed by applying a test based on the proportion of transit dependent in each subarea. Transit dependent, for the purpose of this study, is defined as those most likely to rely on public transit because they are young or transportation handicapped (i.e., elderly or handicapped) or low income or carless.

All 28 subareas (i.e., 20 townships, 5 cities, and 3 villages) were ranked from one to 28 for each of the four factors. For each subarea the four ranks were then added together and divided by four to calculate an average rank for each subarea. A combined rank was established for each subarea based on the highest proportion of transit dependent.

An additional factor was added for the first two categories--young and transportation handicapped. That factor takes into account the actual number of young or transportation handicapped in each subarea. Therefore, a second combined rank was calculated based on the highest numbers of transit dependent. The two sets of highest combined ranks produced a list of three areas that are in the top 25 percent of both lists and four more in the top 25 percent of the first list and four more in the top 25 percent of the second list. Thus, the following were identified:

1. Subareas with the highest proportion of transit dependent (i.e., those seven of the 28 subareas that are in the top quartile of combined ranks, three of which are also in category 2).
2. Subareas with the highest number of transit dependent (i.e., those seven of the 28 subareas that are in the top quartile, three of which are also in category 1).
3. Subareas with both the highest proportion and highest number of transit dependent (i.e., those three subareas common to categories 1 and 2).

Assigning Priorities to Subareas Based on Need

For the highest ranked subareas, needs were further defined in terms of users and geographic area. Even though the highest ranked all had high combined ranks, not all of their individual four factors are high when examined separately. Therefore, the four transit dependence factors were reexamined individually to target the particular transit dependent population in each high-need subarea.

The high-need subareas were also reexamined in terms of specific geographical areas presumed to generate the greatest need for transit. The following factors were considered:

1. Population size,
2. Population density,
3. Location of an urban service area within the township or nearby,
4. Location of rural development centers--both commercial and residential,
5. Access to incorporated areas, particularly those where major trip attractors are located, and
6. Location within the urbanized corridor between Janesville and Beloit.

Other Data Used to Assign Priorities to Subareas

Trip Purposes

In addition to analyzing where the most transit dependent live, needs were also analyzed in terms of where passengers might need to go. Contacts with social service agencies and county planners were used to identify reasons for trips and their probable destination. The following reasons were identified: medical, employment, shopping, higher education, and human service facilities.

Existing Service

An inventory of existing transportation services was made. In-person and telephone interviews were conducted. Additional data were obtained from other recently completed studies on file in the county. Existing transportation services are

1. Municipal transit systems,
2. Human service agencies providing direct transportation service,
3. Taxi companies,
4. Intercity buses, and
5. Other private companies.

In the analysis of these services particular emphasis was placed on those elements of each service that address either general public transportation or the transportation needs of a specific population dependent on public transit. Those elements include

1. Service restrictions (geographical, user eligibility, or trip purpose),
2. Hours of operation,
3. Fares,
4. Type of service and level of passenger assistance,
5. Trip purposes (and specific trip) served and their relative frequency,
6. Types of users served, and
7. Geographical areas served.

Implementation Concerns

The role of (a) existing providers in a countywide transit system, (b) potential funding issues, and (c) local barriers to implementation were also examined. Potential roles for existing providers were explored by examining those operational and administrative characteristics of existing systems that might inhibit or enhance implementation and analyzing how they could be integrated to provide a comprehensive package of countywide transit. Those characteristics examined included fleet size and type, operating hours, type of service, current clientele, service area, and trip served.

The potential funding issues examined include requirements and realities of available funding, and considerations in securing funds to match federal and/or state funds.

Local barriers to implementation that were examined included willingness of providers to participate, regulations, insurance, labor, and local concerns.

Subarea Profiles

A one page profile was prepared for each of the 28 subareas. The profile describes the population characteristics, development pattern, population density, location of major trip generators, and existing transit services. This profile provides a concise description of unmet transit needs within a particular subarea. It is well suited for use by local committee members and legislators. The profile for Milton Township is given as an example.

Needs Profile for Milton Township

Milton Township, in north central Rock County, was ranked fourth along with Avon Township. Of the four individual "transit depen-

dence" factors, only one, vehicle/household was in the highest quartile. One other, percent under age 18, was in the second quartile. The other two, percent transportation handicapped and per capita income, were in the second lowest "need" quartile.

Milton is the eleventh largest subarea (the sixth largest of the eight incorporated areas) with a population of 2,306 at a density of 68.8 per square mile. Its rural residential center, Clear Lake, has 318 residents in the west central portion of the township. In addition, the rural development center is surrounded by urban service areas both in the town of Milton (i.e., the City of Milton and the Consolidated Koskonong Sanitary District) and in the town of Fulton to the west (i.e., the City of Edgerton) and the towns of Janesville and Harmony to the south (i.e., the City of Janesville).

The cities of Milton and Edgerton are the sources of major facilities for the township. The township is served by trip attractors such as the Milton Medical Center and both Mercy Hospital in the City of Janesville and Memorial Community Hospital in Edgerton, each within 8 miles of the City of Milton. Major employers within the City of Milton include the Burdick Corporation (250 employees) and Kenemetics, Inc. There is a nutrition site at St. Mary's Church on Parkview Drive at the southeast edge of the City. Milton College, also in the City of Milton, serves approximately 630 students.

A number of factors increase the Township of Milton's claim to high priority in terms of need. They include the large areas of development, both as sources of trip attractors and as concentrated population centers; the large population (especially when the City of Milton is included); and the proximity of and highway access to both the City of Janesville and the City of Edgerton.

Any system designed for this township would need to acknowledge that although the City of Milton is a major source of trip attractors, it is in the third quartile (next to lowest) of combined ranks and, therefore, not to be counted on for concentrations of "transit dependent." Also, for the Township of Milton, carlessness is in the highest quartile so a system dependent on part of a trip being taken by car would be inappropriate.

USE OF THE TECHNIQUE IN ROCK COUNTY, WISCONSIN

Rock County, Wisconsin, by request of the County Board of Supervisors, was the subject of one of eight feasibility studies funded by the Wisconsin Department of Transportation on Public transportation in a number of rural areas throughout the state. The Board of Supervisors had two goals for the study:

1. To assess the potential for countywide public transportation, and
2. To prepare the public transportation development plan [as part of the County of Rock Transportation Study (CORTS)].

The eight studies were funded through the Federal Highway Administration's Section 18 rural transportation program, which was administrated by the Wisconsin DOT as technical assistance to local governments in the state. Rock County is considerably more urban than the other seven areas in the study and has a municipal transit system that is more developed. The county also has begun limited consolidation of social service agency transportation and administers a program specifically to provide general purpose trips throughout the county to elderly and handicapped residents without regard to agency affiliation. The Rock County study, therefore, focused on the feasibility of establishing a countywide transit system for the general public as an addition to the existing municipal and special needs transportation systems already in place.

The needs assessment technique discussed in this paper was used to identify subareas of potential high transit use by assessing unmet transit needs. This was acomplished by determining the geographical subareas with high proportions and/or high numbers of transit dependent residents, the major trip attractors (i.e., typical origins and destinations) in the area, and the transit services currently serving specific geographical areas, specific types of users and specific types of trip purposes. That assessment of unmet needs was used as the basis for the rest of the study. The needs assessment established priorities for areas of high need. Then, the Advisory Committee established goals for public countywide transportation, and transit options were developed based on the identification of unmet transit needs, available funding, potential barriers to implementation, and the Committee's goals and objectives. The options were evaluated in terms of goals, costs, revenues, estimated ridership, and the potential for implementation. Recommended options were presented to a subcommittee of the local legislature.

Ranking the Subareas

Table 1 shows the rank of each subarea for each of the four transit dependence factors and gives the combined rank for each subarea. Table 2 indicates which quartile the four individual factors fell into for the seven subareas with the highest combined rank. Materials were also prepared showing the population rank, population density, and location and population of rural development centers and urban service areas. Other materials show the geographic areas served by existing providers and the trip purposes served by existing providers.

SECONDARY DATA SOURCES USED IN THE NEEDS ASSESSMENT

The needs assessment technique discussed in this paper represents a low-cost method of fairly and expediently establishing priorities for unmet transit needs in a rural jurisdiction. It is low-cost basically because it depends on the use of secondary data rather than on the collection and analysis of original data. The data sources used in the Rock County study are commonly available nationwide.

Population Characteristics

Population, per capita income, age under 18, and age over 65 are available for 1980 from the U.S. Census Bureau, Department of Commerce. By fall 1982, printed material is expected to be available for all subareas. For areas not classified as urbanized (i.e., based on population density), the data are available for individual towns, which are sometimes further divided into enumeration districts (i.e., an area of about 200 housing units). Urbanized areas are subdivided into census tracts (i.e., containing about 4,000 residents).

In addition, state or local agencies, particularly those that serve the elderly and poor, esti-

Table 1. Rank of subareas by transit dependence factor and all ranks combined.

Subarea	Percent Transportation Handicapped	Percent Under 18	Vehicles per Household	Income	Total	Average	Combined Rank
City							
Beloit	8	23	7	16	54	13.50	8
Edgerton	4	27	10	27	68	17.0	24
Evansville	6	24	12	26	68	17.0	24
Janesville	14	14	8	28	64	16.0	21
Milton	7	25	16	12	60	15.0	14
Village							
Clinton	3	26	17	24	70	17.5	26
Footville	9	17	18	19	63	15.75	19
Orfordville	5	15	20	8	48	12.0	4
Town							
Avon	12	10	24	2	48	12.0	4
Beloit	16	22	4	21	63	15.75	19
Bradford	11	12	26	13	62	15.5	17
Center	17	8	25	2	52	13.0	7
Clinton	25	13	28	14	80	20.0	28
Fulton	10	20	1	25	56	14.0	10
Harmony	28	2	19	9	58	14.5	12
Janesville	1	28	9	6	44	11.0	3
Johnstown	27	3	22	18	70	17.5	26
La Prairie	21	7	14	15	57	14.25	11
Lima	20	19	15	5	59	14.75	13
Magnolia	13	4	11	1	29	7.25	1
Milton	15	11	2	20	48	12.0	4
Newark	26	5	23	7	61	15.25	15
Plymouth	19	1	21	23	64	16.0	21
Porter	18	21	13	12	62	15.5	17
Rock	2	16	3	11	32	8.0	2
Spring Valley	24	6	27	4	61	15.25	15
Turtle	22	18	5	22	67	16.75	23
Union	23	9	6	17	55	13.75	9

Note: The subarea ranked first has the highest overall transit dependency, the subarea ranked second has the next highest transit dependency, and so on.

Table 2. Summary for subareas with highest combined rank.

Subarea	Combined Rank	Percent Transportation Handicapped	Percent Under Age 18	Vehicles per Household	Per Capita Income
Magnolia	1	2nd quartile	highest	3rd quartile	highest
Rock	2	highest	3rd quartile	highest	2nd quartile
Janesville	3	highest	lowest	2nd quartile	highest
Orfordville	4	highest	3rd quartile	2nd quartile	2nd quartile
Avon	4	2nd quartile	2nd quartile	lowest	highest
Milton Township	4	3rd quartile	2nd quartile	highest	3rd quartile
Center	7	3rd quartile	2nd quartile	lowest	highest

Note: Individual ranks have been divided into quartiles as follows:
1-7—highest quartile (most need)
8-14—2nd quartile
15-21—3rd quartile
22-28—lowest quartile (least need)

mate the population characteristics for other than census years by factoring in growth projections. The accuracy of those off-census-year estimates depends on how evenly the growth of an area is distributed throughout that area, because growth projections are usually made at the county or regional level.

In Wisconsin, data on automobile ownership were available by minor civil division from the State Department of Transportation, Division of Motor Vehicles. This may vary from state to state.

The percentage of transportation handicapped is derived by using a formula based on incidence rates in other rural areas. As shown in Table 3, an incidence rate for moderately handicapped and an incidence rate for severely handicapped is applied separately to three age groups.

Land Use and Development Patterns

The location and size of rural developments and urbanized service areas was available in Rock County in the Farmland Preservation Plan prepared by the county planning department. In other areas the data may be available in local economic and community development or land use plans.

Existing Transit Service

Data such as fleet size and type, fares, hours, routes, type of service, and ridership eligibility are often collected and published annually. Sources for data on service in small urban areas are included in the 5-year Transportation Development Plans (TDP) and annually in federal, state, or local applications for transit assistance. In addition, public transit systems are required to keep monthly or quarterly records if they receive federal transit assistance.

Data on specialized transit services are available in grant applications for local, state, or

Table 3. Incidence rates of transportation handicaps by age and severity of handicap (2).

Age	Moderately Transportation Handicapped	Severely Transportation Handicapped
10-59	0.005	0.0107
60-64	0.0322	0.0344
65+	0.114	0.1818

federal funds. In addition transportation often is a separately recorded item in social service agency annual reports. Coordination studies and other local plans are typical sources of information on specialized transit services.

SUMMARY

The needs assessment technique discussed in this paper determines unmet transportation needs using a method that is low-cost and expedient, provides a basis for fair distribution of resources countywide, and makes it possible to present the results to local legislators in a clear, concise form. The use of secondary data reduces both cost and time. The use of proportions, as well as total numbers, of transit dependent within a subarea for assigning priorities to areas of need encourages a fair distribution of funds countywide. A one page profile for each geographical subarea provides an effective method of communicating the results to local legislators. The approach also provides an extensive data base for use in future planning efforts as well as in implementing the proposed service. The data profiles are also well suited to periodic updating for reintroduction at the next legislative session, if necessary.

ACKNOLWEDGMENT

This paper is based on work conducted by Ecosometrics, Inc. under contract to Wisconsin DOT to provide technical assistance through the Federal Highway Administration's Section 18 rural transportation program. The author wishes to thank Kathy Hicks and Jim Beckwith of the Wisconsin DOT for their guidance on the contract and Dave Fodroczi of the Rock County Planning Department for his insights on planning for rural and small urban areas. Jon E. Burkhardt, Sue F. Knapp, and Jeffrey I. Riese were the other authors on the Rock County Study.

REFERENCES

1. H.H. Worthington, J.E. Burkhardt, S.F. Knapp, et al. Feasibility of Countywide Public Transportation for Rock County, Wisconsin, Ecosometrics, Inc., Dec. 10, 1981.
2. Crain and Associates. Definition and Travel Characteristics of the Transportation Handicapped in the CRAG Region. Columbia Region Association of Governments, Sept. 1977.

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

Computerized Management Information Systems for Transit Services in Small Urban and Rural Areas

JOHN COLLURA, RUTH BONSIGNORE, AND PAUL McOWEN

Before 1980 few transit properties in small urban and rural areas used computer-aided information systems. In the last several years, however, these transit agencies have begun to use computers to assist in tabulating information related to operations; administration; billing and accounting; and planning, monitoring, and evaluation. This increased use can be attributed to advances in computer technology as well as to the belief that such computers can improve efficiency and the delivery of transit service. The primary purpose of this research was to review nine automated management information systems (MISs) with respect to their hardware and software characteristics, initial and ongoing costs, and capabilities. This review is carried out within an evaluation framework that facilitates the conduct of a systematic, comprehensive review, in such a manner that transit professionals with little or no computer experience will understand major differences among the MISs and the various options available to automate the processing of information. Other issues regarding the implementation of MISs are also addressed, including staff requirements and available sources of funding for both fixed and recurring costs. The major conclusions of the research are (a) most efforts to computerize transit information systems in small urban and rural areas focus on paratransit services; (b) a comprehensive, low-cost, easy-to-use MIS is needed for fixed-route and fixed-schedule services in small urban and rural areas; and (c) steps should be taken to ensure that the national computer directory to be developed under the direction of NCTRP addresses the need of transit providers in small urban and rural areas.

Current fiscal constraints imposed on public transportation providers across the United States have increased the importance of efficient information management. As a result the use of automation is becoming more prevalent at many levels of transportation management to satisfy a wide range of information needs.

The purpose of this paper is two-fold: (a) to identify a variety of computerized management information systems (MISs) presently used by transit authorities and operators primarily in small urban and rural areas, and (b) to develop and apply an evaluation framework to compare and contrast these MISs.

An overview of the management information needs of small urban and rural operators is provided along with a summary of existing MISs in terms of their service characteristics, software and hardware components, costs, capabilities, and other factors. The review of the automated management information systems in this paper illustrates the diverse application of computer technology to the field of transportation management and should be especially useful in improving the understanding of computers among transportation professionals, particularly professionals involved in the planning and development of MISs for transit services in rural and small urban areas.