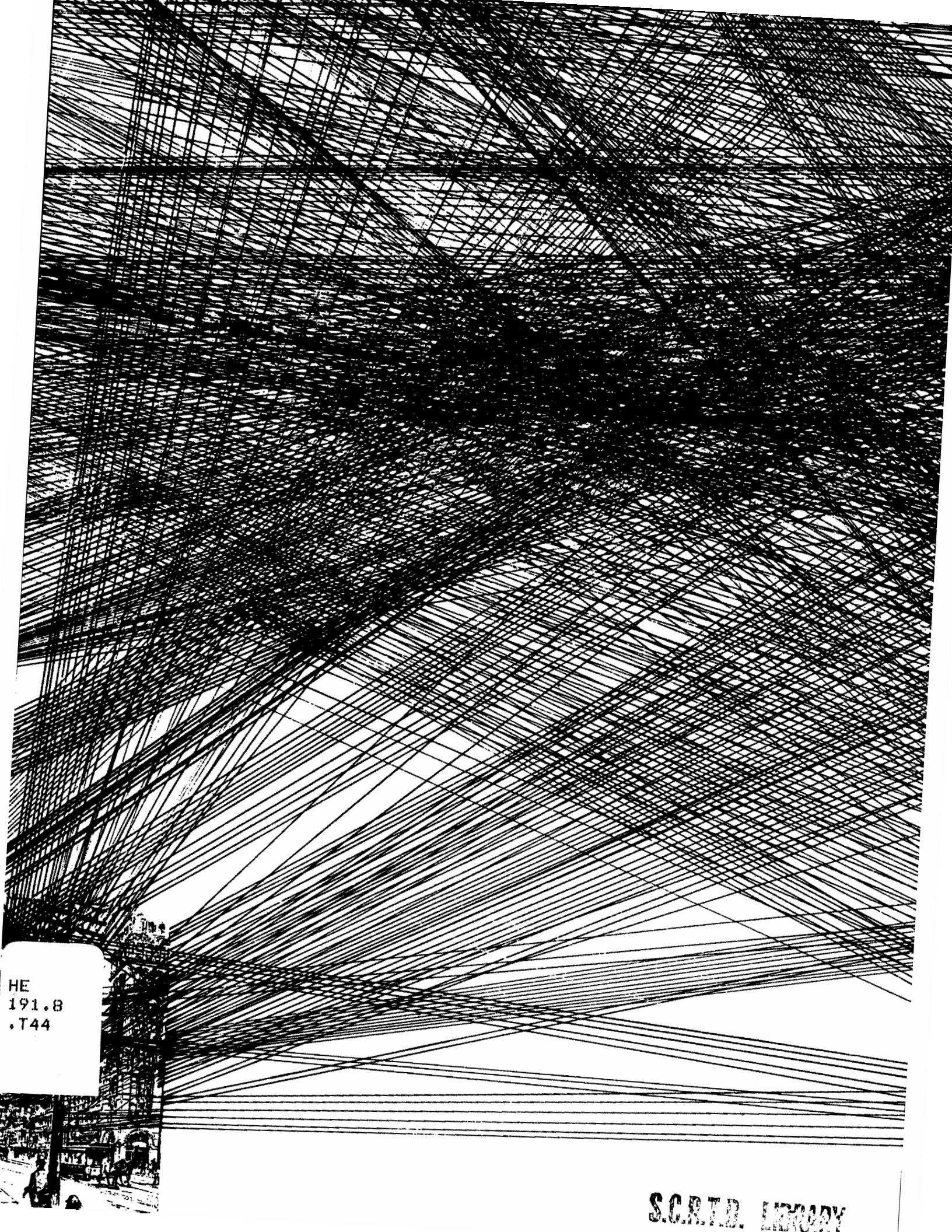

Cover: Disorderly Wires on lower Broadway, New York City, 1889.

Summary of the Telephone Transit Information Systems Workshop

Sponsored by
THE U.S. DEPARTMENT OF TRANSPORTATION
URBAN MASS TRANSPORTATION ADMINISTRATION

November 15-16, 1979
Washington, D.C.

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16. Abstract

Over 100 people representing 40 transit properties attended a workshop dealing with Telephone Transit Information Systems. The transit personnel agreed that the transit system must determine, as policy, the level of service that they want to extend to the patrons. It was felt that the agents must be given relief from the stress of their job. It was determined research is required in the area of agent recruitment and training and in methods of providing technological assists to small properties. The question of the value of telephone information services was addressed and some initial attempts were made at relating the value to the cost of the service.

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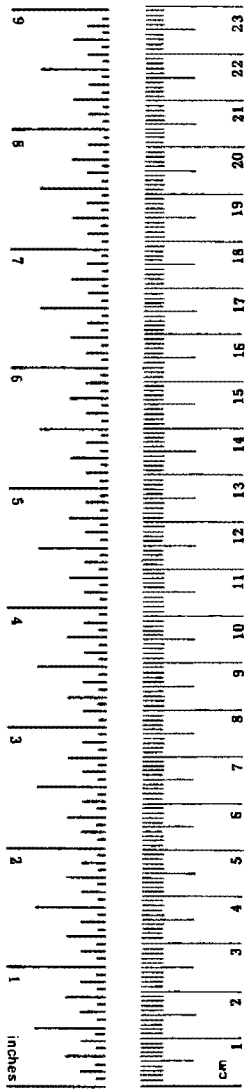
METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

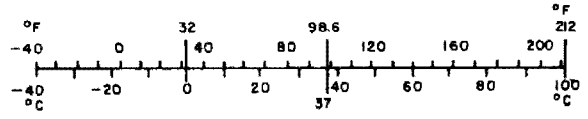
Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



Imagination is more important than knowledge for knowledge is limited, whereas imagination embraces the whole world, stimulating progress, giving birth to evolution.

Albert Einstein

DEPARTMENT OF TRANSPORTATION
URBAN MASS TRANSPORTATION ADMINISTRATION
WASHINGTON, D.C. 20590

Dear Reader:

The Transit Telephone Information Systems Workshop held in November 1979 must be judged a success by any standard. Over 100 people attended, representing 40 transit properties, the communications industry and government. The workshop provided a forum for deliberation of issues and sharing knowledge across the spectrum of transit telephone information service. Participants seized this opportunity and enthusiastically entered the debates. Information was communicated, knowledge was gained, and most of us left with the feeling that even if ultimate answers are lacking, we now can direct better our telephone information activities. Additionally, we left feeling that we have the interest and support of other talented professionals in resolving broader issues of transit telephone information, often beyond our ken.

This proceedings report attempts to capture the flavor of the workshop--its setting, substance, and style--in condensed form. The report is intended to be a reference handbook for telephone information center managers, conveying the essence of ideas brought out at the workshop, upon which practitioners can build property-specific solutions. Admittedly the data and ideas herein are incomplete, but they are an important start toward setting a context for our telephone information activities.

From this start, I look forward to UMTA addressing topics identified as needing further research in this proceedings report. I also look forward to initiatives from transit properties in refining and using this information to improve their telephone information systems. Certainly, judging from the response, follow-on workshops on this subject are needed. I offer a challenge to others to organize and conduct these workshops, to keep abreast of new developments and to bring more focus on specific issues of telephone information systems. The need for continuing the dialogue we have begun can best be measured by the willingness of others to share in these responsibilities.

In closing, my thanks to all who planned and participated in this workshop for making it such a success, and for making it such a memorable and personally rewarding experience.

Sincerely,

John Durham
Office of Technology Development
and Deployment

ACKNOWLEDGMENTS

Much of the success of the workshop must be attributed to those who aided in the planning and provided facilities for the sessions. Urban Mass Transportation Administration (UMTA), American Public Transit Association (APTA), Transportation Research Board (TRB), Washington Metropolitan Area Transit Authority (WMATA), and the transit community in general were generous with their time and effort. It is impossible to mention and thank everyone who helped in various ways, but there are several whose contributions we would like specifically to acknowledge.

First, thanks to Brian Cudahy and Carol Eisen Kerr of UMTA for their recommendations on the scope of the workshop and their assistance in architecting the program.

Al Engelken provided the services of APTA both in publicizing the workshop and drawing valuable comments from the transit industry.

Marylou Damon and Campbell Graeub of TRB were instrumental in providing the prestigious facilities of the National Academy of Sciences for the first day's meeting. Marylou was liberal with her efforts in ensuring that all necessary equipment was available and that all attendees were graciously hosted.

Jim Reading was extremely generous with his time not only as TRB's spokesman at the workshop, but also as a panel moderator in representing Central Ohio Transit Authority (COTA).

Listing all of the contributions of WMATA would take an endless amount of time. John Warrington and Mike Noonchester led the WMATA effort in providing facilities, transportation, and a maximum professional effort in behalf of the workshop. WMATA's entire marketing staff was superb.

The transit properties of the U.S. and Canada supported this effort in great fashion by sending, at no small cost, the best marketeers in the business. Not only did they come to share their successes but also to lay out in the open the mistakes that they have made. Many of the attendees went home armed with lists of ideas to try and precautions to take.

Finally, the members of the workshop panels displayed their skill not only in spelling out their own views but also in drawing out the views of the attendees. The language of the sessions were frank and the biggest criticism heard was -- "We didn't have enough time."

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1. INTRODUCTION

As the costs of operating an automobile increase at an accelerating rate and road congestion makes individual travel more stressful, the transit industry is presented with a golden opportunity to provide the public with an efficient and inexpensive alternative to automobile travel. But transit has recognized that good and efficient service does not necessarily sell itself. Rather, the public must be shown that transit can be integrated into its lifestyle with ease and without fear.

The Urban Mass Transportation Administration (UMTA) has recognized the need for a strong marketing effort on behalf of transit and has supported their efforts in this direction. The Telephone Transit Information System Workshop was sponsored by UMTA's Office of Socio-Economic Research and the Office of Transportation Management with the support of the Transportation Research Board (TRB) and the American Public Transit Association (APTA). The objectives of this workshop were to provide a forum for open discussion of the state-of-the art of telephone information systems, identify the successful techniques used by transit systems and promote their implementation and identify new research needs and ideas.

The workshop was held on November 15, 1979, morning and afternoon at TRB and on the evening of that day and the morning of November 16 at the head office of the Washington Metropolitan Area Transit Authority (WMATA). More than one hundred people from the transit and transit related industries participated. Appendix A lists the attendees and their affiliations and Appendix B is a summary of organizations represented. These organizations included transit systems, suppliers, government agencies and universities.

1.1 Workshop Overview

The workshop was organized into a series of sessions beginning with an overview of the need for transit telephone information and followed by categorized approaches to finding such information. These were defined as:

a. Manual Systems - systems relying on manually referencing information in maps, route descriptions and schedules;

b. Microfiche Systems - systems using information stored on microfiche; and

c. Computerized Systems - systems in which the reference data is digitized.

After brief comments from the panel and the floor each session was broken into four concurrent miniworkshops which afforded all attendees a better chance to express their views and to learn from the proceedings. The miniworkshops were intended to bring out views on the area of good practices, pitfalls to avoid and research needs in transit information. Later sessions provided a demonstration of WMATA's computerized system as well as different views on information processing and future needs.

Table 1 outlines the program and its range of topics related to telephone information systems. The workshop opened with messages from some of the sponsoring groups and included a keynote address by George Pastor, Associate Administrator for Technology Development and Deployment at UMTA. The remainder of the morning session was devoted to a discussion entitled "Need for Transit Information." A number of views of telephone information systems were presented in this session ranging from the concept that telephone systems are a resource that can lend reassurance to the traveler to the view that telephone systems are expensive and should be used only as a support to other, more cost-effective, means of marketing.

The workshop session that followed was devoted to a discussion of the manual system of supplying telephone information to transit patrons. In manual systems the operators rely solely on geographic and transit routing maps, headway sheets and route descriptions as the source of transit information.

Some transit properties have organized this data on microfiche as a faster means of accessing the information. Use of the microfiche system as a method of information retrieval was a subject of debate at another workshop session.

Two transit systems are currently actively testing digitized transit data bases. These systems use a computer, either time shared or dedicated, to provide trip itinerary information to the operator through use of a cathode ray tube (CRT) interfaced between the computer and an entry keyboard. Computer systems were discussed in a workshop demonstrated at the WMATA Telephone Information Center.

TABLE 1 - TELEPHONE INFORMATION SYSTEM WORKSHOP SCHEDULE

DATE : 15 NOVEMBER 1979
PLACE: TRB

TIME	SESSION TYPE	SUBJECT	SPEAKER	MODERATOR
0800	Registration			
0900				J. Durham, UMTA
0905	Opening	Welcome	J. Reading, COTA	
0915	Keynote		G. Pastor, UMTA	
1000	Orientation		J. Durham, UMTA	
1010	Coffee Break			
1030	Panel	Need for Transit Information	J. Warrington, WMATA L. Coffman, Seattle Metro R. Kane, NYCTA	B. Cudahy, UMTA
1200	Lunch			
1330	Opening	Welcome	A. Engelken, APTA	J. Durham, UMTA
1345	Workshop I	Manual Systems	M. Svec, TARC P. Kapic, PANY & NJ J. Eastman, MTA	M. Noonchester, WMATA

TABLE 1 - TELEPHONE INFORMATION SYSTEM WORKSHOP SCHEDULE (Continued)

DATE : 15 NOVEMBER 1979
PLACE: TRB

TIME	SESSION TYPE	SUBJECT	SPEAKER	MODERATOR
1515	Coffee Break			
1525	Workshop II	Microfiche Systems	D. Rosanova, RTA E. Lynch, SEPTA H. Hornung, OCTD	J. Reading, COTA
1700	Reception and Dinner			

DATE : 15 NOVEMBER 1979
PLACE: WMATA

TIME	SESSION TYPE	SUBJECT	SPEAKER	MODERATOR
1930	Workshop III	Computer Systems	M. Munkasey, WMATA J. Byrd, SEPTA P. Brennen, SCRTD	P. Wood, MITRE
	Presentation	AIDS	F. Gray, WMATA P. Brown, WMATA M. Munkasey, WMATA M. Noonchester, WMATA A. Williamson, WMATA	J. Durham, UMTA
2130	End of Day			

TABLE 1 - TELEPHONE INFORMATION SYSTEM WORKSHOP SCHEDULE (Concluded)

DATE : 16 NOVEMBER 1979
PLACE: WMATA

TIME	SESSION TYPE	SUBJECT	SPEAKER	MODERATOR
0900				J. Durham, UMTA
0905	Opening Orientation	Welcome	J. Warrington, WMATA J. Durham, UMTA	
0930	Paper	Systems Integration	D. O'Sullivan, MITRE	
1000	Panel	Information for Tomorrow	T. Mitchell, MITRE G. Lindamood, NBS J. Kates, Josef Kates Associates	
1145	Workshop Summary		Workshop Moderators	
1215	Closing Words		J. Warrington, WMATA	

1.2 Workshop Panel Selection

Selection of the speakers for the workshop was based primarily on the desire to present a range of views, to involve with a wide range of sizes and to be relevant to an audience with wide interests. Following are brief descriptions of a cross section of properties represented to show the diversities among properties having a common interest in transit telephone information.

1.2.1 Opening Panel

The opening panel, "Need for Transit Information", was covered by representatives from WMATA, Seattle Metro, and New York City Transit Authority (NYCTA). WMATA operates in two states and the District of Columbia, serves a transient population and operates both bus and rapid transit systems. Its information system problems are compounded by the constantly changing bus routes and schedules caused by new rapid transit routes being brought into the system. Their policy has been to view the telephone as a form of reassurance to transit customers.

Seattle Metro, on the other hand, has directed their marketing efforts toward increasing the use and quality of maps and printed schedules as a means of attracting new patrons. Their results have been an increased patronage and a decrease in the need for telephone information services.

New York City Transit operates the largest transit network in the U.S., however, their information system answers approximately 1.4 million calls per year which is no more calls than the Regional Transportation Authority (RTA) of Northern Illinois answers and not many more than St. Paul, MN. It was hoped that the workshop might determine if incongruities such as these were management caused or caused by other site specific influences.

1.2.2 Manual Systems Panel

Selection of a panel on manual retrieval telephone systems was difficult because most properties use a manual system and, therefore, there are many good illustrations from which to choose. The Transit Authority of River City (TARC) is a property which is operated by a professional management services company and is representative of a large number of properties which have a clearly defined information system.

The Port Authority of New York and New Jersey operates a rapid transit system and bus terminal in the metropolitan area and two large bus stations. Not only must they provide transit information to patrons, but they must also ensure that the information is given equitably about the schedules of a large number of competing transit operators.

The Metropolitan Transit Authority (MTA) of Nashville, TN was perhaps the smallest of the bus systems represented on the panels. Competition from automobiles in smaller cities is very intense and transit routes and schedules are relatively well known. As a result, MTA must provide very personalized service to relatively few callers.

Microfiche systems are rarely used in transit telephone systems although widely used in other industries. RTA has for a number of years used microfiche assisted telephone systems to provide information for the Chicago Metropolitan Area. Orange County Transit District (OCTD), in Southern California, operates a relatively new microfiche retrieval telephone information system. Southeastern Pennsylvania Transportation Authority (SEPTA) has used a microfiche system in the past but has not been entirely satisfied by its performance in its particular operations setting.

1.2.3 Computerized Systems Panel

The use of computers to provide itinerary information in transit telephone information systems is relatively new. SEPTA has performed pioneering work in this area but has not achieved a fully operational computerized system as of this writing. Much of the efforts that they have expended on their "itinerary system" can be of direct benefit to other properties which plan to computerize this function.

WMATA's Automated Information Directory System (AIDS) is currently in a test phase and is the most recent use of computers in telephone information systems. Their system uses a dedicated mini-computer to translate a digitized transit and geographic data base into trip itineraries. The system supports 35 operator positions and allows for later expansion of service to 50 operator positions.

Southern California Rapid Transit District (SCRTD) has introduced a Computerized Customer Information System (CCIS) for the San Fernando Valley routes on a pilot test basis. CCIS shares its operation on the SCRTD computer with the normal data processing functions at the property.

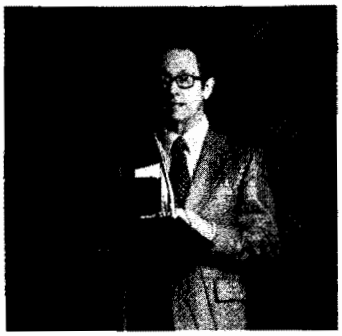
Both the WMATA and SCRTD systems are undergoing tests at the properties to determine if such systems are operationally feasible and can be qualified for UMTA capital funding.

1.3 Transit Information System Survey

During the workshop survey forms on transit telephone information systems were collected. Data from the surveys is listed in Appendix D. An analysis of the data have been made and the results will be published separately.

A glossary of acronyms is included in the report.

2. TRB WELCOME



Jim Reading

Chairman, Committee on Transit Service Characteristics, TRB
General Manager, Central Ohio Transit Authority

Mr. Reading welcomed the attendees to the workshop on behalf of the Transportation Research Board's Committee on Transit Service Characteristics.

Mr. Reading described the background and purpose of the TRB and pointed out that the Transit Service Characteristics Committee is concerned with the identification of specific areas where the operation of transit systems could be more responsive to passenger needs. In addition the committee is concerned with the development of criteria useful to transit management in making transit operations more attractive to users, including transit user information system elements such as service, routes, schedules and fares.

Mr. Reading also described the Transit Marketing and Information Subcommittee which is a steering body for a special study on foreign transit marketing programs and transit user information aids. The subcommittee recommended that a workshop be held in 1979 on Information Aids for Transit Consumers. The workshop covered all information aids with the exception of telephone information systems. It was believed that telephone information systems should be the subject of a separate workshop and it is for that purpose that this workshop is now convened.

Mr. Reading continued that, one of the pressing needs of the transit industry is to take the fear out of riding the bus. Not the fear of safety or health, but the fear of how to use transit.

"Where do I catch the bus?"
"What bus do I take?"
"What time does it arrive?"
"Where do I get off?"
"How much will it cost?"
"How much time will it take?"

These are some of the concerns of potential riders.

Mr. Reading stated that a good telephone information system will assist markedly in this effort as part of a total marketing effort. Timetables, maps, and street and bus signage are the other elements each supported by the others.

He said that the changes of the workshop is to review the state-of-the-art of telephone information systems and make recommendations for the future.

3. KEYNOTE

George Pastor
Associate Administrator for Technology
Development and Deployment

Mr. Pastor led off the keynote of the meeting by stating that the high technology base of the U.S. is exemplified by its telephone system. In some parts of the world, he has found that the response time for long distance telephone calls can be several hours in comparison with the fast, high quality response in the U.S. But despite the fact that the U.S. has long been characterized by advanced technology and high worker productivity, in recent years we have slipped to seventh place out of the eight industrialized western countries, in terms of productivity. He pointed out that although our standard of living is high, our ability to produce goods efficiently is poorer than many nations with severe economic problems. The combination of low productivity and high technology is incongruous.

Mr. Pastor believes that technology can be used to increase productivity in transit telephone information centers; however, UMTA is aware that technological solutions are not the only answers to transit information needs. Human resources and service innovations are also essential ingredients in enhancing transit productivity.

He said that in tandem with his office's work on hardware improvements, part of the effort is directed toward technology sharing. He views such sharing as a two-way exchange - UMTA informing transit of what they and others are doing, and transit informing UMTA of their ideas and research needs. Some of the best ideas came from forums such as this workshop.

4. THE NEED FOR TRANSIT INFORMATION

The first workshop session was devoted to a discussion of the passenger's need for information on transit service.

4.1 Background

Transit system managers have long recognized that fear of the unknown deters many potential passengers from using the transit system. In taking a trip by bus or rail, transit riders face a host of routes, schedule and destination uncertainties unless they have made the trip frequently or have the uncommon knack of seeing the trip by transit as an adventure. Not so with automobile drivers who, even if uncertain of their routes, maintain complete mastery of their vehicles and can exercise more control over arriving at their destinations on time.

Transit information systems can be designed to reduce the fear of riding transit. In particular, telephone systems can be viewed as a means whereby a patron receives accurate, timely information and is provided the personal reassurance needed when traveling in transit.

The sessions on the Need for Transit Information dealt with the problems of:

- effectiveness of the telephone information system,
- quantity and quality of telephone service that is required,
- motivation for telephone operators (agents), and
- available alternatives to telephone.

The session moderator was Brian Cudahy of UMTA and the panelists were John Warrington of WMATA, Ron Kane of NYCTA and Larry Coffman of Seattle Metro.

4.2 Presentations

Dr. Cudahy welcomed the audience and briefly discussed the Office of Transportation Management's function within UMTA which is to support research in the area of transit management sciences, as contrasted to the functions of the Office of Technology Development and Deployment which foster innovation in and application of technology. He stated that the office's challenge to improve transit managerial techniques regarding consumer information requires a knowledge of existing computer

application, technologies, and hardware. Dr. Cudahy said that several issues concerning telephone information systems need clarification, including the question of how useful high technology assists are for improving the current systems.

In his presentation, Mr. Coffman emphasized that telephone information systems must be viewed and managed in relation to other consumer information aids. He stated that:

a. transit operators must utilize a system of aids to provide consumer information and should not rely totally on telephone centers;

b. every effort should be made to reduce the number of telephone centers;

c. work must be continually ongoing to improve design and distribution of other forms of consumer aids (e.g. system maps, timetables, signs at bus/station stops); and,

d. the telephone center should be regarded as a "back-up" system.

Mr. Coffman said the key concerns of telephone information systems are:

- operator training,
- equipment,
- staff utilization,
- information processing (internal and external), and
- how the public is notified in advance of operating changes.

Regarding the operation in Seattle, he stated that the property employs thirty-four permanent and nine temporary telephone operators. In 1979, Seattle began to deemphasize use of the telephone, although there was some fear ridership would fall as a result. But, compared to 1978, Seattle experienced a 17.3% increase in ridership in 1979, and the telephone operators improved service by answering 35% of all incoming calls in 1978 as compared to 75% in 1979. The key to this successful effort was better utilization of the staff; Seattle shifted more operators to morning hours, which, analysis had indicated, was their peak period.

In conclusion, Mr. Coffman called for further information sharing in the area of telephone information systems. Historically, he said, transit managers in private industry grapple with problems by themselves. But, in an age when $50-$100 million are invested annually in transit information, individuals must work together to resolve unanswered questions. Transit managers must share common truths and beliefs and look together at new technologies to meet increasing demands.

Following Mr. Coffman's presentation, Mr. Warrington emphasized that personal assurance is a key factor in an individual's decision to use transit services. A potential rider should receive information from a knowledgeable, confident, friendly, caring source -- namely a telephone operator. Although reinforcement enroute is desirable, reinforcement prior to making an initial trip on transit is essential.

Mr. Warrington stated that at WMATA, one-fifth of all callers to the telephone information center do not get through. He maintained that if just 50% of those who do not get through were to take one roundtrip on the bus at the off-peak fare, an additional $200,000 would be realized in farebox revenue.

Mr. Warrington also recalled that seven years ago WMATA received between 14,000 and 15,000 calls per week and were able to answer only 50%. Today, the telephone center receives over 50,000 calls per week and answers 80-90%. Similar to Seattle, WMATA experienced a 15% increase in ridership last year.

He maintained that receiving a large number of calls is a very good sign, provided callers can get through and receive accurate information and reinforcement. Particularly where a transit system is rapidly changing and a community is highly transient, the public must be able to rely on the telephone center as a source of up-to-date, thorough information. Regardless of how comprehensive and excellent transit marketing programs might be, transit operators cannot overlook consumer needs for information when unpredictable occurances (rumors, snowstorms, wildcat strikes, etc.) take place.

In Mr. Kane's presentation, he stated that the major problem confronting telephone information systems today is the frustration and boredom which telephone operators experience. In addition, he said that a creative marketing approach is needed to increase telephone response times and to handle peak periods in telephone centers. Operators must be quick to convey

information, precise, and friendly; they must know how to elicit the right question and know how to find the right answers. (As an aside, Mr. Kane also stated that telephone queries for bus systems are more difficult to answer than for rail systems).

Mr. Kane maintained that a three-to-one ratio existed between number of calls made to trips taken. He said that in one year in New York the operating budget was $1.5 billion, the twenty-four-hours-a-day telephone center operating budget was $1.5 million, 1.4 million calls were answered and 2 million calls were lost. These figures were generated for a time when new bus maps and timetables were provided to the public. Compared to the previous year, although manpower and number of phone calls answered remained the same, ridership increased by 10%. This illustrates a one-way dependence between call rates and trip generation.

Mr. Kane emphasized that the industry needs to consider:

a. new outlooks on the costs and value of answered telephone calls;

b. a mechanism(s) for recovering costs (e.g. charging the public for timetables, maps, and even telephone calls); and

c. new means for handling telephone information inquiries, perhaps requesting the telephone company to undertake the responsibility--attendees from AT&T later pointed out that their company was not interested in taking over such a role.

4.3 Concluding Commentaries

Dr. Cudahy remarked about the apparently conflicting attitudes expressed in the first two presentations and how each may be appropriate for the systems and clientele to which it relates. He recalled a finding in the UMTA/TRB study of European marketing and consumer information programs in which the Europeans questioned Americans about what was wrong with their marketing programs to require such extensive telephone information systems. They would view their information efforts as unsuccessful if so many calls were received. But, Dr. Cudahy expressed, he suspects that cultural differences may be an influencing factor since Americans are accustomed to using the telephone for ever-increasing needs -- from department store catalog orders, to banking, to finding out what time it is.

Dr. Cudahy stated two interesting facts from his own working experience. In Chicago, it was found that each call answered cost the authority over $1.00; this cost was three times the price of what they were trying to sell! In Boston, he added, a low cost information service was provided using a recorded message rather than a staffed information center. Boston also investigated a fully contracted telephone information service.

Comment was made from the floor that some European cities designed their transit information system by observing the practices of the successful American transit systems. It was felt that U.S. transit, in turn, is rediscovering the methods that they once used.

A statement was made in rebuttal that we must stop comparing ourselves to the Europeans. Our social structure is different as is the cost of fuel for cars and other economic considerations. We must base our transit information system on our own needs rather than trying to replicate the European systems.

One final comment worthy of note emerged from the session. That is that each property should have a conscious, clear policy toward providing telephone information service since that policy will help relate user needs to the design and resources committed to the telephone information system. Such a policy would also become an important reference point in determining productivity and areas for performance improvement within the property.

4.4 General Observations

The session on the Need for Transit Information stirred up a number of subjects.

1. The Need for Telephone Information Systems

   Opposing points of view were expressed by the panelists and discussed at the mini-workshops. Those who thought that telephone systems should be the backbone of the total information system stated that only phone conversations provide the reassurance that travelers need to use the transit systems. On the other hand, those who thought that telephone service should be de-emphasized pointed to the high cost of operating a telephone information system and claimed that heavy phone service indicated failures in the other forms of marketing.

2. Needs of the Transit Industry

The participants stated that the transit industry needs:

- a new approach for answering telephones,
- mechanisms for recovering the cost of calls,
- a new means for handling telephone inquiries, and
- a creative approach to increase telephone response times & handling at peak periods.

3. Major Problems

It was generally agreed by the attendees that a basic problem that must be overcome by transit is the fear of traveling felt by the patron. Problems basic to telephone information systems included: the high cost of operation, and operator boredom and frustration.

4.5 Value of Telephone Transit Information Systems

This section was not a planned part of the workshop, however, the subject of telephone information system value was brought up consistently and debated enthusiastically. Some observations have been collected, which appear to warrant more definitive research.

Relationships were cited between cost of operation, revenue received, trips made and number of calls made. The following four observations related some of these variables:

1. Josef Kates Rule

One call at Mississauga generates one fourth of a trip now and in the future. Assuming that one trip is valued at $0.48 the present value of a call can be evaluated using money valued at 10%:

$$\text{Trip Value} = \frac{\text{Trip Revenue}}{4} + \frac{\text{Trip Revenue}}{4 \times 0.10}$$

$$= \frac{0.48}{4} + \frac{0.48}{4 \times 0.10} = 1.32$$

The value of a complete call is, therefore, $1.32.

2. John Warrington's Calculation

If 50% of those callers who do not get through to the center were to take a minimum valued bus ride, an additional $200,000 in farebox revenue would be realized annually at WMATA.

3. Ron Kane's Observation

A 3/1 ratio existed at NYCTA between calls made to trips taken.

4. Brian Cudahy's Experience

A few years ago in Chicago, it was found that each call cost the authority more than $1.00; this cost was three times the price of the trip that was being sold.

5. MANUAL SYSTEMS

The second workshop session covered the most common form of transit telephone information system using manual search and retrieval.

5.1 Background

Manual systems, as described in this workshop, refer to the use of books and maps as reference sources in a transit telephone information system. Virtually all telephone information systems use agents as interfaces so the problems of operating a manual system are common to all transit properties irrespective of their hardware enhancements and level of automation. For most telephone information systems, the efficient operation of the agent is the key to success.

Some of characteristics of the manual system which were addressed during the workshop include:

- agent training,
- system productivity, and
- level of service.

Mike Noonchester, representing WMATA, was the panel moderator. The panelists, representing transit systems of a variety of size, were Jim Eastman of MTA (Nashville), Melanie Svec from TARC and Paul Kapic representing the Port Authority of New York & New Jersey.

5.2 Presentations

Mr. Noonchester opened the session by stating that although the industry is presently studying various ways of automating or applying technology to the provision of transit information, these efforts are mostly developmental and must be categorized as futuristic. Even if they prove fruitful, most of the nation's transit properties will continue to provide transit information in the same manual manner for a number of years to come. Some smaller properties may never find it cost-effective to make the transition to automation. Despite these automation efforts, he stated, the industry must continue to find ways of improving the quality and productivity of employees operating within the present manual systems.

Mr. Noonchester said that at WMATA they have not only looked at automation but have also looked at manual improvements. One of the interesting results of their study was that a "Hawthorne" type effect was noted. That is, the employees, made aware that their working situation was under study for improvement, in turn, improved their own productivity. The original reason for the improvement has possibly proven to be less important than the improved effort by the agent.

When WMATA investigated ways to improve both the operation of their facility and the training of their employees, they studied the local telephone reservation facility of United Airlines and learned much from their operations. As a result of the experience with United Airlines, WMATA reformatted much of its training. They are now training operators to be sales agents by not merely reacting to customer questions but by taking the initiative in selling transit to the customer.

A number of manual system topics should be researched even if automation proves successful. It is hoped that UMTA will explore these issues with the transit industry as they are now doing in the bus operator training and motivation research with the AFL-CIO. Some of these topics include:

- Initial Training and Skills Enhancement,
- Supervision,
- Personnel Management/Union Relations,
- Discipline,
- Resource Materials (Maps, Printed Schedules),
- Recruitment Process/Skill Level Specification,
- Coping with Change,
- Telephone Communications Systems Management and Operation,
- Staffing Patterns,
- Objective and Goal Setting, and
- Productivity/Motivation.

Mr. Noonchester concluded by stating his belief that if a property could not design and operate an enhanced manual system, then it was not ready to progress to automation.

Following Mr. Noonchester, Mr. Eastman noted that, according to the July 1979 UMTA Directory of Public Transit Systems there are less than 50 transit systems larger than Nashville and more than nine times that number that are smaller. It would seem then, that there is a tremendous need for an adequate, economical, functional, simplified system for operating the telephone information services for all these smaller properties which range in size from one to 150 buses.

In their day-to-day operations, he said, these small transit systems use everything from handwritten notes to public timetables, driver's schedules and dog-eared notebooks. The information retrieval mechanisms range from 3x5 cards to Xeroxed sheets; from fairly complex card files to posted bulletins.

Since the 50 larger transit systems have many more routes, including intermodal operations, serve a larger territory, and carry a great many more passengers than the total of the smaller systems, he concluded that they obviously have need for more complex computerized retrieval systems. But for the smaller systems, a much less complicated operation is probably better.

Following a period of training and about six months of work experience, Nashville's information agents can answer from memory the most-asked questions, and use work sheets only for backup and for information that is seldom requested.

This means that complex microfiche readers and computers, perhaps desirable for the larger systems, are too cumbersome, too costly and too slow for Nashville's operations. When a larger property receives a call, it can take several seconds to type the information request into a computer terminal, have the reply appear on the CRT screen, and then relay it to the customer. A competent operator on a small property can reply almost instantly. This description complements one of the earlier speakers belief that most of the communication time is taken by the caller, not by the retrieval of information. For Nashville's task, the computer would be too slow. So, although transit properties are answering very similar customer questions, most telephone information systems have needs that are quite different.

He postulated that the smaller properties with manual systems, should petition UMTA to make a study of small transit operations to determine the best way to get the job done most effectively and efficiently. He commented that UMTA has been accused of ignoring the small systems. This workshop might encourage UMTA to initiate a study of telephone information systems for small properties to counter that accusation.

Mr. Eastman felt that productivity is probably the most important single facet of a transit information system. Managers need to be aware of the cost of answering an information request, which in Nashville is 14 cents. It would also be desirable to have a firm estimate of the lost call rate at peak service periods. He was not aware of anyone who was computing the potential loss of blocked or lost calls.

He said that most properties promote their telephone information centers, but questioned if they were being over promoted. Are the organization and resources sufficient to meet the number and complexity of calls that transit promotions and the high gas prices are generating? Is the operation of an information center taking too large a share of the marketing budget? What is the real value of telephone information centers? Should they be expanded?...more telephone lines?...more personnel?...more complex equipment? Could this money be spent more profitably in other areas of informational communciations? Should transit re-evaluate how to spend the informational dollars? In sum, is there a better way, a more economical way, a more productive way to meet transit user informational needs?

Mr. Eastman stated that there are no easy, firm and fast answers to questions such as these, but perhaps this workshop would begin to resolve some of these issues.

Mr. Kapic then described the services provided by the Port Authority for 43 private companies. The Port Authority trains telephone agents with the goal of improving agent communication skills, the most significant factor in providing telephone information. Most transit properties, he said, have not worked extensively on the communication problem but have devoted their efforts to information resource operations and access. Improvement in information look-up process will help, but of even greater help would be the shortening of conversation time.

Technological innovations exist that may help reduce the time required to communicate information. For instance, recording of the information provided by the agent for play-back to the patron is being investigated by the Port Authority. This will help to reconfirm the information for the patron and allow the agent to handle the next call.

Mr. Kapic said that telephone information should be viewed as an important marketing tool. He emphasized that the long call should be tolerated and a time limit should not be placed on calls. Potential users might need that extra time to feel comfortable with the transit services and perhaps even switch permanently to public transit.

Following Mr. Kapic, Ms. Svec described TARC as a five year old transit authority serving an area of 375 square miles with 38 bus routes. The transit system operates 250 coaches. TARC's information system is organized at three levels:

1. A Travel Center Supervisor who is experienced on the system bus routes and who is knowledgeable on TARC policy.

2. Two Junior Travel Center Supervisor who monitors operations, prepares statistical reports and trains personnel.

3. Information Specialists who answer calls.

The system is quite productive, handling 3,300 to 3,700 calls per day.

She said that TARC trains the operators to be productive through a 4-week training program divided into six major headings:

1. General Orientation - 1/2 day

   a. TARC policies, goals, structure.
   b. Travel Center - Its goals; what they will be learning and what is expected of them.

2. Materials Furnished

   a. Graphic Sheet Guide.
   b. Major Route book.
   c. Headway book.
   d. Listing of elderly housing and schools, with appropriate routes.
   e. Listing of transfer points and locations for each route (Driver's Trainers wanted them).

3. On-Line Route Observation (Riding Coaches)

   a. Start with easier routes.
   b. Identify transfer points on maps and lists.
   c. Jr. Supervisor rides in car or bus with trainees and teaches transfer points, destination signage, general area--Trainee carries Headway book, notebook and notes the physical parameters of service.
   d. After riding, the trainees color in route on maps, discuss their understanding of the transit system and ask questions.

4. Introduction to Phones and Equipment

   a. Monitoring and statistical reporting system is explained.
   b. Supervisor gives pointers to develop phone etiquette.
   c. Trainee listens in for 2 days, then tries to answer calls.

5. Senior Citizen and Handicapped Programs Are Explained

6. Trainee Testing is Performed Once a Week During Training as an Aid to Trainer and Trainee

The TARC agent can answer in the range of 40 to 90 calls per hour. TARC has conducted a survey of 20 properties to compare wage levels and has found that there seems to be an inverse relationship between wages and productivity. Low wages appear correlated a higher productivity. This has led to the conclusion that it is not necessary to pay high wages to get top productivity.

5.3 Commentary

As with most of the sessions, no clear consensus emerged on best practices and pitfalls to avoid in manual retrieval telephone information systems. Some of the issues which probably will need to be resolved on a property specific basis include:

a. the result of peak hour stress on agent performance,

b. extent of training needed by agents,

c. the hiring of entry level clerks versus career drivers as agents,

d. centralized versus decentralized services (where there is more than one transit service provided),

e. the best available telephone technology for call distribution and management information--one interesting fact presented was that the technology is available to determine the number of lost calls (those which cannot get into the trunk lines during peak periods), and

f. the best management strategies--should complaint calls be separated from information calls--how can peak loads be most effectively handled?

Other issues which may better be addressed by government sponsored research include: the nature and increase of productivity in the telephone information systems; the utility of building a file of user profiles to determine marketing strategies and, under what conditions and in what manner should properties evolve from manual to microfiche and computerized retrieval systems.

6. MICROFICHE SYSTEMS

The third session covered the use of microfiche for data storage and retrieval.

6.1 Background

The microfiche unit provides an agent with very fast access to schedule information and overcomes the problem of leafing through large volumes of schedule information. Microfiche units are virtually standard equipment in libraries, where they have replaced the old classification card system.

The session on microfiche systems generated divergent opinions from the transit properties - some of whom depend on them heavily and others who have tried them and opted for other systems.

The moderator of the panel was Jim Reading of COTA and the panelists were Dave Rosanova of RTA, Ed Lynch of SEPTA and Hil Hornung from OCTD.

6.2 Presentations

Mr. Reading explained that microfiche display units are currently being used by RTA in Chicago, OCTD in Orange County and have had experimental use in both Washington, D.C. and SEPTA. The maps, schedules, fare structures and other supporting materials needed by the information operators are photographed and stored on microfiche. Generally, one fiche will contain all the information needed for one route; and, in many cases, a route can be fully documented using only a small fraction of the fiche. In Chicago and Philadelphia, no route requires more than one card.

Mr. Rosanova followed Mr. Reading with a more detailed view of RTA's information system. Mr. Rosanova stated that the RTA uses experienced bus drivers to man their travel center. This adds to the costs of the system but adds a confidence factor to the reliability of the information. The information system services 131 Chicago Transit Authority (CTA) routes, seven commuter railroads and 35 suburban lines serving six counties.

Each agent's station is equipped with a phone, a microfiche reader and a set of route maps. The microfiche contains schedule data for each route which is accessed by punching the route number into the fiche selection mechanism. It takes four seconds to switch fiches. The fiche system is good for answering schedule and status questions but maps must be used in conjunction with fiches to plan itineraries.

The RTA experienced no problems with agent and management acceptance of the microfiche system. Mr. Rosanova said that a basic requirement for such a system is a positive attitude toward the success of the microfiche system. Use of the fiche has allowed the RTA telephone information center to handle in excess of 3 million calls in 1979 with a capture level of 90%.

Mr. Hornung next described the OCTD system which uses microfiche technology but with entry level agents. Since implementing the microfiche system, agent productivity has risen from 21 to 30 calls/hour and there has been no problems with their acceptance of the microfiche. It takes 10 months for an agent to learn the job and the system thoroughly.

Each microfiche machine operates with a cartridge containing 30 microfiche, thereby allowing the agent to gain access within three seconds to nearly 3,000 pages of information at push-button command. Microfiche is such a dense medium that the entire map book for Orange County can be stored on one microfiche film. Each page is displayed on a 14-inch by 14-inch screen, enlarging the original page by 25%.

Mr. Lynch next stated that the microfiche system did not operate well for SEPTA. He said that he would be pleased to discuss the matter further in the miniworkshop. Apparently SEPTA feels that itinerary information (which is requested in 60% of their calls) is difficult to piece together from microfiches which are route specific. The itinerary problem and the compliance with SEPTA's policy of staffing its information center with its most experienced drivers, has not led to any savings. SEPTA claims that drivers can answer most calls from memory, the quickest information retrieval system and microfiche updating is considered too time consuming and costly.

6.3 Commentary

Comments from the miniworkshops on microfiche systems included:

1. Computer Systems

In setting up a computer system for integration with a microfiche unit, as experienced by SEPTA, the limiting factor is software, not hardware. Capabilities should be included in the system to have a split screen for alpha-numerics and graphics. The need for a split screen, though, makes the problem of updating route information difficult.

2. Agent Training

The agent must be trained first to know the manual techniques of using an information system, before he can be trained to use microfiche. As earlier discussed skilled people are the major ingredient of any telephone information system.

3. Criteria for Adopting Fiche

The key considerations in choosing microfiche over a manual system include:

- Agent background and training,
- Number of route changes per month,
- Time required for printing of reference materials, and
- Types of calls coming into the system (i.e., schedule, route, or itinerary).

4. Problems of Agent Resistance to Change

In changing to a new method of accessing information the following questions should be considered:

- Were the agents involved in selecting the new system,
- Will job descriptions be changed, and
- Must union regulations be modified.

5. Computer Controlled Microfiche Units

A computer controlled microfiche unit is easy for an operator to learn as compared with a manually operated microfiche unit. Although retrieval time is decreased using a computer operated system, the additional savings realized are marginal.

7. COMPUTER SYSTEMS

The final workshop session on the first day was devoted to computer systems.

7.1 Background

Transit systems are beginning to follow the lead of the railroad and airline industries in using computers as rapid information access for the telephone information system. Several larger properties have investigated this approach as a method of reducing the load on the agent and maintaining a satisfactory levelof performance to the calling customer. Some specific transit property goals in converting to computerized systems have been:

- reduction of the average phone time per call,
- increase in the accuracy of information given,
- increase in accuracy and speed of training new personnel, and
- increase in the scope of information available to the patron.

Because of the few properties which have experience with computers in transit information systems, (only SEPTA, SCRTD and WMATA) the level of debate in the workshop sessions was minimal. The sessions were almost tutorial.

Peter Wood of MITRE moderated the workshop session on computer systems. Panelists were James Byrd of SEPTA, Paddie Brennen of SCRTD and Mike Munkasey of WMATA.

7.2 Presentations

Mr. Wood kicked off the session by stating that for many years interest has been expressed in the potential of a computer as a tool for improving the efficiency and effectiveness of transit information services. Indeed MITRE and National Bureau of Standards (NBS) work in this area goes back to 1971 and 1974 respectively. With the continuing reduction in the costs of computers, and the increased computing power and flexibility available from minicomputers, we have now reached the point where, to a limited extent, transit systems have started to apply computers to their telephone information services.

He said that the speakers at the workshop would describe three fundamentally different approaches. SCRTD uses their in-house main-frame UNIVAC 1106 computer on a timesharing basis and only part of the SCRTD system is currently being covered by the computerized system. In contrast, the WMATA system has chosen to provide a complete transit system coverage using a dedicated minicomputer to enhance its transit information retrieval. SEPTA pioneered computerized transit information systems by developing in-house a system for providing itinerary information.

Mr. Wood also stressed the fact that there are basic similarities in these computer systems in that each uses a CRT display and keyboard to search geographic route data bases for optimal and alternative patron itineraries on the transit systems. The information agent remains as an interface to the system by interpreting the callers questions and entering via the CRT, the patron's origin and destination, and preferred arrival or departure time. The system, in response, calculates one or more ways to travel between the origin and destination within the time constraints and displays the itineraries on the CRT along with the appropriate fare requirements.

Mr. Munkasey then elaborated on WMATA's computerized system, termed the AIDS. He described the extensive interaction of the WMATA Office of Data Processing and Office of Marketing needed to develop the AIDS system. AIDS was substantially supported by UMTA at a total cost of about $1.5 million which included a $435,000 R&D grant for software development. Approximately half of this cost was ascribed to data base design, development and initial debugging. The system is expected to reduce search time to 5-7 seconds from the current average of one minute.

AIDS was designed with a number of underlying considerations:

a. The system should be user oriented, requiring little technical expertise by the agent.

b. AIDS must be easily modified for use by other transit systems.

c. The system should be designed to place no additional stress on the agent.

The system computes all alternative itineraries for each trip subject to departure or arrival time constraints. In determining the itineraries, it can minimize travel time, number of transfers, walk distance or the cost of fare.

Mr. Munkasey added that the AIDS is causing management to look at how it can better handle key elements of its management information system, particularly scheduling, routing and planning information. WMATA plans to capture schedule changes through a word processing unit and transmit the change to the AIDS for automatic updating allowing machine processable data to be available also the the scheduling department. As another important spinoff benefit, the Washington Metropolitan Area Council of Governments (COG) has expressed interest in using the computerized data base for other metropolitan activities. It is felt that the cost of the data base can be shared with other functions (such as management information) or other organizations (such as COG carpooling) if institutional barriers are bridged. The system is slated for operation in 1980.

Mr. Munkasey cautioned that WMATA's system implementation has not been without problems. WMATA recommends that properties considering a computerized system look very carefully at the quality of the data available to build the data base and determine precisely the effort that must be expended to maintain and update the data base.

Mr. Byrd then discussed SEPTA's computerized itinerary system and highlighted some other systems developed and studied before considering a computerized itinerary system.

SEPTA's itinerary system runs on a Varian (V/76) minicomputer configuration. The system data base includes 108 bus, trolley and high speed routes and 7000 unique stop locations with appropriate grid codes covering the City Transit Division.

The major capabilities of the system include: trip itinerary display, alternative trip display, connection display, service display and ambigious place display.

The two principal operational problems with the itinerary system have been system crashes and failure to attain optimal trip display response times.

Also SEPTA's itinerary system has not been fully implemented due notedly to the abovementioned problems but also to the low level of funding and lack of management commitment. The system development also suffered a setback with the untimely death of its key technical supporter within the SEPTA management. However, with all things being considered, Mr. Byrd remains optimistic that the itinerary system problems will be rectified and the system will be implemented.

Ms. Brennen described the passenger information system at SCRTD, which services 2,280 square miles of an area in and around Los Angeles and receives calls at a level of ten to thirteen thousand per day. The CCIS was placed in service on 4 June 1979 to handle the routes in the San Fernando Valley. Phone lines from the valley are directed to any one of eight operators who are equipped with CRT's tied to the SCRTD computer.

The operator at SCRTD is able to produce an itinerary for a patron after receiving information on the start and end point of a trip, the time of day and day of week. CCIS, recognizing landmarks and street addresses as well as street intersections, will display an itinerary which describes times of departure and arrival, transfer points and fare to be paid. Alternative routes are also available which may fit a special need of the patron.

Staff at SCRTD can attest that computerizing telephone information will not solve a property's problems all at once. Indeed unforeseen delays, increased effort and sometimes increased costs were experienced in processes supporting implementation of the computerized system. These included:

a. developing management's understanding of problems and needs and obtaining its commitment to the project;

b. specifying correctly the needs, functions and desired performance for the system;

c. obtaining quality data for the data base. The real world of data availability at SCRTD, as with many institutions, is quite different than what it was abstractly taken to be;

d. developing and maintaining an understanding of user needs and ADP abilities as the system was implemented;

e. specifying appropriate acceptance test procedures; and

f. getting the transit information group to change its organizational processes so that the system could be more beneficial to the whole of SCRTD.

SCRTD hopes to test their system thoroughly on the San Fernando Valley pilot implementation before attempting to broaden its application to the entire area. The pilot program involves not only the operational aspects of telephone information systems but also impacts other automated systems of SCRTD. Their skills

in transit automation run not only in the telephone information systems but also in scheduling and vehicle monitoring. Their scheduling system features a version of RUCUS and they intend to implement an automated vehicle monitoring system in the near future. Many of the files of these automated systems contain common information and thus special care is required when they are updated. Opportunity must certainly exist for the integration of these data bases also, but time and resources available have not allowed an examination for potential cost savings in integrating the systems.

The SCRTD is a markedly different installation than the WMATA system which has its own dedicated computer for the passenger information system. The SCRTD computer, a UNIVAC 1106, time shares operation between CCIS and its normal data processing functions. Consequently, there was no need to purchase a special computer for the program. Problems do exist when the accounting department runs payroll and the response time for CCIS increases unacceptably. SCRTD is considering using a minicomputer if they opt for a fully computerized information system. The evaluations of CCIS being conducted at SCRTD with the assistance of UMTA Office of Technology Development and Deployment will serve in part to recommend the best approach toward enlarging CCIS if the larger data base appears to be operational.

7.3 Commentary

The pros and cons of each approach to computerized transit information retrieval became apparent during the presentations and subsequent discussions. The SCRTD approach requires a lower initial investment, but since the telephone information system is competing with other users of the computer (such as payroll) service can be degraded at times. On the other hand, the WMATA approach requires a high initial investment, and careful design to ensure that the system will have the required capacity and performance.

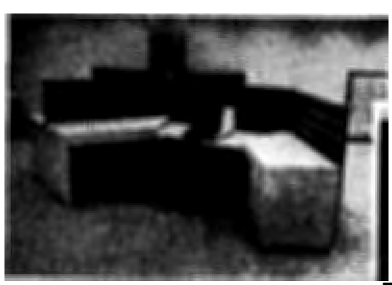
Other comments indicated that computer systems seem to be most valuable when: frequent route or schedule changes are made; agent turnover is high or, agent understanding of the transit system network and geographic area is low. Additionally, if overall reliability in a computerized transit information system is to be maintained, a backup manual system may be needed in case of major computer failure.

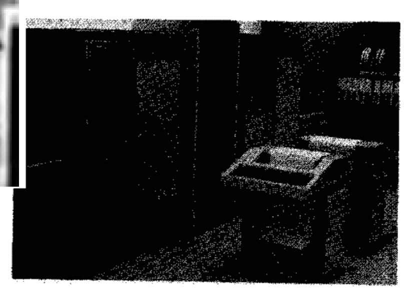
One important consideration that did emerge is that it should not be assumed that a suitable geographical data base is readily available for use in a computerized system, irrespective of the approach adopted. The WMATA facility, which was available for inspection during the workshop, also demonstrated the importance of providing the operators with an environment reflecting good human factors design. A significant decrease in staff turnover appears to have resulted as workers have gone to the upgraded facility.

Because computer applications are still in their early stages with operational data only now being collected on the SCRTD and WMATA systems, the subsequent discussion did not enter deeply into their effectiveness. Some concern was expressed that computers are only appropriate for large transit properties, but a rebuttal was offered by reference to the Mississauga System which is an automated system (has no operator interface) but is a relatively small transit property.

At the workshop, it was possible to review the status of computer applications and to hear, first hand, some of the problems that arise when beginning to apply computers to transit information services. At a later workshop it will be possible to review them in terms of efficiency and effectiveness and, most importantly, their impact upon the riding public. Any definitive statements regarding the impact of computers on transit information systems must be deferred until that time.

8. AIDS DEMONSTRATION





9. SYSTEMS INTEGRATION

Denis O'Sullivan
Department Staff
The MITRE Corporation

The use of computer systems in transit during the past few years has reached a new plateau. Automation within the transit community has become somewhat commonplace to the extent that computers are in use in all but the smallest transit properties. Witness of the introduction to transit during the past 5-10 years are such automated systems as:

- AVM - Automated Vehicle Monitoring,
- RUCUS - Automated Run Cutting and Scheduling,
- SIMS - Service, Inventory and Maintenance System,
- UTPS - UMTA Transportation Planning System, and
- FARE - Financial Accounting and Reporting Elements.

During the workshop, such tools as AIDS and CCIS have demonstrated the real-time use of computers in transit operation.

UMTA has recognized that the level of computer power required to implement some or all of these automated systems has become ponderous. The programming requirements of the transit properties are also multiplying significantly. At the present state, the use of more than one of these systems by a medium size property will not be possible without a new approach to managing the computer system.

One of the more recent tools to be investigated is the use of a data base management system (DBMS) in the organization of the transit files. The DBMS was designed to minimize data redundancy and data storage cost, and allow convenience in updating a database.

The use of a DBMS in a transit system would require:

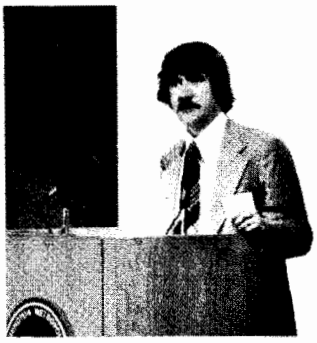
a. definition of the needs of small, medium and large transit systems; and

b. a cost/benefit analysis.

A positive expression from transit would also be in order.

Copies of the viewgraphs presented are shown in Appendix C.

Tom Mitchell



George Lindamood

Josef Kates

The final workshop session was devoted to predicting possible developments in the next decade.

10.1 The Voice Response System - Thomas Mitchell

The Federal Aviation Administration (FAA) is planning to implement a national Flight Service Station (FSS) Automation Program. This program is designed to meet the increasing demand for services to the general aviation fleet without a large increase in operating costs. Service improvements in terms of system capacity, accessiblity, and quality are high on the list of system characteristics. The program makes extensive use of automation and will introduce the concept of direct user access--the capability whereby a pilot directly accesses an FSS computer to obtain a weather briefing and/or file a flight plan. Direct pilot input and computer generated voice response are one of the primary means of providing the improved service.

The Voice Response System (VRS) enables pilots to access a computer data base of weather and flight data. The pilot inputs requests for specific weather reports for locations of interest by utilizing the keys on a TOUCHTONE telephone or keypad adapter on dial-type telephones. Almost immediately the system responds with a computer generated voice. To access this system, the pilot need only have a standard 12-key telephone and a slight knowledge of the manner of communicating with the voice response system. Controlled experiments were conducted by FAA personnel to develop and refine workable procedures and to establish the required weather products.

Application of a VRS for a transit operation would require extensive manipulation of a telephone keyboard by a transit patron. Although there are polarized views concerning the ability of the patron to successfully operate any device, it is evident that the use of a telephone for other than voice communication is a certainty. Consequently, it appears that the transit patron of the near future will use Touchtone devices in increasing regularity and will find it commonplace to communicate through a VRS.

10.2 Information for Tomorrow - George Lindamood

Mr. Lindamood felt that the present focus in industry is on use of data bases. Large companies are consolidating their files and incorporating data base management systems into their data processing facilities.

He stated that future efforts will involve the intertwining of data processing and telecommunications. American Telephone and Telegraph Co. (AT&T), which has heavy expertise in communications is attempting to move into the data processing field. Satellite Business Systems (SBS), destined to be a major factor in communications, has a major backer in IBM, the computer giant.

Mr. Lindamood described the use of distributive processing (DP) in automation. This is a system of linking computers into a network for efficient use. During the last decade, an emphasis was placed on centralizing the computer systems of large companies as opposed to use of many spread out systems. The use of DP will, therefore, create problems for the centralized computer systems which currently exist.

The present industrial phase is based on use of energy; the emerging industrial phase will be based on communications. Japan appears to be growing fastest in this capability. Mr. Lindamood said that this is an area for the U.S. to place emphasis.

10.3 Information for Tomorrow-Now -- Josef Kates

An analysis of the requirements of transit telephone callers is:

- one-third to one-half need schedule data only;
- one-third need detailed itinerary information; and
- the remaining calls deal with fares, complaints or lost and found.

A low cost service which automatically fulfills the requirements in the first category would relieve the pressure on the regular telephone information system. The Easy Rider System in Missisauga, Canada is such a low cost system.

Transit companies have designed their system to minimize the ride time of the passenger. The greatest deterrent to transit travel, however, is the waiting time of the patron. The Easy Rider system is designed to reduce the uncertainty of bus departure times and consequently, reduce wait times. This feature is especially important in Canada where the winter temperatures are very severe.

The system uses radio transmitters in the buses to allow a computer to track the bus progress on its route. This status data on the progress of the bus is then translated into snythesized speech for transit patrons who call in to ask when the next bus will arrive at the stop. Each route and stop has a fully computerized operation -- a unique telephone number to be dialed. The system has the following advantages:

- it is easy to use
- it can handle more calls than riders
- the response is quick
- the cost per call is low
- the information obtained is precise

The Mississauga transit system has noted an immediate 10% ridership increase on routes which use Easy Rider. Off-peak trip rates increase faster than the peak. Tolerance to fare increases is greater on these routes. System ridership increases are highest on low frequency routes. Call rates go up in bad weather. System costs are estimated to vary from a few cents per call for large high volume properties up to 20 cents per call for small low volume properties, due to the fixed costs of the system. An average of 450 calls per 1,000 rides are received on the Easy Rider routes.

11. WORKSHOP RESULTS

During the sessions a number of subjects were discussed that appeared not only to underlay all transit telephone information system operations, but also to be a common concern for all the participants. Some of these subjects were:

- Level of Service,
- Agent Stress and Motivation,
- Agent Recruitment,
- System Productivity, and
- Small Property Operations.

11.1 Level of Service

Transit personnel agreed that to design a telephone system which would provide answers to all inquiries would require an excessively costly system. It was also recognized that for most systems a large proportion of calls receive a busy signal, indicating that the information system is working at capacity. The percentage of calls answered is defined as the level of service. A goal for the level of service (e.g., 70%, 80%, 90%) should be established and the level currently experienced by the transit system should be measured. In this way a transit property can objectively compare its service with the level of service that they would like to offer.

The question was asked, "Can we determine how many calls are made to the telephone information system which result in a busy signal?" The answer from attendees with technical background was "Yes, it can." The cost and level of effort required was not known, but the equipment appears to be commercially available.

11.2 Agent Stress and Motivation

The telephone information agent is subject to considerable stress when performing the job. The agent is under pressure to represent the transit company, to answer the callers politely, to search out information and to present the information to the caller without error. The telephone information system manager, on the other hand, is tasked to motivate the agent and help to relieve their stress.

The attendees proposed, as possible solutions to stress and motivation problems: to provide the agent with the opportunity to talk about the problems of the job; to tell the agents frequently how important they are and how much their performance means to the company; and to give the agent breaks from the job to relieve the monotony. The attendees indicated that research is needed to provide better answers to the problems of agent stress and motivation.

11.3 Agent Recruitment and Training

Methods of obtaining new agents and the procedures for training them were a subject of much discussion. The parameters for recruitment which were discussed included level of pay, and available sources of personnel. Some attendees thought that the level of pay and performance of the agent did not correlate well but that the starting salary was an important consideration for a new agent.

Agents who were recruited from within the company were either former drivers who could not continue to drive a bus, or drivers who were attracted by a higher wage level at the agents job. Former drivers, particularly those with more experience, are able to quickly respond to the majority of calls and it is doubtful that automation of the call answering process can significantly improve their response rate. Operation of the telephone information center should consciously consider the tradeoff between the application of skilled human resources and automation.

Many companies obtained their agents from outside the transit system. An excellent source of agents was found to be women who had young children in school although these women were often restricted in their working hours.

A number of attendees stated that the training program for new agents must be well structured and include on-the-job training. Much of discussions on Manual Systems centered on agent training, and are described within this report.

11.4 System Productivity

The productivity of a telephone information system was discussed throughout the workshop. A subset of this discussion was the cost of the information system service related to its value to the transit property. Some attendees recommended that a study be performed of the cost and benefits of the telephone information system and how they compare with the cost and benefits of

other types of information media such as maps, timetables and recorded messages. Some reflections on the value of a call are made in Section 4.5.

11.5 Special Problems of Small Properties

Some of the attendees from smaller properties questioned the value of high technology information systems. They claimed that these systems were useful only to a few properties. On the other hand, they said that UMTA should provide funds for research on the information systems of properties with a fleet of one to 150 buses. Such research would benefit the largest number of properties in the U.S.

11.6 Research Needs

The attendees identified a series of research needs for transit information systems. These needs have been reported in the body of this document, but are summarized below:

1. Value Of A Telephone Call

   New outlooks should be determined on the cost and value of a telephone call. Mechanisms should be reviewed to recover the cost of a call such as charging the public for timetables, maps and even telephone calls.

2. Operation During Peak Periods

   A creative marketing approach is needed to increase response times and to handle peak periods in telephone centers. Research is needed to help the operators during their periods of frustration and boredom.

3. Operator Training

   Research is needed in the training of telephone operators. Operators must be taught to convey information quickly and precisely. They must be trained to elicit the right question and know how to find the right answer.

4. Special Problems Of Small Systems

Approximately 90% of the properties in the U.S. own less than 150 buses. It would appear that there is a great need for an adequate, economical, functional, simplified system for operating the telephone information services of these smaller properties.

5. Topics For Manually Operated Information Systems

A speaker at the workshop identified the following research topics related to manually operated telephone information systems:

- Initial Training and Skills Enhancement,
- Supervision,
- Personnel Management/Union Relations,
- Discipline,
- Resource Materials (Maps, Printed Schedules),
- Recruitment Process/Skill Level Specification,
- Coping with Change,
- Telephone Communications Systems Management and Operation,
- Staffing Patterns,
- Objective and Goal Setting, and
- Productivity/Motivation.

In addition, issues which were addressed specifically for research included: the nature and increase of productivity in the telephone systems; the utility of building a file of user profiles to determine marketing strategies and under what conditions and in what manner should properties evolve from manual to microfiche and computerized retrieval systems.

6. Lost Call Estimates

It would be desirable to have a firm estimate of the lost call rate at peak periods and the loss in revenue associated with these calls.

7. Computer Systems

Because of the recent introduction of computers into telephone information systems, it would be desirable to hold a later workshop to review the experience observed in computerized information retrieval systems and to determine their effectiveness on the riding public.

APPENDIX A

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APPENDIX B

ORGANIZATIONS REPRESENTED

TRANSIT SYSTEM

Anchorage Public Transit

Birmingham-Jefferson County Transit Authority

Bi-State Development Agency (St. Louis)

Central New York Regional Transit Authority (Syracuse)

Central Ohio Transit Authority (Columbus)

Chicago Transit Authority

City of Winnipeg Transit Authority

Greater Cleveland Regional Transit Authority

Greater Richmond Transit Co.

Lehigh & Northampton Transportation Authority

Long Beach Transit

Metropolitan Transit Authority (Baltimore)

Metropolitan Transit Authority (Houston)

Metropolitan Transit Authority (Nashville)

Metropolitan Atlanta Rapid Transit Authority

Milwaukee County Transit System

Municipality of Metropolitan Seattle

New York City Transit Authority

Orange County Transit District

Ottawa-Carleton Regional Transit Commission

Port Authority of Allegheny County

Port Authority of New York & New Jersey

San Diego Transit Corporation

TRANSIT SYSTEM (Concluded)

San Mateo County Transit District

South Bend Public Transportation Corporation

Southeastern Michigan Transportation Authority

Southern California Rapid Transit District

Transit Authority of River City (Louisville)

Toronto Transit Commission

VIA Metropolitan Transit (San Antonio)

Washington Metropolitan Area Transit Authority

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Transportation Research Board

The University of Pennsylvania

The University of Vermont

TRADE ASSOCIATIONS

American Public Transit Association

GOVERNMENTAL ORGANIZATIONS

Florida Department of Transportation

Metropolitan Transit Commission (Berkeley)

National Bureau of Standards

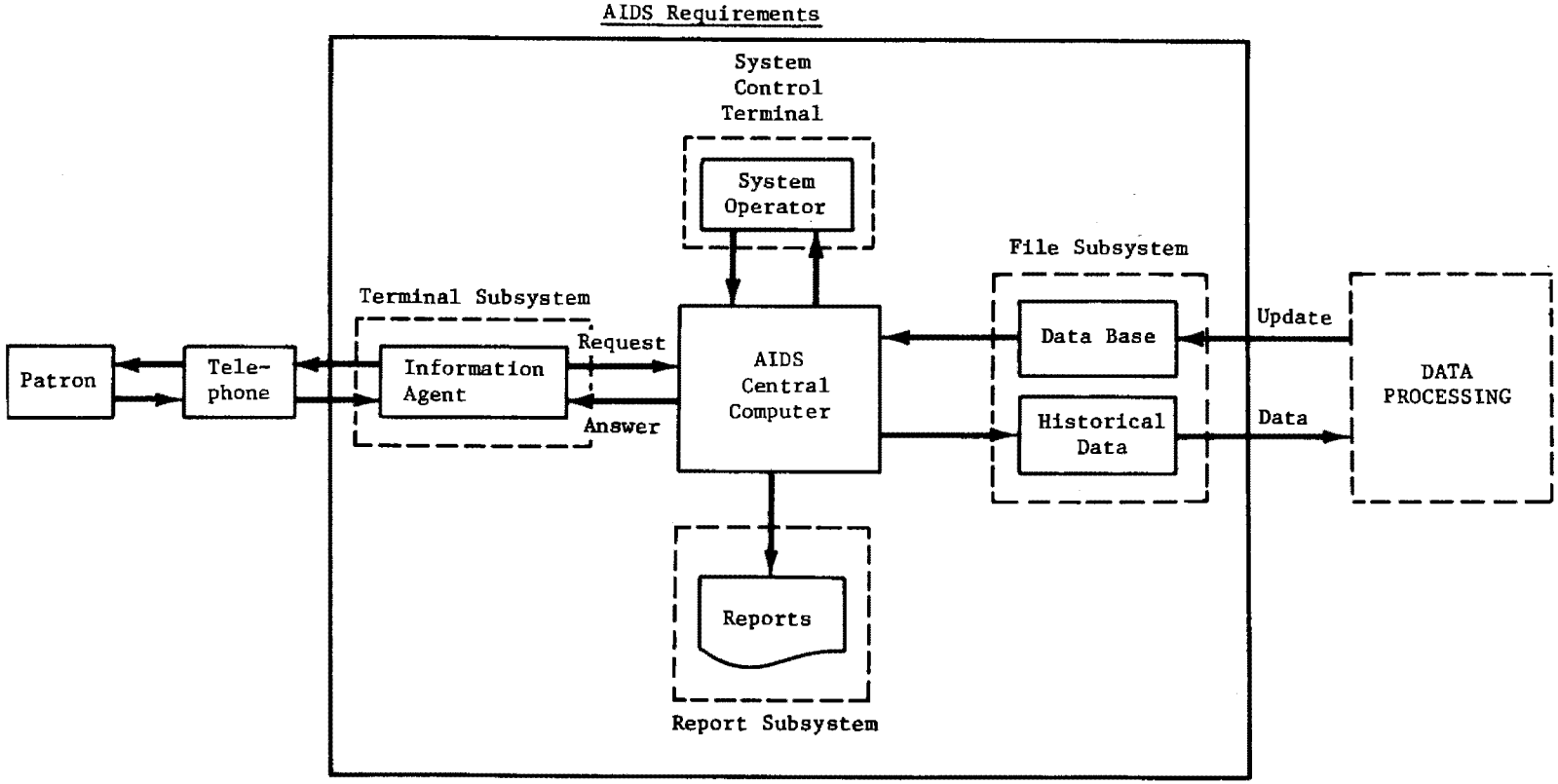
Transportation Systems Center

Urban Mass Transportation Administrations

APPENDIX C

PRESENTED VIEWGRAPHS

INTEGRATION OF AUTOMATED TRANSIT SYSTEMS



AIDS FUNCTIONAL SYSTEM

AIDS FILES

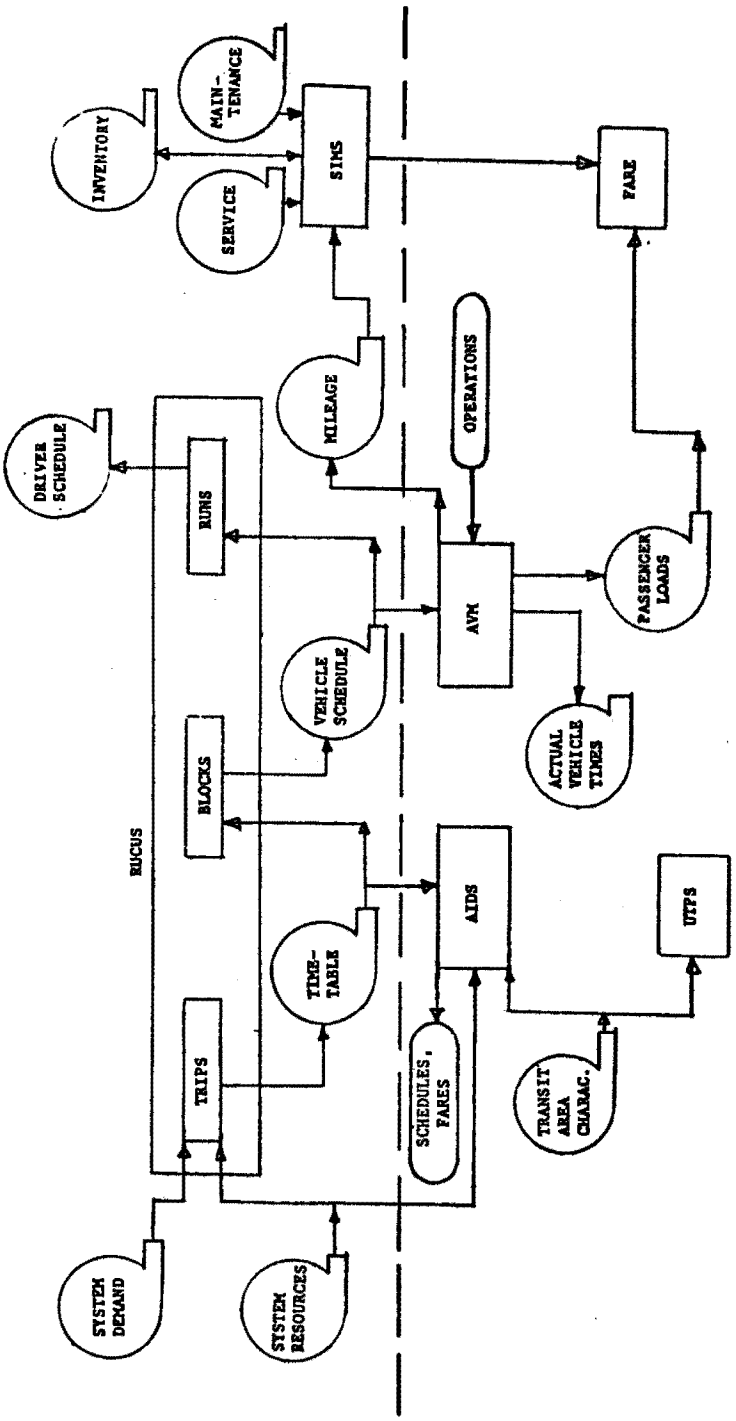
Include:

- Stop Description
- Route Description
- Transit Node File
- ARC File

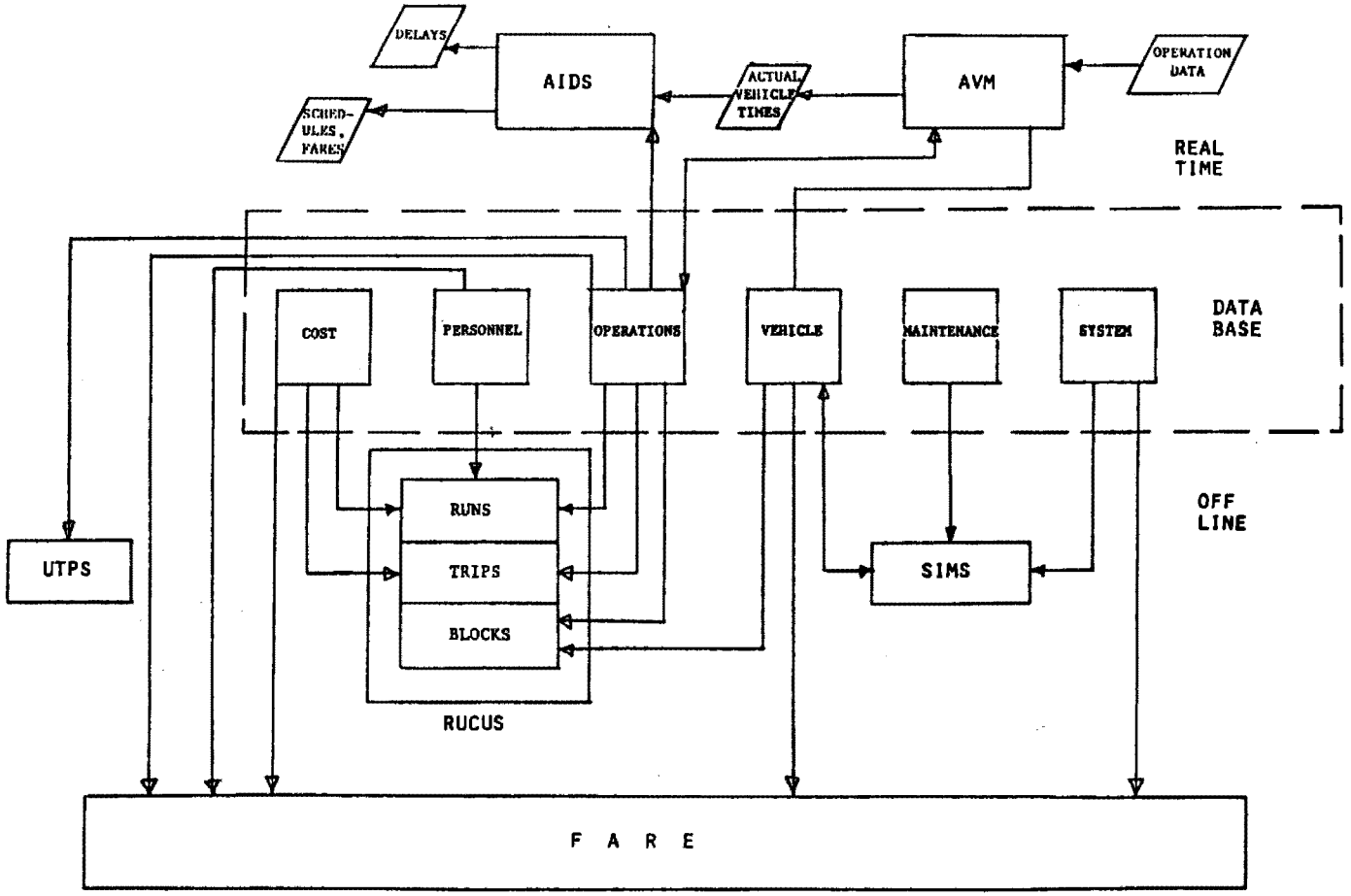
AUTOMATED TRANSIT SYSTEMS

- AVM
- RUCUS
- SIMS
- UTPS
- FARE

AUTOMATED TRANSIT SYSTEM FILES



AUTOMATED TRANSIT SYSTEMS INTEGRATION



DATA BASE MANAGEMENT SYSTEM

Minimizes

- Data Redundancy
- Data Storage Cost
- Problems in Update

DATA BASE MANAGEMENT SYSTEM

Provides

- Fast Access to Data
- Quick Turnaround Reporting

BASIC RESEARCH NEEDS

- Define Needs of Transit
  - Large
  - Medium
  - Small
- Prepare Cost/Benefit Analysis
- Receive Transit Input on Systems

VEHICLE FILE

ID
Type
Capacity
Status
Mileage
Hours
Garage ID

PERSONNEL FILE

Driver

- ID
- Shift
- Routes

COST FILE

Driver Rate
Maintenance Rate
Vehicle Cost

- Per Mile
- Per Hour

Overhead

SYSTEM FILE

Fare

- Zone
- Mode

Revenue Service

- Fuel
- Oil
- Coolant

MAINTENANCE FILE

Vehicle ID
Release Date
Reason

- Maintenance
- Repair
- Breakdown

OPERATIONS FILE

Route ID
Mileage
Pass Load/Day
Max Load Point

- AM
- PM

Time-Table
Zones

APPENDIX D

TELEPHONE TRANSIT INFORMATION SYSTEM SURVEY COMPENDIUM

TELEPHONE TRANSIT INFORMATION SURVEY

PROPERTY NO.	1	2	3	4	5	6	7
1. DAILY OPERATING TIME	0700/2000	0645/1730	0630/2200	0500/2400	0000/2400	0000/2400	0425/0105
WEEKEND OPERATION?	SAT	SAT	YES	YES	YES	YES	SAT
2. NUMBER OF CLERKS EMPLOYED	5	3	34	2	66	32	2
MAX NUMBER DURING DAY	5	3	19	2	37	13	1
3. SALARY/MONTH: TOP	1428	750	1321	950	1790	1212	456
STARTING	1060	600	964		1267	1068	
4. PRIOR EXPERIENCE OF CLERKS	CLERICAL	OTHER	CLERICAL	OTHER	TRANSIT	TRANSIT	TRANSIT
5. NUMBER OF PHONE LINES	4	3	35	7	99	18	4
NUMBER CLERK POSITIONS	5	3	20	7	40	17	2
TOLL FREE LINES?	NO	NO	YES	NO	YES	NO	NO
AUT. CALL DISTR. SYSTEM	NO	NO	YES	NO	YES	YES	NO
6. USE OF REFERENCE MATERIALS							
TIME SCHEDULES	HIGH	HIGH	HIGH	HIGH	NOT APP	HIGH	HIGH
ROUTE MAPS	HIGH	LOW	MEDIUM	LOW	NOT APP	HIGH	HIGH
SYSTEM MAPS	MEDIUM	LOW	HIGH	MEDIUM	HIGH	HIGH	LOW
STREET MAPS	MEDIUM	MEDIUM	MEDIUM	MEDIUM	HIGH	HIGH	HIGH
DIRECTORIES	LOW	NOT APP	LOW	NOT APP	LOW	LOW	HIGH
OTHER	NOT APP	NOT APP	NOT APP	NOT APP	NOT APP	HIGH	MEDIUM
7. TELEPHONE INQUIRY VOLUME							
PEAK HOUR	78	45	350		250	600	60
DAILY	750	490	3750	225	8500	5500	250
ANNUAL(THOUS.)	215	140	1000		2600	1355	64
8. COST PER CALL, CENTS	30		60		70	51	21
TOTAL ANNUAL COST(THOUS.)	63		524		2000	682	13
% OF TRANSIT COST	1.0						0.4
9. TRANSIT SYSTEM DESCRIPTION							
POPULATION SERVED(THOUS.)	204	650	2500	100	7200	1806	290
PASSENGERS/YR(THOUS.)	2239	10500	67200	3000	100000	125000	4800
ANNUAL VEH. MILES(THOUS.)	1620	4930	29000	1600		31200	2000
TOTAL ROUTE MILES	315	358	4804				451
# TRANSIT VEHICLES	28	200	1142	41	5000	1083	65

TELEPHONE TRANSIT INFORMATION SURVEY

PROPERTY NO.	8	9	10	11	12	13	14
1.DAILY OPERATING TIME	0530/0200	0600/2200	0600/2200	0000/2400	0000/2400	0000/2400	0600/2200
WEEKEND OPERATION?	YES	SAT	YES	YES	YES	YES	YES
2.NUMBER OF CLERKS EMPLOYED	28	7	19	12	43	64	26
MAX NUMBER DURING DAY	9	10	7	6	18	23	15
3.SALARY/MONTH:TOP	1422	710	738	1235	1387	1759	1169
STARTING	1075	490	603	1187	1090	687	847
4.PRIOR EXPERIENCE OF CLERKS	OTHER	OTHER	OTHER	TRANSIT	OTHER	TRANSIT	CLERICAL
5.NUMBER OF PHONE LINES	20	7	20	10	32	40	20
NUMBER CLERK POSITIONS	19	7	12	6	22	40	15
TOLL FREE LINES?	YES	NO	NO	NO	YES	NO	YES
AUT. CALL DISTR. SYSTEM	YES	NO	YES	NO	YES	YES	YES
6.USE OF REFERENCE MATERIALS							
TIME SCHEDULES	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH
ROUTE MAPS	MEDIUM	MEDIUM	LOW	MEDIUM	HIGH	HIGH	HIGH
SYSTEM MAPS	LOW	LOW	LOW	MEDIUM	MEDIUM	MEDIUM	MEDIUM
STREET MAPS	HIGH	MEDIUM	LOW	MEDIUM	LOW	HIGH	HIGH
DIRECTORIES	HIGH	MEDIUM	NOT APP	NOT APP	LOW	HIGH	LOW
OTHER	LOW	NOT APP	NOT APP	NOT APP	HIGH	LOW	NOT APP
7.TELEPHONE INQUIRY VOLUME							
PEAK HOUR	425	200			465	450	340
DAILY	6000	2032	4200	3000	5423	4200	3000
ANNUAL(THOUS.)	2000	600	1363	720	1793	1300	878
8.COST PER CALL,CENTS		14		35	45		51
TOTAL ANNUAL COST(THOUS.)		85	178	250	843		493
% OF TRANSIT COST		1.2	0.3	0.5	1.3		1.3
9.TRANSIT SYSTEM DESCRIPTION							
POPULATION SERVED (THOUS.)	2000	480	1070	1000	2128	7500	1800
PASSENGERS/YR(THOUS.)	94000	8700	83000	72000	57000	616837	28800
ANNUAL VEH. MILES (THOUS.)	26000	4670	30500	20000	28000		17200
TOTAL ROUTE MILES	800	316	1992	523	2048	953	1638
# TRANSIT VEHICLES	1018	150	843	578	900	4550	497

TELEPHONE TRANSIT INFORMATION SURVEY

PROPERTY NO.	15	16	17	18	19	20	21
1.DAILY OPERATING TIME	0700/2300	0700/2300	0000/2400	0000/2400	0600/2200	0530/2300	0600/1800
WEEKEND OPERATION?	YES	YES	YES	YES	YES	YES	SAT
2.NUMBER OF CLERKS EMPLOYED	16	19	79	6	23	16	12
MAX NUMBER DURING DAY	6	8	30	3	9	10	10
3.SALARY/MONTH:TOP	876	1239	1317	949	2600	1041	
STARTING	722	917	983	766	788	832	
4.PRIOR EXPERIENCE OF CLERKS	CLERICAL	OTHER	OTHER	OTHER	OTHER	OTHER	OTHER
5.NUMBER OF PHONE LINES	8	19	55	10	27	20	27
NUMBER CLERK POSITIONS	7	15	33	5	9	10	12
TOLL FREE LINES?	NO	YES	NO	YES	YES	NO	YES
AUT. CALL DISTR. SYSTEM	NO	YES	YES	YES	YES	YES	YES
6.USE OF REFERENCE MATERIALS							
TIME SCHEDULES	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH
ROUTE MAPS	LOW	MEDIUM	MEDIUM	NOT APP	HIGH	MEDIUM	HIGH
SYSTEM MAPS	HIGH	NOT APP	MEDIUM	MEDIUM	MEDIUM	LOW	MEDIUM
STREET MAPS	HIGH	HIGH	LOW	LOW	HIGH	HIGH	MEDIUM
DIRECTORIES	NOT APP	MEDIUM	NOT APP	LOW	LOW	LOW	MEDIUM
OTHER	NOT APP	HIGH	NOT APP	NOT APP	HIGH	NOT APP	LOW
7.TELEPHONE INQUIRY VOLUME							
PEAK HOUR	190	250	710		200		
DAILY	2200	2650	6950	1223	1500	2800	1200
ANNUAL(THOUS.)	803	935	1383	382	500	1020	
8.COST PER CALL,CENTS	28	41	100	12		23	
TOTAL ANNUAL COST(THOUS.)	31	380	1438	53	270	230	31
% OF TRANSIT COST						0.7	1.9
9.TRANSIT SYSTEM DESCRIPTION							
POPULATION SERVED(THOUS.)	480	1924		900	580	1200	3800
PASSENGERS/YR(THOUS.)	69190	101239	150000	20000	15000	33622	85000
ANNUAL VEH. MILES (THOUS.)	24268	37498		7285	7400	12764	8500
TOTAL ROUTE MILES	1740	3955		399	640		1200
# TRANSIT VEHICLES	760	1030		239	230	320	316

TELEPHONE TRANSIT INFORMATION SURVEY

PROPERTY NO.	22	23	24	25	26	27	28
1.DAILY OPERATING TIME	0600/2400	0700/2330	0600/2400	0600/2000	0000/2400	0600/2000	0600/2330
WEEKEND OPERATION?	YES	YES	YES	YES	YES	SAT	YES
2.NUMBER OF CLERKS EMPLOYED	23	27	15	10	9	2	58
MAX NUMBER DURING DAY	16	12	8	7	5	2	
3.SALARY/MONTH:TOP	1239	1050	704	818	1150	708	1013
STARTING	1115	850	577	624	1050	533	912
4.PRIOR EXPERIENCE OF CLERKS	OTHER	OTHER	OTHER	OTHER	CLERICAL	CLERICAL	CLERICAL
5.NUMBER OF PHONE LINES	40	16	10	10	6	6	50
NUMBER CLERK POSITIONS	24	12	10	10	6	1	26
TOLL FREE LINES?	NO	NO	NO	NO	NO	NO	NO
AUT. CALL DISTR. SYSTEM	YES	YES	YES	NO	NO	NO	YES
6.USE OF REFERENCE MATERIALS							
TIME SCHEDULES	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH
ROUTE MAPS	LOW	LOW	HIGH	HIGH	HIGH	HIGH	MEDIUM
SYSTEM MAPS	MEDIUM	HIGH	LOW	MEDIUM	HIGH	NOT APP	MEDIUM
STREET MAPS	MEDIUM	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM	MEDIUM
DIRECTORIES	LOW	MEDIUM	LOW	LOW	MEDIUM	LOW	NOT APP
OTHER	NOT APP	NOT APP	LOW	LOW	NOT APP	NOT APP	NOT APP
7.TELEPHONE INQUIRY VOLUME							
PEAK HOUR	650	550	300	180	205		700
DAILY	6000	4500	3300	1500	2000	150	7500
ANNUAL(THOUS.)	2300	1900	1144	550	450		2500
8.COST PER CALL,CENTS	26	45	15		28		50
TOTAL ANNUAL COST(THOUS.)		426	171		125		920
% OF TRANSIT COST		0.2	1.3		0.4		
9.TRANSIT SYSTEM DESCRIPTION							
POPULATION SERVED(THOUS.)	4000	2000	713		600	140	3000
PASSENGERS/YR(THOUS.)	265913	337000	18244		63000	3000	154300
ANNUAL VEH. MILES (THOUS.)	70338	98148	7684		15800	195	51875
TOTAL ROUTE MILES	3515	734	564		301	154	
# TRANSIT VEHICLES	2635	2300	247	400	575	63	1826

GLOSSARY

ADP	Automated Data Processing
AIDS	Automated Information Directory System
AT&T	American Telephone & Telegraph Company
APTA	American Public Transit Association
AVM	Automated Vehicle Monitor
CCIS	Computerized Customer Information System
COG	Washington Metropolitan Area Council of Governments
COTA	Central Ohio Transit Authority
CRT	Cathode Ray Tube
DBMS	Data Base Management System
DOT	U.S. Department of Transportation
DP	Distributive Processing
FAA	Federal Aviation Administration
FARE	Financial Accounting and Reporting Elements
FSS	Flight Service Station
IBM	International Business Machines Corporation
NYCTA	New York City Transit Authority
OCTD	Orange County Transit District
RTA	Regional Transportation Authority of Northern Illinois
RUCUS	Automated Run Cutting and Scheduling System
SBS	Satellite Business Systems

GLOSSARY (Concluded)

SCRTD	Southern California Rapid Transit District
SEPTA	Southeastern Pennsylvania Transportation Authority
SIMS	Service, Inventory and Maintenance System
TARC	Transit Authority of River City
TRB	Transportation Research Board
UMTA	Urban Mass Transportation Administration
UTPS	UMTA Transportation Planning System
VRS	Voice Response System
WMATA	Washington Metropolitan Area Transit Authority