TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
UMTA/TX-88/1087-1		

4. Title and Subtitle	5. Report Date / 6. Performing Organization Code
Automated Transit Ridership Data Collection	5. September 1988 6.
7. Author(s) Kirk E. Barnes and Thomas Urbanik II	8. Performing Organization Report No. Technical Report 1087-1
9. Performing Organization Name and Address Texas Transportation Institute The Texas A&M University System College Station, Texas 77843-3135	10. Work Unit No. 11. Contract or Grant No. Study No. 1-10-87-1087
12. Sponsoring Agency Name and Address Texas State Department of Highways and Public Transportation; Transportation Planning Division P. O. Box 5051 Austin, Texas 78763	13. Type of Report and Period Covered Final - September 1986 February 1988 14. Sponsoring Agency Code

15. Supplementary Notes

Research performed in cooperation with DOT, UMTA.

16. Abstract

Transit systems need to periodically collect and analyze ridership data to determine operational efficiency. Data must also be collected by those transit systems that receive Urban Mass Transportation Administration (UMTA) funding. An automated data collection system can be used to collect, check, arrange, summarize and store bus ridership data. The initial is more than offset by the savings in employee time after implementation.

The Check*mate and TIM software packages developed by Multisystems provides the benefits of an automated data collection system at a reasonable price. However, the documentation that is presently available is inadequate. Implementation of this system would be extremely difficult for a novice user and additional documentation is recommended.

The centralized or pooled concept of an automated data collection system that could be made available to small transit systems in Texas was determined to be not feasible. The influencing factor for this decision include, the logistics of providing the equipment to the transit systems, the difficulties of scheduling and communication, the cost of an adequate number of systems and the time required to train the users. The Multisystems system does however appear to be a reasonable expenditure for individual transit systems.

The final step in evaluating the benefits of an automated system and the recommendation of this study would be to provide a small transit system with the Multisystems system, appropriate hardware and training and then evaluate its use and effectiveness.

17. Key Words	18. Distribution Statement
	No restrictions. This document is available to the public through the National Technical Information Service 5285 Port Royal Road Springfield, Virginia 22161

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	32	

Form DOT F 1700.7 (8-69)

METRIC CONVERSION FACTORS

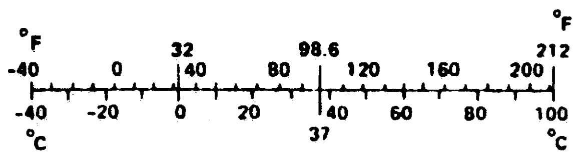
Approximate Conversions to Metric Measures

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



AUTOMATED TRANSIT RIDERSHIP DATA COLLECTION

By
Kirk E. Barnes
Research Associate
and
Thomas Urbanik II
Research Engineer

Technical Report Number 1087-1
Study Number 1-10-87-1087

Sponsored by

Texas State Department of Highways and Public Transportation

In cooperation with
Urban Mass Transportation Administration
U.S. Department of Transportation

Texas Transportation Institute
The Texas A&M University System
College Station, Texas 77843-3135

September 1988

The preparation of this study was financed in part through a grant from the Urban Mass Transportation Administration, United States Department of Transportation under the Urban Mass Transportation Act of 1964, as amended.

IMPLEMENTATION STATEMENT

The study findings indicate that the Multisystems automated data collection system is an effective means of collecting, arranging and transferring bus ridership data. The data is organized and compiled quickly and can be analyzed to make decision making more timely. However, the current documentation for the system was found to be inadequate for the novice user and development of additional documentation is recommended. The concept of a centralized or pooled automated data collection system available to small transit systems for periodic use was determined to be not feasible due to logistics, cost and the training required. Although the system does appear feasible for individual systems, it should be implemented in a small transit system and evaluated in actual operation.

DISCLAIMER

The contents of the report reflect the views of the authors who are responsible for the opinions, findings and conclusions presented herein. The contents do not necessarily reflect the official views of the Texas State Department of Highways and Public Transportation or the Urban Mass Transportation Administration. This report does not constitute a standard, specification or regulation.

ACKNOWLEDGEMENTS

The Texas Transportation Institute would like to acknowledge the assistance and cooperation provided by the following individuals during this study. The study was done under the direction of Ed Collins of D-10, Texas State Department of Highways and Public Transportation, who was instrumental in identifying the opportunity for small transit systems to improve their data collection and analysis procedure. Mr. Gary Ruprecht of Multisystems Inc. provided the technical assistance needed during the setup of the system. Mr. John Wilson and Mrs. Melinda Green Harvey of Citibus in Lubbock, Texas provided assistance during the field testing of the data collection system.

SUMMARY

Transit systems need to periodically collect and analyze ridership data to determine operational efficiency. Data must also be collected by those transit systems that receive Urban Mass Transportation Administration (UMTA) funding. An automated data collection system can be used to collect, check, arrange, summarize and store bus ridership data. The initial cost is more than offset by the savings in employee time after implementation.

The Check*mate and TIM software packages developed by Multisystems provide the benefits of an automated data collection system at a reasonable price. However, the documentation that is presently available is inadequate. Implementation of this system would be extremely difficult for a novice user and additional documentation is recommended.

The centralized or pooled concept of an automated data collection system that could be made available to small transit systems in Texas was determined to be not feasible. The influencing factor for this decision include, the logistics of providing the equipment to the transit systems, the difficulties of scheduling and communication, the cost of an adequate number of systems and the time required to train the users. The Multisystems system does however appear to be a reasonable expenditure for individual transit systems.

The final step in evaluating the benefits of an automated system and the recommendation of this study would be to provide a small transit system with the Multisystems system, appropriate hardware and training and then evaluate its use and effectiveness.

TABLE OF CONTENTS

Page

INTRODUCTION

Transit systems need to periodically collect ridership data for operational and managerial purposes. Emphasis on the operational efficiency of transit systems requires a maximization of route productivity, which can only be evaluated by detailed ridership and schedule performance data. Current UMTA policies and regulations require the periodic reporting of certain operating data for those systems receiving federal funding. Ridership data for these purposes is often collected manually and tabulated in the office. Data collection in this manner is time consuming, expensive, cumbersome and may result in data analysis errors. An automated data collection and information processing system could be employed to more efficiently obtain and report ridership data. This study describes the need, and the feasibility of an automated data collection system for small transit systems in the state of Texas.

PURPOSE OF DATA COLLECTION

The reasons for periodic collection of ridership data for transit systems is two-fold: 1) as a means of managerial control; 2) because a system is required to do so by UMTA.

The management of the transit system must evaluate routing to maximize efficiency and effectiveness. These route attributes can be obtained by analyzing detailed ridership data. These data include accurate ridership and schedule adherance information. Managerial decisions can then be made based on these elements which indicate the productivity of each route. Route evaluation needs to be made periodically so that ridership trends may be documented, and changes forcasted in order to continually make the best use of limited resources.

The Federal Register of 1977 specified that certain operating data should be collected as part of the Section 15 Uniform System of Accounts and

Records and Reporting System. Circulars from the Department of Transportation describe the acceptable sampling procedures, sample size and confidence levels for obtaining operating data for both the fixed route and demand responsive bus systems. The circular for the revenue based sampling procedures for fixed route bus system lists the data elements that are required to be reported annually, (as a minimum) these include :

Unlinked Passenger Trips
Passenger Miles
Passengers Boarded
Trips in Sample
Total Number of Bus Trips
Unlinked Passengers Per Trip
Passenger Miles Per Trip

The general procedure recommended for collecting the unlinked passengers, passenger miles, and trip time data is for the surveyor to ride the buses on the trips selected, count the passengers that board and alight at each point where the bus stops and count the farebox revenues for each trip. The distances between stops are determined from the bus odometer, maps or by retracing the trip by automobile and recording the odometer readings. The surveyor also records the arrival time at each stop so that time between stops can be determined. The combination of on-off counts, distances between stops, time between stops and fare box revenues provides all the information needed to obtain the required estimates.

BENEFITS OF AN AUTOMATED SYSTEM

The use of an automated or semi-automated data collection system can result in improved data turnaround, better quality data, increased employee efficiency and possibly less expense.

Data from an automated system can be organized and compiled quicker with fewer chances of errors than data tabulated from manual counts, since preprocessing (transferring data to a computer) is not necessary. Ridership data can be analyzed and transit decision making can be more timely. Ridership analysis can lead to service alterations, specifically, which routes are good performers, which trips are under utilized, which stops should be relocated and which schedules need to be revised.

Automated systems minimize the tedious task of data coding, statistical manipulations and report preparation. Transit system staff can attend to issues more important than data collection and compilation. Reports can be generated that are easy to understand, analyze and apply.

Automated systems for transit systems may also be more cost effective, depending upon several factors. The number of peak hour buses, the sampling rate of the routes and the frequency of data collection efforts all effect the cost effectiveness of an automated system. The cost of such a system for small transit systems is discussed in more detail in a subsequent section.

ALTERNATIVES

The purpose of this study is to investigate the various methods of autoamated data collection and determine the most cost effective and useful method for small Texas transit systems.

A survey of eleven transit systems in Texas cities of less than 200,000 in population was conducted to determine the interest and feasibility of a centralized system to provide automated data collection capabilities. Seven of the respondents thought that the concept of a centralized data collection system appeared worthy of consideration for their system, three responded negatively and one did not responsd. With the majority of the small transit systems surveyed indicating interest in such an automated system, the next task was to identify the viable alternatives. A completely automated system could include features such as passenger counting by switch mat sensors or photoelectric beams, fare category counting by an electronic fare box and electronic data transmission. These types of devices were considered too expensive for small systems who only periodically had the need to collect ridership data. Therefore, a semi-automated data collection system that includes a manually operated electronic counting device and accompanying data compilation software was found to be the most feasible alternative. Two systems were found that met the criteria of a semi-automated bus ridership data collection system.

EZDATA-micro is a semi-automated data collection system that includes a manually operated electronic data collector and data compilation and report generation software. This system also includes training and instruction by the manufacturer to the purchaser. This system was not chosen for evaluation because of two drawbacks, the stoplist display and cost. The EZDATA system data collectors are hand held units with several buttons to enter the boarding and alighting passengers. The stop display is generic, it only displays stop numbers. A bus stoplist with the corresponding stop numbers must be carried by the data collecter to identify the stops. The data compilation and report generation portions of the EZDATA system require the use of an IBM AT or XT compatible PC. Assuming the transit system already has the PC the cost of the EZDATA-micro system was near $19,000 for the basic package containing one data collector and the software.

Multisystems Inc. has developed a semi-automated ridership data collection system and accompanying software. Their system centers around software developed for an Epson HX-20 or HX-40 portable computer and an IBM compatible PC. The software package that runs on the Epson is called Check*mate and a microcassette drive or ram cartridge is used to store the collected data in a machine readable form. A coded list of the locations at which the bus stops (stoplist) is created on either the Epson or using a word processing program on a PC. As bus stops are reached, the abreviated intersection names are displayed on the screen of the Epson and passenger boardings and alightings are entered. The data is transferred to the PC using a communications program. Additional software for the PC, called TIM (Transit Information Manager), is available to process the ridership data and generate reports. This system cost about $5,100 which includes the cost of the Epson HX-40, Check*mate software and TIM software. This price excludes the cost of an IBM compatible PC, word processing program or communications program which most systems would likely already have. However, these items could cost an additional $2000. Since the Multisystem's system uses easily obtainable hardware (Epson HX-40 portable computer) replacement or repair can be done locally. The generic or non-specialized functions of the portable computer also allow for alternative uses. Features such as the typewriter-like keyboard, multiline display and internal clock make the portable computer a versatile tool for several types of transportation studies. In addition to the bus ridership counts, license plate surveys, vehicle classification surveys and vehicle turning movement counts may be conducted using the Epson HX-40. Because of the more desirable attributes and the lower cost, the Multisystems transit system was chosen for a more detailed evaluation.

CHECK*MATE

Check*mate is the name of the software package developed by Multisystems Inc. for automating the collection of bus ridership data. Passenger boarding and alightings by stop (ridechecks) and bus load and time data at selected points (load or pointchecks) are incorporated into the package. The software is written in BASIC and runs on an Epson HX-20 or HX-40 portable computer. Data is stored by the computer on either a microcassette drive or ram cartridge, depending upon computer model. The Check*mate system consists of two program modules, LOADCHEC and RIDECHEC.

LOADCHEC is used for collecting vehicle times and passenger loads at selected locations. Load or point checks will not be as useful to small transit systems as it would be in larger systems because of the limited number of buses intersecting at transfer points.

RIDECHEC is used for collecting passenger boardings and alightings by stops and times at selected points. The RIDECHEC module is composed of two sections, one defines the trip being made and the other is used for conducting the passenger counts at the stops. The trip definition portion includes route number, direction code, pattern code, trip number, checker number and stop names. The passenger counting section prompts the user with each stop and displays the number of passengers (which is entered by the checker) boarding and alighting as well as a current summation of the number of passengers currently on board. Ridechec uses an internally stored list of stops to aid the user in identifying the location of stops. Stoplists can be created by the user on the Epson or on another computer (using a word processing program such as Wordstar or Wordperfect) and are simply ASCII files (text files that contain no control characters). The stoplist contains information on the number of patterns, direction, number of segments, number of stops, the stop name and whether or not the stop is a key stop. Key stops on a route are those points where a service pattern begins or ends. The data is stored in the available memory of the Epson and can then be later transferred onto another computer for processing, report generation and analysis. The transfer of files to or from the Epson using a PC requires the use of a communications program (such as PROCOMM) that will transfer ASCII files using an RS-232 cable connection.

TRANSIT INFORMATION MANAGER

Transit Information Manager (TIM) is a software package developed by Multisystems Inc. for the processing of bus transit data. The menu driven program consists of four modules or subsystems: data entry, analysis functions, report generation, and data management.

The data entry subsystem is used to: input unverified data (data that has not been checked for errors) either online or through a batch process, verify the data and check for consistency, modify the data if needed and load the verfied data into the master database. The data entry subsystem will handle four types of inputs: load counts, boarding counts, ridechecks and fare box readings.

The analysis functions provide a statistical means of processing the data. Presently included in this subsystem is the difference of means test and sample size calculation. Future implementation includes bivariate regression analysis, trend line regression analysis and a section 15 analysis.

The report generation subsystem is used to generate and print up to 17 predefined reports.

The data management subsystem allows the user to move verified data from on-line to inactive storage and retrieve verified data from inactive storage. It is also used to delete records, define the parameters of the service network and schedule, and define the formats of input data files.

FIELD TEST

Citibus, a small bus transit system in Lubbock, Texas, operating 13 routes and 25 peak hour buses, was selected for a field test of the Multisystems automated ridership data collection system. An Epson HX-40 portable computer and the Check*mate system was used to collect passenger boarding and alighting data. An IBM compatible PC was used with the TIM software to process and report the data.

Prior to the actual data collection a stoplist had to be created. The stoplist is used to prompt the user with the locations of bus stops. A word processing program (Wordstar) was used on a PC to create the needed stoplist. The stoplist was created on the PC only because of the easier editing capabilities of Wordstar than with the BASIC editor. A commumications program (PROCOMM) was used to send the stoplist from the PC to the Epson. The CONVERTA file on the Epson was used to receive the stoplist during the transfer. The stoplist is composed of three types of records arranged in a specific order: route description first, pattern description next and stop description. The fields of each record are in a fixed order and are separated by commas. The route description records include a route identifier and the number of patterns, segments and stops in each direction. The pattern description records describe the stops that are on a service pattern. The stop description records identify stop names, segment the stop is on and whether or not the stop is a key stop.

Two routes were chosen and a stoplist was created for each. Both routes originated from the CBD and returned to the CBD at 30 minute headways. One route contained 71 stops and the other had 52 stops. Ridership data was collected during one day for four trips on each route. Data collection was initiated by choosing the Ridechec option from the main menu displayed on the Epson. As the program prompts the user, he must enter the stoplist to be used, the checker id, direction, trip code (an eight digit trip identifier), and a pattern code. The number of passengers already on board is coded and the first stop is then displayed. Boarding and alighting passengers are entered and are displayed as well as a summation of the number of passengers currently on board. Certain keys on the Epson are assigned certain functions by the Check*mate software. The layout of the various keys are shown in Figure 1. The data is stored on the RAM cartridge in machine readable 40 column format. The data stored includes the date (from the internal clock on the Epson), checker id, trip id, stop id, boardings, alightings and arrival time for each stop.

The PC was again used with the communication program to receive the ridecheck data from the Epson. The XFRCKDAT file is used on the Epson to initiate the transfer. After the data was transferred to the PC, the Transit Information Manager (TIM) software was used to verify, process and generate reports for the data collected.

TIM was written for an IBM-PC using MS-DOS operating system. Minimum hardware requirements for the TIM software include: 192K RAM memory, monochrome or color 80 column display terminal, 5 mb hard disk and an 80 column character printer. The PC used during this study was a COMPAQ 286 with two 20 mb hard disks, no hardware limitations with TIM were encountered. The TIM software (contained on three double sided double density floppy disks) was loaded onto one of the hard disks. Before any of the TIM options could be used an ID and password had to be entered, this was accomplished by using the DMU utility that was contained in the TIM software package.

The first task after entering TIM was to define the network and schedule. The Data Management Subsystem was first selected and then the Network/Schedule Definition option. The network was defined by stepping through all nine functions of the network definition menu. The menu includes a definition of: periods, stops, segments, routes, branches, directions, run time classes, service and trips. There are separate screens for each. This procedure allows the user to enter data which defines or modifies the various elements of the service network or the schedule. The network may then be archived (used to make major modifications before reloading into the database) or retrieved (used to load a new or modified network to the database).

Figure 1. Epson HX-40

Data can be entered into TIM through the use of an input screen or an input file. Input screens may be useful to small transit users that have only a limited amount of data. However, in this study the Check*mate system was used and input file was generated (Ridechec output). A format then had to be defined for the input file. The format screen tells TIM the order, column number and field width of elements in the input file. The ridecheck data was then loaded into the input verification database. Additional software that is not contained in the Multisystem system and must be acquired through some other source is that of a communications program to transfer files between the PC and the Epson. The data was then "verified" to make sure that the data fields were of the correct form and that the specified data was consistent with the route structure that was previously defined. Any errors found during the verification procedure are automatically printed out on an Unverified Data Report at the conclusion of the verification process. Mistakes that were made during the data collection process were corrected using the Modify Input Data option. The data was "re-verified" and after finding no errors, the verified data was loaded into the master database. All errors must be eliminated before the data can be made available for analysis and reporting purposes.

The final task was to enter the Report Generator subsystem and print the applicable reports. The following reports were generated for each route: Basic Ride Check, Summary Ride Check, Loading Profile and Running Time Profile. Since no fare category can be counted with Check*mate the Basic Fare Category, Summary Revenue and Fare Category and Ridership Trend Reports were not printed. Since data was collected for only one day a Loading Trend Report was not generated. A sample output from the Basic Ride Check, Loading Profile and Running Time Reports are shown in the appendix.

LABOR REQUIREMENTS

The actual cost of an automated data collection system not only includes the initial capital expenditure but also the setup time and the time spent collecting the data. The setup time for Multisystem's system includes stoplist preparation, network definition and schedule definition. A skilled user can construct a stoplist in a matter of minutes, a novice may require several hours. Since stoplists are unique for each branch, several stoplists may be required for a single route. The network/schedule portion of TIM was the most labor intensive portion of this study. An inexperienced user will require several hours in an attempt to code his first route. Thus the setup of the Multisystems automated data collection system could conceivably take one person 1-2 weeks for a transit system the size of that in Lubbock. Once the system is setup (stoplist coded, network and schedule defined), considerable savings in time can be achieved over a conventional manual system. The data can be entered onto the Epson portable computer and within minutes of transferring to a PC the data can be printed in a report form (assuming there are no errors in the data).

UMTA circular C 2710.1 provides guidelines for sampling rates that transit systems should follow in preparing the Section 15 reports. The sampling frequency ranges from two random bus trips every day to fifteen random bus trips every sixth day. The more frequent sampling rate represents about three hours labor for data collection and at least that many more to enter the data into some storage facility (database) and process reports. The data collection process for the less frequent sampling rate would probably require two people for an entire day with a corresponding increase in processing time. An updated UMTA circular C 2710.4 provides guidelines for sampling rate based on fare box revenues. The sampling rate precribed in this circular is four random bus samples per week. The sample size is reduced considerably, but the data collection will still require approximately 6 hours labor per week excluding the time required to transfer the data to storage. The use of Multisystems Check*mate system for data collection will take approximately the same amount of time as a manual ridecheck count, but the transfer capability of Check*mate data to a storage facility (TIM database) is dramatically less time consuming. The TIM system is extremely effective in checking, processing and printing transit reports.

CENTRALIZED SYSTEM

The concept of a centralized system is an equipment pool, managed by some authority which would provide the capability of automated data collection to transit systems on a periodic basis. Several alternatives were considered for a centralized data collection system for small transit systems and each was determined to be not feasible. For UMTA Section 15 reports for fixed route bus systems data must be collected on a minimum of four trips per week. The frequency at which this data must be collected produces a logistics problem with the hardware itself. Scheduling and communications problems may also occur between the central office and the transit systems. To accomodate the needs of the transit systems across the state several data collection systems would be required, thereby reducing the cost savings of an equipment pool. The use of an automated data collection system on an annual or semi-annual basis for statistical purposes was also determined to be not feasible. The training time required for the efficient use of a system such as the Multisystems one precludes such a limited use. The only reasonable use of an automated data collection system such as the Multisystem system is for an individual transit provider to purchase and implement the system itself.

OBSERVATIONS

Several undesirable or inconsistent traits were observed in both the Check*mate and TIM systems. As stated before, the creation of a stoplist in Check*mate is very confusing for the novice user, as is the procedure for file transfers using a PC. Better documentation could remedy both of these areas of difficulty. The TIM system could also use additional documentation. Several example networks including a graphical representation with stops indicated and proper coding techniques would be extremely helpful. One of the reasons that the Multisystems system was chosen over the other systems was its ability to prompt the user with a stoplist of actual street names. The system is indeed capable of this attribute, but in an awkward manner. When "DEPART" is entered upon leaving a stop, that screen is stored, but the next stop is not displayed. The next stop is displayed only when "ARRIVE" is pressed or when "NEXT" is pressed. To display the next stop before reaching it, the user must enter "NEXT" and then enter "PREVIOUS" before reaching that stop to avoid skipping it. The system may have been easier to use if the next stop was displayed upon entering "DEPART". The "Already on Board" and "Remaining on Board" records of the Ridechec output were not recognized by TIM, and could only be used if corresponding stops named "ALRDONB" and

"REMONBRD" were created. TIM will accept up to seven different fare categories, Check*mate will only record one. However this inconsistency between Check*mate and TIM may be unavoidable and would place the burden on the observer to distinguish the category of each passenger.

CONCLUSIONS AND RECOMMENDATIONS

The provision of an equipment pool to provide automated data collection capabilities to small transit systems does not appear desireable based on cost, logistical considerations and training requirements. The TIM system appears to be a reasonable expenditure for an individual transit system if integrated into an ongoing performance monitoring system. The critcal question which has not been answered by this study is whether an automated data collection system would be effectively used by a small transit system.

The next logical step in evaluating the benefits of an automated data collection system would be to pilot test the system in actual daily use. Given the availability of all the necessary hardware except for a microcomputer, the cost of implementing a pilot system involves the purchase of a microcomputer, development of the appropriate users manual and establishment of the initial data base. In addition , the pilot evaluation should include an evaluation of the use and effectiveness of the system. The Lubbock transit system would appear to be a good candidate for a pilot test.

APPENDIX

ROUTE: 1 DUNBAR EAST
DIRECTION: 0
RUN #:
START TIME: 06:45
DATE: TH 10/29/1987

****
* BASIC RIDE CHECK REPORT *
****

LOCATION	TIME	BOARD INGS	ALIGHT INGS	ON BOARD	BOARDINGS BY FARE CATEGORY: FARE CAT1	FARE CAT2	FARE CAT3	FARE CAT4	FARE CAT5	FARE CAT6	FARE CAT7
BROADWA & TEXAS		4	0	4	4	0	0	0	0	0	0
BROADWA & AVE G		0	0	4	0	0	0	0	0	0	0
BROADWA & AVE F		0	0	4	0	0	0	0	0	0	0
BROADWA & AVE E		0	0	4	0	0	0	0	0	0	0
AVE E & 13TH		0	0	4	0	0	0	0	0	0	0
AVE E & 14TH		0	0	4	0	0	0	0	0	0	0
AVE E & 15TH		0	0	4	0	0	0	0	0	0	0
AVE E & 16TH		0	0	4	0	0	0	0	0	0	0
AVE E & 17TH		0	0	4	0	0	0	0	0	0	0
17TH & AVE D		0	0	4	0	0	0	0	0	0	0
17TH & AVE C		0	0	4	0	0	0	0	0	0	0
17TH & AVE B		0	0	4	0	0	0	0	0	0	0
17TH & AVE A		0	0	4	0	0	0	0	0	0	0
AVE & 18TH		0	0	4	0	0	0	0	0	0	0
19TH & AVE A		0	0	4	0	0	0	0	0	0	0
19TH & BIRCH		0	0	4	0	0	0	0	0	0	0
BIRCH & 20TH		0	0	4	0	0	0	0	0	0	0
CEDAR & 20TH		0	0	4	0	0	0	0	0	0	0
CEDAR & 23RD		0	0	4	0	0	0	0	0	0	0
CEDAR & 26TH		1	0	5	1	0	0	0	0	0	0
CEDAR & CORONAD		0	0	5	0	0	0	0	0	0	0
CORONAD & IVORY		0	0	5	0	0	0	0	0	0	0
IVORY & 28TH		2	0	7	2	0	0	0	0	0	0
28TH & HICKORY		0	0	7	0	0	0	0	0	0	0
28TH & GLOBE		0	0	7	0	0	0	0	0	0	0
GLOBE & 26TH		0	0	7	0	0	0	0	0	0	0
26TH & HICKORY		0	1	6	0	0	0	0	0	0	0
24TH & OAK		0	0	6	0	0	0	0	0	0	0
OAK & 25TH		0	0	6	0	0	0	0	0	0	0
25TH & WEBER		0	0	6	0	0	0	0	0	0	0
WEBER & 26TH		0	0	6	0	0	0	0	0	0	0
WEBER & OAK		2	0	8	2	0	0	0	0	0	0
WEBER & 27TH		3	0	11	3	0	0	0	0	0	0
WEBER & 28TH		0	0	11	0	0	0	0	0	0	0
WEBER & QUIRT		0	0	11	0	0	0	0	0	0	0
31ST & QUIRT		0	0	11	0	0	0	0	0	0	0
31ST & REDBUD		0	1	10	0	0	0	0	0	0	0
TOTAL		12	2		12	0	0	0	0	0	0

RPT 2.3.1 02/24/1988 TEXAS A&M UNIVERSITY VERSION 1.2 PAGE 1

ROUTE: 1 DUNBAR EAST
BRANCH:1
DIRECTION: 0
PERIOD: 00:00 TO 24:00
DATE RANGE: 10/29/1987 TO 10/29/1987

****
* LOADING PROFILE REPORT *
****

STOP LOCATION	DIST	OBS	ON	OFF	ON BOARD	AVERAGE ON BOARD 1 2 3 4 5 6 7 0 0 0 0 0 0 0
BROADWAY & TEXAS	0.0	1	4.0	.0	4.0	**
BROADWAY & AVE G	.1	1	.0	.0	4.0	**
BROADWAY & AVE F	.2	1	.0	.0	4.0	**
BROADWAY & AVE E	.2	1	.0	.0	4.0	**
AVE E & 13TH	.3	1	.0	.0	4.0	**
AVE E & 14TH	.4	1	.0	.0	4.0	**
AVE E & 15TH	.4	1	.0	.0	4.0	**
AVE E & 16TH	.5	1	.0	.0	4.0	**
AVE E & 17TH	.5	1	.0	.0	4.0	**
17TH & AVE D	.6	1	.0	.0	4.0	**
17TH & AVE C	.7	1	.0	.0	4.0	**
17TH & AVE B	.7	1	.0	.0	4.0	**
17TH & AVE A	.8	1	.0	.0	4.0	**
AVE A & 18TH	.8	1	.0	.0	4.0	**
19TH & AVE A	.9	1	.0	.0	4.0	**
19TH & BIRCH	1.0	1	.0	.0	4.0	**
BIRCH & 20TH	1.0	1	.0	.0	4.0	**
CEDAR & 20TH	1.1	1	.0	.0	4.0	**
CEDAR & 23RD	1.3	1	.0	.0	4.0	**
CEDAR & 26TH	1.5	1	1.0	.0	5.0	**
CEDAR & CORONADO	1.6	1	.0	.0	5.0	**
CORONADO & IVORY	2.2	1	.0	.0	5.0	**
IVORY & 28TH	2.3	1	2.0	.0	7.0	***
28TH & HICKORY	2.3	1	.0	.0	7.0	***
28TH & GLOBE	2.4	1	.0	.0	7.0	***
GLOBE & 26TH	2.5	1	.0	.0	7.0	***
26TH & HICKORY	2.5	1	.0	1.0	6.0	***
24TH & OAK	3.1	1	.0	.0	6.0	***
OAK & 25TH	3.2	1	.0	.0	6.0	***
25TH & WEBER	3.3	1	.0	.0	6.0	***
WEBER & 26TH	3.4	1	.0	.0	6.0	***
WEBER & OAK	3.4	1	2.0	.0	8.0	****
WEBER & 27TH	3.5	1	3.0	.0	11.0	*****
WEBER & 28TH	3.6	1	.0	.0	11.0	*****
WEBER & QUIRT	3.6	1	.0	.0	11.0	*****
31ST & QUIRT	3.7	1	.0	.0	11.0	*****
31ST & REDBUD	3.7	1	.0	1.0	10.0	*****

ROUTE: 1 DUNBAR EAST
BRANCH: 1
DIRECTION: 0
PERIOD: 00:00 TO 24:00
DATE RANGE: 10/29/1987 TO 10/29/1987

****
* LOADING PROFILE REPORT *
****

STOP LOCATION	DIST	OBS	ON	OFF	ON BOARD	AVERAGE ON BOARD 1 0	2 0	3 0	4 0	5 0	6 0	7 0

AVERAGE PASSENGERS ON BOARD: 5.43
AVERAGE LOAD FACTOR: 0.00
AVERAGE PASSENGER MILES: 20.3
AVERAGE TRIP LENGTH: 1.7

ROUTE: 1 DUNBAR EAST
BRANCH:1
DIRECTION: 0
PERIOD: 00:00 TO 24:00
DATE RANGE: 10/29/1987 TO 10/29/1987

****
* RUNNING TIME PROFILE REPORT *
****

		-INCREMENTAL RUN TIME-			-CUMULATIVE RUN TIME-			
LOCATION	TRIPS	SCHED	ACTUAL	DIFF	SCHED	ACTUAL	DIFF	AVG SPEED
BROADWAY & TEXAS								
31ST & REDBUD	1	15.0	14.0	-1.0	15.0	14.0	-1.0	16.0
TOTAL ROUTE								16.0