

Producing Section 15 Service-Consumed Data: Challenge for Large Transit Authorities

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Large transit authorities encounter many difficulties collecting the operating statistics required for UMTA Section 9 funding. Transit agencies that operate rail and bus systems 24 hours per day, 365 days per year must gather statistics from a universe of riders that is sometimes difficult to capture through UMTA-suggested random sampling. This paper examines how the Chicago Transit Authority (CTA) is meeting the challenge of collecting Section 15 service-consumed data from a large, dynamic transit system. The CTA method of determining annual unlinked trips and passenger-miles for the bus and rail systems is presented here. This includes the resources required to assign and monitor data collection efforts as well as problems regularly encountered in-the-field by data collection personnel. CTA's stratified rail sampling plan and the needs of large transit systems are discussed along with suggestions for more efficient data gathering techniques.

All U.S. transit systems report annual ridership and passenger-mile statistics to UMTA to qualify for Section 9 funding. UMTA Circular 2710.4 suggests that a sample size of 208 fixed-route bus trips per year will yield operating data that satisfy the specified confidence and precision levels of 95 percent and ± 10 percent respectively. This paper examines the methodology used by the Chicago Transit Authority (CTA) to meet the challenge of collecting service-consumed data for both bus and rail service.

Since the UMTA circular exists as merely a guideline delineating data collection requirements for all transit authorities (TAs), we will discuss alternative sampling methodologies that conform to UMTA specifications but that are more appropriate for CTA and perhaps other large agencies. Evidence is presented to suggest that the collection of an equal number of good observations is considerably more difficult for large TAs than for smaller transit systems—if quality control is maintained. Data gathering procedures must be more sophisticated to acquire statistically valid results from a system that operates 24 hours per day, 365 days per year. Beginning with sample design, we will show how single random sampling, without stratification, may misrepresent ridership statistics of large bus and rail systems. The 1988 CTA stratified rail sampling plan will be presented along with January through June sample results. Random trip selection, scheduling, and field problems encountered during the entire

data gathering process will be examined as well as administrative and quality-control difficulties such problems create. And finally, suggestions for additional, more-efficient data gathering methods will be discussed.

SAMPLE DESIGN

Bus System

UMTA Circular 2710.4 (1) details the approved data gathering methodology for all fixed-route bus systems. A sample of 208 bus trips randomly selected and sampled weekly throughout the reporting year is suggested to adhere to 95 percent confidence levels at ± 10 percent relative precision. The recommended revenue-based method estimates the number of annual unlinked trips and passenger-miles from the fare revenue collected and the passenger-miles observed during the 208 sample trips. CTA, however, has chosen to use the trip-length statistic, rather than the revenue/unlinked trip statistic, to estimate passenger-miles, although revenue data are still collected for comparative purposes.

Precision of ± 10 percent may be adequate for UMTA reporting of unlinked trips, but it is not sufficient for CTA's in-house purposes. A 10 percent error in annual unlinked trips totaling over 400 million is greater than the year-to-year change in ridership. Precision of only ± 40 -million riders provides a poor basis for predicting operating income. Consequently, CTA uses a full-count of unlinked trips, counting every single passenger as he or she boards a bus.

All CTA buses are equipped with General Farebox Industries (GFI) electronic fareboxes capable of tabulating the number of boarding passengers by the fare medium presented or deposited. Bus operators register each boarding passenger by pressing the appropriate farebox key corresponding to the fare payment presented. The fareboxes used by CTA since 1988 electronically transmit these counts to the central farebox computer each day. In this manner, CTA can monitor ridership daily, weekly, and monthly, by route, fare category, payment method, and so on. And, since the bus operators have proven to be 98 percent accurate in keying in boarding passengers, the full-count method has proven much more efficient and precise to CTA management than the revenue-based method of estimating unlinked trips.

The Section 15 report of 1987 was the first in which CTA reported unlinked trips based on the full count taken from

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the fareboxes. In 1986 the revenue-based method was reported, even though full-count data were available. The 1987 and subsequent Section 15 reports use the sample trips only for the purpose of calculating the statistic of average trip length. This number is then multiplied by the number of unlinked trips (from the farebox) to estimate passenger-miles.

Because Section 15 sample trips for CTA purposes are used only to determine average trip lengths, a simple random sample, as suggested by UMTA, could tend to misrepresent average trip length because of the randomness in the selection process. Because the sampling unit in the revenue-based method is a bus trip, the universe from which a random trip is selected is the daily schedule of all bus trips.

At CTA, as at other large agencies, buses are in operation around-the-clock, even though over 50 percent of all rides occur during the 6 hr of the weekday a.m. and p.m. rush periods. Bus operations are sized to carry the peak passenger demands. However, to maintain service quality in the off-peak hours, bus trips are not scheduled in direct proportion to ridership. When selecting random sample bus trips, the chance of picking a midday or evening trip is higher than the proportion of riders or passenger-miles carried, because the buses operating in those time periods transport a lower proportion of CTA's bus riders (see Table 1). In addition, because average trip lengths are longer during a.m. and p.m. rush periods as a result of people commuting longer distances to and from work, a disproportionate number of midday sample trips will misrepresent the average trip length of the majority of system bus riders.

The weekday on which bus trips are to be sampled is also randomized, as suggested by UMTA. However, CTA has performed statistical analyses on the data base of 1987 sample bus trips that negate the need for weekday randomization. Average trip lengths collected on different weekdays in 1987 were compared for statistically significant differences using the general linear model procedure of the Statistical Analysis

TABLE 1 CTA BUS SYSTEM LOAD FACTORS BY TIME ON WEEKDAY

Weekday Time Period (hours)	1987 Load Factors ^a	Percentage of Daily Unlinked Trips
A.M. Peak (0600-0900)	16.9	24.1
Midday (0900-1500)	12.9	29.0
P.M. Peak (1500-1800)	19.2	26.1
Other (1800-0600)	11.6	20.8

^aPassenger-miles/revenue-vehicle-miles.

TABLE 2 DUNCAN'S MULTIPLE RANGE TEST

Duncan ^a Grouping	Mean	No. of Trips	Day
A	2.29	40	Friday
A	2.27	31	Thursday
A	2.16	23	Wednesday
A	2.05	42	Monday
A	2.04	38	Tuesday

NOTE: Variable: 1987 bus average trip length. alpha = 0.05; degree of freedom = 1.69; mean of square error = 1.05.

^aMeans with the same letter are not significantly different.

System (SAS). Analyses of variance between the means collected in each time interval were analyzed via the *t*-test (least significant difference), the Tukey studentized range test, and the Duncan multiple range test. All results revealed no significant difference in the mean trip length at 95 percent confidence—regardless of the weekday on which the data were collected (see Table 2). It is expected that the 1988 bus sample trip results will also reflect this finding.

Rail System

CTA's rail system sample design evolved in a different way. The 1986 Section 15 report was the first one in which UMTA required both rail and bus passenger-miles to be collected in the same reporting year. Previous rail passenger-mile data had only been gathered periodically because of the relatively great expense and unavailability of staff time. The resulting statistic of average rail passenger trip length was then used in Section 15 reports for several subsequent years.

Part of what makes rail passenger-miles more challenging to gather is the absence of any UMTA-suggested sampling plan. Therefore, most rail systems, including CTA, have developed their own customized rail sampling plans to meet UMTA's statistical standards—95 percent confidence, ± 10 percent precision, sampled weekly throughout the year.

Rail ridership at CTA has been measured by fare collecting employees (ticket agents and conductors) since the mid-1970s yielding a full-count of unlinked trips daily. Nearly all passengers paying with cash, transfer, or pass must go through a turnstile, either manually operated or automated, before gaining access to the rail system. (In times of low traffic, conductors collect fares on board, which accounts for approximately 2 percent of annual boardings.) Therefore, as with the bus system, Section 15 sample trips are only required to determine average passenger trip length.

Average trip length is determined by assigning data collectors to ride in one rail car of a sample trip from terminus to terminus counting the number of passengers boarding and alighting at each station. Passenger loads are calculated and multiplied by the distances between stations to determine passenger-miles. The sum of the passenger-miles divided by the sum of boarding passengers (unlinked trips) is the average trip length for the sample trip.

Before the 1988 fiscal year, CTA designed its current rail sampling plan and submitted it to UMTA for approval. As mentioned earlier, simple random samples may not adequately represent ridership on a system that operates 24 hr/day. For example, ridership behavior in the early morning hours is unlikely to resemble that of the p.m. rush period. Therefore, a stratified sampling plan was selected that compensates for shifts in observed passenger-miles that are a function of the time of day. This methodology provides a more valid, cross-sectional profile of CTA rail riders.

The strata used for this plan are based on the following time of day and day of week intervals: a.m. peak, midday, p.m. peak, other (weekday), Saturday, and Sunday. The total sample is allocated among the mutually exclusive strata based on the proportion of the total unlinked trips boarding during the time period relative to each stratum. Worst-case sample

variances from 1985 were used as a historical reference to calculate the following sample size:

$$n = (z^2/r^2)c^2 \quad n = 152 \text{ sample trips}$$

where

- Z = 95 percent confidence Z value of 1.96,
- r = relative precision of ± 10 percent, and
- c = coefficient of variation—estimated at 0.628 (worst-case variance from 1985 rail data).

Because this sample size calculation is based on the minimum requirements specified by UMTA, CTA has increased the sample design for 1988 to 100 rail trips to compensate for any unforeseen sampling error that may arise from the implementation of a new sampling plan. Even at 300 samples, this number is less than half the number of samples taken in 1987.

The CTA stratified rail sampling procedure is designed so that sample sizes may change relative to observed sample variances. In other words, the learning curve process will increase precision so that sample sizes in subsequent years may be reduced and still meet UMTA confidence levels and precision requirements. The 1988 year-to-date statistics show CTA rail sample trips to have ± 4 percent precision at a 95 percent confidence interval after only 158 sample trips.

As with the bus system, various techniques for testing analysis of variance have been applied to the year-to-date rail sample results. As expected, no significant differences were detected in average trip length data collected on various weekdays. Significant differences in mean trip length were detected, however, when comparing means collected during different time-of-day intervals. This analysis further confirms that time of day is the most appropriate variable on which the strata for this sampling plan should be based. Year-end testing of these data is expected to reaffirm these findings and to serve as justification for slight modifications in the 1989 sampling scheme. In addition, special counts will be scheduled to continually verify time-of-day ridership proportions and to analyze new ridership trends by corridor, rail line, station, and time of day.

APPLYING THE METHODS

Trip Selection

Once the appropriate sample sizes have been determined, the practical aspects of implementing the plan come into play. Since both bus and rail sampling plans are trip-based, the sample selection process now moves to the schedules.

Bus

The bus sampling plan suggested in UMTA Circular 2710.4 (the current method used by CTA) calls for 208 bus trips sampled throughout the reporting year. But because bus schedules change periodically, sample trips cannot be selected too far in advance. Thus, it is a crucial aspect of the sampling process to have up-to-date and accurate schedules. In a large system such as CTA's, this seemingly simple requirement can become quite complex. Just finding a place to physically locate schedules for over 26,000 daily bus trips operating over 133

bus routes on weekdays is difficult, and it is even more difficult to make sure that the schedules you have are all up-to-date.

Currently, all random trip selections are primarily a manual process based on these schedules. The mere size of this 26,000 weekday trip data base (plus 20,000 Saturday trips and 18,000 Sunday and holiday trips) has caused problems in the quest for computerization. However, this process is moving forward, and currently a personal computer is used to select the random trip number, which is then manually looked up in the schedules. Continual dialogue with the CTA Schedules Department is necessary to be alerted of changes in schedules, dates, times, routes, and so on. Often timetable changes will force the cancellation of scheduled Section 15 sample trips, and replacements must be selected.

CTA presently selects bus sample trips just before new bus schedules go into effect for ease in work-load scheduling and to minimize the effects of schedule changes. On average, 2 full days of staff time are dedicated to bus trip selection each month. The 208 annual trips are divided into about 18 trips per month. Sample trips are scheduled each week of the month based on the randomization of the day of the week on which the sample is to be taken.

Rail

Selecting trips for the rail system is not quite as cumbersome as it is for the bus system because daily trips are just over 2,100 in number. Samples are selected from each time-of-day/day-of-week stratum based on the proportion of unlinked rail trips occurring in each time period. Those proportions are indicated in Table 3.

A random sample of rail trips based on these proportions is selected on a monthly basis. With a total annual sample size of 300 rail trips, about 6 trips are sampled weekly. The day of the week on which the sample is to be collected, as well as the car of the train in which the data collector should ride, are also randomized. The selected trips are manually located in the appropriate schedules and then assigned. Obviously, constant dialogue is also critical with the rail schedules department to maintain current copies of schedules and to be aware of any pending changes in service. The process of selecting rail sample trips each month takes about 6 hr of staff time; computerization may also speed this process in the not-too-distant future.

Collecting Data

The process considered thus far uses considerable management and staff time to prepare lists of randomly selected trips.

TABLE 3 CTA RAIL PLAN STRATIFICATION

Stratum	Time Interval	Proportion of Total Sample (%)
Weekday		
A.M. Peak	0600–1859	23
Midday	0900–1459	22
P.M. Peak	1500–1759	28
Other	1800–0559	14
Saturday	0001–2400	8
Sunday	0001–2400	5

Beginning in 1987 data collection has been done by a staff of field data collectors who are not limited by standard traffic-checking work rules and practices and are hired at up to \$25,000/year to collect these data. Work schedules are prepared weekly for this field staff from lists of randomly selected trips. This change in method eliminated problems experienced in 1986 and 1987 when a small staff was available for data collection only part time, limiting its effectiveness. The use of full-time data collectors observing more stringent field procedures has resulted in much better control over the data-collecting process. This has allowed CTA to meet its data-collecting objectives in a more regular manner.

Since the beginning of 1988, weekly work schedules have been written for a fluctuating staff of one to three data collectors. Work schedules made from lists of randomly selected bus and rail trips are augmented by work orders, assignment sheets, and data-collecting forms. Other field work and office assignments are completed, provided that they do not interfere with Section 15 data collection.

Integrated Scheduling of Bus and Rail Trips

Combining bus and rail trip assignments achieved substantial savings in the number of person-days required to collect data. Section 15 data collection for CTA's bus and rail systems was fully integrated in the first 6 months of 1988. This change not only helped to justify the use of full-time data collectors but was consistent with the needs of the 1988 sampling plan.

Integration of bus and rail trips significantly reduced the minimum number of person-days that would have been required to collect these data had separate staffs been used as in 1987 (see Table 4).

Integrating bus and rail scheduling is advantageous because trips that are randomly selected by day of the week often cluster in ways that make combining several trips into a single day's work schedule impossible. For example, the May 1988 rail list of 33 sampled trips required a minimum of 21 person-days to complete.

May's Tuesday trips help to explain why so many person-days are necessary. The eight rail trips listed for Tuesday required 7 person-days to complete because only one observation could be done on the same day as any other rail piece.

Weekly Work-Based Scheduling Difficulties

The process of writing weekly work schedules is a complex networking task. Factors in efficient scheduling are up-to-date

knowledge of the bus and rail systems; clear understanding of work rules, scheduling policies, and other limitations; awareness of missed trip rates; and other miscellaneous factors that may affect trips.

Some scheduling difficulties stem from the size and complexity of CTA's bus and rail systems, which operate 24 hr/day over more than 250 sq mi. In assembling work days from randomly selected work pieces, considerable travel time between segments frequently prevents the assignment of otherwise compatible work assignments.

To minimize time lost traveling to and from the general office in downtown Chicago's Merchandise Mart, data collectors collect and drop off work pieces only once a week. Sometimes a week or more will go by before a trip can be verified as being missed. This limits the number of trips available to be scheduled and lengthens the time required to write work schedules.

Because trips are missed regularly, limited overscheduling is done so that after voided and missed trips are eliminated the total number of valid trips completed is the number required. Also considered are the completion rates of the data collectors available to work in that week. These may alter the number of trips assigned.

Table 5 shows the rate at which data collectors were successful in locating and riding the assigned run or its follower. Riding a scheduled run's immediate follower to the same destination was counted as a successfully completed trip. A stricter rule allowing only the selected trip would reduce completion rates by at least 10 percent.

Scheduling Challenges

Two scheduling problems are imposed by the suggested UMTA guidelines. First, gathering data each week causes great inefficiencies in the collection of the requisite 208 bus trips. Second, the time needed to learn that a selected trip worked in the field is invalid is often considerable.

In the first half of 1988 approximately 13 percent of scheduled bus trips were missed. Some of these misses were a result of problems encountered by data collectors using CTA to travel from one assignment to another. Other trips were cancelled, turned back, or delayed to such an extent that a data collector would have to miss a substantial amount of other assigned work to wait for that trip.

This problem is typical of a large property, which may have as many as 35 buses operating on 30 or more miles of a route at any one time. If traffic is slowed or other problems occur,

TABLE 4 NUMBER OF DAYS ON WHICH PASSENGER-MILE DATA WERE COLLECTED, JANUARY-JUNE 1988

Month	Bus	Rail	Bus Days + Rail Days	Bus Days Combined With Rail Days	Days Saved (%)
January	20	19	39	33	15.4
February	24	22	46	22	52.2
March	6	13	19	15	21.1
April	13	16	29	19	34.5
May	20	24	44	26	40.9
June	12	20	32	27	15.6
Total	95	114	209	142	32.1

TABLE 5 DATA COLLECTION COMPLETION RATES, JANUARY–JUNE 1988

Collector	Assigned	Completed	Missed	Complete (%)
Bus Only				
A	72	66	6	91.7
B	34	26	8	76.5
C	13	10	3	76.9
D	19	18	1	94.7
Total	138	120	18	87.0
Rail Only				
A	118	109	9	92.3
B	48	40	8	83.3
C	1	1	0	100.0
D	19	17	2	89.4
Total	186	167	19	89.8
Bus and Rail Combined				
A	190	175	15	92.1
B	82	66	16	80.4
C	14	10	3	71.4
D	38	35	3	92.1
Total	324	287	37	88.6

a data collector waiting in the field often has no way to know whether or when the scheduled run will arrive.

A method using schedule-based trip selection as the basis for the data collection process, that is, a method in which time, route, and direction are the basis for trip selection rather than the requirement that a specific run be met, would greatly enhance the data collection process and make trips selected more truly representative. For example, a data collector is assigned to collect data on a bus trip, Run 362, scheduled to leave for the 95th/Dan Ryan rapid transit terminal at 0733. Instead of waiting for Run 362, which has been running 45 min behind schedule because of a freight train delay at the beginning of its run, the data collector boards whatever bus is going to that same destination nearest 0733. In this way, the data collector would be measuring the average trip length of the passengers traveling at the time the trip was scheduled instead of measuring passengers traveling considerably later.

The second challenge, delay, which occurs in determining whether trips are valid, can be considerable. If a data collector knows that he or she has a missed or voided trip, sometimes that trip can be reincorporated into the next week's work schedule. However, more often than not, the data collector either believes that the correct trip was worked or fails to notice a problem with the trip so that a minimum 1-week delay occurs before a trip can be rescheduled. This is particularly a problem when the trip missed is a late night trip. Despite careful review by office staff, problems can also appear when attempting to obtain farebox reports or when doing the distance calculations, as will be discussed later.

Data Analysis

Once each week CTA's data collectors turn in work completed the previous week. For each individual trip, staff must verify

the assignment, determine revenue, determine distance, and complete the passenger-miles calculation.

Verification of Assignment

Verification of assignment is the first step in the post-data-collection-and-analysis process and is done in conjunction with the payroll process. A careful check must be made that the correct trip was worked and that the data collected are auditable and self-consistent. Stringent application of procedures developed within the department to handle issues involved in the data collection and verification process are an important part of maintaining the integrity of this process and ensuring that the required levels of precision and confidence are maintained.

When a data collector turns in the week's assignment sheets with work orders and data sheets attached, each work piece is examined to see that all pieces of information needed have been provided (i.e., driver or conductor badge number, car number, and actual times of trip start and finish); that the information on the data sheets indicates that the trip worked was at the proper time, between scheduled termini, and in the right direction; and that all information on the data sheet is self-consistent, that is, the data collector's addition is correct, that the number of passengers boarding and alighting match, and, in the case of bus trips, that the street names recorded are legible and clear.

Determination of Revenue

As mentioned before, to calculate overall unlinked trips using the revenue-based method, a GFI farebox report is needed for each successfully completed bus trip. This report must be

ordered from the CTA's farebox computer. These farebox reports list the total revenue collected by fare category for each bus for an entire day. When a new driver boards the bus or a new run is initiated, a new line is generated by the farebox. At the start and end of each sample trip, the data collector asks the driver to enter the coded run number 999 into the bus farebox. This generates an individual line of data for that trip. Even when the driver fails to enter the complete 999 or replaces his driver badge number instead of his new run number, a new line is generated separating the information from this trip from all others completed by the vehicle that day. This information serves as a further check that the data collector actually boarded the vehicle.

Occasionally, there are problems with locating the proper farebox report for each vehicle among the daily reports generated for 2,247 buses operating out of 10 garages. Because farebox reports are organized by garage and dated by the day on which the fareboxes are probed at their home garage for the information recorded in them, several attempts are sometimes needed before the farebox report is found. Drivers, data collectors, and fareboxes all provide sources of error in this system. When a farebox report cannot be found, an otherwise complete and successful trip must be repeated.

Distance Calculation

Calculating distance for rail trips is easy and can be done simply by computer since the distance between rail stops is clearly known. However, the distance portion of the bus passenger-miles calculation is done manually using a scale and a good Rand McNally street map. This process is complicated by the fact that many of the routes served have several different variations.

When map work for the 1987 calculations began, it took a minimum of 2 hr per trip to complete each piece, that is, a maximum of four trips a day were being completed. By the end of the year, with the use of as much previous work as possible, the maximum number of trips that could be done in a day rose to eight.

More advantage could not be taken of route duplication because the pattern of stops used by passengers for a bus is different from one bus trip to another. Currently, a project is under way to simplify this process and accurately list the distance between all stops in all directions on all route variations on the system—a process so lengthy that it will probably be some time before useful data are available.

As with all other sections of the process, considerable supervisory time is spent making sure that all parts of the measurement process make sense, for example, that the total distance between stops matches the known route length. (Obtaining accurate route lengths was a time-consuming process in itself.)

Passenger-Miles Calculation

After map work is complete, passenger-miles traveled on each sample bus trip are determined. Rail calculations are easily performed using a Lotus 1-2-3 spreadsheet with accurate interstation distances stored. At CTA, each bus and rail sample

trip is then entered into separate SAS data bases for calculating the overall average trip lengths and precision levels at 95 percent confidence for both the bus and the rail systems.

CONCLUSION

As is evident by now, many factors affect the ability of a large transit agency to collect Section 15 data. All things considered, meeting UMTA reporting requirements is quite expensive for CTA and for other large agencies. Data collected through this process are no doubt valuable to transit planners, but are they worth the expense incurred? Individualized modifications in the UMTA guidelines can facilitate the ability of large systems to gather the required reporting statistics more efficiently without sacrificing validity, still using manual observation of boardings and alightings.

Stratified sampling, for example, can prove more representative of overall system ridership especially for large 24 hr/day transit agencies. The concept of CTA's stratified rail plan is also transferable to the bus system and can better represent overall bus system ridership. Selecting a proportionate random sample in each stratum will reduce the variances normally seen in simply random samples. The size of the annual samples can, therefore, be reduced and still meet the current confidence and precision requirements.

Sampling each week also creates difficulty and unnecessary expense in gathering CTA ridership data. Annual CTA ridership typically varies less than 5 percent from year to year, although seasonal changes are observed. These seasonal changes, such as the absence of students in the summer, would still be represented in the sample if the sampling was performed on a monthly or quarterly basis. Quarterly sampling would allow a sampling blitz to occur in which trips are randomly selected and the data gathered in a 2 to 3 week period four times per year. With this method it may no longer be necessary to maintain a full staff of data collectors throughout the year especially if checkers or other operations personnel could be used.

Monthly samples would allow more efficient scheduling of sample trips even with the current staff of data collectors because the mandatory weekly sampling rule is removed. Either method permits more concentration of sample trips so that weekly staff time spent selecting random trips, scheduling their completion, and auditing and tabulating the results is slashed. Agency staff can then be allocated more efficiently. Every season of the year and every day of the week would still be represented in the sample and confidence and precision levels would go unchanged.

The requirement to randomize the day of the week on which sample trip data are collected is also an unnecessary expense for CTA and possibly other 24 hr/day systems. Statistical analyses have proven that day of the week is not a significant variable in determining average passenger trip lengths for weekday rail or bus samples. Eliminating this requirement further eases the burden of scheduling efficient data collection work pieces, and, because of randomness inherent in the process of assigning work-pieces, each weekday would still be represented in the annual sample.

Changes in technology can also ease the difficulty of collecting sample trip data. CTA is planning to install automatic

passenger counters (APCs) on up to 25 percent of its bus fleet in the early 1990s. Not only will APCs facilitate transportation planning, but this technology can also be used for collecting Section 15 bus passenger-miles data. CTA has not yet sought UMTA approval for a method that relies on APC-equipped buses, but the potential for further efficiencies via this method looms on the horizon.

A better understanding of these and the other issues mentioned in this paper relative to the Section 15 data collection process at large agencies is important for transit officials. The requirement of collecting annual data is a necessary one, but more flexibility in UMTA regulations would be beneficial to all U.S. public transit systems—large and small. If individual agencies are allowed to adapt the basic UMTA requirements to fit the specialized needs of each system, valid data can still be gathered while permitting each transit authority to spend

more valuable staff time analyzing the results of the actual ridership data collected. The transit service supplied can then better meet the transit service demand of urban areas all across the nation.

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