METRO TRANSIT RIDERSHIP AUDIT

PROGRAM EVALUATION AND AUDIT

METROPOLITAN COUNCIL

February 2018

INTRODUCTION

Background

Each weekday, Metro Transit provides more than 250,000 rides across 131 routes. This includes urban local and suburban local bus routes, express buses, two light rail systems and a commuter rail. In 2016, Metro Transit provided 58.9 million bus rides and 23.7 million rail rides, resulting in a total of 82.6 million rides.

Customers are counted through a variety of ways:

- Paying through a Farebox on a bus that accepts dollar bills, coins, tokens, coupons, and transfers;
- Bus operators can press a designated key on the Farebox keypad for fares such as free rides, Mobile App rides, reduced fare rides, et al;
- Tagging a card validator on a bus or at a station using a stored value card, such as a Go-To card, MetroPass, U-Pass, College Pass, and Student Pass;
- INIT 3-dimensional Automatic Passenger Counters (APCs) on the Light Rail;
- Four-Light Beam Automatic Passenger Counters (APCs) on Bus Rapid Transit (BRT);
- Online ticket sales, Mobile App activizations, card validators and manual counts by Metro Transit police on the NorthStar.

The monthly rider counts are produced by the Revenue and Ridership Department, which is part of Metro Transit's Finance department.

Purpose

The purpose of this Metro Transit Ridership Estimate Audit was to evaluate the methods and controls used for counting passengers across the bus and rail systems.

Scope

This audit covered activities related to the counting and estimating of Metro Transit rides.

Methodology

To understand the ridership calculation process, the following methods were used:

- Review of Metro Transit ridership calculations and work instructions.
- Review of National Transit Database (NTD) and Federal Transit Administration (FTA) reporting requirements.
- Literature review of transit agency NTD and FTA reporting best practices.
- Review the accuracy of Metro Transit APC data on Light Rail and Bus.
- Review of Metro Transit GFI Regional Fare and Cubic Data.
- Interviews with Metro Transit Ridership Staff and Metro Transit Finance Management.

Assurances

This audit was conducted in accordance with the Institute of Internal Auditors' International Standards for the Professional Practice of Internal Auditing and the U.S. Government Accountability Office's Government Auditing Standards.

OBSERVATIONS

National Transit Database Reporting

Metro Transit currently uses data from the Farebox, GFI TRIM units, Cubic readers, online ticket activizations, Mobile App sales, and APCs for reporting ridership across the system. Metro Transit is responsible for reporting system ridership to the National Transit Database on a monthly and annual basis. The National Transit Database is a data repository for transit systems' financial, operating and asset data. Transit agencies that receive funding from the Federal Transit Administration are required to report their system data, which includes ridership.[1]

Audit reviewed National Transit Database and Federal Transit Administration reporting requirements and best practices to ensure Metro Transit's ridership estimate methodology is following the published guidelines for reporting ridership estimates. The National Transit Database Policy Manual states that "transit agencies may collect data during the year by using drivers' logs, scheduling software, automatic passenger counters, and fareboxes."[2] If APCs are installed on every fleet vehicle and a 100-percent count can be obtained, an agency may use APC data for reporting and only conduct a small number of manual counts to check for accuracy. In 2016, the Federal Transit Administration stated that "APC technologies have advanced to the point where they produce better data than sampling with manual counts,"[3] so fewer comparison counts are required of reporters using APC data. With the increased accuracy of APC technology, the NTD allows agencies to use APC data in any NTD-approved sampling plan, even if the entire fleet is not fully equipped with APCs.[4] Dr. Xuehao Chu of the University of South Florida published a guide to creating a customized sampling plan for NTD reporting and explains that an agency can utilize all of its valid APC-equipped vehicles to capture system-wide ridership data by establishing a vehicle rotation plan.[5] According to Metro Transit staff, about 92-percent of the bus fleet is currently equipped with APCs. The remaining eight-percent of the fleet will become equipped as the older busses are retired and replaced with new ones, a process that will not be completed until 2020 at the earliest.

If an agency cannot obtain a 100-percent rider count, they must report based on a sampling methodology that has been approved by a qualified statistician. The methodology must also meet the FTA's 95-percent confidence and 10-percent precision levels. NTD emphasizes that a sampling plan should be revised when major changes are made to an agency's service.[6]

In Audit's literature review of reporting best practices, Audit did not find current documentation of agencies combining APC data with other data sources to estimate ridership. While not all agencies today have APCs installed on all of their fleet vehicles, most of the current ridership estimate literature refers to using APCs as the primary data source. It is likely that other agencies without 100-percent

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[1] Federal Transit Administration – The National Transit Database website (www.transit.dot.gov/ntd).
[2] National Transit Database Policy Manual, p. 92.
[3] Notice of Request for Comments on Update to the Uniform System of Accounts and Changes to the National Transit Database Reporting Requirements, Feb. 3, 2016.
[4] Notice of Request.
[5] Chu, Xuehao and Ike Ubaka (2004), "A Guide to Customized Sampling Plans for National Transit Database Reporting." *Journal of Public Transportation*, Vol 7., No. 4., p. 23.
[6] National Transit Database Sampling Manual, p. 14.

APC coverage are supplementing their estimate with other data sources, however, the transit industry is moving towards most agencies using APC data for the sake of simplicity and accuracy.

Ridership Estimate

The Ridership Department collects data from the GFI Farebox and TRIM units on buses, Cubic readers on buses, at Light Rail and Bus Rapid Transit stations, and APC data from INIT APCs on Light Rail vehicles and four Light-Beam APCs on A-Line buses. This data is used each month by the Ridership Department to calculate the number of rides by service type (bus, light rail or commuter rail) and the number of rides by fare type. These calculations are compared with the previous year and are also used to project the total number of system riders for the year.

Audit reviewed the Ridership Department's process and work instructions for compiling source ridership data and calculating the number of riders. According to the Ridership Department, the methodology used to estimate bus ridership was approved about nine years ago. The data for estimating bus ridership comes from the GFI Farebox (cash, coupons, tokens, tickets, etc), GFI TRIM units (transfers), and Cubic readers (stored value cards) on-board busses. Although APCs are installed on-board much of the Metro Transit bus fleet, they are not used in calculating ridership for the majority of bus service; APCs on-board buses are only used by the Service Development for route planning and analysis and to calculate A-Line BRT rides. Once the data is totaled, Ridership department staff add 1,800 rides per day to account for additional rides that are not captured by the Farebox or Cubic reader. The Ridership Department indicated this number is arbitrary and Audit found it to be based on work instructions last updated in 2008. Additionally, the Farebox cannot record specific fare media once it has recorded 100 pieces of data; this results in many rides being recorded as 'unknown'. Ridership spreads these unknown rides across different fare products to adjust the rider breakdowns accordingly.

Light Rail data comes from INIT 3-dimensional APCs. Green Line vehicles are 100-percent covered by APCs, while only 30-percent of Blue Line vehicles are covered. The data collected from Blue Line vehicles equipped with APCs is used to extrapolate an estimate for the entire line.[7]

Since Light Rail vehicles carry a large volume of passengers to and from special events, such as Twins and Vikings games, Ridership makes special adjustments to Light Rail ridership estimates on these days. APC data is typically blocked out two hours before and after the event, as well as during the event. Ridership then uses the event's actual attendance to estimate the Light Rail ridership during this time.[8]

The A-Line BRT rider data is also gathered from four light-beam APCs. These figures are then adjusted by eight-percent to determine final ridership calculations. APCs are necessary on proof of payment service like A-Line because there are no fareboxes or Cubic readers on the busses. Ridership adjusts the APC-reported data by eight-percent to account for overcounting of actual rides counted by the APCs. This adjustment factor is established through manual counts conducted by the Ridership

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[7] Overnight airport shuttle trips are removed from the Blue Line's total number of daily trips taken, because the trains going between the airport terminals do not leave the tunnel and therefore do not have signal to record the number of rides.

[8] This estimate is based on manual counts of ridership during similar events, which are then used to calculate the proportion of the event's actual attendance that rode Light Rail.

Department and is continually monitored and adjusted. In 2016, Audit conducted a manual count of the A-Line APCs and found the APCs to be undercounting actual boardings by two-percent.[9] Overall the front door boardings were overcounted by about three-percent while back door boardings were undercounted by about 11-percent. The differences are likely a result of the wider backdoor, which is designed to facilitate multiple people entering the doors at the same time, or drivers getting on and off the bus. The APCs do not always recognize multiple passengers boarding or alighting at the same time and the APCs count drivers getting on and off the bus, as well as people getting on and off at layovers but not actually riding for a trip.

The NorthStar Commuter Rail rides are calculated from the card readers on the platforms, online NorthStar ticket sales, mobile app activizations, and Metro Transit police estimates of free rides. NorthStar vehicles are not equipped with APCs. Online tickets are adjusted by Ridership based on the specific fare product to account for how many total riders were likely on a ticket. For example, 3.6 riders are added for each Family Ticket purchased, because the family only needs to download a single pass for the whole family. Additionally, 57 riders are added per day to account for veterans riding the NorthStar for free. This adjustment factor is based on manual counts conducted by the Metro Transit Police Department and likely comes from veterans taking the NorthStar to and from the VA hospital located near the NorthStar's Ramsey station.

APC and Farebox Reconciliation

The Ridership and Service Development Departments use two separate data sources to calculate ridership based on their different needs. The Ridership Department is primarily interested in reporting total rides, while Service Development is interested in analyzing rides by stop to be used for route analysis and planning. Ridership Department staff calculates bus ridership using GFI Fareboxes, TRIM units and Cubic readers on buses. Farebox and TRIM data is collected when cash boxes are emptied in garages. Cubic data is automatically registered in the Go-To database when a bus enters the garage and connects to the wireless system. This data is processed daily and used to calculate total ridership on the bus system. Rides are also broken down by fare media type to report how riders are paying their fare. Service Development uses passenger counts from the APCs to obtain ridership numbers for bus routes. This data is used for route analysis and route planning and is processed for accuracy.

Audit reviewed and compared the two data sources to analyze how closely the two estimates are to one another. A representative sample of the system's buses (N=274) was selected from July 2017 and the buses selected were matched to routes. APC, Farebox and Cubic data were compared from a particular route's operating day (Farebox probe to Farebox probe). For the purpose of this analysis, Audit used archived APC data, which has already been processed for accuracy. This means that any trips Service Development identified as inaccurate had been removed from the population. Audit calculated and identified differences between the ride counts from APC data and Farebox data.

The total number of bus trips included in the analysis was 5,259; of these trips, 1,877 (36-percent) did not have APC data available in the archives which could have been because it had been removed in processing. Removing bus trips without APC data, Audit found that about 65-percent of APC and

[9] Audits analysis looked at boardings by all persons that boarded the bus through one of the two doors. This analysis includes riders, drivers, audit staff counting riders, and any other person that boarded the bus during layovers.

Farebox trips are within 10 riders of one another. While this is a large portion of trips in close agreement to one another, it leaves between 30- and 40-percent of trips not in agreement. These results indicate that—at this time—APCs cannot be used as substitutes for most bus ridership calculations, nor can the Farebox be used as a substitute in the APC ridership calculations. To determine whether APCs could be a suitable substitute for current methodologies used in NTD reporting, a more in-depth analysis using direct observation of actual ridership would be needed.

CONCLUSIONS

Metro Transit's use of both APC and Farebox data for NTD reporting meets industry standards. While the Ridership Department's work instructions were found to be outdated, their current processes capture the majority of the system's riders through APCs on Light Rails and BRTs; and Farebox, TRIM units and Cubic readers on buses. As Metro Transit expands proof of payment service throughout the system, APCs will become increasingly relied upon to estimate ridership for all purposes, including NTD reporting. Currently, several projects including Orange Line, Gold Line, C Line and D Line are all planned as proof of payment Bus Rapid Transit services. A fresh look at current methodologies and further analysis as to the accuracy of APCs will help position the agency to ensure ridership calculations remain accurate and consistent across the system.

RECOMMENDATIONS

Program Evaluation and Audit recommendations are categorized according to the level of risk they pose for the Council. The categories are:

1. **Essential** – Steps must be taken to avoid the emergence of critical risks to the Council or to add great value to the Council and its programs. Essential recommendations are tracked through the Audit Database and status is reported twice annually to the Council's Audit Committee.
2. **Significant** – Adds value to programs or initiatives of the Council, but is not necessary to avoid major control risks or other critical risk exposures. Significant recommendations are also tracked with status reports to the Council's Audit Committee.
3. **Considerations** – Recommendation would be beneficial, but may be subject to being set aside in favor of higher priority activities for the Council, or may require collaboration with another program area or division. Considerations are not tracked or reported. Their implementation is solely at the hands of management.
4. **Verbal recommendation** – An issue was found that bears mentioning, but is not sufficient to constitute a control risk or other repercussions to warrant inclusion in the written report. Verbal recommendations are documented in the file, but are not tracked or reported regularly.

1. **(Significant) Metro Transit Ridership should update work instructions and assumptions used to calculate the system's ridership estimate.**

   Work instructions do not reflect all of the calculations being done and include outdated pieces of data inputs. Assumptions are also being used that are based on ridership behavior from several years ago, which does not reflect the current system. Both of these changes are important in making sure the ridership estimate reflect Metro Transit's current system.

   Management Response: *Staff will review and update work instructions to reflect current data calculation practices. Staff will also review data assumptions and their factored adjustments to ensure they are reasonable and represent current ridership behavior and patterns.*

   Staff Responsible*: Richard Moore (Supervisor, Revenue and Ridership Analysis) and Michael Watters (Analyst, Revenue and Ridership Analysis)*

   Timetable*: March 1, 2018.*

   Thrive 2040 Principles*: Accountability*

2. **(Significant) Metro Transit should evaluate options for and commence further analysis of the accuracy of Farebox and Automatic Passenger Counter rider estimates on buses.**

   Both systems are used in estimating the number of passengers on Metro Transit buses and both systems have unestablished error rates. Further examination and development of system error rates would refine current estimates for reporting and service development purposes.

Management Response: *Staff are exploring options on various methods to analyze and compare APC and Farebox data to determine data comparability, differences and error rates. One option being considered is hiring an outside consultant to help with the Farebox data and analysis comparisons. Once this analysis is completed, any recommended changes will be discussed with Internal Audit before being implemented.*

Staff Responsible*: John Levin (Director, Strategic Initiatives)*

Timetable*: December 31, 2018.*

Thrive 2040 Principles*: Collaboration and Accountability*

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