Uncovering San Francisco Muni's Proof-of-Payment Patterns to Help Reduce Fare Evasion

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ABSTRACT

When transit customers pay fares, they contribute their "fair" share to help fund service. In San Francisco, anecdotal observations had reinforced perceptions that a high percentage of Muni riders were not paying, possibly costing the San Francisco Municipal Transportation Agency (SFMTA) tens of millions of dollars annually in lost revenue. In 2009, the SFMTA, which operates Muni, conducted a Proof-of-Payment Study to answer longstanding questions about fare payment patterns and identify strategies to improve fare enforcement. The resulting survey of 41,239 customers on 1,141 vehicle runs provided enough samples by time period, route and vehicle occupancy to identify fare payment patterns at a disaggregated level. The study found a 9.5-percent minimum systemwide fare evasion rate that varied by route, location, time period, level of enforcement and door of entry, amounting to an estimated $19 million annually in uncaptured revenue based on 2009 fares. Although surveyors observed that there was no "typical" violator, the data showed that fare evasion was more prevalent on certain routes and during the afternoon and evening hours. Besides providing base data to measure future progress, the study enabled the SFMTA to educate its customers about proof-of-payment requirements and deploy its fare enforcement personnel more efficiently and cost-effectively in an effort to improve fare compliance.

INTRODUCTION

Collecting fare revenue is essential to a transit organization's ability to provide service, especially in a tough fiscal environment with limited resources. This is particularly evident in San Francisco, a dense 47 square-mile city with approximately 815,000 residents where the heavily-ridden Muni system provides around 700,000 trips on an average weekday. Operated by the San Francisco Municipal Transportation Agency (SFMTA), Muni maintains a diverse transit fleet of light rail vehicles, historic streetcars, buses (electric trolley coaches and motor coaches) and cable cars. A well-functioning Muni network is integral to achieving the goals of the city's adopted "Transit First" Policy.

As vital as Muni is to San Francisco's mobility, environment and quality of life, a longstanding perception exists that many people do not pay their fare. This perception has reduced public confidence in the SFMTA and made it harder to identify new funding and implement service initiatives. While the vast majority pays the appropriate fare, those who do not pay frustrate other customers and reduce the financial resources available to operate comprehensive and reliable transit.

Like other agencies that have implemented proof-of-payment, the SFMTA wanted to better understand how customers pay to address policy questions relating to fare enforcement, revenues and operations. In 2009, the SFMTA conducted a Proof-of-Payment Study to investigate fare payment patterns, assess their financial and operational impacts, and identify strategies to improve the efficiency and cost-effectiveness of fare enforcement. In an objective and comprehensive analysis, SFMTA employees spent three months surveying customers on nearly every bus and rail route during all times of the day and on different days of the week. The team did not survey cable cars, a unique transportation mode that is the subject of other SFMTA management efforts. Study goals included:

- To determine the magnitude of fare evasion through a statistically-significant survey;
- To quantify fare evasion's financial impact; and
- To assist in deploying Transit Fare Inspectors effectively

Survey teams observed 41,239 customers on 1,141 vehicle runs, a sample size that provided a snapshot of fare payment patterns at a disaggregated level. The SFMTA found a minimum 9.5-percent systemwide fare evasion rate, defined as the percentage of customers unable to display valid proof-of-payment, which may include a small number of customers who paid cash but were unaware they needed to obtain a transfer/fare receipt as proof-of-payment. The SFMTA estimated that fare evasion, which varied by route, location, time period, level of enforcement and door of entry, lowered revenues by $19 million annually.

STUDY BACKGROUND AND PURPOSE

This research may prove valuable to transit providers that employ or are considering a proof-of-payment system. While proof-of-payment may necessitate additional enforcement and revenue collection personnel, it may also reduce dwell times, potentially resulting in higher ridership and/or fewer vehicles to maintain service levels. A proof-of-payment system may also increase the actual or perceived fare evasion, although alternative fare collection systems with operator fare verification and gated station entrances do not necessarily guarantee full fare compliance. Transit agencies may need to weigh the financial impacts of fare evasion relative to the costs and potential ancillary benefits of a proof-of-payment system.

In the United States and Canada, random fare inspection typically occurs on "open" light rail or commuter rail lines where customers purchase fare media at vending machines and access barrier-free platforms. In contrast, "closed" rail systems with faregates require tickets or smart cards to enter and/or exit stations and usually do not require fare inspectors to enforce fare payment. Bus proof-of-payment systems are still rare; operators typically check fares as customers enter through the front door. However,

proof-of-payment is becoming more common on bus rapid transit (BRT) lines in places such as Cleveland, Eugene, Las Vegas, Los Angeles, New York, Ottawa, suburban Toronto and Vancouver. These systems usually feature wayside ticket vending machines where customers pre-purchase fares and then enter the bus through any door.

The SFMTA is unusual among United States transit properties because its proof-of-payment program is effective not just on light rail and streetcars, but on all buses as well. On Muni, Transit Fare Inspectors may issue a $75 citation to customers without a valid transfer/fare receipt, pass, Clipper® smart card or single-ride limited-use ticket (electronically verified by inspector handheld units), or other form of proof-of-payment. Payment policies vary by location and vehicle mode:

- At underground Muni Metro light rail stations, customers pass through faregates before accessing boarding platforms. SFMTA's old faregates unlocked when customers deposited the coin fare or inserted their passes through a magnetic stripe reader. Since the survey, the SFMTA has replaced these faregates. Customers now load value or pass products onto a Clipper® Card or purchase a limited-use ticket at a ticket vending machine. They then tag the card or ticket on a faregate reader or display a paper transfer/fare receipt to a station agent who will then release the faregate.
- At light rail surface stops, cash-paying customers must enter through the front door of the first car, deposit their money into the farebox in the operator's cab, and obtain a paper transfer/fare receipt from the operator as proof-of-payment. Customers with valid pre-paid fare media may enter through any door of any car. Clipper® Card and limited-use ticket users must tag a reader adjacent to each set of doors upon entry.
- On buses and historic streetcars, everyone must enter through the front door unless an authorized SFMTA employee is present to verify proof-of-payment and permit back-door entry. Cash customers deposit their money into the farebox and obtain a transfer/fare receipt from the operator. Other customers display their pass or transfer/fare receipt to the operator or tag their Clipper® Card or limited-use ticket on a reader. Cash customers cannot buy a single-ride ticket off-board since it would be cost-prohibitive to install and maintain ticket vending machines at every stop.

Besides uncovering overall proof-of-payment patterns, SFMTA's study also focused on understanding the impacts of Muni's back-door boarding culture. Back-door boarding on buses occurs frequently, not just when it is permitted officially during the rare times that an authorized SFMTA employee is present to check fares (Figure 1). Despite signage prohibiting back-door entry, some Muni practices may have encouraged it. Operators often open back doors to accelerate loading and maintain schedules. Clipper® smart card readers are also located at the back door. Many customers have grown accustomed to entering through the back door without showing fare media or encountering Transit Fare Inspectors.

Notwithstanding revenue impacts, officially permitting back-door boarding systemwide could expedite the fare collection process and enhance Muni's operating performance. Without de facto back-door boarding at certain stops, some routes would experience significant delays. On average, nearly 70 customers board a Muni bus (electric trolley coaches and motor coaches) per hour. This boarding rate places Muni alongside New York City Transit with the most unlinked passenger trips per vehicle revenue hour in the United States (*1*).

FIGURE 1 Back-Door Boarding.

LITERATURE REVIEW

In designing the survey, the SFMTA researched previous efforts to measure systemwide fare evasion, both in San Francisco and elsewhere. For a more thorough understanding of proof-of-payment, the SFMTA concluded that its effort would require substantially more data than previous surveys.

The SFMTA launched its Proof-of-Payment program on segments of the Muni light rail system between 1993 and 1998. Initially, the San Francisco Police Department (SFPD) enforced fares. Between March 1998 and December 1999, SFPD observations along one line (N Judah) and at two surface stations along another line (M Ocean View) found that less than 1 percent of customers lacked proof-of-payment. After transitioning enforcement from the SFPD to its own Transit Fare Inspectors, the SFMTA estimated a fare evasion rate of 1.5 percent to 2.0 percent (*2*). Those figures appeared to be significantly less than anecdotal observations.

In 2006, a consultant study estimated a systemwide 10.5-percent evasion rate (*3*). Although this finding was close to that of the 2009 study, it was hampered by a small sample size and non-representative sampling. For example, most samples came from routes comprising just one-quarter of Muni's ridership and no observations took place on weekends.

The SFMTA also examined fare evasion assessments elsewhere. In Portland, Oregon, for example, Tri-Met analyzed fare evasion in the Rose Quarter district in conjunction with extending a fare-free zone (*4*). In addition, the Transportation Research Board published *A Toolkit for Self-Service, Barrier-Free Fare Collection* in 2002 as part of the Transit Cooperative Research Program. In this report, several large transit systems in the United States, Canada, and Europe had self-reported fare evasion rates ranging mostly from 1 to 6 percent (*5*). While this literature assisted the SFMTA with its survey design, staff concluded there were limitations in its applicability. First, proof-of-payment in the studied cities almost exclusively applied to rail lines with off-board fare collection, not buses with on-board farebox equipment. Second, the surveyed transit systems did not use consistent methodologies in their calculations, making it difficult to compare San Francisco and other cities directly.

SURVEY METHODOLOGY

Any market research initiative faces the challenge of understanding customer behavior from a limited sample aiming to represent a target population. Regardless of methodology, surveying fare evasion patterns presents additional challenges. Determining customer behavior on a moving, possibly crowded bus or train inherently limits achieving 100-percent accuracy despite the best efforts of fare inspectors or surveyors, especially when the focus subjects may purposely avoid or deceive the survey team. Nonetheless, the results suggest some bounds on the magnitude of fare evasion.

Adopting a "blank slate" survey approach, the SFMTA made no prior assumptions about how, where and when fare evasion occurred. Survey teams travelled throughout San Francisco during all times of the day to uncover fare payment patterns. Standard procedure is to check all customers on a vehicle or passing through a checkpoint within a station's fare-paid zone. Therefore, surveyors did not collect demographic data since it would not add value to the Proof-of-Payment program or alter enforcement procedures.

The survey plan achieved a reasonably representative ridership sample by route and time period, subject to logistical and financial constraints. It included observations on all rail lines and bus routes, except for special limited-service buses and those routes the SFMTA was going to discontinue under a planned route restructuring. While the survey plan could not precisely mirror ridership to the stop level by time period due to resource limitations, it employed several strategies to gather representative samples:

- Major crosstown and radial routes were surveyed at least ten times and at least once during each weekday time period, with most routes being surveyed at least twenty times.
- Lower-ridership community routes were surveyed at least once during each weekday time period, with the exception of the evening hours due to resource constraints.
- On most routes, surveys took place at multiple locations (primarily high-ridership transfer points) to reflect customer turnover. On express buses and other routes with low customer turnover, surveyors boarded near peak-load points to maximize observations.
- Surveys took place on 45 days throughout the study period, including weekends. To reflect varying ridership patterns, most major routes were surveyed on at least 10 different days.

Each survey team consisted of two uniformed Transit Fare Inspectors and two recorders. Teams employed two methodologies to determine fare payment:

- Spot Check – Survey teams waited inconspicuously at a stop until all customers had boarded and alighted. After boarding, one recorder and one Transit Fare Inspector began checking all customers in front while their partners began checking the rear before meeting in the middle. Transit Fare Inspectors asked customers to provide their proof-of-payment and announced their findings to recorders who marked down the information. Usually, at least one team member spoke Spanish or Chinese to assist customers in those languages.
- Ride Along – "Spot checks" had two limitations: (a) survey teams could not determine whether customers displaying a valid transfer/fare receipt had paid the appropriate fare, and (b) they could not distinguish which customers had entered through the back door. To better understand these issues, for approximately one-third of observations, survey teams would complete a "spot check" and then continue to "ride along" for multiple stops.

  During a "ride along", Transit Fare Inspectors remained inconspicuous by sitting or hiding in the accordion section on articulated vehicles. Although vehicle operators were aware of the team's presence during a "ride along", they were instructed not to modify normal interactions with customers. To avoid confrontations, operators would sometimes issue a transfer/fare receipt even if the customer did not pay the full fare. If survey team members did not hear the farebox

beep, they would record a fare underpayment. The team could also determine whether customers who entered through the back door had valid fare media. The team watched closely for customer intent. For example, if someone walked past the operator and sat down, and then saw a Transit Fare Inspector and went to pay, surveyors would record that the customer had paid nothing.

In terms of overall results, the two methodologies differed in that "ride alongs" enabled survey teams to detect underpayments that would have been classified as valid with "spot checks". Teams witnessed relatively few underpayments (88), sufficient to know they occur regularly but not enough to determine an underpayment rate with statistical confidence or to alter the overall fare evasion rate substantially when integrating the results of the two methodologies. Underpayments remain an unknown variable and consequently the SFMTA has presented the overall fare evasion rate as a minimum.

The "ride alongs" also provided an adequate sample size (857 observations) to estimate a back-door fare evasion rate. This did not alter the overall results; either methodology would have detected whether these back-door boarders had valid proof-of-payment but only the "ride alongs" allowed teams to identify them as back-door boarders per se.

SFMTA staff determined that 200 to 1,000 customer observations would be needed to estimate a systemwide fare evasion rate within a ±3 percent margin of error (subject to the inherent limitations of the survey methodology) at a 95-percent confidence level, assuming the actual rate ranged between 5 and 35 percent. However, this sample size would not provide enough detail to understand spatial and temporal fare payment patterns and inform an enforcement deployment plan. Thus, staff gathered a much larger representative sample to permit data disaggregation with a high degree of statistical confidence. Survey teams ultimately sampled 41,239 customers, with sufficient observations to identify trends by route, time period and vehicle occupancy. Table 1 details the margin of error in each category at a 95 percent confidence level.

TABLE 1 Statistical Margin of Error for Samples Collected

Fare Analysis Category	Quantity of Samples Collected	Margin of Error (at a 95% confidence level)*
Systemwide	38,672 ("base" survey prior to fare increase) 41,239 (includes supplementary "after" survey following fare increase)	±0.3%
Route	Typically 200 to 1,500+ per local route	Majority of Routes ±2.5% All but 5 routes ±5%
Time Period	At least 2,500 per time period (AM Peak, Midday, School, PM Peak, Evening and Weekend)	±1.3% or better
Back-Door Boarding	857 successful or attempted back-door boardings	±3.3%
Vehicle Occupancy	4,650 to 16,000 by occupancy level (ridership less than 50% of seats, 50-100% of seats, 100-125% of seats, and more than 125% of seats)	±0.9% or better

* The margin of error is subject to the limitations of collecting fare evasion data and detecting fare underpayments as discussed in the Survey Methodology section.

SURVEY FINDINGS

Overall, a minimum of 9.5 percent of surveyed riders lacked valid proof-of-payment, but the number is probably higher due to fare underpayments. This estimate reflects appropriate weighing of raw data by time period and route, with adjustments so that the samples reflect the proportional ridership distribution by time period and route. The SFMTA estimates ridership by rotating vehicles equipped with Automatic

Passenger Counters on different routes and employing a sampling methodology approved by the Federal Transit Administration for National Transit Database reporting.

Customers employed multiple methods to avoid fare payment (Figure 2). Of the roughly one out of ten customers without valid proof-of-payment:

- 50 percent displayed no fare media or presumably had none because they "walked away" (left the vehicle or did not board after seeing the survey team)
- 26 percent had expired or otherwise invalid transfer/fare receipts
- 7 percent were age-ineligible adults with a discount Youth or Senior Pass
- 2 percent were people with disabilities who used their Regional Transit Connection card improperly, usually by not purchasing a monthly sticker
- 1 percent used counterfeit passes
- 14 percent had invalid proof-of-payment for other reasons

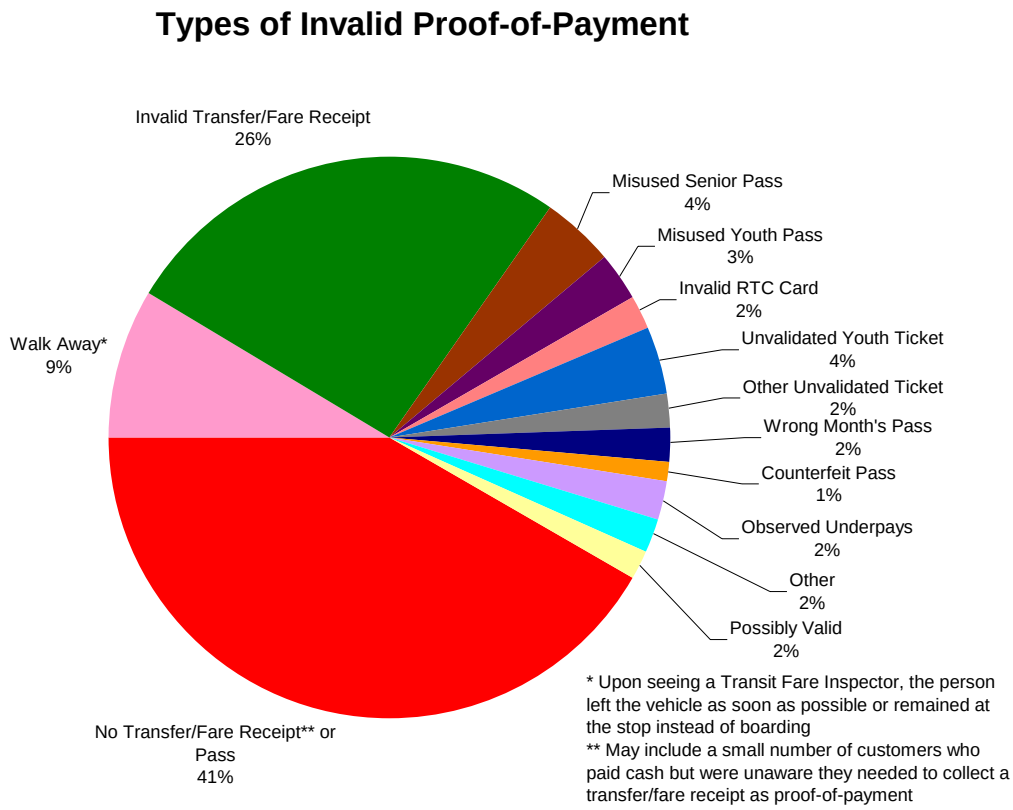

FIGURE 2 Types of Fare Evasion.

Factors Influencing Fare Evasion

Surveyors observed that there was no "typical" fare evader. Fare issues could arise anywhere anytime. Nevertheless, fare evasion varied greatly by route and location, time period, level of enforcement and door of entry (Table 2).

1
2
3 **TABLE 2 Disaggregated Survey Results**

Fare Analysis Category		Customer Observations	Vehicle Runs Observed	Fare Evasion Rate (a)	Margin of Error (b)
Systemwide (c)	All Routes and Times (prior to fare increase)	38,672(c)	1,089	9.5% (d)	±0.3%
Route (Top 10 Bus Corridors and All Rail Lines) (c)	1 California (TC)	893	29	4.5%	±1.3%
	5 Fulton (TC)	740	23	9.7%	±2.1%
	6 Parnassus/71 Haight-Noriega (TC/MC)	1,760	60	9.0%	±1.3%
	8X Bayshore Express (formerly 9X) (MC)	1,882	37	14.0%	±1.5%
	14 Mission/14L Mission Limited (TC/MC)	1,760	44	19.9%	±1.8%
	22 Fillmore (TC)	1,074	31	9.7%	±1.7%
	29 Sunset (MC)	750	25	9.2%	±2.0%
	30 Stockton (TC)	1,316	32	8.4%	±1.5%
	38 Geary/38L Geary Limited (MC)	2,739	61	9.5%	±1.1%
	49 Van Ness-Mission (TC)	1,258	33	12.2%	±1.8%
	F Market & Wharves (HS)	1,546	35	12.0%	±1.6%
	J Church (LR)	734	17	5.6%	±1.6%
	K Ingleside (LR)	870	26	3.8%	±1.2%
	L Taraval (LR)	1,023	34	2.4%	±0.9%
	M Ocean View (LR)	1,216	29	3.8%	±1.0%
	N Judah (LR)	1,469	34	2.5%	±0.8%
	T Third (LR)	666	18	15.2%	±2.7%
Time Period (c)	Weekday Morning Peak (7 am.-9 am)	9,056	250	6.2%	±0.5%
	Weekday Midday (9 am-2 pm)	7,655	230	9.5%	±0.7%
	Weekday School (2 pm-4 pm)	7,170	206	9.8%	±0.7%
	Weekday Afternoon Peak (4 pm-7 pm)	9,249	252	10.5%	±0.6%
	Weekday Evening (7 pm-10 pm)	2,923	85	14.5%	±1.3%
	Weekend (All Day)	2,619	66	12.3%	±1.3%
Level of Enforcement (c)	Heavy (Muni Metro light rail)	6,024	158	4.7%	±0.5%
	Light (buses and historic streetcars)	32,648	931	10.5%	±0.3%
Back-Door Boarding	Observed Attempted and Successful Back-Door Boarding Entries	857	207	55.3%	±3.3%
Vehicle Occupancy (c)	Ridership less than 50% of seats	5,008	317	9.2%	±0.8%
	Ridership 50-100% of seats	15,939	477	9.3%	±0.5%
	Ridership 100-125% of seats	13,064	235	9.5%	±0.5%
	Ridership more than 125% of seats	4,661	59	10.5%	±0.9%
Fare Increase	Before (selected routes and times of day)	7,557	173	12.1%	±0.7%
	After (same routes and times of day)	2,567	52	12.6%	±1.3%

(HS) = Historic Streetcar, (LR) = Light Rail, (MC) = Motor Coach, (TC) = Electric Trolley Coach

(a) "Fare evasion rate" represents customers without valid proof-of-payment. It does not necessarily account for all cases of fare evasion (for example, undetected underpaying customers who still received a valid transfer/fare receipt). It may also include a small number of customers who paid their fare but were unaware they needed to obtain a transfer/fare receipt as proof-of-payment.

(b) Margin of error at a 95% confidence level.

(c) Consists of "base" survey data taken before the July 1, 2009 fare increase (38,672 customer observations) and excludes supplementary "after" data (2,567 customer observations).

(d) The 9.5% systemwide fare evasion rate is a minimum estimate that reflects weighing by time period and route.

- Route and Location – Fare evasion occurs everywhere, but is concentrated in Downtown San Francisco and the city's eastern half. Figure 3 illustrates Muni routes shaded by their estimated fare evasion rate, with line thickness reflecting average weekday ridership. Figure 4 shows the observed rate associated with survey boarding locations. The circle shading indicates the evasion rate while the circle size indicates the number of customers surveyed without proof-of-payment.

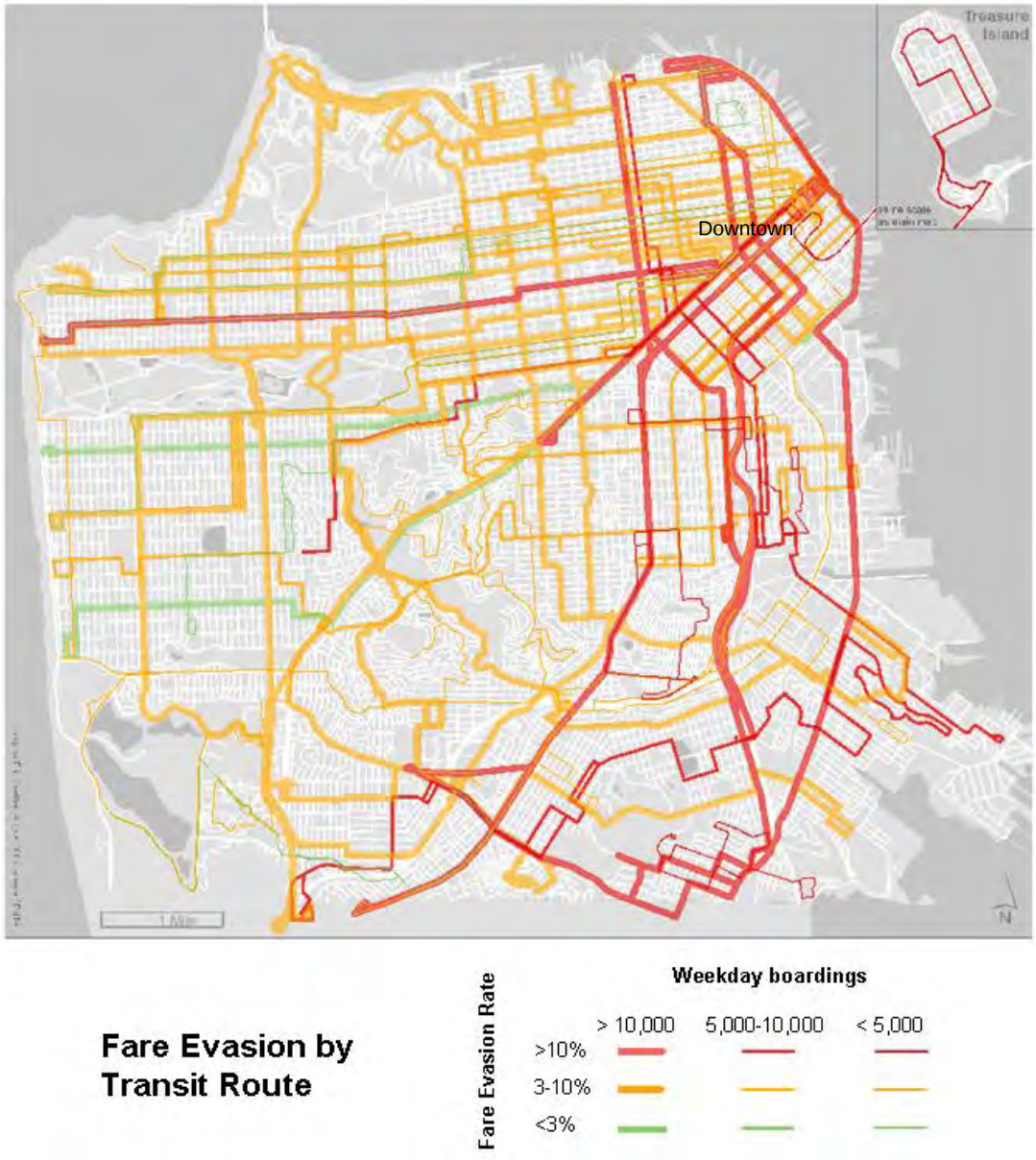

FIGURE 3 Map of Fare Evasion Rates by Route.

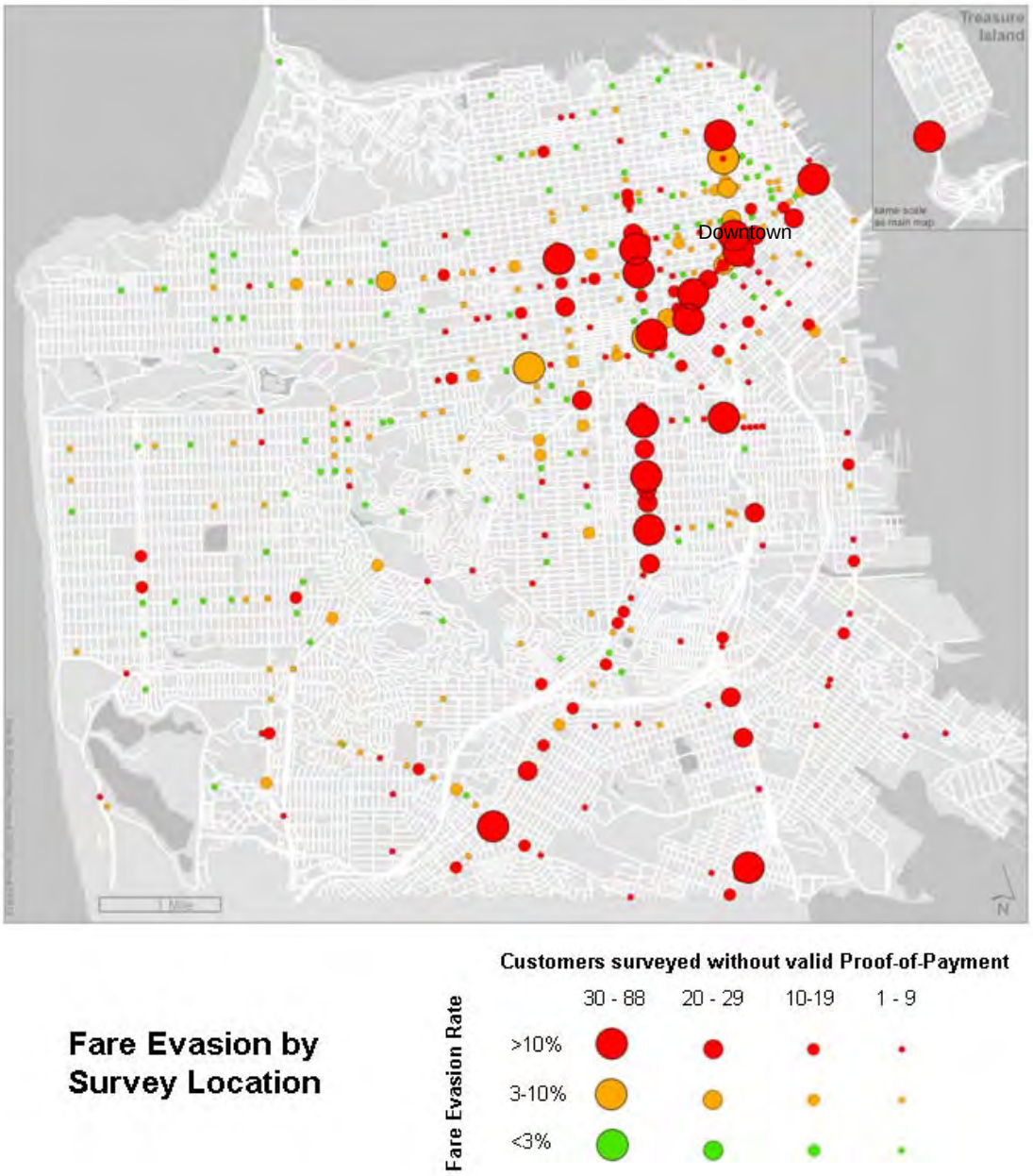

FIGURE 4 Map of Fare Evasion Observations by Survey Location.

- Time Period – Fare evasion increased as the day progressed, from 6 percent in the morning to 14 percent in the evening. Survey teams observed that morning peak ridership tends to be commuter-oriented with higher monthly pass usage. Later, a greater percentage of customers either paid nothing or presented expired transfers/fare receipts.
- Level of Enforcement – On Muni buses and historic streetcars, where Transit Fare Inspectors rarely appeared, the evasion rate was approximately 10.5 percent. Bus and streetcar operators checked fares but may have hesitated to confront fare evaders out of concern for their own safety and security. In contrast, the evasion rate averaged less than 5 percent on the light rail system where Transit Fare Inspectors have enforced proof-of-payment for over a decade. Faregates at

subway stations possibly may have deterred fare evasion on the light rail system, but the old emergency exit swing gates in use during the survey were unlocked and may have also enabled people to pass through unstaffed entrances without encountering SFMTA employees.

- Back-Door Boarding – Of the 857 people that survey teams observed either successfully boarding or attempting to board the back door of buses, the fare evasion rate was 55 percent – over five times higher than the systemwide average. Although back-door boarding appears to facilitate fare evasion, an immediate shift to exclusive front-door boarding could slow travel times, particularly on some of Muni's busiest routes that average over 100 boardings per vehicle hour.

Other factors did not appear to impact fare payment patterns significantly.

- Vehicle Occupancy – The fare evasion rate on heavily-crowded vehicles was only about one percentage point higher than on less-crowded vehicles. Nevertheless, on average the absolute number of customers without proof-of-payment was higher on heavily-crowded vehicles simply because they had heavier ridership, possibly creating the perception that the fare evasion rate was correlated with vehicle crowding.
- Fare Increase – During the survey, the SFMTA raised cash fares from $1.50 to $2.00 for adults and from $0.50 to $0.75 for seniors, people with disabilities and youths, and increased corresponding monthly pass prices. Fare evasion rates for comparable routes and times before and after the fare increase were within 0.5 percentage points of each other (12.1 percent with a margin of error of ±0.7 percent before versus 12.6 percent after). Given that the number of customer observations after the fare increase was approximately one-third of those before (and therefore statistically less precise), it appears that the fare increase probably had little to no impact on fare payment patterns.

Uncaptured Revenue Estimates

Based on the survey, the SFMTA estimated that it could increase fare revenue by $19.2 million annually in the unlikely scenario of 100-percent fare compliance, or about $2 million for each percentage point reduction in the fare evasion rate. About $15 million of the uncaptured revenue stemmed from customers lacking any fare media or having expired or otherwise invalid transfers/fare receipts. Fare underpayment was estimated to cost at least $2 million while the misuse of Youth and Senior Passes by age-ineligible adults lowered revenues by $1.3 million. Other fare violations, such as counterfeit passes, passes from the wrong month, or misused visitor passes, accounted for less than $1 million in uncaptured revenues.

FARE ENFORCEMENT CHANGES

Prior to the study, fare enforcement's focus on light rail – comprising one-quarter of system ridership – meant that most Muni customers rarely encountered fare inspectors. Expanding enforcement to buses and historic streetcars and maintaining the inspection rate would have required roughly 300 percent more inspectors. Although the SFMTA had planned a 30 percent increase (from 46 to 60 full-time inspectors) for Fiscal Year 2009-2010, funding shortfalls precluded even this level of additional staffing.

The study enabled the SFMTA to develop inspector deployment schedules that balanced two goals within the limited resources available:

- Ensuring that all customers expect that a fare inspection might occur anywhere anytime
- Increasing fare compliance on routes and at times with substantial fare evasion issues

The study revealed that fare inspection schedules did not correspond with when fare evasion was most likely to occur (Figure 5). Generally, the estimated number of fare evaders on weekdays peaked

from 1 pm to 7 pm, with significant occurrences in the evening. In contrast, staffing was oriented towards the morning, particularly on Mondays and Fridays when half the inspectors had a regular day off. During evening Giants baseball games requiring up to six inspectors, there might be just two others covering the remainder of the system.

Using the study results, the SFMTA moved shifts one to three hours later to reallocate more resources towards the afternoon and evening. For example:

- The Monday-Friday day shift was moved to end at 3:30 pm instead of 2:00 pm
- The Tuesday-Saturday day shift was moved to end at 5:00 pm instead of 2:00 pm
- The Sunday-Thursday mid-shift was moved to end at 7:30 pm instead of 6:30 pm
- The Tuesday-Saturday mid-shift was moved to end at 8:30 pm instead of 6:30 pm

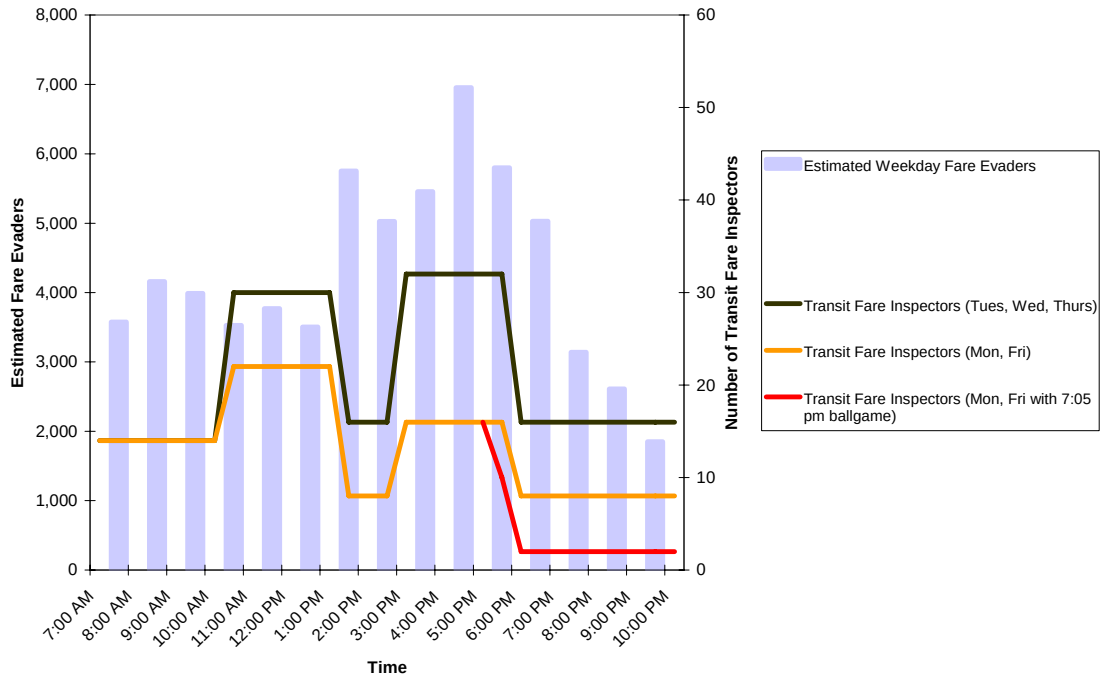

FIGURE 5 Weekday Fare Inspector Staffing During the Survey vs. Estimated Fare Evaders by Time of Day.

In addition to deploying two-person fare inspection teams to bus routes with identified fare evasion issues, the SFMTA initiated "Enhanced Fare Enforcement" operations at major stops. Up to six inspectors check on-board and alighting customers while a vehicle waits at a stop, typically in under a minute. Fare inspection teams have issued as many as 50 citations per hour. These operations have taken place not only where there is above-average fare evasion, but also in other locations so that all customers can expect a fare inspection (Figure 6**)**. The SFMTA has conducted outreach in English, Spanish and Chinese (Figure 7) to increase public awareness of the purpose of its fare enforcement program and to educate customers that they must carry valid proof-of-payment at all times. Multilingual automated bus announcements also notify customers that they must always possess proof-of-payment.

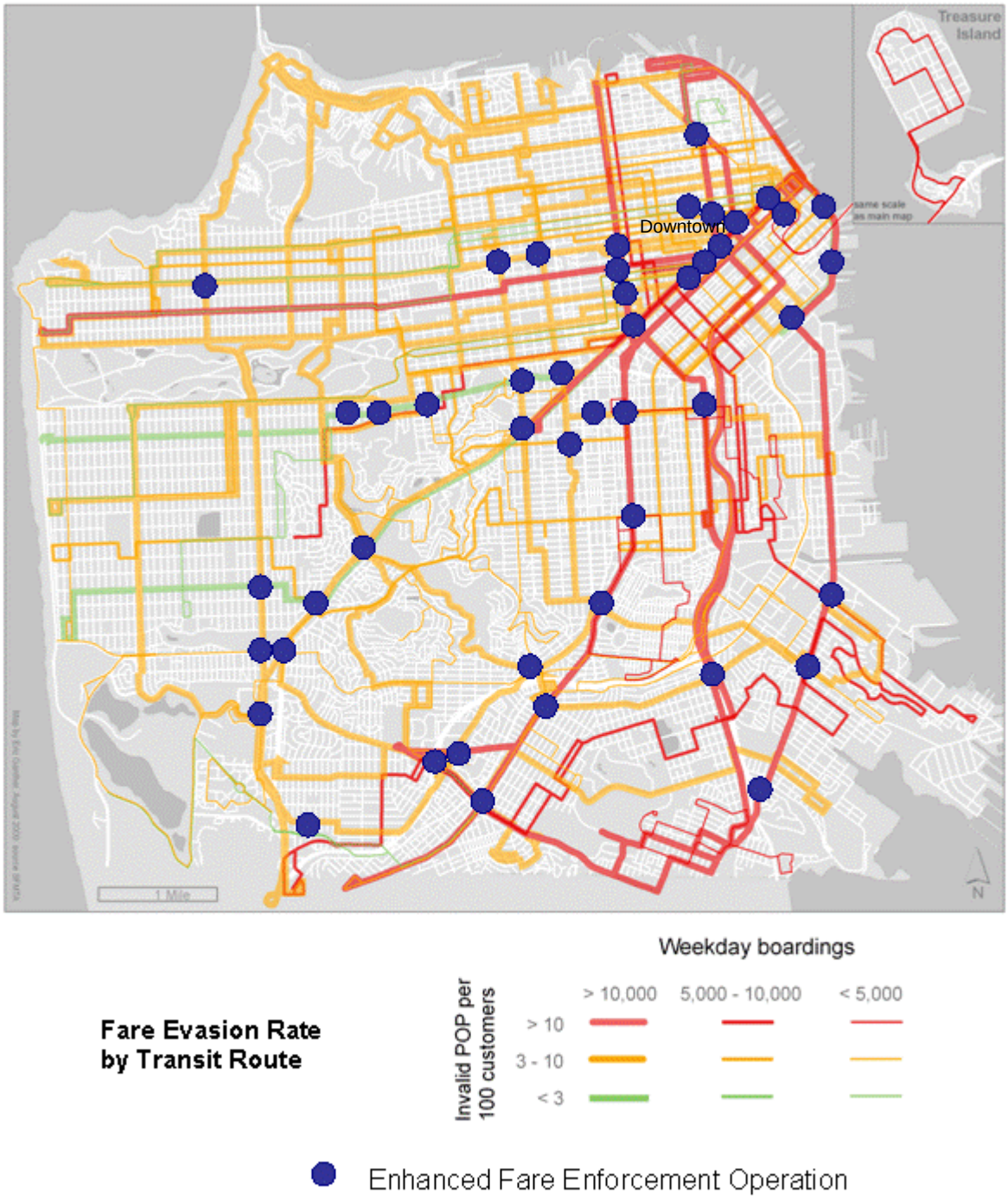

FIGURE 6 Transit Fare Inspector "Enhanced Fare Enforcement" Operations.

FIGURE 7 Multilingual Outreach to Discourage Fare Evasion.

Currently, the SFMTA is contemplating a pilot program to permit back-door boarding officially along four bus corridors. These corridors have a combined weekday ridership of approximately 150,000 with fare evasion rates ranging from 10 to 20 percent. The SFMTA is also evaluating whether to hire more Transit Fare Inspectors to boost enforcement coverage on these routes. While additional staff would increase operating costs, greater enforcement may also increase fare revenue. The SFMTA is also estimating the potential operating cost savings that back-door boarding could produce by reducing the number of vehicles required to maintain service headways.

IMPLICATIONS FOR OTHER TRANSIT SYSTEMS

While all transit systems have unique characteristics, they also encounter common fare compliance issues. A Proof-of-Payment Study adapted to localized needs may help systems address questions such as:

- Do perceptions of fare evasion match reality?
- Because it costs money to collect money, how much should be invested in fare enforcement and equipment to reduce fare evasion rates to "acceptable" levels?
- Should a rail system have proof-of-payment, faregates with station agents, or both?
- Should buses convert to proof-of-payment? If so, are off-board ticket vending machines required? Alternatively, can customers purchase tickets on-board to reduce vending machine capital, operating and maintenance costs?
- Is there an "optimal" enforcement level where additional staff costs do not exceed the expected fare revenue gains from greater fare inspection and the potential operating cost savings from expedited boarding?

- What is an appropriate fine for failure to display valid proof-of-payment?
- How are fare enforcement policies sensitive to a transit system's demographically-diverse customer base?
- What additional staffing might be required to ensure "equitable" enforcement that extends to all locations, including places with low fare evasion?

SFMTA's study found that each percentage point reduction in the fare evasion rate equates to approximately $2 million in additional revenue based on 2009 fare rates. After accounting for citation revenue, the net Proof-of-Payment labor budget for fiscal year 2009-2010 totaled about $3 million, or less than 2 percent of the $188 million in fare revenue collected. These figures suggest that the Proof-of-Payment program would "pay" for itself if the presence of Transit Fare Inspectors reduced the systemwide fare evasion rate by just 2 percentage points.

Beyond these financial criteria, a transit system may wish to consider the non-monetary value of proof-of-payment. The perception or reality that some people ride for free can make it difficult for an organization to gain political support, secure new funding or implement fare changes. Finally, proof-of-payment may also bring operational benefits. Sixty percent of Muni bus customers use passes and officially allowing them to board through the back door may reduce dwell times substantially. The SFMTA has estimated that increasing average Muni bus speeds from 8 to 8.5 miles per hour would reduce average passenger costs per trip by 5 percent or conversely would equate to adding approximately 30 peak buses.

CONCLUSION

Like other transit providers, SFMTA's recent operating budget pressures have impacted service and fares. A lean fiscal environment has made it all the more imperative to collect fares from those not paying their "fair" share. SFMTA's Proof-of-Payment Study continues to provide a quantitative and analytical basis for policy decisions relating to inspector deployment, boarding procedures and other issues. The SFMTA intends to conduct supplementary surveys every one to two years to measure progress towards improving fare compliance.

Prior to the study, many people might have been surprised to learn that 9 out of 10 people possessed valid proof-of-payment when riding Muni. With few exceptions, at least 8 out of 10 people on average had valid proof-of-payment even for the most problematic routes and times of day. Though fare evasion remains a significant issue, especially considering the estimated $19 million in annual uncaptured fare revenue, the study curbed speculation that the magnitude of the problem was far greater.

For some, the study results might still appear to contradict their anecdotal observations. This divergence between perception and reality underscores that fare evasion, particularly blatant forms such as entering through the back door without paying, is highly visible and can shape public impressions of a transit system and its management. In contrast, creating the expectation that one might encounter a Transit Fare Inspector anywhere anytime can lower perceived and actual fare evasion and increase public respect for the system. Perhaps most importantly, the study affirmed that investing in a fare inspection program and gathering research data to deploy enforcement resources strategically can yield significant benefits and help build a culture of fare compliance.

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