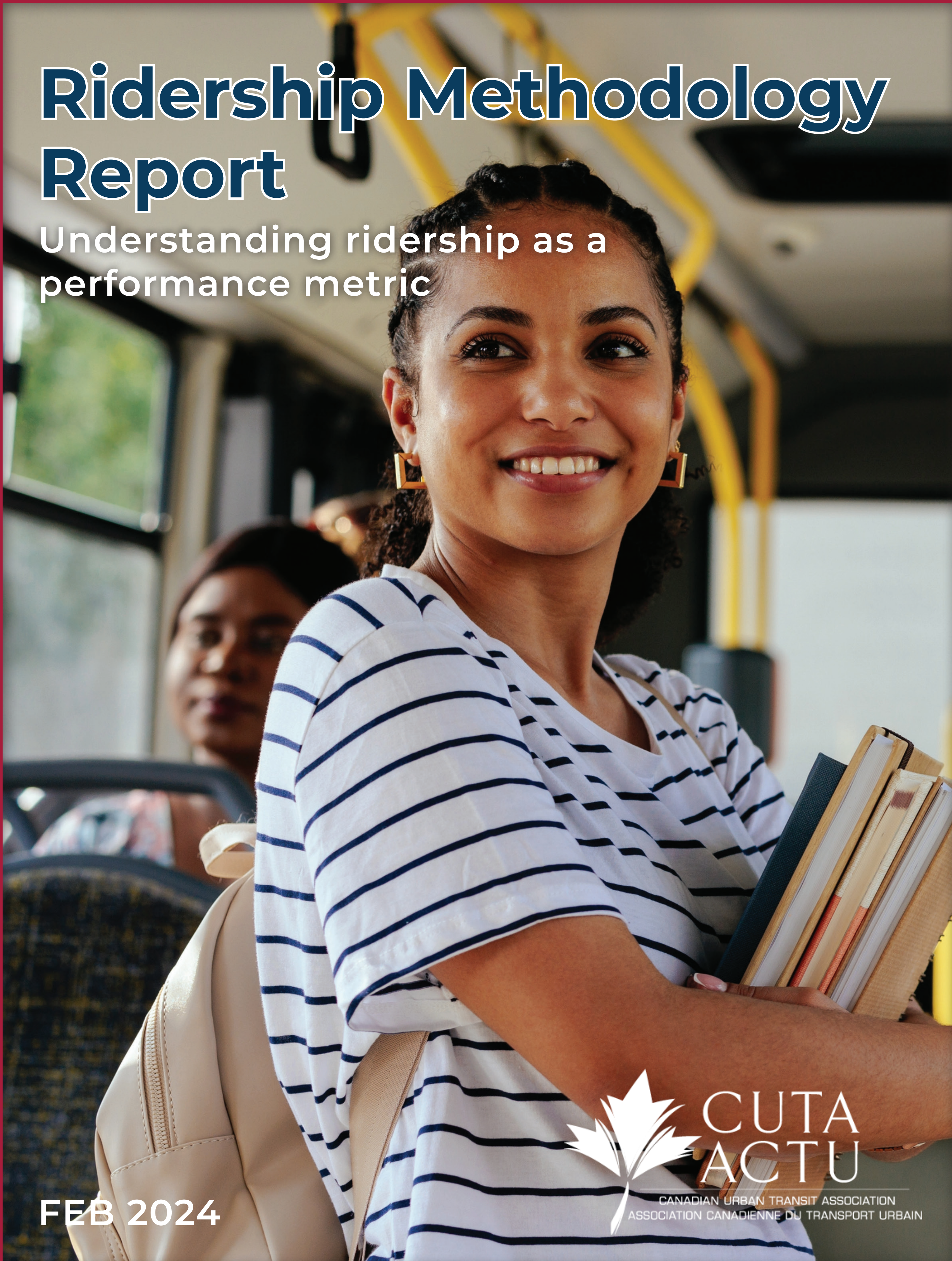
Ridership Methodology Report

Understanding ridership as a performance metric



FEB 2024

CUTA
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CANADIAN URBAN TRANSIT ASSOCIATION
ASSOCIATION CANADIENNE DU TRANSPORT URBAIN

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Background

In 2022, CUTA held a ridership workshop to engage with its transit system members about ridership as a performance metric. Based on CUTA transit system member engagement ridership can be both a helpful performance metric but also problematic in some scenarios. Ridership can have varied interpretations by system and each system values ridership as a metric differently.

These differences can lead to inconsistent ridership benchmarking and communication issues both within an organization and between systems at a national level. Transit systems expressed that ridership is problematic because of the variability in understanding the metric and its comparability and that CUTA was positioned to provide clarity on the topic.

Project Overview

The purpose of this document is to improve the understanding of ridership to facilitate fairer comparisons and evaluations of transit performance. This document is intended to only provide consideration of how ridership can be used as a metric and considerations on its fairness given that ridership methodologies are different between systems which affect comparability. This document is not intended to create standards for ridership methodologies used by each transit system.

To improve the understanding of ridership, this document will address the following topic areas:

1. What is ridership?
2. How is ridership calculated?
3. Why is ridership as a metric complex or problematic?
4. When should we use ridership as a metric?

Executive Summary

This document explores the intricacies of transit ridership, with a primary focus on the initiatives undertaken by the Canadian Urban Transit Association (CUTA) to navigate the complexities associated with ridership. Ridership, fundamentally defined as the quantification of linked trips within public transit system, is underscored by CUTA's commitment to standardized terminology for consistent interpretation across transit systems. Emphasizing its multifaceted role, this document articulates the significance of ridership in evaluating the efficacy of public transit services and its direct impact on securing essential funding, particularly within the Canadian context.

A comprehensive examination of ridership methodologies forms a central component of the document, delineating the nuances between estimation-based and technology-based approaches. The former encompasses methods such as farebox revenue calculations, pass multipliers, manual counts, and transfer rate calculations, while the latter incorporates cutting-edge solutions like Automatic Passenger Counters (APC) and fare card validation systems. The document also delves into exceptional scenarios and considerations, shedding light on challenges related to cross-boundary services, tracking free fares, managing time-based transfers, addressing fare evasion, and navigating the disparities between reported and actual ridership figures.

Throughout this report, a recurring theme emerges regarding the imperative need for precise definitions and standardized methodologies in the realm of ridership calculations. This clarity is deemed essential for fostering equitable comparisons, particularly in the allocation of funding, as underscored by the dynamic shifts in public transit usage patterns exemplified by the disruptive impact of the COVID-19 pandemic on ridership trends.

1. Ridership Overview

At its core, ridership is a measurement of passenger usage through tracking the number of trips provided by public transportation. Ridership can be defined differently based on context which can lead to problems when it is used as a performance indicator. CUTA defines ridership as the cumulative number of one-way, linked trips provided by public transit. Here, 'linked trips' refer to journeys from an origin to a destination, with trips involving transfers counted only once. For this document and all CUTA related resources, ridership is defined in this manner.

In Canada, the concept of ridership is commonly interpreted as linked trips, a standard largely established by CUTA's data collection and benchmarking programs. These linked trips, which form the core measure for ridership, represent continuous journeys from an origin to a destination, regardless of the number of transfers involved.

1.1. What is ridership used for?

Ridership measures how many people are utilizing public transit services for their daily activities and travel needs. Ridership is a temporal snapshot of public transit usage by counting the number of passenger trips taken on public transit. Each transit system in Canada measures ridership in some manner. As such, ridership often underpins the calculation of other key performance indicators, essential for assessing the effectiveness and efficiency of public transit systems.

Ridership is impactful as a metric because it enables stakeholders to leverage this data in advocating for public funding of transit systems. In Canada, the accuracy of ridership reporting is crucial for transit systems due to its direct impact on funding allocations. Programs like the Investing in Canada Infrastructure Program (ICIP), Public Transit Infrastructure Fund Program (PTIF), and Ontario's Dedicated Gas Tax Fund integrate ridership figures into their funding distribution models, making precise ridership data essential for these transit agencies.

1.2. When is ridership applicable?

Ridership is a viable metric to benchmark passenger usage. It is a metric that has a robust history of collection and reporting making it accessible and easily understood. Although methodologies to determine ridership vary between transit systems, the general principals in tracking passenger trips are widely understood and practiced. For this reason, ridership is a convenient metric for many stakeholders to use in order to understand the progression of passenger usage. Ridership becomes most applicable and reliable as a metric when there is comparability between transit systems, specifically when these systems employ similar methodologies for measuring ridership and maintain sound, accurate data. When looking at the community benefits of public transit, ridership is often seen as a multiplier in determining the extent to which community benefits of public transit are realized. Benefits such as modal shifts, decarbonization, decongestion, etc. are actualized once passengers utilize public transit which is captured through ridership.

1.3. When is ridership inapplicable?

Ridership can, however, be reductive when used by different levels of Canadian government to allocate and justify the public funding of transit, despite criticisms regarding the fairness and accuracy of this approach. Several Canadian funding sources allocate resources based on ridership where higher ridership means more funding. The reasoning behind this funding approach is based on ridership's ability to measure passenger usage, therefore, larger systems that transport more people should receive more funding to support their greater scale of operations. This reasoning is not the reality for all transit systems because reported ridership is unpredictable and can fluctuate independently from a transit system's operation size.

Ridership is an after-event metric that measures passenger usage after it has already occurred. Ridership as a metric is important in charting the progress of passenger usage, however ridership data in itself is not predictive and does not inherently inform strategies needed to influence or shape future trends in transit usage. It is also detrimental to systems to allocate funding based solely on ridership as it does not account for untapped ridership from potential transit growth and expansion.

As detailed in CUTA's Ridership Trends research, ridership is most influenced by levels of service provided. To provide increased levels of service, transit systems require greater amounts of funding to operate more vehicles and at greater frequencies. Sustainable funding levels ensure the greatest chances of increased ridership levels. Therefore, it is important to decouple funding and ridership challenging the notion that funding levels should always trend in parallel with ridership figures.

Funding levels should be assessed in a manner that maximizes the potential for increased ridership, while recognizing that ridership can fluctuate independently of funding levels due to factors such as the accuracy of reported ridership or unprecedented circumstances that change passenger travel behaviours all together.

Transit systems across Canada use different methodologies to determine ridership, which are subsequently listed in greater detail in the following paragraphs. Each methodology is applicable to different systems based on unique fare policies and technological capabilities. Transit systems that have changed their ridership methodologies due to fare system innovations experienced notable fluctuations in the accuracy of their reported ridership. This suggests that the accuracy of each ridership methodology is different and that comparability between systems is jeopardized when systems use different methodologies. This becomes a problem when funding is derived from ridership comparisons, as the inconsistency of ridership methodologies can lead to inequitable distributions of funding. Discrepancies in how ridership is reported—leading to increases or decreases not reflective of actual changes in transit usage—do not alter the genuine, consistent need for public funding.

Operational needs and requirements of transit systems remain constant, irrespective of fluctuations in reported ridership due to methodological changes.

Another example of how a transit system's ridership can fluctuate separately from funding levels are sudden drastic changes in passenger travel patterns. For instance, the COVID-19 pandemic demonstrated how precautions taken to minimize the risk of virus transmission through social distancing and isolation resulted in an immediate and dramatic decrease in ridership (National ridership in Canada decreased on average by approximately 60%). Despite this decrease in ridership and passenger demand, transit systems were expected to provide similar or identical levels of service to ensure essential frontline workers could continue commuting to their jobs. This was a taxing period for public transit in Canada as fare revenue was significantly reduced and more public funding was needed to sustain transit operations, while additional operating costs related to pandemic precautions, such as PPP equipment procurement and installation, were also incurred.

Since the onset of the pandemic, ridership rates have been trending unevenly between transit systems compared to pre-pandemic levels. Some systems continue to experience reduced levels of ridership, while other systems have fully recovered and in some cases, even surpassed pre-pandemic levels. Given these circumstances, using ridership as a primary metric for funding allocation in the postpandemic era has become problematic. Transit systems experiencing low ridership due to the lingering effects of Covid-19 require more funding to offset continued revenue shortfalls. In contrast, other systems have recovered more rapidly and require additional support to meet growing demand.

2. Ridership Methodologies

Ridership methodologies are the techniques that transit systems use to track and calculate ridership figures. The precision of these methodologies directly correlates to the accuracy of ridership figures. Each method of calculating ridership can have varying levels of success and accuracy dependent on its applicability. Ridership methodologies typically begin by examining fare validation or passenger onboardings as a basis for counting trips.

The ways in which passengers board or pay their fares directly influences the applicability of different ridership methodologies. Generally, transit systems that use manual methods for collecting fares will rely on estimations or calculations, while other agencies that use technology and software to collect fares will have automated systems to track ridership. In this segment, we provide a high-level overview of the most prevalent ridership methodologies used in the industry.

2.1. Estimation-based Ridership Methodologies

Estimation-based ridership methodologies use some form of calculation with assumptions made to accurately approximate ridership. Estimation-based methodologies are prevalent among transit systems that have not adopted technologies capable of counting passenger trips. However, estimation-based methods are not mutually exclusive to technological implementations. Some transit systems that have adopted technology such as fare cards and Automatic Passenger Counters (APCs) may still rely on forms of estimation or business intelligence to calculate actual ridership based on passenger data extracted from these technologies.

2.1.1. Farebox Revenue and Sale Calculations

Overview	Farebox revenue and sale calculations determine passenger trips by analyzing fare revenue collected and sale of fare products such as passes, tokens, punch cards, etc. The general method consists of counting the sale of fare products as a certain number of trips using pass multipliers or treating tokens or tickets as individual trips. Fare revenue is pooled together and usually divided by an average fare to estimate how many trips were taken.
Applicability	• Fare products that account for a certain number of trips such as tickets, tokens, passes, etc • Fare revenue that is not automatically tabulated such as manual fareboxes.
Linked Trips	Farebox revenue and sale calculations measure passenger trips based on fare validation. Each trip estimated through analysis of the revenue and sale of fare products is considered as linked trips as transfers made along the journey would not generate additional revenue nor fare products.
Unlinked Trips	Unlinked trips cannot be directly calculated by analyzing revenue or fare product sales, as transfers typically do not incur additional fare payments.
Considerations	• Free trips would not be accounted for under farebox revenue and sale calculations as they seldom require any form of sale or fare validation. • Analyzing the sale of fare products could potentially overestimate passenger trips compared to analyzing fare products that are validated. Tickets and tokens, for example, could be purchased but not validated.

2.1.2. Pass Multipliers

Overview	A multiplier factor applied to the sale of passes to estimate how many trips should be counted towards each transit pass sold.
Applicability	• Transit passes where usage rate of the pass cannot be counted.
Linked Trips	Pass multipliers primarily count linked trips. The estimation of how many trips is taken with a pass do not consider transfers.
Unlinked Trips	Pass multipliers could be adjusted to a higher multiplier to consider pass usage focusing on unlinked trips. The adjustment would most likely consider transfer ratios to advise on this multiplier.
Considerations	• Pass multipliers should be calibrated based on customer travel studies such as travel diaries or customer interviews. • Pass multipliers generalize travel patterns among pass purchasing customers and so actual passenger trips could differ from what is estimated. • Pass multipliers need to be updated regularly as factors affecting travel behaviours can change such as pass pricing, cost of living, diversity of fare options, etc.

2.1.3. Manual Counts

Overview	Passenger trips are manually counted by transit staff as passengers board vehicles. Operators or other transit staff riding along will count passengers using clickers, pen and paper, tablets, or other counters.
Applicability	• Transit systems that have no automatic methods of counting passenger trips. • Small sized systems where counting smaller passenger transit loads is feasible. • Counting trips can be a form of validating the accuracy of other forms of passenger trips calculation.
Linked Trips	Staff counting passengers can accurately count linked trips if they are able to distinguish between passengers who are transferring and those who are starting new trips. When customers are required to show paper transfers, it becomes easier to distinguish these as linked trips, since the use of a transfer indicates a continuation of an initial journey. However, for customers using transit passes, which are shown for both new trips and transfers, it becomes more challenging to differentiate between a new trip and a linked trip.
Unlinked Trips	Manual counts in transit systems primarily focus on tallying unlinked trips. In this method, each passenger boarding a transit vehicle is counted individually, representing a single unlinked trip.
Considerations	• Human error and ease of counting are factors of counting discrepancies. High vehicle occupancy, rear-door boarding, or operators dealing with customers are examples of factors that make precise manual counting challenging.

2.1.4. Transfer Rate Calculations

Overview	Transfer rates is the percentage of linked trips that include at least one transfer to complete the trip. Transfer rate calculations use transfer rate and either linked or unlinked trip data to calculate the other. Transfer rates are determined through travel studies such as customer travel diaries or interviews.
Applicability	• When either only linked or unlinked trip data is available, and the counterpart needs to be determined. • Systems that have a reliable method of determining transfer rate through customer studies.
Linked Trips	Linked trips can be calculated by taking unlinked trip data and dividing by a factor of (1 + transfer rate %)
Unlinked Trips	Unlinked trips can be calculated by taking linked trips and multiplying by a factor of (1 + transfer rate %)
Considerations	• A more detailed formula could be developed by systems to consider what the trip data could look like with consideration to trips with multiple transfers.

2.2. Technology-based Passenger Trips Methodologies

As transit systems increasingly adopt technology-based methods for fare payments, there's a corresponding shift towards more technology-based counting methods, as opposed to reliance on estimation-based approaches. This has wide implications for ridership methodologies, as it transforms ridership calculations from being largely assumption-based and reliant on estimations to becoming more precise and data-driven. Stakeholders may be left with a problem of reconciling multiple ridership figures as technological implementations produce a more accurate number than previous estimates.

Compared to estimation-based methodologies, technology-based methodologies typically capture passenger trips more accurately[1]. However, even with advanced technology, some level of estimation and calculation may still be necessary to accurately account for aspects like transfers and cross-boundary services.

"Compared to estimation-based methodologies, technology-based methodologies typically capture passenger trips more accurately"

Virginia Transportation Research Council
Development of Guidelines for Collecting Transit Ridership Data
http://www.virginiadot.org/vtrc/main/online_reports/pdf/22-r22.pdf

2.2.1. Automatic Passenger Counters (APC)

Overview	Automatic passenger counters are on-board equipment that counts passengers entering and exiting public transit vehicles. The technology used to count passengers can be by weight, motion, or other sensors
Applicability	• APCs are applicable to all transit systems and can add another layer of trip validation to other methods of counting passengers.
Linked Trips	Linked trips cannot be calculated directly using APC technology. APCs count passengers at a sensory level which would not be able to capture if passengers entering a public transit vehicle are transferring or starting a new trip.
Unlinked Trips	APCs primarily count unlinked trips, by counting passengers as they board public transit vehicles.
Considerations	• The accuracy of APC data depends on the accuracy of the technology and sensory method being used. • APC data can be used as a foundation to calculate linked trips or validate or methods of passenger trips calculation. • APCs track passengers regardless of fare payment so free trips and fare evaders could also be tracked. • APCs may have counting complications when onboarding is overcrowded or busy.

2.2.2. Fare Card Validation

Overview	Fare card systems deploy technology and software that allow passengers to pay their fares using electronic cards that are loaded with funds and fare products and then tapped at fare terminals for validation. The policies at each transit agency will determine when passengers must tap their fare cards (i.e. when boarding, transferring, or exiting public transit vehicles). Fare cards are also called smart cards in some jurisdictions. Some fare card systems allow open payment using credit or debit cards in addition to the system's fare card.
Applicability	• Fare card systems are more prevalent among medium to large-sized transit systems, as they can often be a more cost-efficient option compared to manual fare collection.
Linked Trips	A fare card system will primarily track linked trips if customers do not need to tap their fare cards again during transfers or if the technology and software used in the system has the business intelligence to distinguish when a card tap is a transfer instead of a new trip.
Unlinked Trips	Unlinked trips could be calculated using fare card validation if passengers are expected to tap their fare cards at points of transfer. Each tap would then be considered as an unlinked trip.
Considerations	• The accuracy and richness of fare card data will depend on system's fare policies as well as the capability of the technology and software used. Some fare card systems have been criticized as lacking built-in business intelligence for passenger trips counting. • Free trips or transit passes loaded onto fare cards may not require fare cards to be tapped which make it difficult to track free trips. • Customer compliance or understanding of tapping fare cards for payment could affect passenger counts. • Cyber-attacks or other factors taking down the fare card technology and software can impact the measurement of passenger trips

3. Ridership Methodology Exceptions

Certain passenger trips present challenges in tracking or calculation, necessitating additional steps beyond typical ridership methodologies to accurately discern them. These trips are difficult to track because, they do not have a point of validation or their trip extends outside of a system's purview. This section highlights some of these trip scenarios.

3.1. Cross-boundary Service

Cross-boundary service refers to transit services that cross or transfer through municipal boundaries. Cross-boundary service sometimes requires agreed upon fare policies between two transit systems that allow passengers to transfer for free or a concession.

In the event of cross-boundary service transfers, each transit agency that participates in providing service to the passenger is eligible to count that as a linked trip for their own agency regardless of the transfer. This approach is an equitable way of measuring passenger usage at the system level but double counts the trip at a regional level.

3.2. Free Fares

Free fare trips are included in ridership figures as they are passenger trips provided despite no fare revenue being generated. Free transit is typically provided for children, youth, seniors, transit employees, and other municipal workers. Free fare trips exclude trips that are taken where passengers who are expected to pay board transit without paying.

Free fares can be challenging to calculate depending on how free fares are validated. Ridership calculations require some form of validation to tabulate that a trip was taken. Paid fares use revenue or fare validation, but free trips may not require passengers to validate anything as no fare needs to be paid. Some systems have fare policies that require passengers to validate fare cards or passes for free trips which helps track free fare trips. Otherwise, estimation-based methodologies are commonly used to calculate free fare trips.

Transit systems with fare structures that include a wide range of free fare categories often face the challenge of accounting for a greater distribution of free fare trips compared to systems with fewer free fare options.

3.3. Time-based Transfers

Time-based transfers are fare policies where passengers can make an unlimited number of transfers within a time frame to complete their origin-to-destination trip. Time-based transfers add a complexity to ridership calculation due to the inability for some systems to discern whether trips made within the transfer window are new origin-to-destination trips or transfers. Some systems view time-based transfers as a time limited transit pass due to passengers taking advantage of unlimited transfers to make multiple trips.

The number of linked trips counted within the time-based transfer window will depend on how accurately transit systems can track new origin-to-destination trips. For example, if a transit system can discern that a passenger is making a trip from their home to a grocery store and then starting a new trip returning home within the time-based transfer window, then it is reasonable to count two linked trips in this scenario. If a system cannot confirm whether passengers are making new trips or transferring within the window, then each time-based transfer window should only be counted as a single linked trip.

3.4. Fare Evasion

Fare evasion occurs when passengers do not pay fares to board public transit when they were expected to either intentionally or unintentionally. In most cases, transit systems will not be able to track fare evaders as they will skip points of fare validation, however, other technology such as APC or security camera footage could capture fare evaders. CUTA currently does not allow trips that are estimated as taken but fare payment was evaded to be counted towards ridership figures. The methodologies in which fare evaded trips are inconclusive between systems.

3.5. Actual vs Reported Ridership

Ridership calculation methods are intended to track as accurately as possible how many passenger trips are provided by public transit. Each ridership methodology has varying levels of accuracy and success in determining the number of trips provided. Due to variations in the accuracy of different ridership calculation methodologies, discrepancies often arise between what is reported and the actual ridership figures. For example, ridership calculated using fare revenue is making an estimation based on the revenue received. Passes, tickets, or punch cards purchased will be estimated for a certain number of trips, however passengers may not validate these fares so actual ridership could be lower.

When benchmarking ridership between transit systems, it is important to consider that the differences in ridership figures may be due to the methodologies that each system uses.

Discrepancies between reported and actual ridership are especially apparent when transit systems adopt technology-based methods over estimation-based methods and find that their actual ridership is different from their reported ridership. In such scenarios, it may be challenging for systems to be able to communicate that while their reported ridership has changed due to their calculation methods, their actual ridership figures remain relatively consistent

CUTA
ACTU
CANADIAN URBAN TRANSIT ASSOCIATION
ASSOCIATION CANADIENNE DU TRANSPORT URBAIN

Head Office

Suite 1401, 55 York St.
Toronto, Ontario
Canada M5J 1R7
(416) 365 9800

Ottawa Office

Suite 200, 440 Laurier Ave. W.
Ottawa, Ontario
Canada K1R 7X6
(416) 365 9800

CUTAACTU.CA