Enhancing Student Outcomes While Strengthening Transit: An Analysis of LA Metro's GoPass Fareless Pilot Program

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A Research Report from the Pacific Southwest Region University Transportation Center

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16. Abstract
This study aimed to analyze LA Metro's GoPass program, examining its usage patterns, participant characteristics, role in ridership recovery, and impact on students' attendance. It also investigated free and discounted student transit pass programs across California and the influence of the COVID-19 pandemic. GoPass constituted 12.3% of LA Metro's 2022 bus tap boardings, a significant portion amid a 33.4% overall ridership decrease compared to 2019. Spatial regression showed higher GoPass usage in areas with more young males and Asian residents, denser transit stops, mixed land use, and better transit access to participating schools.

MUSD schools showed improved attendance in 2023 compared to 2022, particularly in intermediate schools. GoPass usage was highest among high schoolers, and increased use correlated with improved attendance, especially for minority and economically disadvantaged students, suggesting reduced absenteeism. Elementary and intermediate schools showed mixed attendance results. Our 2024 survey of transit agencies reveal that 38 agencies participating in both the 2019 and 2024 surveys expanded their student pass programs post-pandemic to boost ridership. LA Metro's GoPass, a leading example adopted by agencies like Santa Monica, Long Beach Transit, and Gardena (GTrans), has a positive impact on ridership.
Understanding the usage and characteristics of GoPass riders, both before and during the pandemic, is crucial for enhancing current fare-based incentive programs. These insights can also guide other transit agencies in developing similar initiatives to boost ridership and support students' access to transportation.

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The Pacific Southwest Region UTC conducts an integrated, multidisciplinary program of research, education and technology transfer aimed at *improving the mobility of people and goods throughout the region.* Our program is organized around four themes: 1) technology to address transportation problems and improve mobility; 2) improving mobility for vulnerable populations; 3) Improving resilience and protecting the environment; and 4) managing mobility in high growth areas.

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Disclosure

Jean-Daniel Saphores and Farzana Khatun conducted this research titled, "Enhancing Student Outcomes While Strengthening Transit: An Analysis of LA Metro's GoPass Fareless Pilot Program" at the Institute of Transportation Studies at the University of California, Irvine. The research took place from June 2023 to June 2024 and was funded by a grant from the US Department of Transportation and California Department of Transportation in the amount of $95,248. The research was conducted as part of the Pacific Southwest Region University Transportation Center research program.

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Abstract

This study aimed to analyze LA Metro's GoPass program, examining its usage patterns, participant characteristics, role in ridership recovery, and impact on students' attendance. It also investigated free and discounted student transit pass programs across California and the influence of the COVID-19 pandemic.

GoPass constituted 12.3% of LA Metro's 2022 bus tap boardings, a significant portion amid a 33.4% overall ridership decrease compared to 2019. Spatial regression showed higher GoPass usage in areas with more young males and Asian residents, denser transit stops, mixed land use, and better transit access to participating schools.

MUSD schools showed improved attendance in 2023 compared to 2022, particularly in intermediate schools. GoPass usage was highest among high schoolers, and increased use correlated with improved attendance, especially for minority and economically disadvantaged students, suggesting reduced absenteeism. Elementary and intermediate schools showed mixed attendance results.

Our 2024 survey of transit agencies reveal that 38 agencies participating in both the 2019 and 2024 surveys expanded their student pass programs post-pandemic to boost ridership. LA Metro's GoPass, a leading example adopted by agencies like Santa Monica, Long Beach Transit, and Gardena (GTrans), has a positive impact on ridership.

Understanding the usage and characteristics of GoPass riders, both before and during the pandemic, is crucial for enhancing current fare-based incentive programs. These insights can also guide other transit agencies in developing similar initiatives to boost ridership and support students' access to transportation.

Enhancing Student Outcomes While Strengthening Transit: An Analysis of LA Metro's GoPass Fareless Pilot Program

Executive Summary

The COVID-19 pandemic severely disrupted public transit, causing an 81% drop in U.S. transit ridership between April 2019 and April 2020. The subsequent recovery has been slow and uneven. To combat this, transit agencies have employed strategies like community outreach, service adjustments, and free or reduced fare programs (FRFPs). FRFPs often target specific groups, notably students. These programs aim to increase ridership and address transportation inequities affecting low-income and minority students. These students often face barriers in accessing quality schools in affluent areas due to a lack of affordable transportation.

California transit agencies are increasingly using FRFPs to boost ridership, with LA Metro's GoPass for K-14 students as a prime example. GoPass significantly impacts ridership, accounting for 12.3% of LA Metro bus boardings by fall 2022. However, a comprehensive analysis of the broader impacts of these programs is needed. This study examines LA Metro's GoPass usage patterns. It will analyze the characteristics of student users via a spatial model and investigate GoPass's impact on student academic welfare. In addition to the GoPass analysis, a survey of California transit organizations will update a 2019 survey (*1*). This aims to document student FRFP prevalence and features, and to assess the pandemic's effects on these programs and overall ridership.

In 2022, GoPass represented 12.3% of LA Metro's bus boardings and 5.4% of train boardings. Weekday usage peaked during school commute times (7-8 am and 3-4 pm). A 2023 GoPass bus boarding analysis confirmed strong spatial effects, validating the use of a spatial model. GoPass boardings positively correlated with nearby transit stops, varied land use, and proximity to participating schools. Conversely, boardings negatively correlated with cars per household, property crimes, multifamily housing, and population density.

MUSD schools showed improved attendance in 2023 compared to 2022, with intermediate schools showing the highest rates. High schoolers used GoPass most frequently, and their usage correlated with better attendance. Specifically, increased GoPass use positively correlated with improved attendance, especially for minority and economically disadvantaged high school students, suggesting the program reduces absenteeism. Elementary and intermediate schools showed mixed attendance results, indicating the program's impact varies by grade level.

A 2024 survey of 67 transit agencies (38 from the 2019 survey and 29 new participants) revealed a significant increase in FRFPs between the 2018-19 and 2022-23 fiscal years, particularly for post-secondary/college and K-12 programs. In 2022-23, 15 of 38 agencies offered free fare programs, and 13 offered reduced fare programs, with about two-thirds launched post-pandemic. Funding for K-12

student pass programs increased in 2023, with more agencies reporting dedicated funding. In 2023, these programs positively impacted ridership. Agencies reported an average 73% ridership decline during the pandemic and implemented safety measures to aid recovery.

These findings highlight the growing importance and potential of student FRFPs in addressing transit ridership recovery and transportation equity post-pandemic.

Background

The COVID-19 pandemic caused a precipitous 81% decline in transit ridership between April 2019 and April 2020, and recovery remains incomplete and uneven across most regions (*2*). In response, US transit agencies have implemented a variety of strategies to attract riders back to the system, including community engagement to understand rider needs and preferences, service adjustments to accommodate evolving travel patterns (e.g., schedule and route modifications), and the introduction of fare discounts or free transit pass programs, especially for students.

Free and reduced-fare transit pass programs offer a dual benefit: they support ridership recovery and address transportation inequities faced by low-income and minority students. Reliable and affordable transportation is often a barrier for these students, as high-performing schools are frequently located in more affluent neighborhoods, distant from where they live. A 2017 report from the Center on Reinventing Public Education (CRPE) (3) noted that student transportation represents nearly 3.5% of all K-12 expenditures for the 2017-2018 school year. As school budgets have tightened, many districts have restricted eligibility for free school transportation, shifting the burden to parents. Many families rely on public transit for school commutes, but even small transit fees can be a hardship for low-income families, potentially leading to school absences or foregone extracurricular activities. In Los Angeles Unified, for example, 80% of students come from families below the poverty line (*4*), highlighting the financial challenges many families face. To alleviate these obstacles, some school districts have partnered with transit agencies to offer free transit passes.

In Los Angeles (LA) County, the LA County Metropolitan Transportation Authority (LA Metro) created in the fall of 2021 the GoPass program, which provides free bus and train transportation to students in participating schools, from kindergarten to community colleges (community colleges cover grades 13-14, 2 years after the last year of high school), or simply K-14. It is the most extensive fareless program for K-14 students in the U.S. and quickly became popular. By winter 2023, over 241,000 students had registered, generating over 1.2 million monthly boardings. The GoPass program has three main goals: regain some of the transit ridership lost during the COVID-19 pandemic, provide accessible transportation to disadvantaged students, and explore seamless payment options for younger transit users.

Although many other transit organizations in the U.S. have introduced free or discounted pass programs for students enrolled in K-12 schools, community colleges, and universities (*1*), with a few exceptions, these programs have received limited attention from transportation scholars (including target population, impact on ridership, impact on fiscal health, sustainability). As noted in (*5*), few academic studies have evaluated programs that provide students free or discounted access to public transit (notable exceptions include (*5*–*8*). LA Metro's GoPass Fareless Pilot program for K-14 students, launched

on October 1, 2021, offers a golden opportunity to start filling this gap from the point of view of transit agencies.

To address these research gaps, this study investigated two key areas. First, we analyzed LA Metro's GoPass program to understand the usage of fare-based incentives and their contribution to ridership recovery. Second, we surveyed California transit organizations to document existing free and discounted transit pass programs for students (K-12, post-secondary, and college) and to assess the impact of COVID-19 on these programs. This study is structured into five parts:

First, we conducted a literature review of free and discounted transit pass programs since 2000, building upon the work in (*1*), with a focus on their potential to increase transit ridership.

Second, to analyze student usage of the GoPass program and its contribution to LA Metro's ridership, we examined the travel patterns of enrolled students using boarding data provided by LA Metro (with the assistance of Ms. Deming). This dataset includes temporal (day and time) and spatial (latitude and longitude) information. Because students only tap their cards upon boarding (not alighting), and due to privacy restrictions preventing the tracking of individual tap cards, we only have origin information, not destinations. Therefore, our analysis of LA Metro's 2022 boarding data focuses on these origin points. While GoPass began in Fall 2021, limited initial ridership and the absence of a tap card requirement until January 2022 make the 2022 data the most reliable for analysis.

Third, to analyze GoPass usage (individual data unavailable due to privacy restrictions), we employed a generalized spatial model to explain GoPass 2023 bus boardings aggregated by census tracts, using a comprehensive set of explanatory variables. Recognizing that census tract boundaries are not necessarily relevant to bus users, we posited that boardings at a bus stop within walking distance of multiple census tracts are likely influenced by the characteristics of those surrounding tracts. Therefore, we anticipated spatial interactions between boardings in neighboring census tracts.

Fourth, to analyze the impact of LA Metro's GoPass on student attendance in the Montebello Unified School District (MUSD). After attempting several times for over a year, we could not get the attendance and graduation data from the LAUSD (Los Angeles Unified School District). Finally, we conducted a simple analysis using MUSD (Montebello Unified School District) data collected through our contacts from the Los Angeles (LA) Metro for task 4. We gathered MUSD's weekly attendance data for 2022 and 2023 for elementary, intermediate, and high schools from the MUSD and their hourly GoPass Tap data for 2022 (November and December) and 2023 (January-December except July) from LA Metro.

Fifth, we conducted a follow-up online survey of California transit organizations, based on the study in (*1*), to gather information about the existence and characteristics of current free/discounted transit pass programs for K-14, and college students. We also inquired about the impact of COVID-19 on ridership, recovery strategies, and measures adopted to aid in that recovery.

sk 1: Literature Review

Many California students face significant transportation challenges getting to and from school. Living too far for walking or biking, and lacking access to school buses or family transportation, they rely on public transit. However, even small transit fares can pose financial hardship for low-income families, potentially leading to school absences or missed extracurricular opportunities. To address this issue, some school districts have partnered with transit agencies to provide free or deeply discounted public transportation access for students whose transportation needs cannot be met by traditional school bus services.

Over the past two decades, US transit agencies have implemented various free and discounted pass programs for students at all levels, from K-12 to university. However, with a few exceptions (*5*, *6*, *9–11*), the impact of these programs on transit ridership has been relatively understudied by academics. Furthermore, existing research on school-public transportation partnerships tends to focus primarily on programs serving four-year universities (*12–16*), leaving a gap in understanding the effects of programs for younger students.

This document reviews existing research on free and discounted transit pass programs for K-14 students, summarizing key findings to inform our own study. Our search strategy involved using Google Scholar and Google's Search Engine to identify peer-reviewed journal and conference papers, reports, and policy briefs published since 2003. We employed various keyword combinations, including "free transit pass," "reduced transit pass," "discounted transit pass," along with "student," "students' welfare," or "student attendance," and focused our search on studies conducted in California, the US, and Canada.

The following review begins by examining studies on the impact of school transportation on student well-being. We then discuss research on discounted and free transit pass programs. While this review builds upon the work presented in (*1*), it also incorporates numerous relevant publications from the past three years. Finally, we highlight the research gaps that motivated this study.

Impact of Fare-Free Transit Pass Programs on Students' Ridership

Programs for High School, Community College, or Younger Students

AC Transit's program, which provided 24,000 bus passes to low-income middle and high school students, offers an early example of student transit pass programs. While the program did not demonstrably affect school attendance after one year (*17*), it did increase bus ridership. A study evaluating the program (*6*) confirmed no significant impact on attendance or graduation rates after one year, but did find increased bus ridership and participation in after-school programs and weekend trips (for activities such as employment and cultural events). Interestingly, bus ridership patterns varied by race. Among free bus pass holders, 26% of Asian students used the bus to get to school in the morning, compared to 67% of Black students. However, these racial variations were less pronounced for trips home from school.

While free student transit programs aim to improve educational access, they may not fully address the transportation challenges faced by many students, particularly those from minority groups. Transit networks are often designed to facilitate commutes to job centers, not necessarily to schools, and high-performing schools tend to be concentrated in affluent neighborhoods (*9*). A Denver, Colorado study of

approximately 550,000 6th and 9th grade students (*9*) found that only 53% of Hispanic and 63% of African American students lived within 30 minutes of a top-rated school, compared to 69% of White students. This disparity highlights the potential limitations of relying solely on public transit to equalize access to quality education.

A study in Baltimore, Maryland (*10*) further emphasized the challenges of using public transit to address unequal access to high-performing schools. Researchers used a fixed effects panel regression model to analyze the impact of public transportation on school attendance for 2,801 students transitioning from 8th to 9th grade. Their findings suggested that the complexities of public transit, particularly the need for transfers, can lengthen commutes and contribute to student absences.

The studies by (*9*) and (*10*) concluded that simply providing free transit passes would not necessarily lead to improved school enrollment or academic performance if high-performing schools remain geographically inaccessible to students in underserved communities.

A study evaluating the Minneapolis Go-To Student Free Pass program (*5*), which replaced the traditional yellow school bus system, found a positive impact on student attendance. Student-reported use of the free pass reduced excused absences by 11.5%, while simply being eligible for the pass reduced excused absences by a more substantial 27.5%. The study also noted that the program had an even greater effect on students living within the school's original walk zone (within 2 miles), suggesting that it was particularly effective in facilitating access for students who previously may have faced barriers to transportation.

Similarly, a study of the Minneapolis, MN Student Pass program (*18*), which provided high school students with unlimited free rides between 5 am and 10 pm during the school year, found a 23% reduction in absenteeism among pass users, along with an increase in their GPAs. The program's positive effects were particularly pronounced for students eligible for free/reduced lunch, as well as for Black, foreign-born, and students from single-parent families.

In contrast, a study of a free transit pass program for K-12 students in Tallahassee, Florida (*19*) found an *increase* in chronic absenteeism among middle and high school students. The authors hypothesized that unrestricted access to free transit may have inadvertently enabled students to skip school more easily. They also suggested that the complexity of some public transit routes may have negatively affected school attendance.

While other studies primarily focused on the effects of free transit passes on school attendance and academic performance, a study by (*20*) examined the impact of Sacramento, CA's RydeFreeRT program on student travel. Surveying 5,600 K-12 students in 2019, they found a statistically significant increase in students using RydeFreeRT for school commutes and a corresponding decrease in automobile use. (*20*) also observed that RydeFreeRT facilitated student travel to destinations beyond school.

Research on reduced and free transit pass programs in Los Angeles County includes a study of the University of California, Los Angeles's Unlimited Access program (also known as BruinGO) (*21*). This

analysis found a 56% increase in transit use and a 20% decrease in solo driving during the program's first year.

A 2013 joint study by Los Angeles County school districts and the Metropolitan Transportation Authority (MTA) explored the potential impact of free, unrestricted transit passes for all local students (preschool through college) on various factors, including student health, school attendance, transit ridership, and after-school program participation (*7*). Based on a literature review and expert interviews, the study projected a 6 to 14 percent increase in transit ridership within the first two years (equivalent to 63,200 to 158,000 additional daily riders) and a 26 percent increase after ten years (284,000 daily riders). While this specific program was never implemented, it can be considered a forerunner to LA Metro's GoPass program.

Partnerships between municipalities and transit agencies have increasingly led to successful programs. One example is the Massachusetts Bay Transportation Authority (MBTA) program, which in 2015 offered monthly discounted passes to students and young adults aged 19-21 who were not enrolled in school (*22*).

A study of the U-Pass program at Rio Hondo Community College in Whittier, CA (*11*) examined the program's impact on academic outcomes for 28,463 students using propensity score matching. The researchers found that U-Pass users had higher semester-to-semester retention rates, completed more course credits, and were 27% more likely to graduate within the study period. Notably, these benefits disproportionately accrued to Hispanic and lower-income students, and the positive effects remained consistent across gender and enrollment status (full-time or part-time).

Despite its scale and potential impact, LA Metro's GoPass program has received limited scholarly attention. One exception is the work of Cruz (*23*), who investigated the relationship between GoPass enrollment and the Student Equity Needs Index (SENI). Cruz found that schools with higher SENI scores (indicating greater disadvantage) also had higher GoPass enrollment rates among students with disabilities. Furthermore, the study revealed that GoPass enrollment rates were 12.8% higher in middle schools and 29.4% higher in high schools compared to elementary schools.

Examining the Canadian context for student free transit programs can provide valuable insights due to similarities with the US. Of the three Canadian studies identified (*12*, *16*, *24*), two reported positive outcomes: (*12*) found potential benefits for students at Simon Fraser University, and (*24*) observed positive effects for high school students in Kingston, Ontario. The third study, focusing on a discounted pass program for University of Quebec in Montreal students, found only a moderate to negligible impact on transit use, likely due to the fact that approximately 46% of students with access to the discounted passes lived with their parents, often further from campus (*16*). In Kingston, Ontario (*24*), a survey of 9th and 12th-grade students explored the program's impact on travel patterns. Older students used the passes more frequently, possibly due to increased independent travel. Ridership peaked on weekday mornings (7-9 am) and afternoons (2-4 pm), with weekend trips accounting for about 15% of overall ridership. Interestingly, many stops frequented by students were located near shopping areas, not directly adjacent to high schools.

Table 1 summarizes a selection of the research discussed in this review. Several gaps exist in the literature on student public transportation passes. Beyond the ongoing debate about the impact of such passes on school attendance, there is a lack of research analyzing the effects of free or discounted passes specifically in California. With the exceptions of (*11*), which studied a community college U-Pass program, which explored a hypothetical program, and (*23*), which examined the correlation between GoPass enrollment and SENI scores, LA Metro's GoPass program remains largely unexamined.

Table 1. Summary of selected studies on free transit pass programs for students

Authors (year)	Data and study area	Questions considered	Significant variables and findings
(*21*)	- Unlimited access (via BruinGO) at the University of California, Los Angeles - 1997–1998 - Descriptive statistics	- Effect of BruinGO on commuting modes (bus, drive alone, vanpool, carpool, bike, walk) by faculty, staff, and students?	- During the first year of the BruinGO program, transit use increased by 56% year, and solo driving decreased by 20%
(*6*)	- AC transit-free bus passes in San Francisco - 1,073 (2002) and 1,234 (2003) students from 17 schools - Before and after program surveys, interviews, focus groups. Descriptive statistics	- Mode to school? Weekend ridership? Attendance, after-school program?	- 1. No impact on school attendance but a significant impact on after-school activities, especially for middle school students (+13%) - 2. Between 2001 & 2003, low-income students' weekend trips increased from 42% to 45%
(*12*)	- Survey of alums of Simon Fraser University in Canada (n=204)	- Usage of transit after graduation	- (+) had a U-Pass in university, current transit access; 2. No significance: frequency of transit use during university, gender, income, marital status
(*7*)	- Estimated costs of transit for 640,000 LAUSD students for the 2012–2013 school year - Expert opinion, descriptive statistics, cost–benefit analysis.	- Impacts on schools & districts, transit agencies, and riders?	- 1. (+) revenue; 2. (-) revenue, (+) ridership; 3. (-) juvenile contact with justice system, (+) crowding
(*9*)	- 2014 data from 8,000 Denver Public Schools students' records - Descriptive statistics	- Accessibility of top middle/high schools	- (+) white, (+) FRL non-eligibility, (-) Hispanic
(*13*)	- Survey of 21 transit agencies and 20 universities in the US	- Factors contributing to a successful universal college student transit pass program	- (+) stable funding, broad support, identified/clear benefits, ongoing marketing, formal agreements
(*10*)	- Baltimore City Public Schools provided MTA bus passes - 2,801 unique 8th & 9th grade students in 2013-14 & 2014-15, respectively. - Fixed effect panel model	- Travel time? Impact on attendance? Days absent?	- 1. (+) increase between 8th & 9th grade: 2. Students enrolled for a full year at the same school had better attendance and were less likely to be chronically absent.

Authors (year)	Data and study area	Questions considered	Significant variables and findings
(*11*)	-28,463 community college students at Rio Hondo College, Los Angeles -Fall 2016, 2017, and 2018 -Propensity Score Matching (PSM)	-U-Pass receivers? Student retention? Credit completion?	-1. (+) female, (+) <25 years old, (+) Hispanic, (+) financial aid recipient, (-) white or Asian; 2. (+) Receiving U-Pass
(*20*)	-2,592 7th-11th grade students in the Sacramento City Unified School District -2 surveys: 09/20 & 04/20 -Descriptive statistics	-Impact on absences, tardies? Transit ridership after implementation?	-1. No substantial differences in either; 2: disproportionately (+) black, white, fewer computers at home
(*14*)	-Administrative records from 245 female engineering students at Qatar University	-GPA, class attendance, class passing	-(+) bus service usage
(*5*)	-Minneapolis Go-To Student Pass Program -1,433 high school students (Spring 2013 & Fall 2014). In-class online survey (May & June 2015). -Poisson regression, Difference-in-differences & 2-way fixed effects	-Impact on excused absences? Impact on a number of unexcused absences?	-1. (-) pass use, (-) pass eligibility, (-) FRL status; 2. largely unchanged
(*15*)	-246 survey respondents at Marquette University, Milwaukee, WI (n = 229 in the model)	-U-PASS usage	-(-) car ownership, (-) white, (+) perception of safety, (-) perception of punctuality/reliability
(*19*)	-Attendance data from 754 middle/high schools in Florida -2013-2018 -Synthetic control method	-Impact on school attendance and chronic absenteeism?	-(+) proportion of racial minorities, (+) proportion of FRL students
(*16*)	-2014 university travel survey with 1,870 usable responses (15.8%) -Cross-sectional survey of UQAM students (Montreal, Canada)	-Probability of transit use	-(-) age of student (flattens at 26+)
(*23*)	-667 schools (in the Los Angeles Unified School District) -2021-2022 school year) -Ordinary Least Squares	-Did GoPass impact underprivileged schools?	-(+) % of Low-Income Students with Disabilities, (+) FRL eligible, -(-) % Standard English Learners

Task 2: Travel patterns of students

For task 2, we analyzed the travel patterns of students participating in LA Metro's GoPass program. Given that tap cards are used only upon boarding (not alighting), and that privacy regulations preclude tracking individual cards, our analysis is based on aggregate boarding data provided by LA Metro for 2022. Although GoPass launched in Fall 2021, the limited number of boardings during that initial period, combined with the absence of a tap card requirement until January 2022, makes the 2022 data the most suitable for examining student travel patterns.

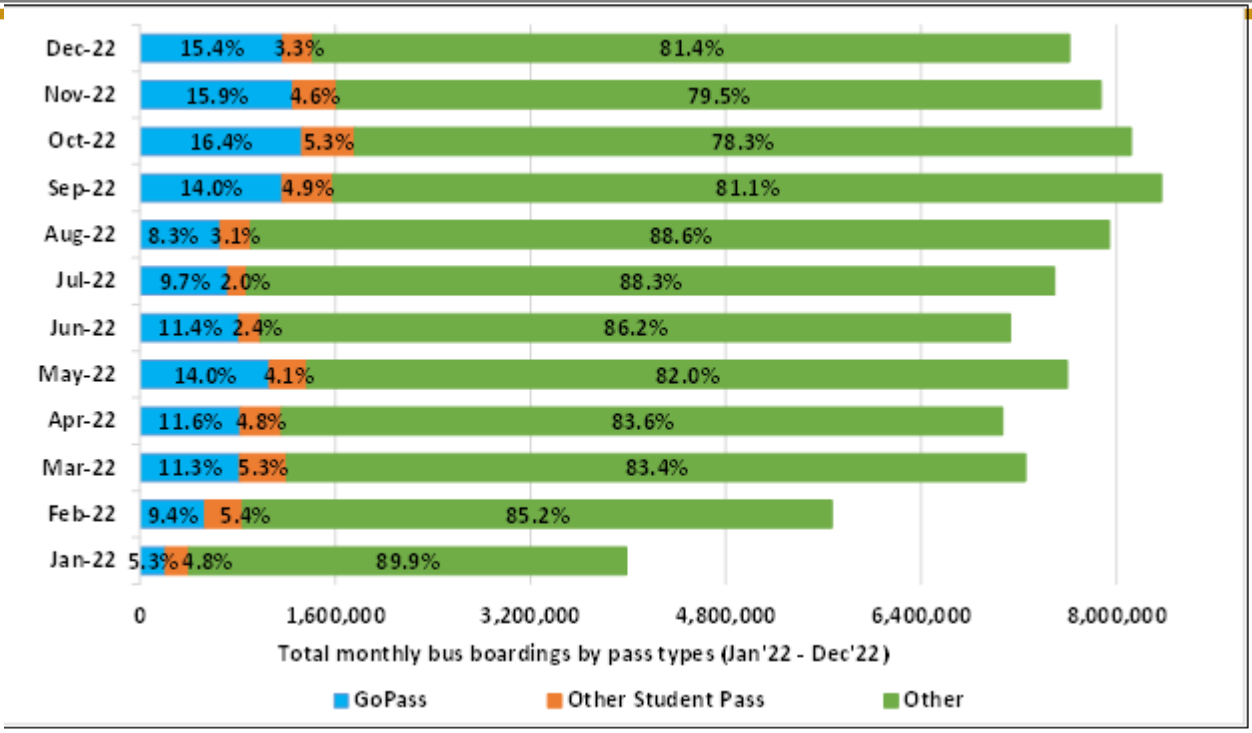
Total boardings by months

In 2022, LA Metro had 86,119,927 bus boardings and 21,882,697 train boardings, of which 12.3% (10,563,671) and 5.4% (1,170,840) came from GoPass. Table 2 presents a summary of boardings by month.

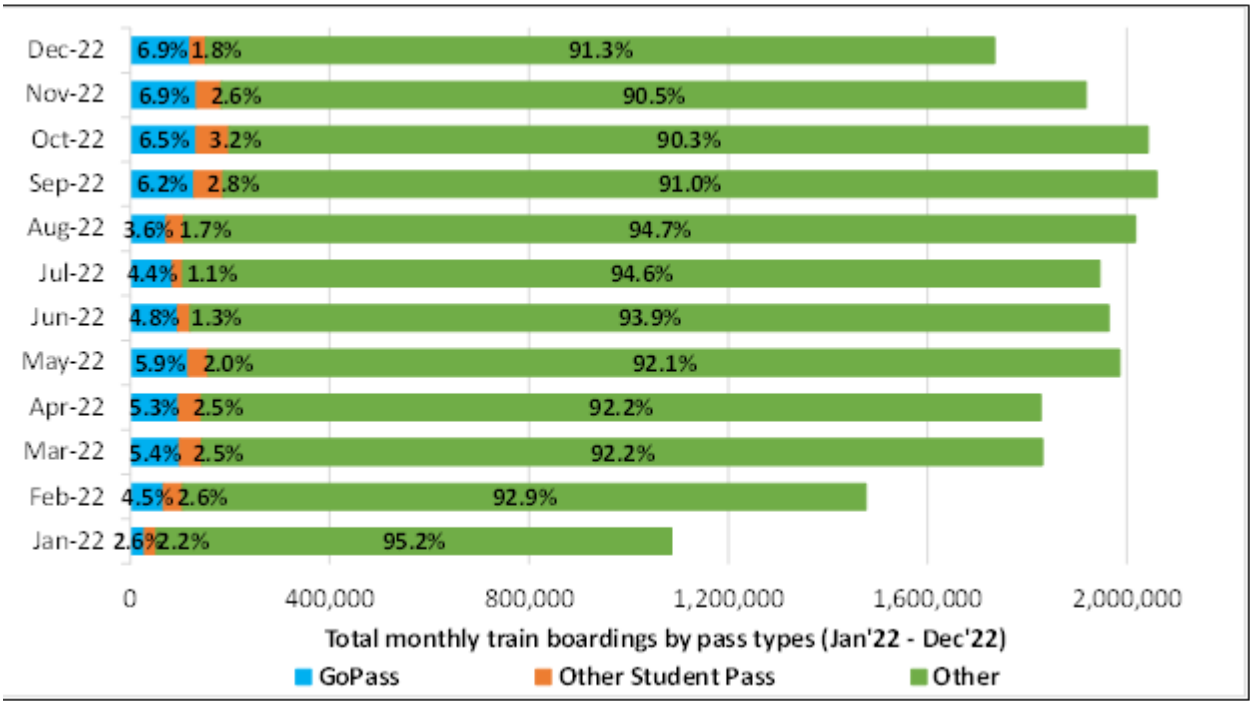
Table 2. Monthly GoPass boardings by mode

	Bus			Train		
Month	GoPass	Total boardings	GoPass as a % of all bus boardings	GoPass	Total boardings	GoPass as a % of all train boardings
Jan-22	210,031	3,985,811	5.3%	28,218	1,085,643	2.6%
Feb-22	532,588	5,669,049	9.4%	66,297	1,475,759	4.5%
Mar-22	819,138	7,254,492	11.3%	98,315	1,830,475	5.4%
Apr-22	821,891	7,066,933	11.6%	96,770	1,826,671	5.3%
May-22	1,060,232	7,596,600	14.0%	116,677	1,985,512	5.9%
Jun-22	813,692	7,132,101	11.4%	95,220	1,963,364	4.8%
Jul-22	724,028	7,492,668	9.7%	84,667	1,945,168	4.4%
Aug-22	658,879	7,943,006	8.3%	72,110	2,016,674	3.6%
Sep-22	1,168,161	8,368,160	14.0%	127,890	2,059,657	6.2%
Oct-22	1,329,001	8,120,821	16.4%	132,415	2,041,740	6.5%
Nov-22	1,253,788	7,874,589	15.9%	132,587	1,917,892	6.9%
Dec-22	1,172,242	7,615,697	15.4%	119,674	1,734,142	6.9%
Total	**10,563,671**	**86,119,927**	**12.3%**	**1,170,840**	**21,882,697**	**5.4%**

Figure 1 also depicts monthly boardings by mode. Panel A shows that GoPass boardings made up between 5.3% (January) and 16.4% (October) of boardings for buses and between 2.6% (January) and 6.9% (November and December) for trains. GoPass boardings are lower during the summer because of the academic calendar. They also dwarf the boardings from other student pass programs offered by LA Metro.



Panel A. Buses

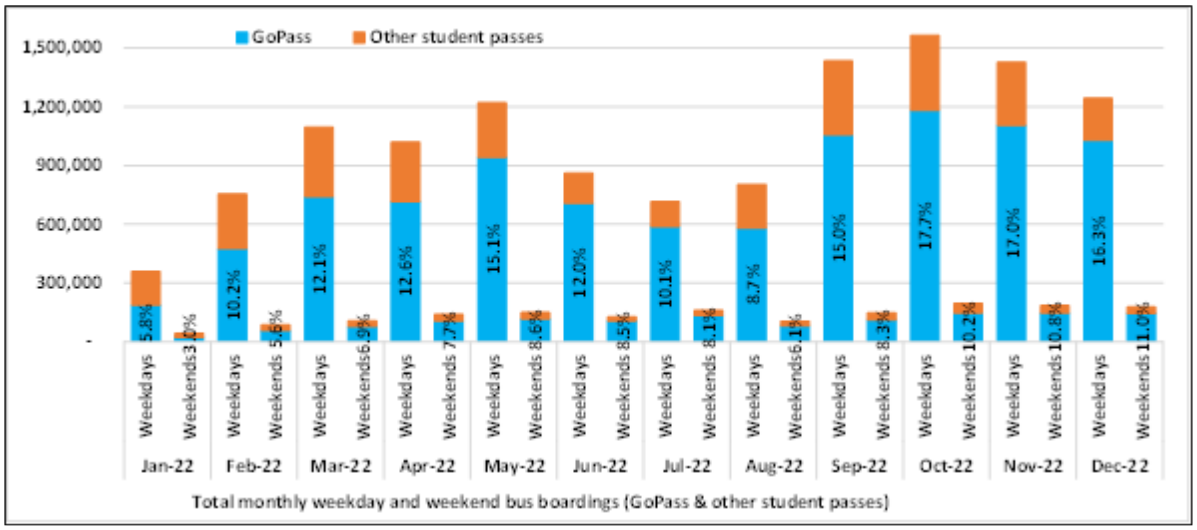


Panel B. Trains

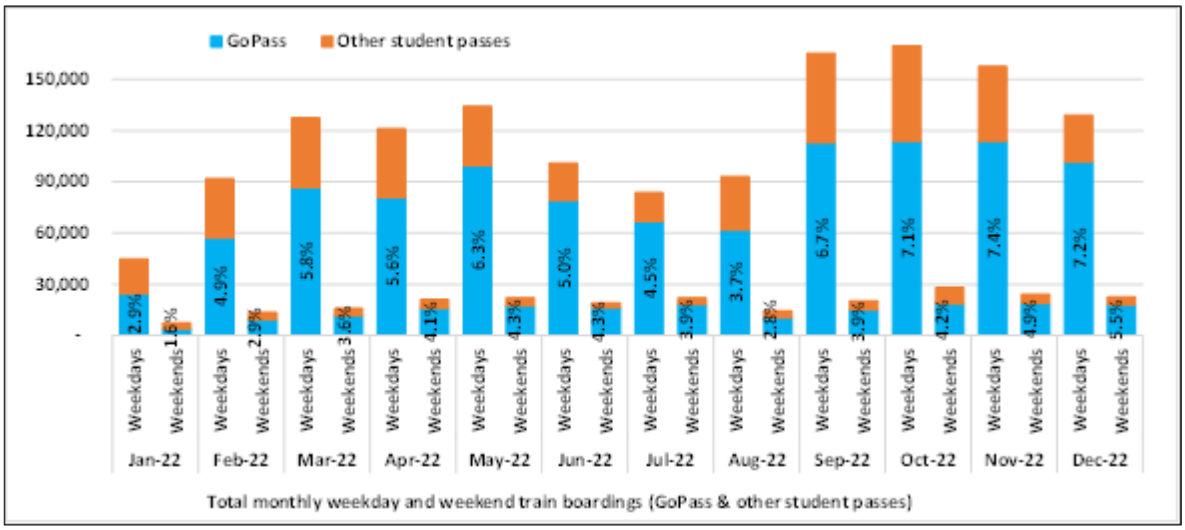
Figure 1. GoPass and total boardings by month

Total boardings by months: weekdays vs. weekends and day of the week

It is also interesting to know what share of boardings occurs on weekends versus weekdays by buses and trains (Panels A and B of Figure 2). For buses, Panel A of Figure 2 shows that weekday GoPass boardings varied between 5.8% (January 2022) and 17.7% (October 2022) of total LA Metro monthly boardings, while weekend GoPass boardings ranged between 3.0% (January 2022) and 11.0% (December 2022). The weekend-to-weekday boardings ratio varied between 10.5% (March 2022) and 23.1% (July 2022). The latter corresponds to a time when most LAUSD students were on vacation.



Panel A. Buses



Panel B. Trains

Figure 2. Total boardings by months, weekdays vs. weekends

For trains, results are similar, although GoPass represents a smaller share of total boardings, possibly because commuters make up a larger share of train ridership. From Panel B of Figure 2, we see that weekday GoPass train boardings ranged between 2.9% (January 2022) and 7.4% (November 2022), while weekend train boardings varied between 1.6% (January 2022) and 5.5% (December 2022). The weekend-to-weekday train boarding ratio was slightly higher than that for buses: 13.3% (March 2022) and 27.1% (July 2022). The growth of the GoPass program, with the addition of new participating schools, contributed to higher boardings for both buses and trains in the fall of 2022.

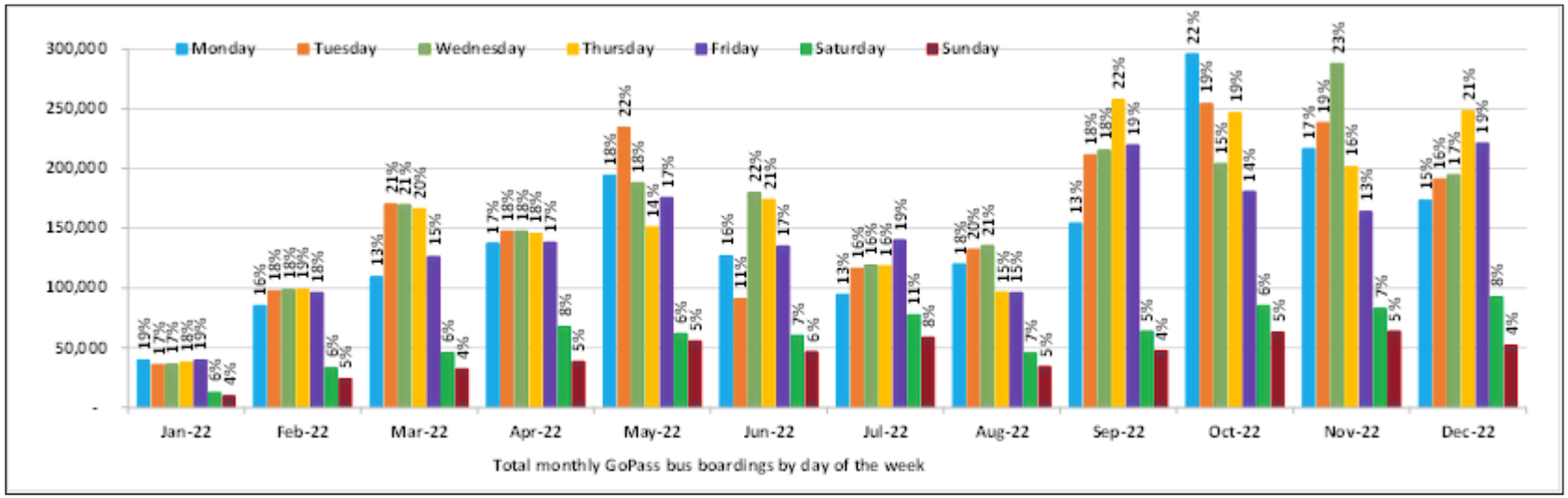
A look at GoPass boardings by day of the week (Figure 3) shows that they are highest mid-week (mostly Tuesdays and Wednesdays between February and May 2022). However, between September and December, these peaks vary: Thursday was the busiest day for September and December, but for October, it was Monday, and for November, it was Wednesday. For weekend boardings, Saturdays are more popular than Sundays.

Boardings by time of day

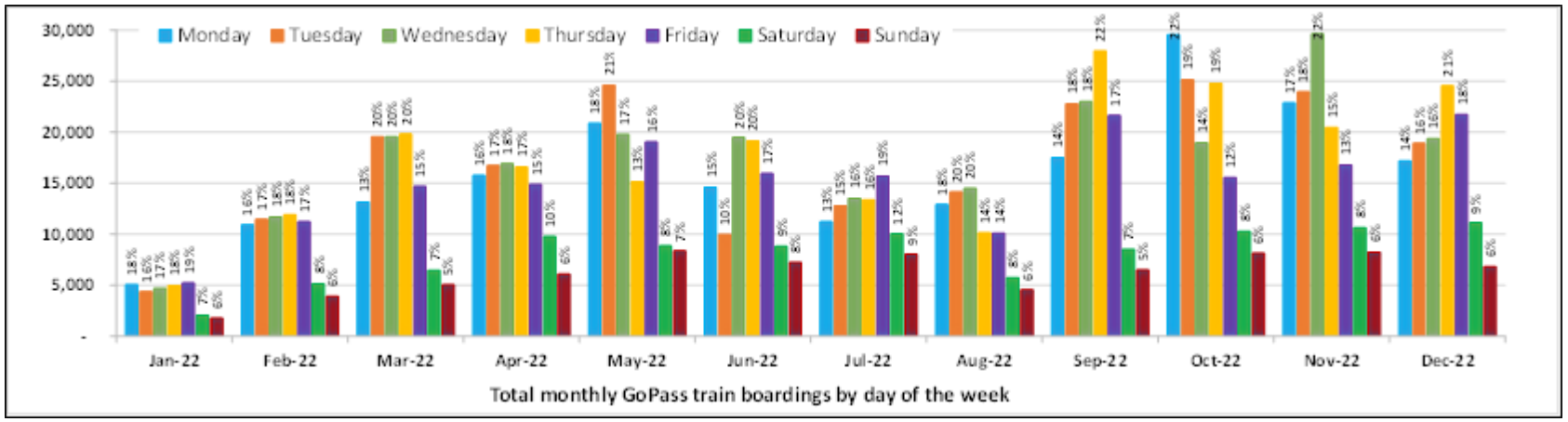
Figures 4 and 5 show monthly boardings by hour for GoPass and for passengers who do not have student passes. This information is important for operational purposes, although we learned from personal communications with LA Metro staff that GoPass does not necessitate adding buses. Still, it helped fill regularly scheduled buses on several lines and (to a smaller extent) contributed to train boardings.

Starting with general boardings, they pick up between 5 and 6 am to culminate between 7 and 8 am for the morning peak for both buses (Figure 4) and trains (Figure 5). We also note that the morning peak is slightly sharper and not as broad as the evening peak, which starts ramping up between 3 and 4 pm before beginning to ramp down around 6 pm. From Panel A (Figure 4), we see a gradual build-up in boardings from January to March as Angelinos emerge from COVID-19 and gradually increase their transit use. In the last two months of 2022, there was a slight drop in train transit use, while for buses, November and December boardings increased slightly during the day but decreased after the pm peak.

We observe similar patterns for GoPass boardings, with a gradual increase from January to May as more schools sign up for this program, a decrease during the summer, and an increase again in August and September as students return to school. The morning peak for GoPass boarding is also between 7 and 8 am, but it is earlier (between 3 and 4 pm) than the evening, which should help LA Metro manage its capacity. As expected, morning and afternoon peaks are less marked in July, as many students are out of school.

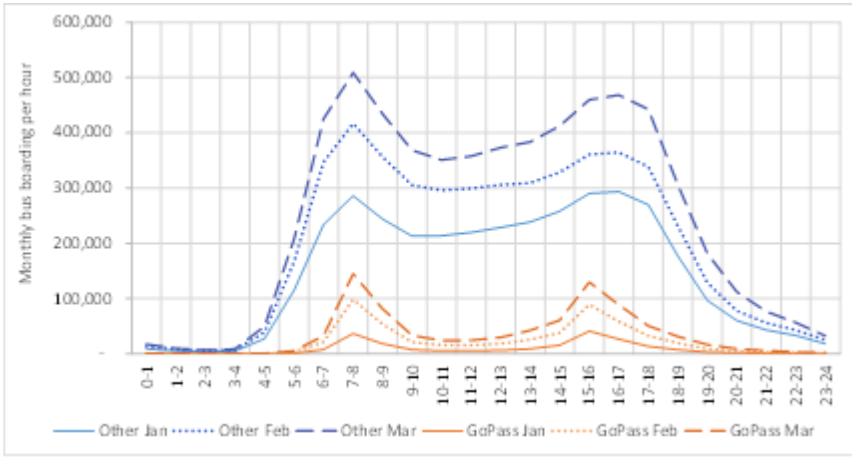


Panel A: Bus boardings

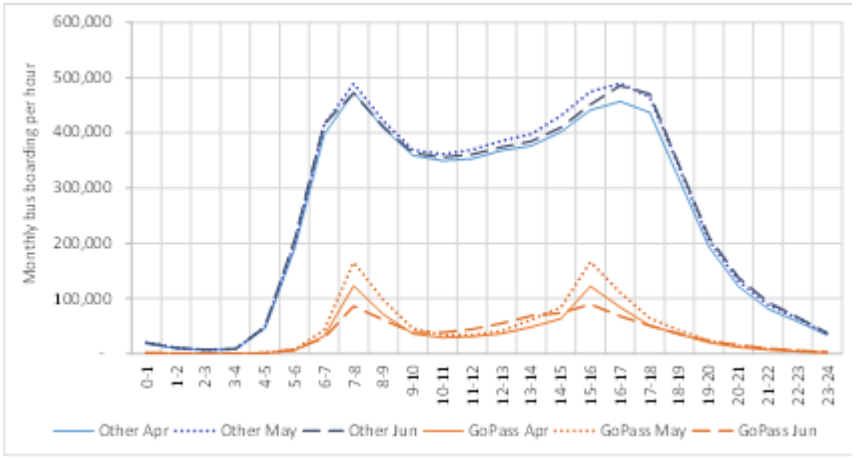


Panel B: Train boardings

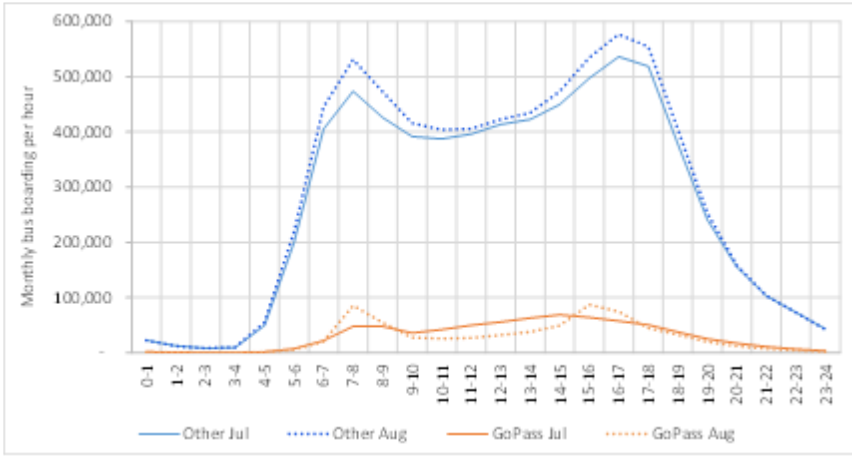
Figure 3. Total monthly boardings by day of the week



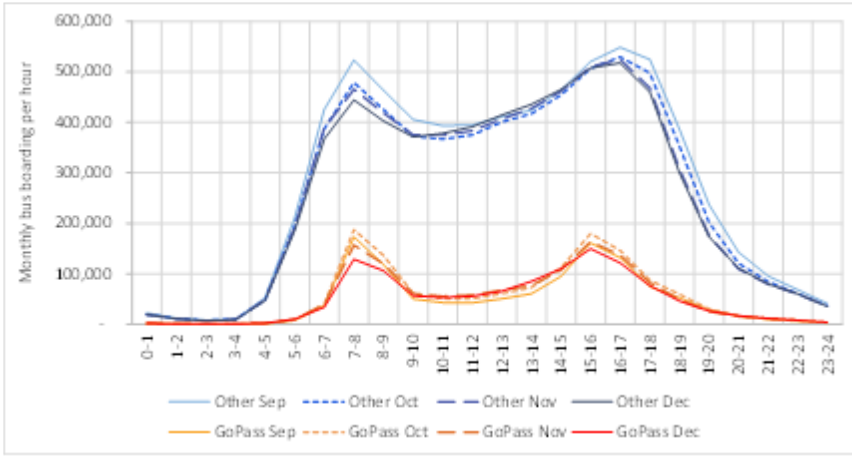
Panel A: January-March



Panel B: April-June

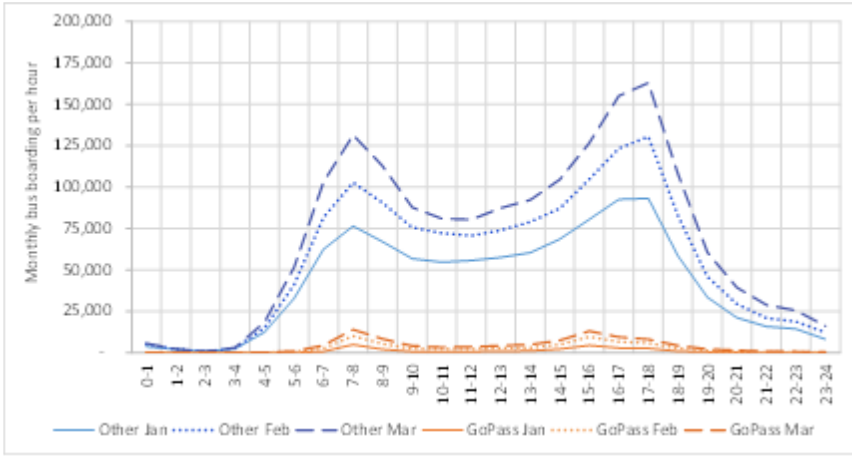


Panel C: July-August

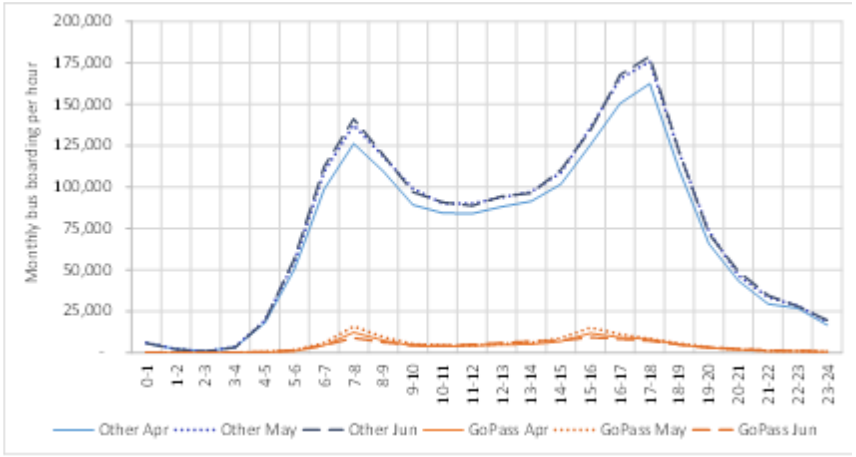


Panel D: September-December

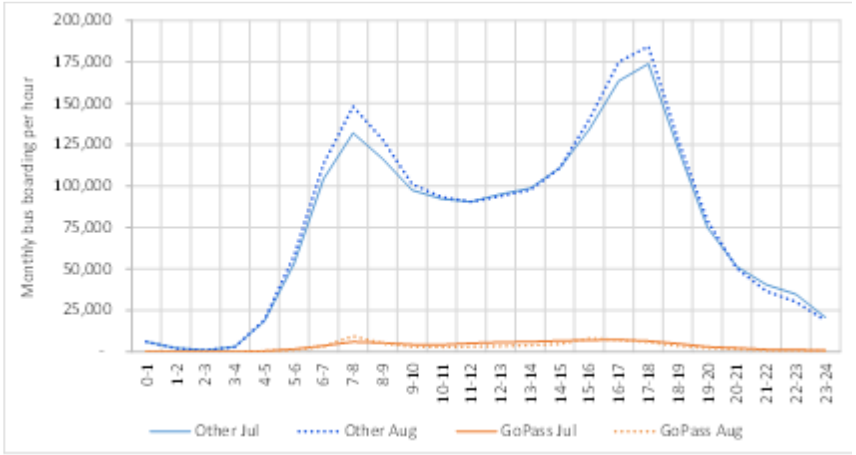
Figure 4. Monthly bus boardings by hour



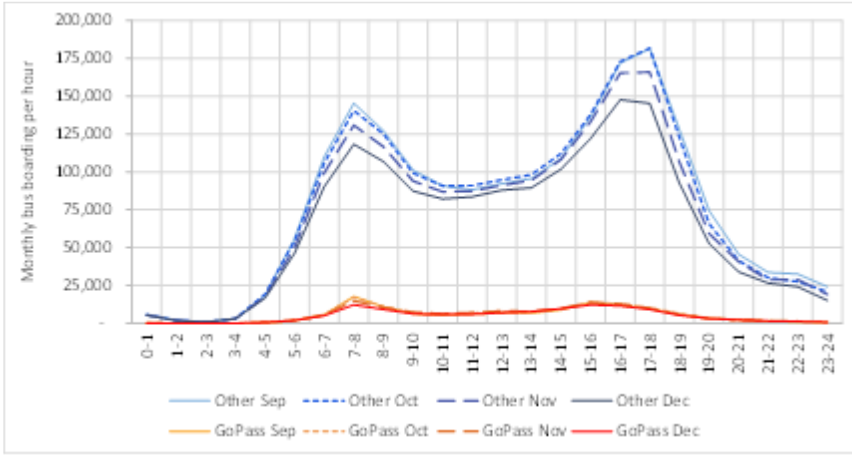
Panel A: January-March



Panel B: April-June



Panel C: July-August



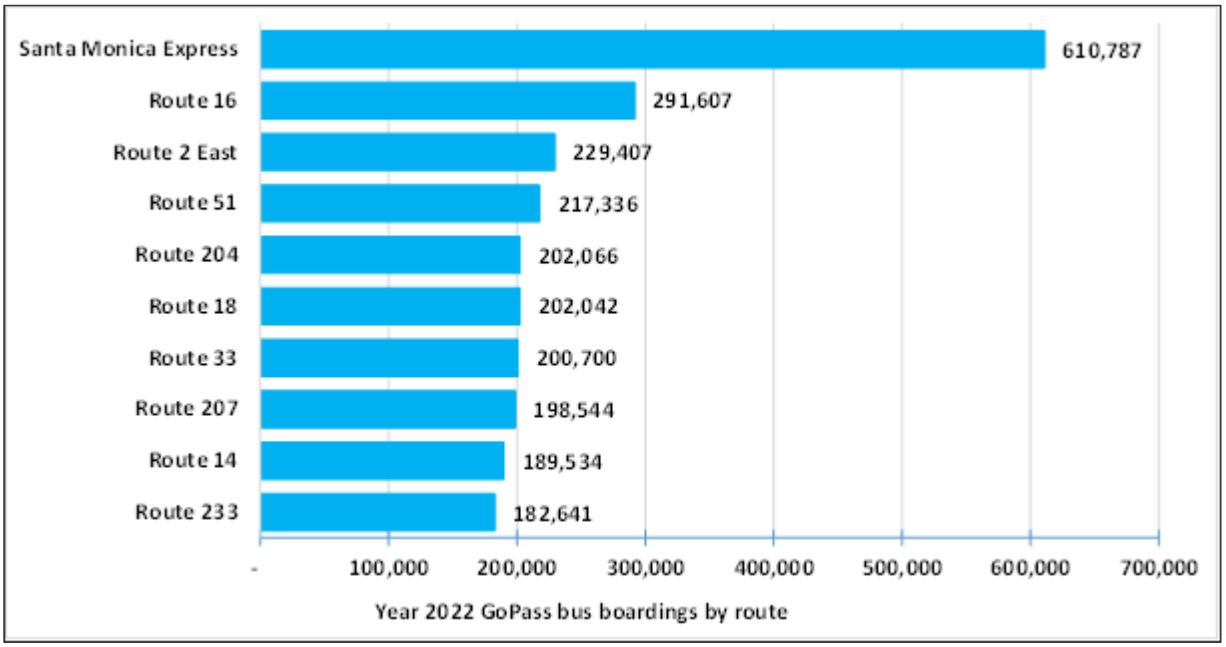
Panel D: September-December

Figure 5. Monthly train boardings by hour

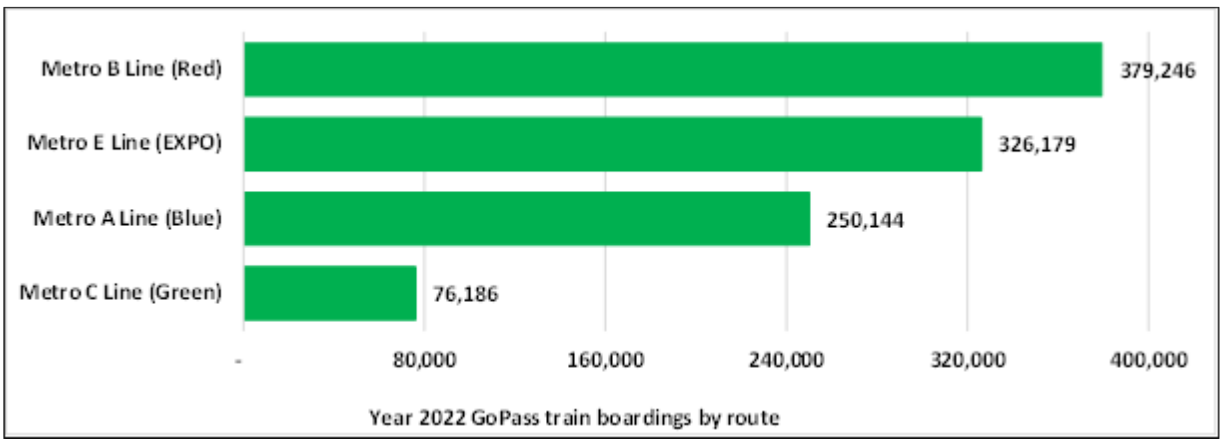
Boardings by line

A spatial analysis of boardings is also useful for LA Metro to efficiently manage its buses and trains. The top routes (in terms of boardings) for buses and trains are shown in Figure 6.

Panel A of Figure 6 shows that the top bus route is the Santa Monica Express, which connects downtown Los Angeles to Santa Monica, with over 610,000 boardings in 2022. It is followed by Route 16, which is parallel to the Santa Monica Express for most of its length, and goes from downtown Los Angeles to West Hollywood.



Panel A. Top 10 GoPass bus routes based on boardings (2022)



Panel B. Top 4 GoPass train routes based on boardings (2022)

Figure 6. Top GoPass bus and train routes for year 2022

Figure 7 shows the location of the top 10 GoPass bus routes for 2022. Most run west or south from downtown Los Angeles and serve the denser parts of the City. A total of 324 different bus lines saw some GoPass boardings in 2022, but the top 40 routes captured over 75% of total boardings.

Figure 8 shows the top four GoPass train lines, although we note that the fourth most important train line for GoPass boardings (the Green line) has less than a third as many boardings as the third most important GoPass line (the Blue line). These top four train lines had close to 90% of all GoPass train boardings in 2022 (over 80% for the top three train lines). Although train lines extend considerably the reach of GoPass, they have only 25% of the boardings of bus lines.

GoPass operators

A total of thirteen operators carried GoPass bus passengers between January 2022 and September 2022, but the top three (77.3% for La Metro, 11.3% for Long Beach Transit, and 5.8% for Santa Monica's Big Blue Bus) captured 94.4% of boardings in 2022.

For trains, seven operators carried GoPass holders, but LA Metro is by far the main provider with 98.6% of 2022 boardings.

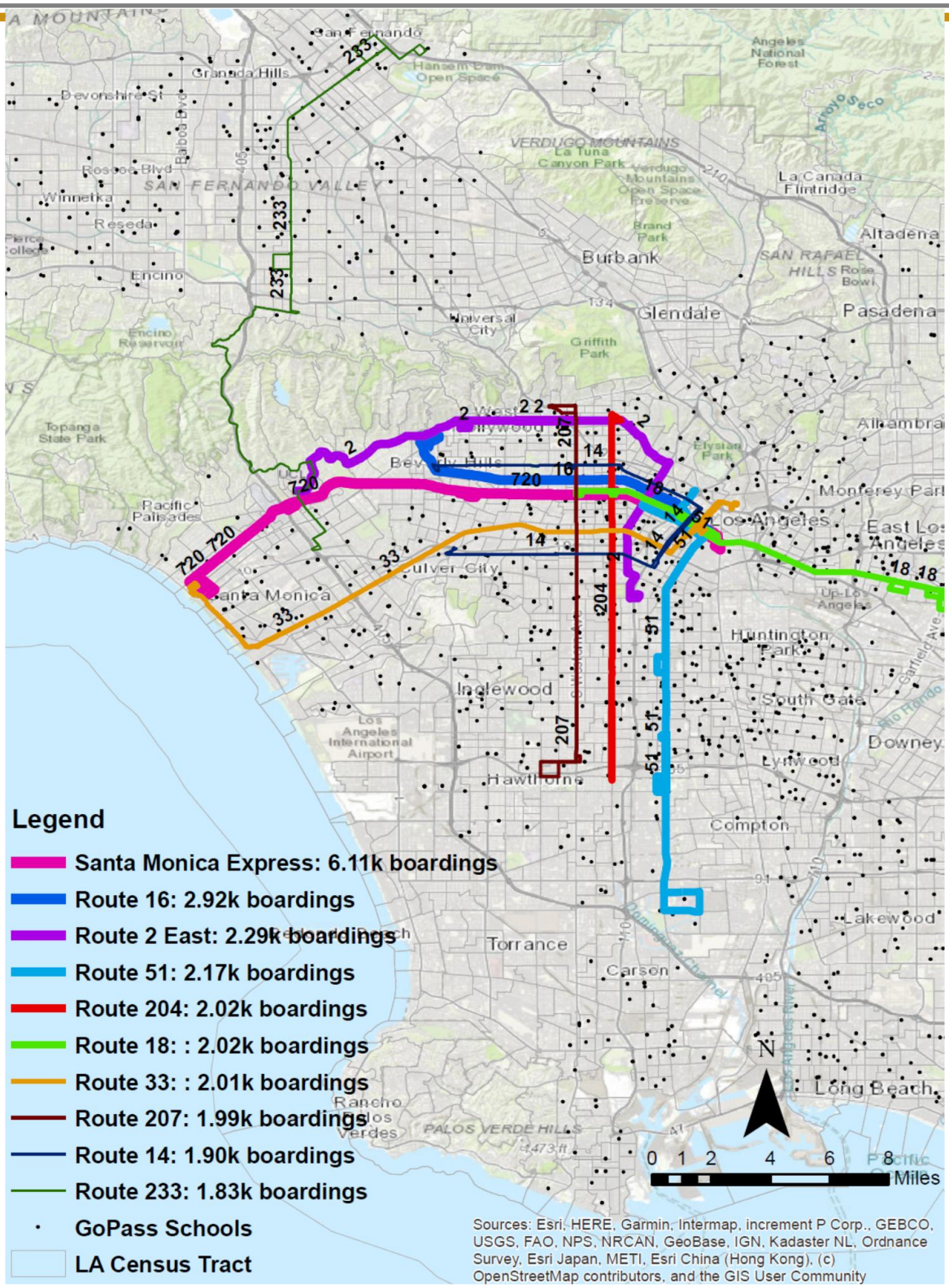


Figure 7. Top 10 GoPass bus routes (2022)

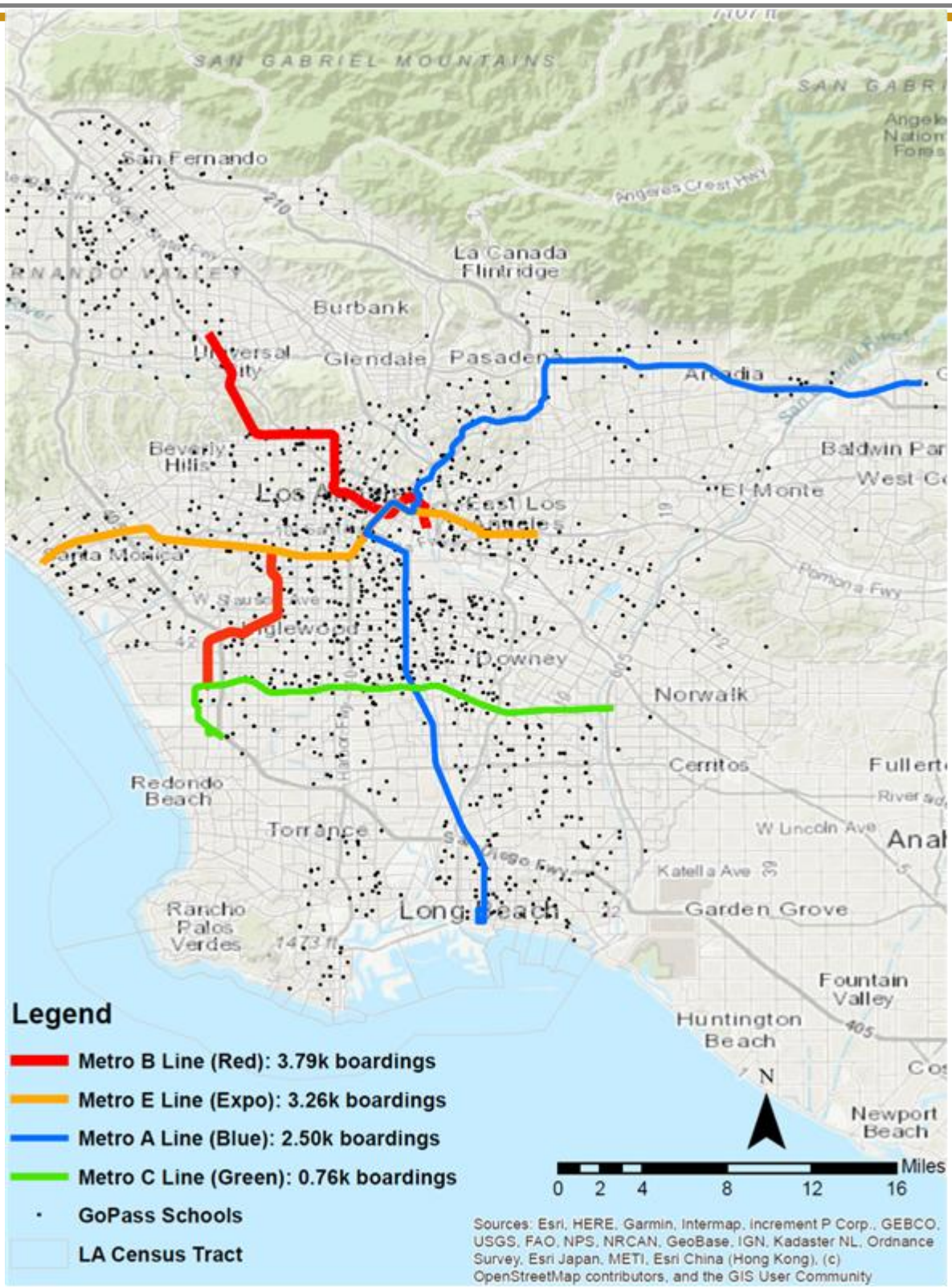


Figure 8. Top 4 GoPass train routes (2022)

Task 3: Characteristics of Participating Students

Our third task involved estimating a generalized spatial model to explain GoPass enrollment at the census tract level, using a comprehensive set of explanatory variables. Lacking individual tap card data for GoPass participants, we instead used a spatial regression model to analyze statistically aggregated GoPass boarding data for 2023, also by census tract. Figure 9 depicts our dependent variable.

Given that bus users are unaffected by census tract boundaries, GoPass boardings at a bus stop near multiple tracts are likely influenced by the characteristics of all those neighboring areas. This suggests spatial interactions between boardings in adjacent census tracts.

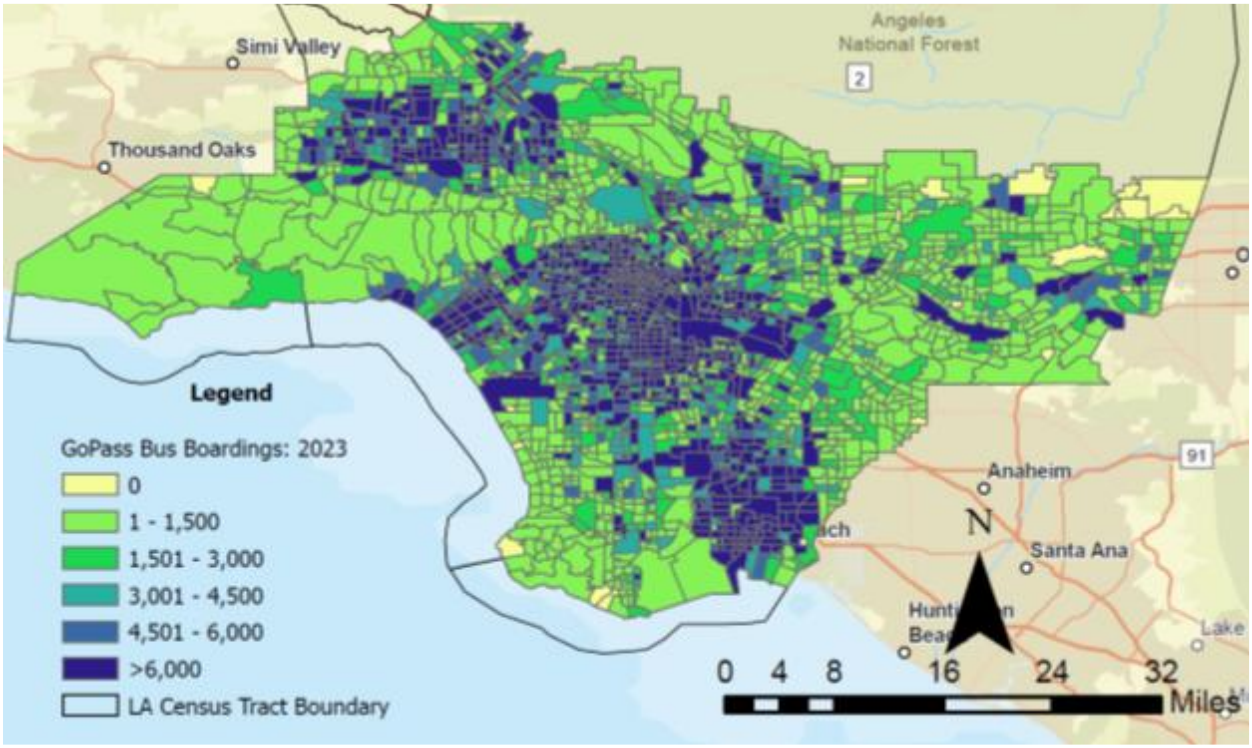


Figure 9. Distribution of GoPass bus boardings by census tract (Jan-Dec 2023)

Data

The selection of our explanatory variables was guided by our literature review and the available data. We organized these variables into five sets: socioeconomic characteristics, crime, social vulnerability, the built environment, and proximity to participating schools.

Socioeconomic characteristics

To account for socioeconomic factors, we extracted data on several characteristics by census tract from the American Community Survey's 5-year estimates (2018-2022). This census tract-level data is essential for our spatial analysis.

The socioeconomic variables selected for this analysis included key individual characteristics (gender, race, Hispanic status, educational attainment for those 25 and older, and employment status) and

household characteristics (income, structure, and vehicles) known to influence travel behavior. Data on housing units by occupancy type and housing cost was also included to capture the impact of housing market conditions.

Consistent with the literature (*22*, *25*, *26*), we collected data on gender, race, and Hispanic status, recognizing their potential influence on commuting mode choice. Gender and age data were collected for three age groups (under 5, 5-20, and over 20), with counts provided for both male and female individuals. Data on race included counts for White, African American, Asian, and an "Other" category. The number of Hispanic individuals was also retrieved.

As education and employment status can affect student commuting patterns (*27*, *28*), we collected data on educational attainment (for those 25+) and employment status (for those 18+). While parental education and employment data would be preferable, these variables serve as a reasonable proxy.

Household characteristics play a key role in determining how students commute to school (*11*, *28*, *29*). To capture these influences, we included the following variables in our model: median household income (in 2021 inflation-adjusted dollars), the number of households categorized by size (one, two, three, and four or more members), and the number of adults with and without children under 18.

To account for the potential influence of vehicle ownership on student commuting patterns (*28*, *29*), we obtained data on the number of housing units with zero, one, two, three, or four or more vehicles.

The influence of housing and housing costs on boardings was also considered through the inclusion of data on the number of rented and owned housing units, median gross rent, and median home value.

Crime

Given the importance of crime in student commuting safety (*30*–*33*), we collected and processed violent and property crime data from multiple sources (Los Angeles Police Department, Long Beach Police Department, and Los Angeles County Sheriff's Department) using GIS. Where census tract-level data were unavailable (primarily in smaller cities), we used average city-level crime statistics. A one-year lag was applied to all crime data to reflect the time required for crime information to become known and for households to adjust student commuting modes.

Social Vulnerability Index (SVI)

We are investigating whether students who benefit from GoPass live in areas with higher social vulnerability. To do this, we included the Social Vulnerability Index (SVI) in our models. The SVI, a measure of community resilience developed by the CDC and the Agency for Toxic Substances and Disease Registry (*34*), captures factors that influence a community's ability to recover from disasters.

To calculate the 2020 SVI at the census-tract level, the CDC uses four components (or "themes"). For each component, the percentile ranks of its ACS 5-year variables are summed: 1) socioeconomic status (income, poverty, employment, and education); 2) household composition and disability (age, single parenting, and disability); 3) minority status and language (race, ethnicity, and English-language proficiency); and 4) housing type and transportation (housing structure, crowding, and vehicle access).

The sums are then ranked, producing percentiles from 0 to 1, where higher values indicate greater vulnerability.

Figure 10 illustrates the geographic distribution of the overall SVI within our study area. Comparison with bus boarding data shows a concentration of highly vulnerable census tracts in areas with higher GoPass boardings.

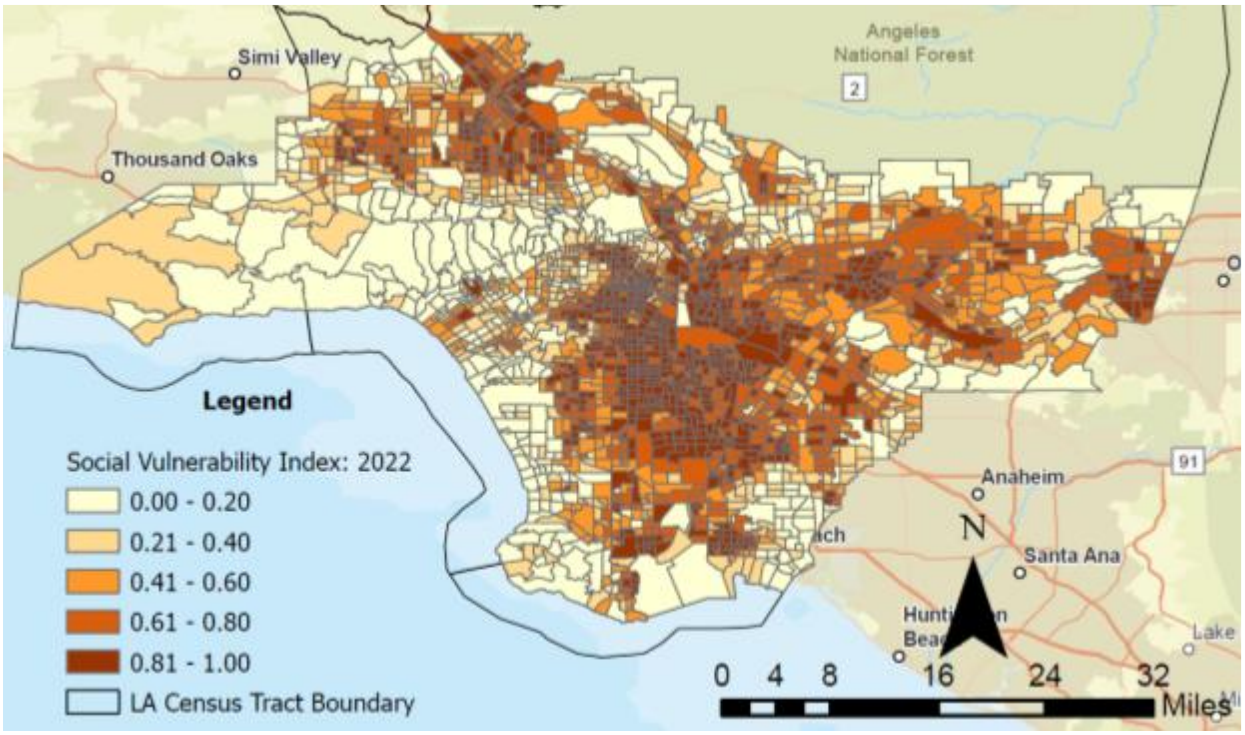


Figure 10. Social Vulnerability Index

Built environment

Our built environment variables encompass several factors: density (population and intersection), housing (single- and multi-family and non-residential units), land use diversity (entropy index), transit access (number of transit stops and GoPass-participating schools within 30 minutes by bus), and network characteristics (network density).

It is generally accepted that higher population densities facilitate the provision of effective transit services, thereby increasing student bus ridership (*35–37*). Population density for each census tract was calculated using population and boundary shapefile data obtained from the Census Bureau's TIGER/Line Shapefiles, supplemented with area data from the LA County website.

To examine the influence of housing stock on GoPass bus boardings, we incorporated the number of single-family, multi-family, and non-residential parcels in each census tract. This approach is supported by research indicating that children in high-density single-family areas are less likely to use bus transit

(*36*, *37*), likely due to factors such as safety and affluence (*36*). These variables were generated using GIS and 2019 parcel-level land use data from Southern California Association of Governments (SCAG).

The mix of different land uses in an area, known as land use diversity, is generally associated with increased transit ridership (*38*, *39*). However, the relationship between land use diversity and school commuting is complex. While some research suggests a positive link with students' active commute to school (*40*), other studies have found a negative association (*41*). To quantify land use diversity in our study area, we calculated an entropy index (EI):

$$\boldsymbol{EI_i} = \frac{-\sum_k p_{ki}(\ln p_{ki})}{\ln N_i} \quad (1)$$

In the above, "k" refers to a land use category, p_{ki} is the proportion of land use "k" in census tract "i," and Ni is the number of land-use categories in census tract "i". The entropy index ranges from 0 to 1, where zero is the most diverse, and 1 indicates a single land use.

Given the established relationship between transit service availability and the presence of transit lines and stops (*42*–*44*), a variable representing the number of transit stops per census tract was constructed. Transit stop data were sourced from the General Transit Feed Specification (GTFS) and Transitland and subsequently aggregated to the census tract level using GIS.

The potential influence of intersection and network density on transit ridership has been documented in the literature (*39*, *42*, *45*). Data pertaining to both intersection density (intersections per square mile) and road density (road length per square mile) were obtained from the EPA's Smart Location Mapping.

Access to transit facilities, particularly within walking distance, is known to promote walking and public transit use (*46*). To capture this effect in our model, we calculated the number of GoPass-participating schools accessible within a 20-minute bus ride (equivalent to 3.33 miles at 10 mph) and a 10-minute walk from the bus stop. This variable is motivated by data from the 2017 NHTS, which indicates a median door-to-door commute time of 32 minutes for students using public transit, compared to approximately 14 minutes for those who walk, bike, or are driven. Summary statistics for all variables, including some rescaled for modeling purposes, are presented in Table 3.

Table 3. Summary statistics of the spatial model variables (N=2,163)

Variables	Mean	SD	Min	Max
A. Dependent variables				
Total annual GoPass bus boardings ('00,000): 2023	0.069	0.112	0.000	1.296
B. Explanatory Variables				
1. Socio-Economic Characteristics				
Number of males <5 years old ('00,000)	0.001	0.001	0.000	0.005
Number of males 5 to 20 years old ('00,000)	0.004	0.002	0.000	0.042
Number of males >20 years old ('00,000)	0.015	0.005	0.000	0.085
Number of females <5 years old ('00,000)	0.001	0.001	0.000	0.007
Number of females 5 to 20 years old ('00,000)	0.004	0.002	0.000	0.064
Number of females >20 years old ('00,000)	0.015	0.005	0.000	0.047

Race ('00,000)				
Number of Whites	0.015	0.010	0.000	0.075
Number of African Americans	0.003	0.005	0.000	0.052
Number of Asians	0.006	0.007	0.000	0.050
Number of "others"	0.015	0.010	0.000	0.062
Hispanic status ('00,000)				
Number of Hispanics	0.019	0.014	0.000	0.076
Number of non-Hispanics	0.020	0.014	0.000	0.101
Educational Attainment (25 years and over) ('00,000)				
Less than high school and high school	0.011	0.007	0.000	0.043
GED, some college, and associate degree	0.007	0.004	0.000	0.026
Bachelor, master, doctorate, professional	0.010	0.007	0.000	0.065
Employment Status ('000)				
Number of people 18 and over in the labor force	2.103	0.771	0.000	7.868
Number of people 18 and over not in the labor force	1.127	0.512	0.000	8.635
Median household income (in 100,000 of 2021 inflation-adjusted dollars)	0.887	0.396	0.094	2.500
Number of households of a given size ('00,000)				
1 member households	0.004	0.003	0.000	0.028
2 member households	0.004	0.002	0.000	0.023
3 member households	0.002	0.001	0.000	0.009
4+ member households	0.004	0.002	0.000	0.011
Household structure ('000)				
Number of households with children under 18	0.273	0.140	0.000	1.079
Number of households with no children under 18	0.415	0.208	0.000	1.929
Number of housing units by vehicle ownership ('000)				
0 vehicle	0.120	0.129	0.000	1.252
1 vehicle	0.460	0.313	0.000	2.938
2 vehicles	0.466	0.239	0.000	2.733
3 vehicles	0.186	0.120	0.000	0.880
4 and more vehicles	0.114	0.095	0.000	0.564
Homeownership ('00,000)				
Number of housing units owned	0.006	0.004	0.000	0.023
Number of housing units rented	0.007	0.005	0.000	0.051
Home value/rent ('00,000)				
Median gross rent of renter-occupied housing units ($)	0.020	0.006	0.003	0.035
Median gross value of owner-occupied housing units ($)	8.332	3.854	1.123	20.000
2. Social Vulnerability Index				
Socioeconomic status	0.597	0.283	0.001	1.000
Household characteristics	0.520	0.288	0.000	0.999
Racial and Ethnic Minority Status	0.641	0.296	0.002	0.995
Housing Type & Transportation	0.562	0.283	0.000	1.000
3. Crime ('000)				
Number of Property crimes	0.092	0.085	0.000	1.244
Number of Violent crimes	0.024	0.026	0.000	0.383
4. Built Environment				
Population density (10,000 persons per sq. miles)	1.414	1.159	0.000	12.670
Number of single-family units (SFU; ten thousand)	0.057	0.049	0.000	0.235
Number of multifamily units (MFU; ten thousand)	0.021	0.022	0.000	0.193
Number of nonresidential units (NRU; ten thousand)	0.012	0.016	0.000	0.221
Land use diversity (Entropy index)	0.464	0.190	0.000	0.988
Number of transit stops (TS)	10.665	9.998	0.000	149.000
Intersection density (10,000 intersections per sq. miles)	0.011	0.009	0.000	0.082

Network density (road length per sq. miles)	20.327	11.587	0.000	66.341
Number of participating schools within 5000 m buffer of TS	0.560	0.973	0.000	9.000

Econometric Framework

Due to limited information on individual GoPass usage, our analysis focuses on census tracts where GoPass boardings occurred. The dependent variable is the total number of GoPass boardings within each census tract in 2023. Since bus users are not constrained by census tract boundaries, boardings at a stop near a boundary are likely influenced by characteristics of adjacent tracts. Additionally, the number of nearby bus stops can affect boardings due to transfers between lines (*46*). Therefore, we anticipate spatial interactions between boardings in neighboring census tracts.

To account for potential spatial dependencies, we employed spatial regression models rather than ordinary least squares (OLS), as OLS estimators are biased and inconsistent in the presence of spatial interactions. Our analysis began with 2,496 census tracts in Los Angeles County, of which 2,432 had GoPass boardings in 2023. To capture spatial relationships, we retained selected neighboring tracts with zero boardings, resulting in a final sample of 2,337 census tracts.

The presence of spatial interactions was assessed using Moran's I statistic (*47*). Significant spatial autocorrelation was detected in the dependent variable. This finding was corroborated by the results of Lagrange multiplier (LM) tests (*48*), which demonstrated high significance for both the spatial lag and spatial error terms.

Spatial model

We estimated a generalized spatial lag model to capture the complex spatial relationships present in our data. This model incorporates spatial dependencies in the dependent variable, the explanatory variables, and the error term. The model, with N observations and Q explanatory variables (including a constant), is specified as follows:

Given the evidence of spatial interactions, we employed a generalized spatial lag model. This model accounts for spatial effects arising from the dependent variable, the explanatory variables, and the error term. Our model, with N observations and Q explanatory variables (including a constant), can be expressed as:

$$\begin{cases} \boldsymbol{B} = \rho \boldsymbol{W}\boldsymbol{B} + \boldsymbol{X}\boldsymbol{\beta} + \boldsymbol{W}\boldsymbol{X}\boldsymbol{\gamma} + \boldsymbol{\varepsilon}, \\ \boldsymbol{\varepsilon} = \lambda \boldsymbol{W}\boldsymbol{\varepsilon} + \boldsymbol{\mu}, \end{cases} \tag{2}$$

where:

- $\boldsymbol{B}$ is an $N\times1$ vector of census tract boardings;
- $\boldsymbol{W}$ is an $N\times N$ spatial weight matrix that keeps track of census tracts that share a border;
- $\boldsymbol{X}$ is an $N\times Q$ matrix of exogenous explanatory variables;
- ρ and λ are unknown spatial lag parameters for $\boldsymbol{B}$ and the errors, respectively;
- $\boldsymbol{\beta}$ and $\boldsymbol{\gamma}$ are $Q\times1$ vectors of unknown coefficients to be estimated jointly with ρ and λ;
- $\boldsymbol{\varepsilon}$ is an $N\times1$ vector of correlated residuals, and $\boldsymbol{\mu}$ is an $N\times1$ vector of independent and identically distributed errors.

In Equation 2, λWB models the spatial spillover from boardings in adjacent census tracts; $X\beta$ captures the impacts of various explanatory variables (socioeconomic characteristics, crime land use, and school proximity) on boardings in a census tract; and $WX\gamma$ reflects the impacts on boardings of explanatory variables for adjacent census tracts. The second equation models residual spatial autocorrelation.

If λ = 0, Equation 2 simplifies to a spatial Durbin model (*47*). If both λ = 0 and $\boldsymbol{\gamma}$=0, it becomes a spatial lag model, whereas if ρ=0 and $\boldsymbol{\gamma}$=0, it simplifies to a spatial error model. Finally, if ρ=0, λ=0, and $\boldsymbol{\gamma}$=0. Equation 2 reduces to a simple linear regression model.

As shown in (*49*), heteroskedastic errors can lead to biased and inconsistent estimates when using maximum likelihood to estimate generalized spatial regression models. To address this issue, we employed the generalized spatial two-stage least squares (GS2SLS) estimator derived by (*50*). GS2SLS, implemented in Stata 17, relies on instrumental variables and the generalized method of moments to produce consistent estimates even in the presence of heteroskedasticity.

Weight matrix

For this study, a contiguity weight matrix was chosen due to its relevance to our research question. We constructed the initial weight matrix by assigning a value of one to cells corresponding to census tracts sharing a boundary (even a single point) and zero to all other cells, with zeros along the main diagonal. To facilitate interpretation of the results, we then row-normalized the matrix (*47*). This row normalization implies that both ρ and λ must be between -1 and 1 for the model to function correctly.

Interpreting results

Interpreting estimates of a spatial regression model is not as straightforward as interpreting estimates of a linear regression model because of the spatial lag terms $\rho \boldsymbol{WB}$ and $\boldsymbol{WX\gamma}$, which create feedback effects between neighboring census tracts. Assuming that $|\rho|<1$ and $|\lambda|<1$ and denoting by $\boldsymbol{I}$ the N×N identity matrix, both $(\mathbf{I} - \rho \boldsymbol{W})^{-1}$ and $(\mathbf{I} - \lambda \boldsymbol{W})^{-1}$ are well-defined (*47*), so when we isolate B on the left side of Equation 1:

$$\boldsymbol{B} = (\boldsymbol{I} - \rho \boldsymbol{W})^{-1}[\boldsymbol{X\beta} + \boldsymbol{WX\gamma}] + (\boldsymbol{I} - \rho \boldsymbol{W})^{-1}(\boldsymbol{I} - \lambda \boldsymbol{W})^{-1}\boldsymbol{\mu}, \quad (3)$$

which suggests that, in general, the derivative of $\boldsymbol{B_i}$ with respect to one of the explanatory variables for census tract "$_i$" depends on other coefficients of $\boldsymbol{X}$, possibly from other census tracts via $(\mathbf{I} - \rho \boldsymbol{W})^{-1}$. Moreover, unlike for linear regression, the derivative of $\boldsymbol{B_i}$ with respect to an explanatory variable for census tract $j \neq i$ is not necessarily zero. Since many partial derivatives could be nonzero, we follow (*51,* pp. 36-37) and report for each explanatory variable $q \in \{1,\ldots,Q-1\}$ the following scalar summary measures:

- The average direct impact (ADIq), which is the average impact on each observation from changing its own q^{th} explanatory variable, including the feedback passing through neighbors and back to each observation;
- The average indirect impact (AIIq), which is the average impact on each observation of changing the q^{th} explanatory variable of another observation. It represents spatial spillovers; and
- The average total impact (ATIq), which is the sum of average direct and indirect impacts.

Results and Discussion

Robustness checks

Our model selection process involved a comprehensive evaluation of various specifications. We varied the transformation of the dependent and explanatory variables (log and non-log), the estimation method (GS2SLS and ML), and the spatial weight matrix. Three weight matrix specifications were considered: first-order neighbors only, first- and second-order neighbors, and first- and second-order neighbors with a 50% weight assigned to second-order neighbors. Table 4 summarizes the resulting estimates of ρ and λ, along with the AIC and BIC values used to compare and select the best-performing model.

Table 4. Robustness Checks

Weight matrix 1: first order neighbor only	Weight matrix 2: first and second-order neighbor	Weight matrix 3: first and second-order neighbors (50%)
A. Untransformed dependent variable with count explanatory variables		
Generalized spatial two-stage least squares (GS2SLS)		
ρ: 0.936, λ: -0.683	ρ: 0.995, λ: -0.950	ρ: 0.975, λ: -0.567
Maximum Likelihood		
ρ: 0.719, λ: -0.529 AIC: -4935.77 BIC: -4595.01	ρ: 0.851, λ: -0.946 AIC: -4850.82 BIC: -4510.06	ρ: 0.660, λ: -0.250 AIC: -4910.50 BIC: -4569.74
B. Log transformed dependent and non-binary explanatory variables		
Generalized spatial two-stage least squares (GS2SLS)		
ρ: 0.957, λ: -0.759	ρ: 1.030, λ: -0.955	ρ: 1.008, λ: -0.692
Maximum Likelihood		
ρ: 0.746, λ: -0.575 AIC: -6012.22 BIC: -5626.03	ρ: 0.839, λ: -0.857 AIC: -5911.83 BIC: -5525.64	ρ: 0.667, λ: -0.226 AIC: -5993.62 BIC: -5607.43

Note: Except for the λ value for the third weight matrix and the ML estimates (in both A and B), the ρ and λ values for all the other configurations are significant.

Based on our model selection criteria, we chose the GS2SLS model with the first weight matrix as our preferred specification. The GS2SLS model using the second weight matrix produced a near-impermissible ρ value (0.995 ≈ 1), and the ML model with that same weight matrix had higher AIC and BIC values, indicating a less desirable fit.

Findings

We used Stata 17 for our statistical work, with the "spregress" command for our spatial models.

Multicollinearity was identified as a potential issue in the initial variable set. Consequently, several variables were removed from consideration, including educational attainment (bachelor's, master's, doctorate, and professional degrees), Hispanic status, household size, and housing tenure (rented and owner-occupied units). The final dataset, with a maximum VIF of approximately 6, is deemed to be free of problematic multicollinearity.

Table 5 presents the estimated model coefficients (β, γ, ρ, and λ). The statistically significant ρ and λ confirm the presence of spatial effects. Both are within the permissible range (-1 to 1) given our row-normalized weight matrix.

Six socioeconomic variables have statistically significant average direct effects (ADIs). These ADIs represent the average change in annual GoPass boardings within a census tract resulting from a one-unit increase in the corresponding variable. The socioeconomic variables with positive and significant ADIs include the number of 5 to 20-year-old males (ADI=3.275*), Asians (ADI=1.155†), and "other races" (ADI=0.984†). Conversely, the number of households with two (ADI=-0.040†), three (ADI=-0.078†), and four vehicles or more (ADI=-0.124‡) have negative and statistically significant ADI values. These results were expected. First, young men are more likely than young women to take transit because of safety

concerns (*52*, *53*). Second, nonwhite students benefit most from improved school accessibility (*20*, *54*). Third, as more households have access to alternative modes, fewer students are likely to use GoPass. The relatively large ADI value for housing units with three or four or more cars also highlights the importance of motor vehicles in Los Angeles.

The second set of significant variables for GoPass boardings are crime variables. As expected, census tracts with higher rates of property crimes carried fewer GoPass boardings (ADI = -0.093†). This could be because property crimes often occur in areas with high population density and at transportation hubs, potentially making these areas less desirable for transit use (*55*, *56*). However, the ADI sign for violent crimes is positive (ADI = 0.538‡), which is counterintuitive. The positive association between violent crime and GoPass boardings may simply reflect the fact that students in high-crime areas often have few alternatives for getting to school. They may rely more heavily on public transit because options like walking, biking, or being driven are less accessible or less safe. Conversely, students in lower-crime areas are often more affluent and have greater access to private transportation, such as cars.
While the magnitude of their effects is relatively small, built environment variables are also strong statistical predictors of GoPass bus boardings aggregated by census tract. From average direct impacts (ADI = 0.014‡), we see that bus boardings increase with more participating schools located approximately 30 min from the centroid of a census tract. GoPass boardings also increase with more transit stops (ADI = 0.004‡) and more diverse land use (ADI=0.027†).

Conversely, as the number of multifamily units increases in a census tract, the number of GoPass boardings decreases (ADI = -0.270†). This is unsurprising because the transportation literature shows that children living in multifamily residential neighborhoods are more likely to walk and bike to school (*36*). Similarly, a higher population density negatively impacts bus boardings (ADI = -0.010‡), likely
No variables have a significant average indirect impact, and only two have substantial average total impacts. First, we note that an increase in household units with access to two private vehicles has a statistically significant negative ATI value (ATI=-0.594*), reiterating the superiority of private vehicles' convenience over public transit, as people presumably drive to/from school. Similarly, the proximity of participating schools to a transit stop has a positive and significant ATI (GoPass: ATI = 0.074*).

Table 5. Estimated parameters and average direct, indirect, and total effects

Variables	β	γ	ADI	AII	ATI
1. Socioeconomic Characteristics					
Male: 5 to 20 years old	1.128	2.762	3.275*	57.058	60.334
Female: 5 to 20 years old	1.989	-4.082	0.739	-33.209	-32.47
Race/Ethnicity (base = White)					
African American	0.849	-0.850	0.818	-0.83	-0.012
Asian	1.179*	-1.145*	1.155†	-0.634	0.521
Other	1.079*	-1.180*	0.984†	-2.54	-1.557
GED, some college, and associate degree	0.333	-0.025	0.494	4.279	4.773
People not in the labor force	-0.002	0.005	0.000	0.057	0.057
Annual household income	0.000	0.000	0.000	0.000	0.000
Households with no children under 18	0.006	0.034	0.028	0.586	0.614
Housing units with auto ownership (base = 0 vehicle)					
1 vehicle	0.006	0.003	0.011	0.128	0.138
2 vehicles	-0.019	-0.019	-0.040†	-0.554	-0.594*
3 vehicles	-0.089‡	0.103*	-0.078†	0.292	0.214
4 vehicles or more	-0.086†	0.013	-0.124‡	-1.009	-1.134
Home value/rent					
Rent of renter-occupied housing units ($)	0.544	-1.022	0.256	-7.664	-7.409
Value of owner-occupied housing units ($)	0.001	-0.001	0.001	-0.005	-0.004
2. Social Vulnerability Index					
SVI_1: Socioeconomic status	0.007	-0.015	0.002	-0.126	-0.124
SVI_2: Household composition	0.001	0.000	0.002	0.015	0.017
SVI_4: Housing type & transportation	0.016	-0.025	0.01	-0.148	-0.138
3. Crime					
Property crimes	-0.095†	0.092	-0.093†	0.047	-0.046
Violent crimes	0.585‡	-0.629‡	0.538‡	-1.232	-0.693
4. Built Environment					
Population density	-0.012‡	0.016‡	-0.010‡	0.065	0.055
Multifamily units (MFU)	-0.231*	0.145	-0.270†	-1.056	-1.326
Nonresidential units (NRU)	-0.198	0.128	-0.230	-0.857	-1.087
Land use diversity (Entropy index)	0.021*	-0.009	0.027†	0.157	0.184
Transit stops	0.004‡	-0.004‡	0.004‡	-0.003	0.001
Intersection density	0.694	-0.690	0.671	-0.609	0.062
Network density	0.000	0.000	0.000	-0.002	-0.003
Number of participating schools within 5 km around transit stops	0.012‡	-0.007*	0.014‡	0.060	0.074*
Constant	0.009		3.275*	57.058	60.334

Notes. 1. ‡: p value < 0.01; †: p value < 0.05; *: p value < 0.10.
2. The spatial lag coefficient for our dependent variable is ρ = 0.936‡. The spatial lag coefficient for errors is λ =-0.683‡. Pseudo R2: 0.377. N=2163.
3. Our spatial unit of analysis is a census tract in LA County.
4. Our dependent variable is the annual number of GoPass bus boardings in a census tract (year 2023).
5. Except for the social vulnerability and land use diversity indices, all the other variables are counts or continuous.
6. +Racial and ethnic minority statuses and single-family units (SFUs) were dropped due to multicollinearity.

because school commutes tend to be shorter in higher-density areas, resulting in a greater likelihood of walking and biking and a lower tendency to take the bus (*36*).

Task 4: Analysis of Academic Impacts

After attempting several times for over a year, we could not get the attendance and graduation data from the LAUSD (Los Angeles Unified School District). Finally, we conducted a simple analysis using MUSD (Montebello Unified School District) data collected through our contacts from Los Angeles (LA) Metro for task 4. We gathered MUSD's weekly attendance data for 2022 and 2023 for elementary, intermediate, and high schools from the MUSD and their hourly GoPass Tap data for 2022 (November and December) and 2023 (Jan-Dec except July) from LA Metro. The following sections describe MUSD's schools' information and how LA Metro's GoPass impacted student attendance at MUSD's schools.

Montebello Unified School District

Montebello Unified School District (MUSD) predominantly serves the cities of Montebello, Bell Gardens, Commerce, portions of Los Angeles, Monterey Park, Pico Rivera, Rosemead, and South San Gabriel. It is located in LA County, the largest county in California. Figure 11 shows the MUSD's location with respect to other unified school districts (USD) in LA County and the locations of elementary, intermediate, and high schools within the MUSD. MUSD has 30 schools: seventeen are elementary, eight are intermediary, and six are high and four are adult schools. Located within 15 minutes driving distances of LA downtown, MUSD serves a diverse population, with 92% being Hispanic, to fulfill its mission to prepare students for academic and personal success.

MUSD's attendances in 2022 and 2023

The average percentage of weekly attendance data for 2022 and 2023 reveals that attendance in 2023 was comparatively better than the previous year for schools in MUSD, with Intermediate schools being top in the position (2022 vs. 2023: 92.1% vs. 93.5%), followed by Elementary schools (2022 vs. 2023: 89.8% vs. 92.2%) and high schools (2022 vs. 2023: 89.0% vs. 89.2%).

We plotted the average weekly percentage differences between 2022 and 2023 for each type of school in MUSD to understand the attendance trend in these two years. These are shown in Panels A, B, and C of Figure 12. All the elementary schools observed an uptick in attendance in 2023, which ranged from as low as 0.4% for Potrero Heights Elementary to as high as 4.2% for Winter Gardens Elementary.

Even though the MUSD's intermediate schools' overall average attendance outperformed the other two types of schools in the district, an individual school breakdown shows that among the eight schools, two schools had significantly lower average attendance rates in 2023 than in 2022: La Merced Academy (2.2%↓), and Montebello Intermediate (2.3%↓). Some week's abnormal attendance rates were the

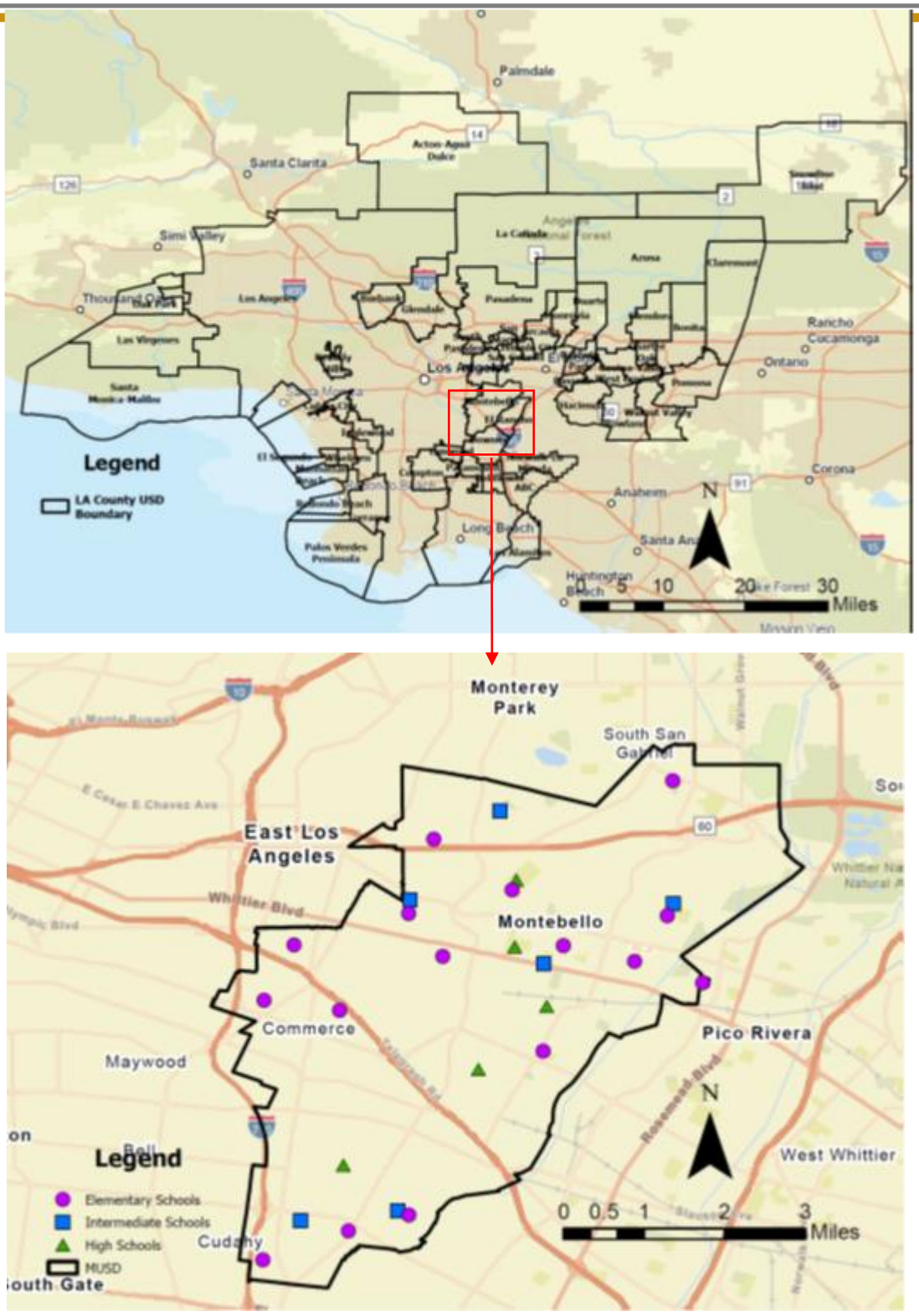
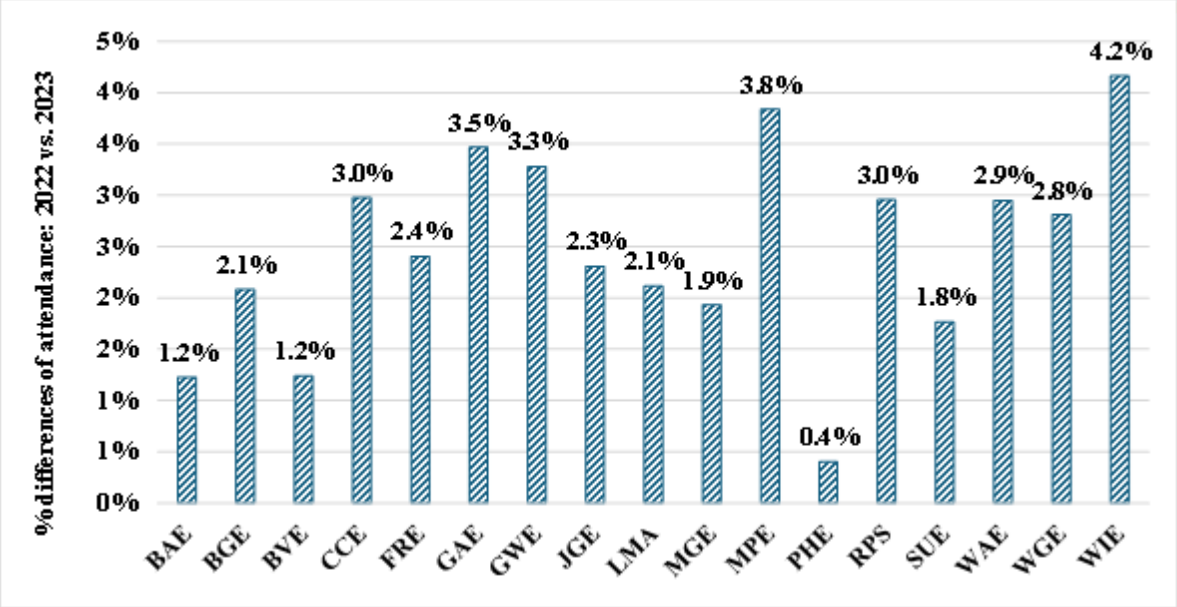
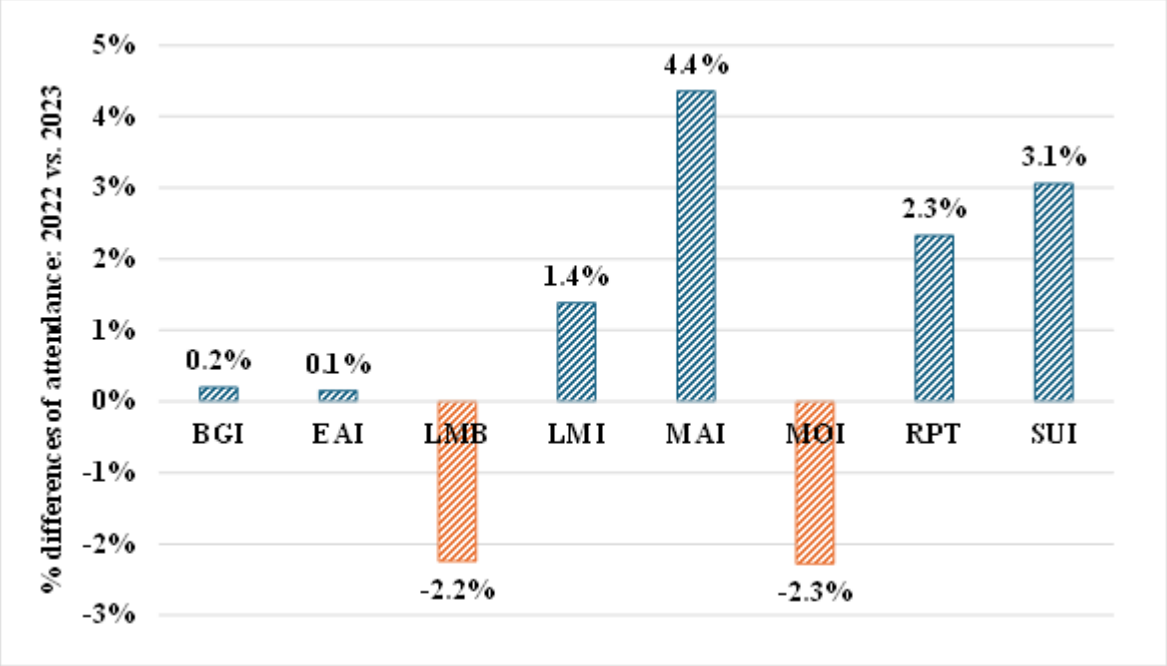


Figure 11. Locations of the Montebello Unified Schools District in LA County and MUSD schools in the district.

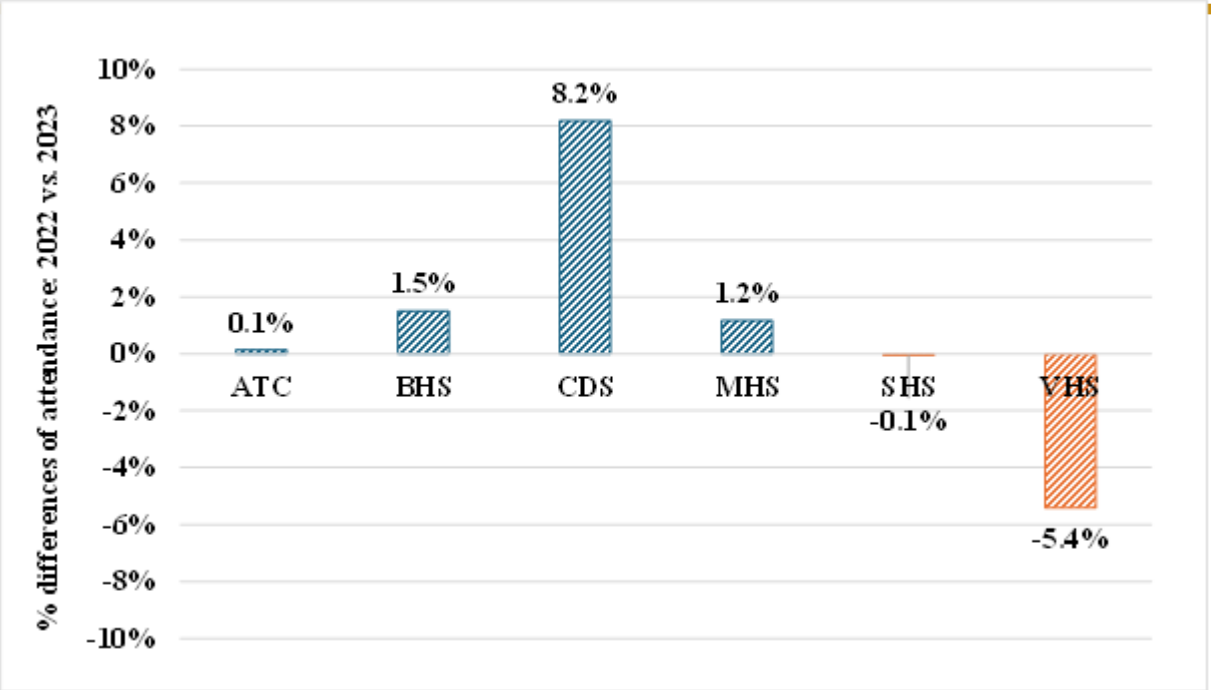
(Source: 1. USD Boundary: https://nces.ed.gov/programs/edge/Geographic/DistrictBoundaries, 2. Schools: LA county GIS Hub)



Panel A: MUSD's elementary schools



Panel B: MUSD's intermediate schools



Panel C: MUSD's high schools

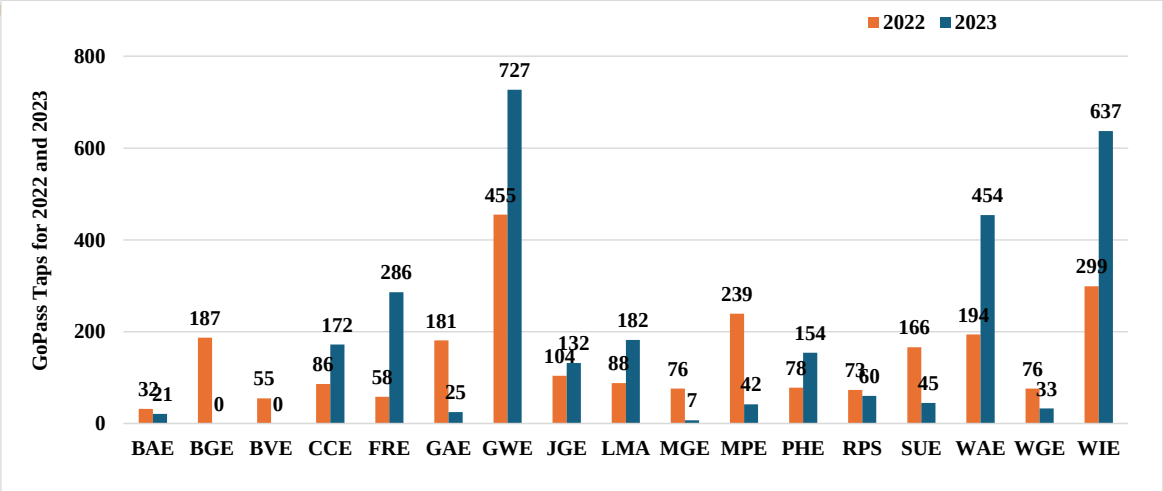
Figure 12. Percentage differences of weekly attendance data between 2022 and 2023 for MUSD's schools

reason for such a decline. For instance, in the 1st week of September (5-8) in 2023, Montebello Intermediate's attendance rate was 72.03%, an 18.40% lower percentage than the year before (90.43%). The average attendance rates for MUSD's high schools were similar in 2022 and 2023. However, among the six high schools, the attendance rate for Montebello Community Day School substantially increased in 2023: the percentage difference between the two years for this school is 8.2%.

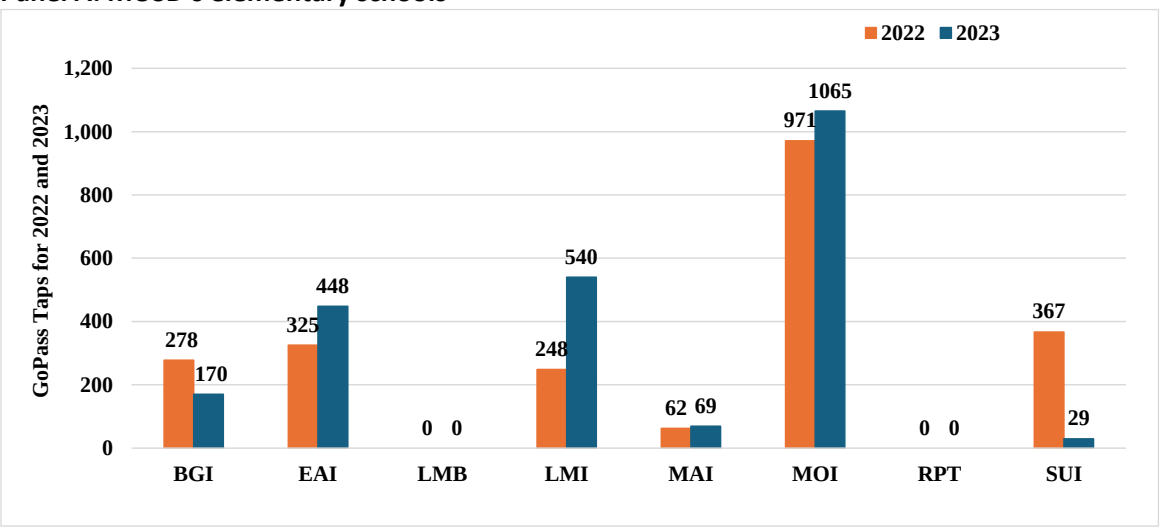
MUSD's taps in 2022 and 2023

We do not have complete tap data for schools in MUSD. Therefore, we created simple bar charts to provide a synopsis of the taps in MUSD's schools. Among the three types of schools, MUSD's high schoolers' rate of using GoPasses (2022 vs. 2023: 11,516 vs. 21,052) was substantially higher than that of elementary (2022 vs. 2023: 2,447 vs. 2,977) and intermediate schoolers (2022 vs. 2023: 2,251 vs. 2,321). This is an expected outcome as GoPass is most attractive to high school students.

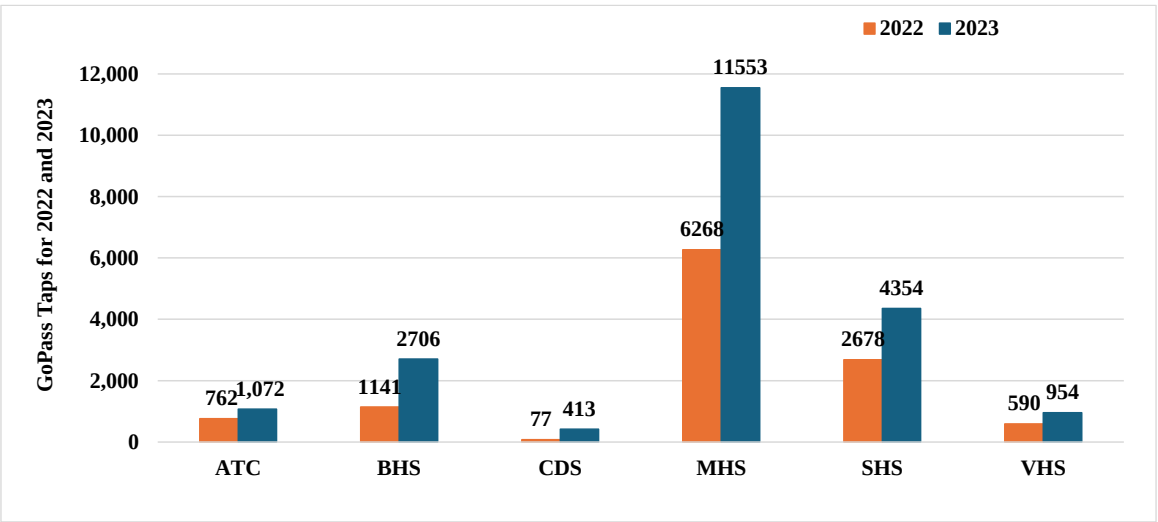
Panels A, B, and C of Figure 13 show the trend of GoPass tapping among the three types of schools in MUSD between 2022 and 2023. Fremont Elementary (393%↑) and La Merced Intermediate (118%↑) are the top contenders among all other elementary and intermediate schools, respectively, and they observed the highest percentage increase in tapping between 2022 and 2023. While elementary and intermediate schools fluctuate in using the GoPass, all high schoolers increased their GoPaAss tapping in



Panel A: MUSD's elementary schools



Panel B: MUSD's intermediate schools



Panel C: MUSD's high schools

Figure 13. GoPass taps in 2022 and 2023 for MUSD's schools

2023 compared to 2022, with Montebello Community Day School being the top contender (a 436% increase of tapping in 2023 than 2022).

Correlation between attendances and Tap

We cannot generalize the correlation findings between GoPass and attendance data because we have too few tap records. However, we created Figure 14 with the correlation values for MUSD's selected elementary, intermediate, and high schools to show a probable relationship between these two variables. Figure 14 shows that, in general, correlation values for high schools are predominantly positive, whereas these values vary between positive and negative values among elementary and intermediate schools.

Montebello Community Day School (0.53), Bell Gardens High (0.67), and Schurr High (0.82) have potentially high (>0.5) and positive correlation values, which is also evident from the GoPass taps difference between 2022 and 2023 (see Figure 13). Montebello Community Day School's (CDS) total GoPass tapping substantially increased in 2023 compared to 2022 (2023 vs. 2022: 77 vs. 413 taps). GoPass has potentially helped minority and economically disadvantaged students of the CDS, who are the majority in this school, to have accessible and affordable transport, allowing them to attend school more. This is also true for the other two schools with high correlation values, where enrolled students mostly come from less privileged families.

For intermediate schools, except for Eastmont Intermediate who had a positive correlation value between GoPass tapping and attendances (0.58), most of the values are negative. This finding is also evident from the GoPass tapings: Bell Gardens Intermediate tapping decreased by 39% in 2023 compared to 2022, affecting student attendance in the school.

For elementary schools, things are slightly better than intermediate schools: free GoPass helped Fremont Elementary's students for a smooth ride to school as the total number of taps increased from 58 to 266.

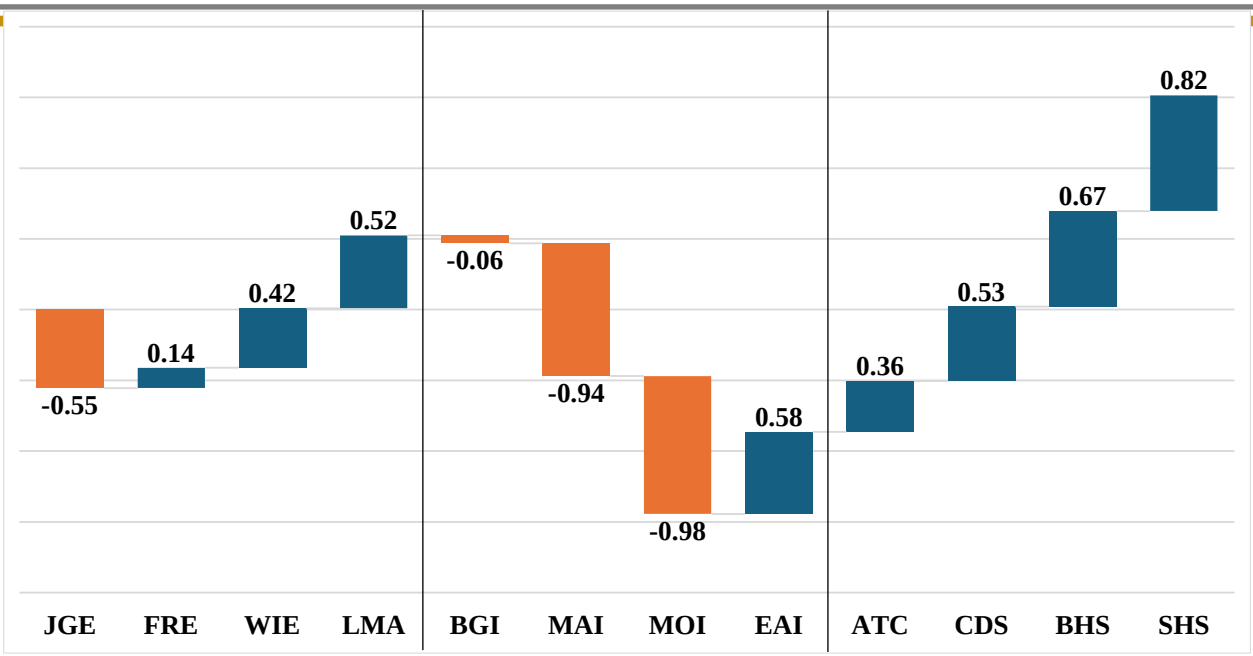


Figure 14. Correlation values between % differences of attendances and GoPass taps (2023 and 2022)

Task 5: Transit Survey

Survey respondents

This section details the results of an online survey of California transit professionals, conducted from June to September 2024 with the support of the California Transit Association (CTA). This survey was a follow-up to the study presented in (*1*) and aimed to gather updated information on free and discounted transit pass programs for K-14, college, and university students. The survey also explored the impact of COVID-19 on ridership, ridership recovery strategies, and measures implemented to facilitate recovery. Specifically, the survey collected data on program rationale, eligibility criteria, funding sources, program duration, the pandemic's influence on program popularity, program closures (related or unrelated to the pandemic), measures taken to mitigate virus spread during lockdowns, and the programs' impact on ridership, transit finances, and fare recovery ratios. The original survey was revised based on feedback from colleagues and the CTA. The survey instrument is available in Appendix 1. Question Pro was used to design and administer the survey.

Our 2024 survey received responses from 67 transit organizations, including 29 new participants and 38 organizations that also participated in the 2019 survey. Of the agencies surveyed in 2019, three reported ceasing operations or merging with other entities. One organization declined to participate. The participating organizations are:

1. Vine: Their services are currently operated by the Napa Valley Transportation Authority
2. City of Elk Grove: City of Elk Grove stopped operating transit in 2021. It was annexed into the SacRT (Sacramento Regional Transit District) system.
3. City of Modesto: The City of Modesto no longer operates transit; they separated and created StanRTA (The Stanislaus Regional Transit Authority), which currently operates in Modesto.
4. City of Manteca: Rejected to take the survey

We have not heard back from twelve organizations, even after contacting them multiple times for our 2024 survey.

Results and Discussion

Characteristics of Respondents who Participated in 2019 and 2024 surveys

We received complete responses from 38 transit agencies that participated in both our 2019 and 2024 surveys. To gauge the expertise of the respondents, we included questions about their professional experience. In 2019, the median experience of respondents from these agencies was 5 years. By 2024, the median experience within the same group of agencies had increased slightly to 5.5 years (Figure 15), suggesting a modest growth in experience among the personnel completing the survey.

Of the 38 organizations that responded to both the 2019 and 2024 surveys, 28 are classified as full NTD (National Transit Database) reporters, and four are reduced NTD reporters. Five organizations did not specify their reporting status, and one is a plan NTD reporter.

The majority of the 67 responding transit agencies operate in urbanized areas (34 agencies). Within those urbanized areas, there's a relatively even split between larger metropolitan areas (19 agencies in areas with over 500,000 inhabitants) and smaller urban areas (15 agencies in areas with under 500,000 inhabitants). Only a small fraction (3 agencies) operate in non-urbanized areas with populations under 500,000.

There were no significant changes in the types of transit services offered by the responding agencies between 2019 and 2024. Figure 16 shows the distribution of modes operated, with bus, commuter bus, and demand response services being the most common. The "other" category primarily consists of paratransit services, along with some cable car operations, local and intercity taxi programs, and ferry services.

Overall Comparison of Free and Reduced Fare Programs (FRFP) of the 38 Transit Agencies

Two survey questions focused on the number of free or reduced transit fare programs offered by each agency during the fiscal years 2018-2019 and 2022-2023. Figure 17 indicates that all 34 agencies offered at least one such program in both fiscal years.

LA Metro's GoPass is among the most popular ones, and other than LA Metro, it was opted for by agencies like City of Santa Monica, Long Beach Transit, and City of Gardena (GTrans). In Los Angeles (LA) County, the LA County Metropolitan Transportation Authority (LA Metro) created in the fall of 2021 the GoPass program, which provides free bus and train transportation to students in participating schools, from kindergarten to community colleges (community colleges cover grades 13-14, 2 years after the last year of high school), or simply K-14. It is the US's most extensive fareless program for K-14 students and quickly became popular. By winter 2023, over 241,000 students had registered, generating over 1.2 million monthly boardings.

A significant discrepancy emerged when comparing the total number of free and reduced fare programs (FRFPs) for K-12 students reported in our 2019 survey (31) with the data collected in the 2024 survey (Figure 17). The 2024 respondents appear to have provided inaccurate information regarding the number of K-12 programs in the 2018-2019 fiscal year. A similar, though much smaller, discrepancy was observed for post-secondary and college programs. Potential explanations for these inconsistencies include institutional memory loss or a lack of awareness among the 2024 respondents regarding programs in place before the pandemic.

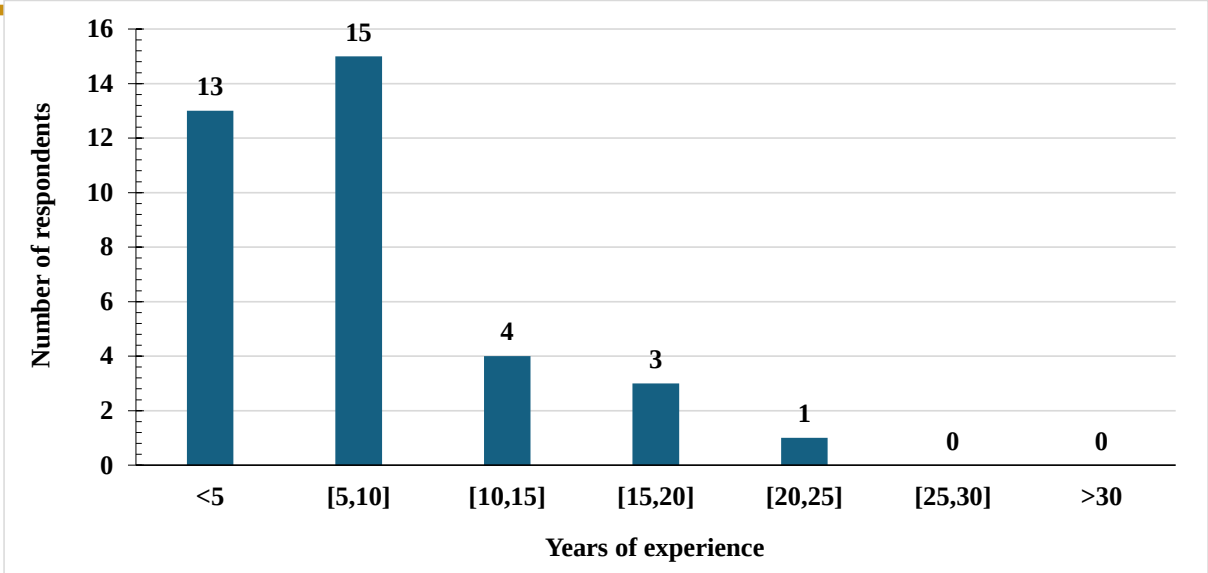


Figure 15. Professional experience of survey respondents of the 38 transit agencies who also participated in the 2019 survey

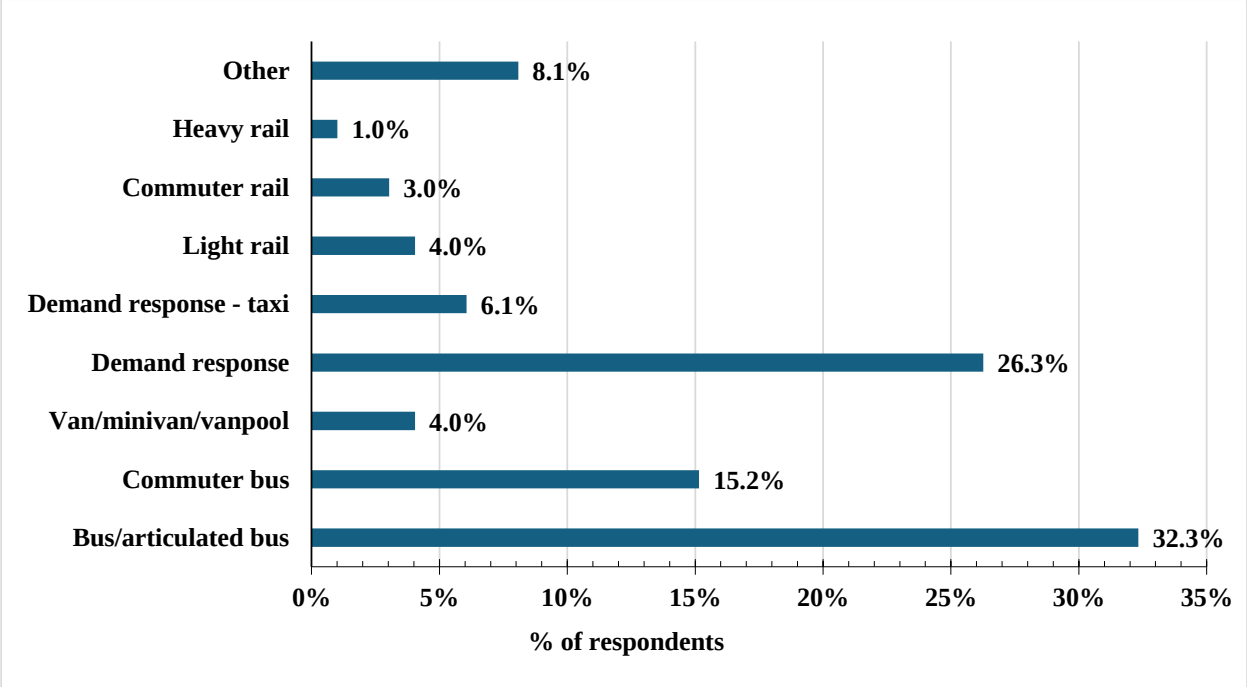


Figure 16. Modes operated by responding 38 transit agencies who also participated in the 2019 survey

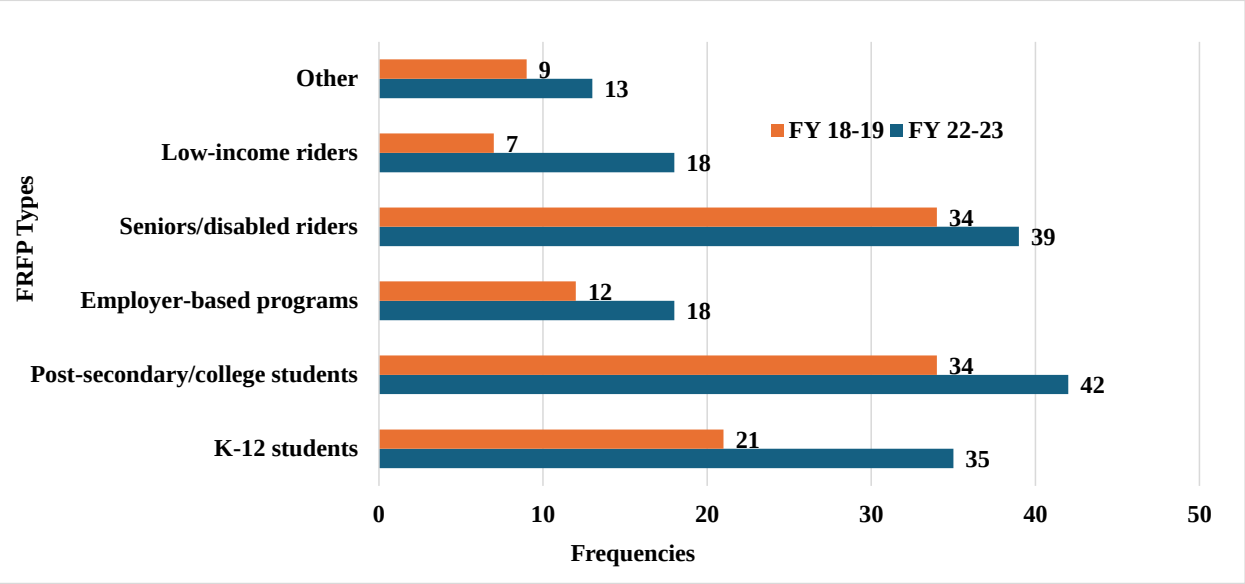


Figure 17.Different types of free and reduced fare programs (FRFP) offered by the 38 transit organizations in 2023 and 2019

Comparison of K-12 and Post-Secondary Programs of the Organization Who Participated in Both Surveys

Based on the responses from the 38 organizations that participated in both the 2019 and 2024 surveys, we compiled Table 6 to illustrate the changes in the status of free and reduced fare programs (FRFPs) for K-12 and post-secondary/college students between those two years.

Table 6. Status of the K-12 and post-secondary programs of the transit organizations that participated in the 2019 and 2024 surveys

SI	Transit organizations who participated in the 2019 and 2024 surveys	2019 Survey		2024 Survey	
		K12	PS	K12	PS
1	City of Petaluma	✓	✓	✓	✓
2	Humboldt Transit Authority	✗	✓	✓	✓
3	Yuba-Sutter Transit Authority	✓	✗	✓	✗
4	Solano County Transit (SolTrans)	✓	✓	✗	✓
5	San Joaquin Regional Rail Commission	✓	✗	✓	✓
6	Monterey-Salinas Transit	✓	✓	✓	✓
7	San Francisco Municipal Transportation Agency	✓	✗	✓	✗
8	North County Transit District	✗	✓	✓	✓
9	City of Santa Monica	✓	✓	✓	✓
10	Ventura County Transportation Commission	✗	✓	✓	✓
11	Antelope Valley Transit Authority	✗	✓	✗	✓
12	Riverside Transit Agency	✓	✓	✓	✓
13	Golden Gate Bridge, Highway and Transportation District	✓	✗	✓	✓
14	San Luis Obispo Regional Transit Authority	✓	✗	✗	✓

15	City of Fairfield, California	✓	✓	✗	✓
16	San Francisco Bay Area Rapid Transit District	✓	✓	✓	✓
17	City of Santa Clarita	✗	✓	✗	✗
18	Foothill Transit	✓	✓	✓	✓
19	City of Union City	✓	✗	✓	✗
20	City of San Luis Obispo	✓	✓	✓	✓
21	Santa Cruz Metropolitan Transit District	✗	✗	✓	✓
22	City of Santa Rosa	✓	✓	✓	✓
23	Long Beach Transit	✗	✗	✓	✓
24	County of Placer	✓	✗	✗	✓
25	San Diego Metropolitan Transit System	✓	✓	✓	✓
26	City of Gardena	✓	✓	✓	✓
27	County of Siskiyou (STAGE)	✓	✓	✓	✓
28	Santa Barbara Metropolitan Transit District	✓	✓	✓	✓
29	Fresno County Rural Transit Agency	✗	✗	✗	✓
30	Santa Clara Valley Transportation Authority	✓	✓	✓	✓
31	Orange County Transportation Authority (OCTA)	✗	✓	✓	✓
32	City of Thousand Oaks	✓	✓	✓	✓
33	Tahoe Transportation District	✗	✗	✗	✗
34	Napa Valley Transportation Authority (Change it)	✓	✗	✓	✗
35	City of Fresno (Fresno Area Express)	✗	✓	✓	✓
36	Gold Coast Transit District	✗	✓	✓	✓
37	Sacramento Regional Transit District	✓	✓	✓	✓
38	Anaheim Transportation Network	✗	✓	✗	✗
Note:					
New K-12 and post-secondary/college FRFPs after the pandemic		K-12 (✓)		PS/College (✓)	

Table 6 reveals several trends in K-12 free and reduced fare programs (FRFPs) between 2019 and 2024. Some organizations discontinued existing programs, while others implemented new ones or modified the eligibility criteria of their existing programs. The new K-12 FRFPs are generally quite recent, having been in place for 2-3 years. Many of these programs were launched shortly after the onset of the pandemic, with some starting around late 2021 and others in 2022. Several noteworthy examples of these new programs include:

1. Humboldt Transit Authority's Summer Youth Pass,
2. North County Transit District's Youth Opportunity Pass,
3. Ventura County Transportation Commission's Youth Ride Free,
4. Santa Cruz Metropolitan Transit District's Youth Cruz Free,
5. City of Santa Rosa's UR Free Youth,
6. Long Beach Transit's GoPass Program,
7. OCTA's Youth Ride Free Program,
8. City of Fresno's Student Bus Pass Program, and

9. Gold Coast Transit District's Youth Ride Free.

On the other hand, some agencies offering FRFPs for K-12 students in 2019 adopted new K-12 programs in 2023. Some notable mentions are:

1. Petaluma Transit's K-12 Free Youth Program,
2. Monterey-Salinas Transit's Youth Pass Program,
3. Santa Monica's GoPass,
4. San Diego MTS's Youth fare and passes and Youth Opportunity Pass
5. City of Gardena's GoPass,
6. Siskiyou County Transit (STAGE) $1 for all fares,
7. Thousand Oaks Transit's Youth Ride Free,
8. City of Fresno's Youth Fare,
9. Riverside Transit Agency's 25 Cent Fares for Youth, Seniors, Disabled, Medicare Cardholders and Veterans, and $5 30-day Pass

As previously mentioned, LA Metro's GoPass program has become a leading example of a successful free and reduced fare program (FRFP), serving as a model for other transit agencies.

In the 2022-2023 fiscal year, 15 transit organizations offered free fare programs, and 13 offered reduced fare programs. Approximately two-thirds (18) of these programs were initiated after the start of the pandemic. Table 7 details the free and reduced fare programs (FRFPs) offered by 28 agencies for K-12 students. Eligibility criteria vary considerably. Some programs, like Gold Coast Transit District's Youth Ride Free, do not require enrollment. Others, such as Santa Monica's GoPass, mandate registration. Some programs have restrictions on mode or purpose (e.g., North County Transit District's Youth Opportunity Pass), while others, like Ventura County Transportation Commission's Youth Ride Free, offer unlimited access to fixed-route transit for youths 18 and under, regardless of time or destination.

Possible reasons for the uptick in K-12 programs are improved funding (Figure 18) from school districts (2018-2019 vs. 2022-2023: 0 vs. 5) and other sources (2018-2019 vs. 2022-2023: 8 vs. 20) such as LCTOP (Low Carbon Transit Operations Program), operating budget of the agencies (e.g., SFMTA), State and Federal - Clean Air, transportation sales tax (e.g., Measure BB), Transportation Fund for Clean Air (Bay Area Air Quality Management District), or a city's general fund.

The increase in K-12 free and reduced fare programs (FRFPs) could be attributed to several factors, notably increased funding. Figure 18 shows a significant rise in funding from both school districts and other sources. Direct funding from school districts increased from 0 in 2018-2019 to 5 in 2022-2023. Funding from other sources also saw a substantial jump, going from 8 in 2018-2019 to 20 in 2022-2023. These "other sources" encompass a variety of funding mechanisms, including:

Table 7. K-12 FRFPs offered by the selected agencies of the 38 transit organizations in 2022-23 fiscal year

	Transit Agency	K-12 programs	Free fare/pass	Reduced fare/pass	Mode restrictions?	Time/Purpose restriction?	Enrollment requirement?
1	City of Petaluma	K-12 Free Youth Program	✓		No	No	No
2	Humboldt Transit Authority	Summer Youth Pass	✓		No	No	No
3	Yuba-Sutter Transit Authority	Discounted Youth Fares and Discounted Monthly Passes		✓	No	No	No
4	San Joaquin Regional Rail Commission	Children Discount		✓	NA	NA	No
5	Monterey-Salinas Transit	Youth Pass Program		✓	No	No	No
6	San Francisco Municipal Transportation Agency	Free Muni for Youth	✓		No	No	No
7	North County Transit District	Youth Opportunity Pass	✓		Yes (Demand response excluded)	No	No
8	Santa Monica's Big Blue Bus	GoPass	✓		No	No	Yes
9	Ventura County Transportation Commission	Youth Ride Free	✓		No	No	No
10	Golden Gate Bridge Highway and Transportation District	50% Fare Reduction for Youth		✓	No	No	No
11	Riverside Transit Agency (RTA)	25 cent fares and $5 for a 30-day pass		✓	NA	NA	NA
12	San Francisco Bay Area Rapid Transit	Youth discount		✓	NA	NA	No
13	Foothill Transit	K-12 Student Discount		✓	NA	NA	No
14	City of Union City - Union City Transit	Student Transit Pass Program	✓		No	No	Yes
15	San Luis Obispo (SLO) Transit	K-12 Discounted Pass Program		✓	No	No	No
16	Santa Cruz Metropolitan Transit District	Youth Cruz Free	✓		Yes (Only local routes included)	No	No

17	City of Santa Rosa CityBus	UR Free Youth	✓		Yes (Fixed routes only)	No	No
18	Long Beach Transit	TAP Reduced Fare and GoPass		✓	No	No	Yes
19	San Diego MTS	Youth fare and passes; Youth Opportunity Pass		✓	NA	NA	Yes
20	City of Gardena	GoPass	✓		No	No	Yes
21	Siskiyou County Transit (STAGE)	$1 all fares		✓	No	No	No
22	Santa Barbara MTD	Discounted fare on 10 rides and 30 day passes for youth		✓	NA	NA	No
23	Santa Clara Valley Transportation Authority	Class Pass	✓		Yes (request to use VTA routes)	Yes (Schools going on a Class trip)	Yes
24	Orange County Transportation Authority	Youth Ride Free Program	✓		No	No	No
25	Thousand Oaks Transit	Youth Ride Free	✓		No	No	No
26	Napa Valley Transportation Authority	Youth Fare		✓	Yes (only applicable to MB and DR; CB not included)	No	No
27	City of Fresno	Student Bus Pass Program		✓	No	No	No
28	Gold Coast Transit District	Youth Ride Free	✓		No	No	No
29	Sacramento Regional Transit District	RydeFreeRt	✓		No	No	No

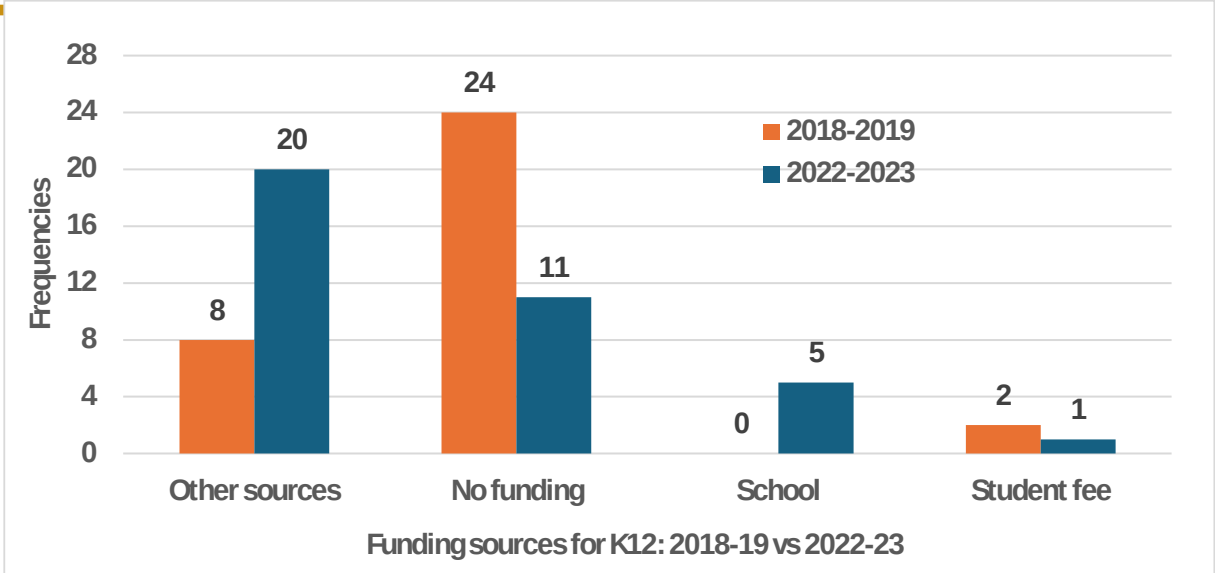


Figure 18. Comparison of funding sources for 38 organizations' K-12 programs

- LCTOP (Low Carbon Transit Operations Program): This program provides funding for transit projects that reduce greenhouse gas emissions.
- Agency Operating Budgets: Some agencies, like SFMTA, may allocate funds from their operating budgets to support FRFPs.
- State and Federal Clean Air Funds: Funding earmarked for clean air initiatives can be used to support programs that encourage public transit use.
- Transportation Sales Taxes: Local transportation sales taxes, such as Measure BB, can generate revenue for transit programs, including FRFPs.
- Transportation Fund for Clean Air: Regional air quality management districts, like the Bay Area Air Quality Management District, may provide funding for projects that improve air quality, such as FRFPs.
- City General Funds: Cities may allocate general fund revenue to support local transit programs, including those benefiting students.

The combination of increased support from school districts and a wider range of external funding options has likely played a significant role in the expansion of K-12 FRFPs.

A notable shift in funding availability occurred between the 2019 and 2024 surveys. In 2019, 24 agencies reported having no funding for these programs. By 2024, that number had decreased significantly to only 11 agencies (Figure 18). This suggests a substantial improvement in funding availability for free and reduced fare programs.

The data suggests a positive impact of these programs on ridership during the 2022-2023 fiscal year (Figure 19). These programs appear to have a stronger positive effect on ridership in 2023 compared to

the pre-pandemic period. In 2019, 11 transit agencies reported a positive impact of K-12 programs on ridership. This number increased to 20 in 2023, potentially due to agencies implementing free fares for students or initiating new post-pandemic programs to recover lost ridership. For example, Thousand Oaks Transit saw a 54.5% increase in overall ridership after launching their "Youth Ride Free" program in September 2022, which allows K-12 students to ride all fixed bus routes for free without enrollment.

However, the impact on overall ridership varies significantly, ranging from a modest 4% increase for Humboldt Transit Authority's "Summer Youth Pass" (launched in 2022) to a substantial 318% increase for Long Beach Transit's "GoPass" program (also started in 2022). Agencies that adopted GoPass programs have generally observed a sharp rise in ridership.

Some agencies experienced dramatic ridership increases immediately after implementing K-12 programs. For instance, Santa Cruz Metropolitan Transit District's "Youth Cruz Free" program, launched in March 2023, resulted in a 32.8% ridership increase in the fourth quarter of 2023 (April-June) compared to the same quarter of the previous year.

Similar to the trend observed with K-12 programs, some agencies also implemented new free and reduced fare programs (FRFPs) for post-secondary and college students in 2023. These new programs include:

1. Monterey-Salinas Transit's College EcoSmart Pass Program for Hartnell and Monterey Peninsula College,
2. Santa Monica's GoPass for community colleges,
3. Antelope Valley Transit Authority's Antelope Valley College pass,
4. Riverside Transit Agency's (RTA) Go-Pass for Moreno Valley College, MSJC, Norco College and Riverside City College.
5. Golden Gate Bridge, Highway and Transportation District's Clipper Bay Pass (Regional Program),
6. San Luis Obispo Regional Transit Authority's Cuesta Community College,
7. San Francisco Bay Area Rapid Transit's Clipper BayPass Clipper
8. Long Beach Transit's GoPass
9. Placer County's Ride free with your Sierra College ID,
10. GTrans/City of Gardena's GoPass
11. Siskiyou County Transit's (STAGE) $1 fares
12. Thousand Oaks Transit's Free College Ride
13. City of Fresno's College Student Fare Program

LA Metro's GoPass program has also proven popular among post-secondary and college students, particularly those attending community colleges.

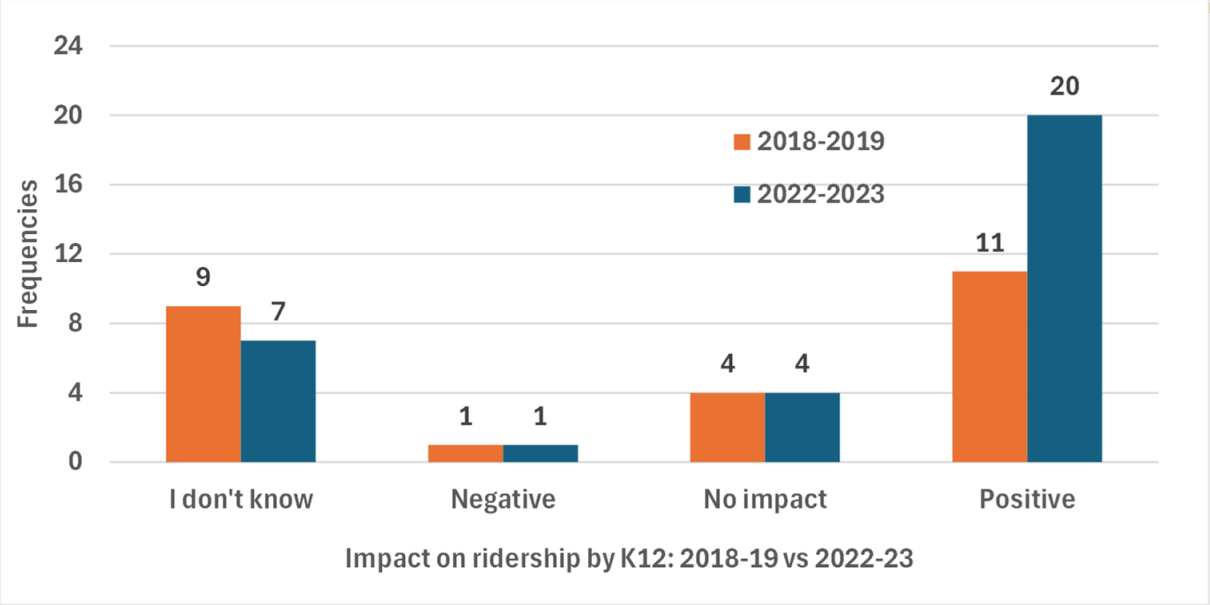


Figure 19. Comparison of impact on ridership for 38 organizations' K-12 programs

The trend for post-secondary programs among the 38 organizations is also positive. The number of such programs increased from 36 in 2019 to 42 in 2023. In the 2022-2023 fiscal year, 22 transit organizations offered free fare programs, and 10 offered reduced fare programs. Approximately 43% (14) of these post-secondary programs were launched after the pandemic. Table 8 lists the FRFPs for post-secondary and college students at 31 agencies. A key difference from K-12 programs is that enrollment in a specific college or university is typically required for eligibility in post-secondary programs. With a few exceptions (e.g., San Diego MTS's College & Semester passes and U-Pass), most of these programs are unrestricted, allowing students to use transit services on any route at any time.

Funding patterns for post-secondary and college free and reduced fare programs differ from those for K-12 programs (Figure 20). A notable change is the substantial decrease in funding from school districts for these programs between 2019 and 2023 (from 13 agencies contributing in 2019 to only 4 in 2023). However, this decrease in school district funding was offset by increases in funding from other sources and student fees during the same period. The Low Carbon Transit Operations Program (LCTOP) is a significant contributor among these "other sources" of funding for post-secondary and college programs.

Similar to the K-12 programs, post-secondary/college free and reduced fare programs (FRFPs) also demonstrate a stronger positive impact on ridership in 2023 compared to the pre-pandemic period (Figure 21). In 2019, 16 transit agencies reported positive ridership effects from these programs. This number rose to 21 in 2023, likely due to some agencies transitioning to free fares for post-secondary students.

Table 8. Post-secondary and college FRFPs offered by the selected agencies of the 38 transit organizations in 2022-23 fiscal year

	Transit Agency	K-12 programs	Free fare/pass	Reduced fare/pass	Route/Mode restrictions?	Time/Purpose restriction?	Enrollment required?
1	City of Petaluma	Santa Rosa Junior College Pass program	✓		NA	NA	No
2	Humboldt Transit Authority	Jack Pass (Cal Poly Humboldt)	✓		NA	NA	No
3	SolTrans	Solano Community College Students Ride Free with Student ID	✓		No	No	No
4	San Joaquin Regional Rail Commission	Student Incentive Program		✓	NA	NA	Yes
5	Monterey-Salinas Transit	College EcoSmart Pass Program for CSUMB, Hartnell, and Monterey Peninsula College	✓		No	No	No
6	North County Transit District	U Pass	✓		No	No	Yes
7	Santa Monica's Big Blue Bus	GoPass and U-PASS	✓	✓	No	No	Yes
8	Ventura County Transportation Commission	College Ride Free	✓		No	No	Yes
9	Antelope Valley Transit Authority	Antelope Valley College	✓		No	No	Yes
10	Riverside Transit Agency (RTA)	U-Pass, Go-Pass, and $5 30-day pass	✓		No	No	Yes/No
11	Golden Gate Bridge Highway and Transportation District	Clipper BayPass (Regional Program)	✓		NA	NA	Yes
12	San Luis Obispo Regional Transit Authority	Cuesta Community College	✓		Yes	Yes	No
13	City of Fairfield/FAST	Solano Community College Free Transit Fare Program	✓		NA	NA	Yes
14	San Francisco Bay Area Rapid Transit	Higher Education Discount Program		✓	NA	NA	Yes
15	Foothill Transit	Class Pass	✓		No	No	Yes

16	San Luis Obispo (SLO) Transit	There is no name	✓		No	No	Yes
17	Santa Cruz Metropolitan Transit District	UCSC and Cabrillo College Pass Programs	✓		No	No	Yes
18	City of Santa Rosa CityBus	No specific name	✓		No	No	No
19	Long Beach Transit	TAP Reduced Fare and GoPass		✓	NA	NA	Yes
20	Placer County - Placer County Transit and Tahoe Truckee Area Regional Transit	Ride free with your Sierra College ID (Subsidized by Sierra College)	✓		No	No	No
21	San Diego MTS	College & Semester passes and U-Pass		✓	Yes (Fixed route buses and trolleys)	NA	Yes
22	City of Gardena	GoPass	✓		No	No	Yes
23	Siskiyou County Transit (STAGE)	$1 fares		✓	NA	NA	NA
24	Santa Barbara MTD	UCSB and SBCC pass program		✓	No	No	Yes
25	Fresno County Rural Transit Agency	Student monthly pass		✓	Yes	Yes	Yes
26	Santa Clara Valley Transportation Authority	SmartPass Program		✓	No	No	Yes
27	Orange County Transportation Authority	College Pass Program	✓		No	No	Yes
28	Thousand Oaks Transit	Free College Ride	✓		NA	NA	No
29	City of Fresno	College Student Fare Program		✓	NA	NA	Yes
30	Gold Coast Transit District	College Ride Free Program	✓		No	No	Yes
31	Sacramento Regional Transit District	College pass	✓		No	No	Yes

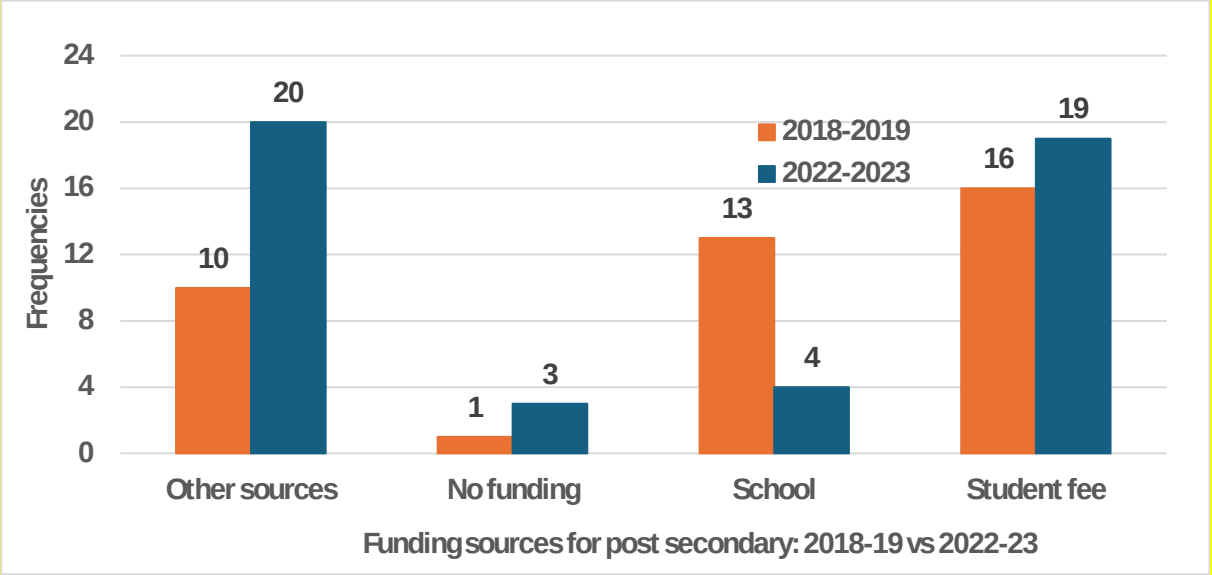


Figure 20. Comparison of funding sources for 38 organization's post-secondary/college programs

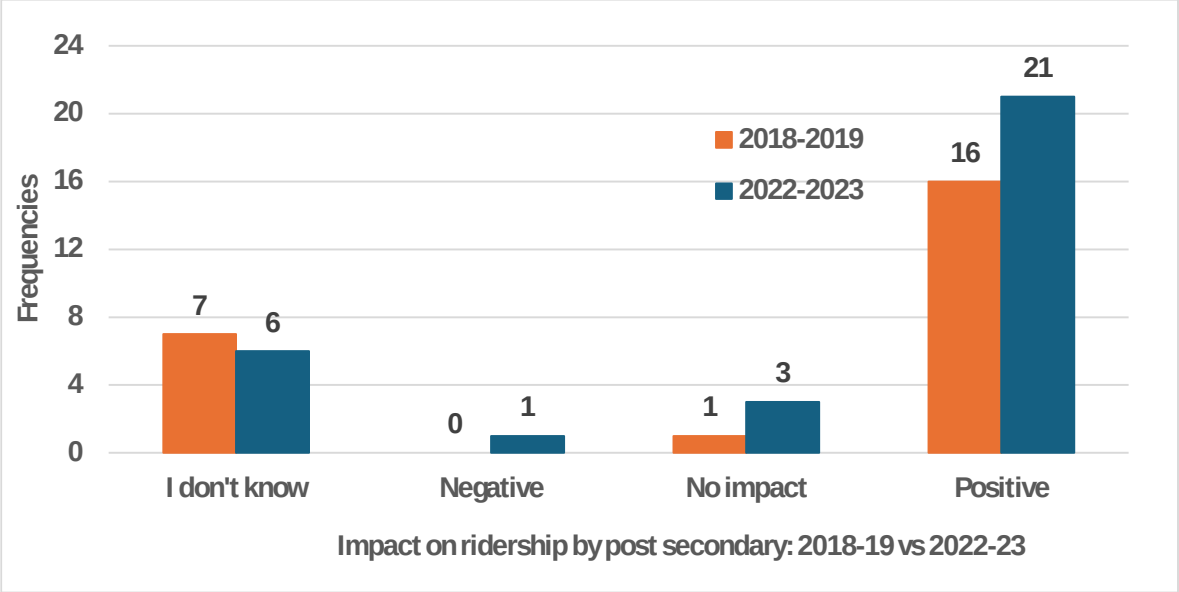


Figure 21. Comparison of impact on ridership for 38 organization's post-secondary/college programs

COVID-19, ridership and measures taken by the transit organizations

The COVID-19 pandemic had a significant negative impact on transit ridership (Figure 22). 28 organizations reported experiencing declines, with an average drop of 73% at the pandemic's peak. Among these 28 organizations, approximately 93% (26 agencies) saw ridership decreases in the 40-80% range (Figure 22). Two agencies reported extreme cases of ridership decline: Thousand Oaks (190% decrease) and San Luis Obispo (SLO) Transit (250% decrease). Ten organizations did not provide specific percentage declines. The largest ridership decreases typically occurred during weekday off-peak periods (average decline of 73%), followed by weekday peak periods (average decline of 50%) and weekends (average decline of 38%). Some organizations, including SLO Transit, Santa Barbara MTD, San Joaquin

Regional Rail Commission, North County Transit District, and San Francisco Bay Area Rapid Transit, were able to provide more granular data on ridership changes across different times of day and week, even if they didn't track overall percentage changes.

Despite the ridership declines, transit organizations implemented various measures to mitigate the spread of COVID-19 and encourage riders to return (Figure 23). Some of the most common precautions included: Mandating masks on transit vehicles (17.9%), Implementing social distancing protocols (17.6%), and Enhancing cleaning and disinfection procedures for buses and other vehicles (17.2%).

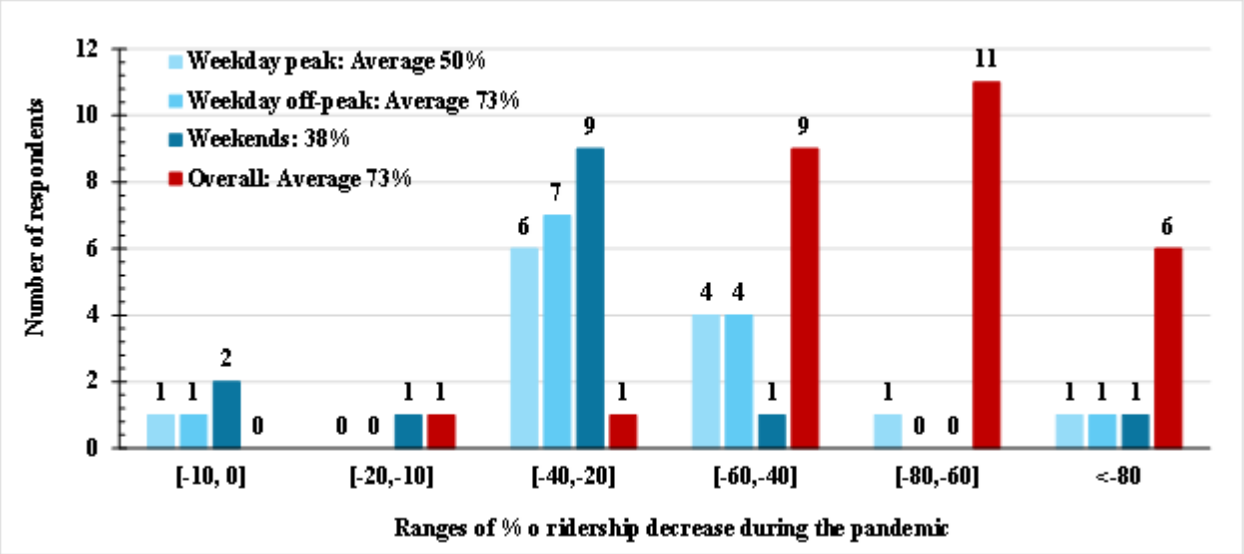


Figure 22. Impact of COVID-19 on ridership

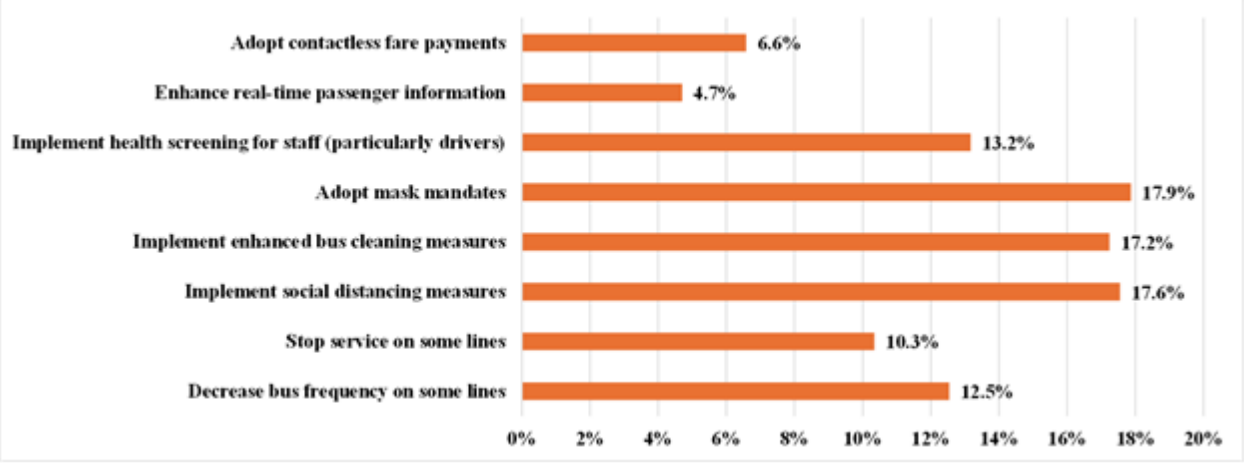


Figure 23. Measures taken by the 67 transit agencies during the COVID-19 pandemic.

Conclusions

Our study examined California's transit agencies to understand the current landscape of free and discounted transit pass programs for students at the K-12, post-secondary, and college levels, including the impact of the COVID-19 pandemic on these programs. In addition, we conducted an in-depth analysis of LA Metro's GoPass program to assess the effectiveness of fare-based incentives in promoting ridership recovery.

Findings from LA Metro's GoPass Program

GoPass made a substantial impact on LA Metro's ridership in 2022, accounting for a significant portion of both bus and train boardings, specifically 12.3% of all bus boardings (10.6 million trips) and 5.4% of all train boardings (1.2 million trips). Although the program was still developing in the first quarter of 2022, usage patterns indicate that weekday ridership is highest on Tuesdays, Wednesdays, and Thursdays, with peak boarding times occurring between 7 and 8 am and between 3 and 4 pm. It is noteworthy that the afternoon peak for GoPass users occurs earlier than the general afternoon transit peak. Furthermore, a large majority (75%) of GoPass bus trips are concentrated on just 40 of the region's 324 bus lines, suggesting that the program effectively serves Los Angeles' most densely populated areas.

Analysis of 2023 bus boardings, aggregated by census tract and modeled using a generalized spatial lag model with a comprehensive set of explanatory variables, confirms the presence of strong spatial effects. The direct average impacts reveal that census tracts with specific characteristics are more likely to see increased GoPass boardings; these characteristics include a higher number of male Asians, more transit stops, varied land use, and a greater number of participating schools within a 30-minute transit commute. In contrast, GoPass boardings tend to decrease in areas with a higher number of housing units with two or more private cars, increased property crimes, more multifamily residential units, and higher population density.

The findings suggest that racially vulnerable communities exhibit both higher current GoPass usage and potential for increased enrollment. Consequently, targeted outreach initiatives and a deeper understanding of the specific needs of these communities could significantly enhance GoPass enrollment.

It's great to see that overall attendance in MUSD schools improved from 2022 to 2023, with intermediate schools leading the way in attendance rates. High school students were the most frequent users of the GoPass. Interestingly, data suggests a positive link between using the GoPass and attending school, especially among high school students who are minorities or economically disadvantaged. Elementary and intermediate schools showed a less consistent connection between GoPass taps and attendance.

Findings from the transit survey

In a 2024 survey, 67 organizations participated, with 38 having also taken part in the 2019 survey and 29 being new participants. Among the 38 repeat respondents, there was a notable increase in fare-based incentive programs between the 2018-19 and 2022-23 financial years. This expansion was particularly significant in post-secondary/college programs, which rose from 34 to 42, and in K-12 programs, which increased from 21 to 35. By the 2022-2023 fiscal year, 15 of the 38 transit agencies offered free fare programs, and 13 offered reduced fare programs, with approximately two-thirds (18 programs) of these initiatives being launched after the onset of the pandemic.

Several agencies have implemented successful programs, including LA Metro's GoPass, which provides free bus and train rides to students from kindergarten through community college at participating schools. Similar programs have been adopted by other agencies such as the City of Santa Monica, Long Beach Transit, and the City of Gardena (GTrans). Funding for K-12 student pass programs has seen improvement, with fewer agencies reporting a lack of dedicated funding in 2023 (11 agencies) compared to 2019 (24 agencies). While funding from school districts increased for K-12 programs in 2023, this was not the case for post-secondary/college programs. However, both types of programs benefited from funding from other sources, including LCTOP, state and federal clean air initiatives, transportation sales taxes, the Transportation Fund for Clean Air, and city general funds.

These K-12 student transit programs are demonstrating a positive impact on ridership in 2023 compared to pre-pandemic levels. The number of transit agencies reporting a positive impact has increased from 11 in 2019 to 20 in 2023, and post-secondary programs have shown a similar trend, with agencies reporting positive impacts rising from 16 in 2019 to 21 in 2023. Despite an average ridership decline of 73% across all 38 transit agencies during the pandemic, these organizations have implemented safety measures to encourage riders to return. Common precautions included mandating masks on transit (17.9%), implementing social distancing protocols (17.6%), and enhancing bus cleaning procedures (17.2%).

Policy implications

To align with the goals of the proposed Freedom to Move Act (sponsored by Rep. Pressley and Sen. Markey, advocating for federal investment in fare-free transit initiatives, especially for low-income communities), we recommend making LA Metro's GoPass program permanent. For GoPass to be financially sustainable long-term, we suggest that participating school districts contribute more to the program's cost, estimated to be less than $30 per student annually. However, this effort is hampered by the Los Angeles Unified School District's reluctance to share attendance and graduation data with LA Metro. This data is crucial for understanding the impact of GoPass usage on school absenteeism, which is directly tied to state funding.

The long-term financial viability of public transit is closely linked to the issue of fare evasion, a problem exacerbated by the pandemic (*57*). As demonstrated by recent events in New York City (*58*), severe fare evasion can jeopardize even free transit pass programs. While many agencies temporarily suspended fare collection during the pandemic to minimize contact, support essential workers, and improve accessibility for disadvantaged groups, this policy also led to unintended consequences. Increased presence of homeless individuals in transit vehicles and facilities created a sense of insecurity among

other passengers (*59*), potentially hindering ridership recovery. Furthermore, research has linked fare evasion to violent crime (*60*). The temporary shift to fare-free transit may have also altered riders' perceptions of fare payment, contributing to a post-pandemic increase in fare evasion, a trend observed in some areas (*61*, *62*). Free transit programs, therefore, risk normalizing the idea that fare payment is optional, further threatening long-term financial stability.

Fare evasion poses a significant financial challenge to transit agencies, particularly when funding for new infrastructure is critically needed (*63*). While many large transit systems face growing budget deficits, LA Metro is somewhat insulated from this problem compared to systems in cities like San Francisco, Chicago, and Philadelphia. This relative financial stability stems from LA Metro's diverse funding sources, which include billions of dollars annually from four half-cent sales tax measures, in addition to state and federal grants and toll revenues (*64*). Notably, fare revenue constitutes a very small portion (under 2%) of LA Metro's substantial $9.1 billion budget.

The "broken windows" theory has been invoked as a rationale for increasing transit fare enforcement (*61*, *65*), often through the deployment of more fare inspectors. However, this approach has faced criticism for potentially disproportionately targeting vulnerable populations, including the poor and homeless (*66*). Another proposed solution involves increasing police presence on transit to deter crime. LA Metro has been piloting a "Tap to Exit" policy, requiring riders to tap their fare cards upon exiting. Following a reported 40% decrease in crime and incidents after implementing this policy (*67*), LA Metro is considering expanding the program to other parts of its system

Several strategies have been proposed to address fare evasion and crime on public transit. One approach, drawing on the "broken windows" theory, suggests increasing the number of fare inspectors (*61*, *65*). However, this tactic has been criticized for potentially disproportionately targeting vulnerable populations, such as the poor and homeless (*66*). Another suggestion involves increasing police presence to deter crime. LA Metro has been piloting a "Tap to Exit" system, requiring riders to tap their fare cards both upon entering and exiting. Preliminary results indicate a 40% reduction in reported crime and incidents following the implementation of this policy (*67*), prompting LA Metro to consider expanding the program.

While the effectiveness of free transit pass programs in boosting ridership has varied, well-designed programs have demonstrated success when implemented effectively. LA Metro and its partner schools could explore targeted free transit pass programs designed using the insurance model (Nuworsoo, 2004). This model involves a large group of potential riders (e.g., students, employees) periodically paying a lump sum to the transit agency, even though only a portion of the group will actually use transit.

To encourage ridership among women, who frequently cite safety concerns as a barrier (Loukaitou-Sideris, 2014; Lubitow et al., 2020), LA Metro should prioritize improving safety on buses and at transit stops. Potential measures include ensuring adequate lighting, providing comfortable seating and a clean environment, and installing CCTV cameras.

This study has several limitations. First, the tap card data used may underestimate actual GoPass usage due to limited enforcement. Second, the unavailability of detailed crime location data for smaller cities in Los Angeles County necessitated the use of average city-level crime data, which may have introduced some bias. Finally, access to ride-hailing data from the California Public Utility Commission was not

possible; however, we believe the impact of this omission is minimal, as regular ride-hailing use for school commutes would likely be cost-prohibitive for most students.

Future research could explore the impact of free transit pass programs on key educational outcomes, such as school attendance, dropout rates, and graduation rates. Additionally, a spatial and temporal analysis at the bus line level could offer valuable insights into how programs like GoPass can mitigate ridership losses resulting from the COVID-19 pandemic.

References

1. Saphores, J.-D., D. Shah, and F. Khatun. A Review of Reduced and Free Transit Fare Programs in California. *eScholarship*, 2020. https://doi.org/10.7922/G2XP735Q.
2. Office of Budget and Policy, F. T. A. *Effects of the COVID-19 Pandemic on Transit Ridership and Accessibility (No. 0268)*. Washington, DC., 2024.
3. Gross, B., and P. Denice. Can Public Transportation Improve Students' Access to Denver's Best Schools of Choice? 2017, p. 22.
4. Beutner, A., and A. Retana. The Importance of Free Transportation for Students. *Los Angeles Daily News*. https://www.dailynews.com/2020/02/01/the-importance-of-free-transportation-for-students/. Accessed Feb. 6, 2025.
5. Wexler, N., G. Ryan, K. Das, and Y. Fan. Free Transit Passes and School Attendance among High School Students. *Transportation Research Record: Journal of the Transportation Research Board*, Vol. 2675, No. 8, 2021, pp. 135–147. https://doi.org/10.1177/0361198121996360.
6. McDonald, N., S. Librera, and E. Deakin. Free Transit for Low-Income Youth: Experience in San Francisco Bay Area, California. *Transportation Research Record: Journal of the Transportation Research Board*, Vol. 1887, No. 1, 2004, pp. 153–160. https://doi.org/10.3141/1887-18.
7. Gase, L., T. Kuo, S. Teutsch, and J. Fielding. Estimating the Costs and Benefits of Providing Free Public Transit Passes to Students in Los Angeles County: Lessons Learned in Applying a Health Lens to Decision-Making. *International Journal of Environmental Research and Public Health*, Vol. 11, No. 11, 2014, pp. 11384–11397. https://doi.org/10.3390/ijerph111111384.
8. Vincent, J. M., C. Makarewicz, R. Miller, J. Ehrman, and D. L. McKoy. *Beyond the Yellow Bus: Promising Practices for Maximizing Access to Opportunity Through Innovations in Student Transportation*. Center for Cities + Schools, Berkeley, CA, 2014, pp. 1–46.
9. Gross, B., and P. Denice. *Can Public Transportation Improve Students' Access to Denver's Best Schools of Choice?* Center on Reinventing Public Education, 2017, pp. 1–22.
10. Stein, M. L., and J. A. Grigg. Missing Bus, Missing School: Establishing the Relationship Between Public Transit Use and Student Absenteeism. *American Educational Research Journal*, Vol. 56, No. 5, 2019, pp. 1834–1860. https://doi.org/10.3102/0002831219833917.
11. Clay, J. R., and J. L. Valentine. Impact of Transportation Supports on Students' Academic Outcomes: A Quasi-Experimental Study of the U-Pass at Rio Hondo College. 2021.
12. Cooper, E. C. *Creating a Transit Generation*. Master thesis. Simon Fraser University, 2009.
13. Han, D., J. Yu, E. Beimborn, Z. Jin, and W. Tan. Elements of Successful Universal Student Transit Pass Programs from Planning to Implementation: A Benchmark Study. *Transportation Research Record: Journal of the Transportation Research Board*, Vol. 2673, No. 4, 2019, pp. 833–843. https://doi.org/10.1177/0361198119834916.
14. Shaaban, K., and R. Reda. Impact of College Provided Transportation on the Absenteeism and Academic Performance of Engineering Students. *Eurasia Journal of Mathematics, Science and Technology Education*, Vol. 17, No. 3, 2021, p. em1944. https://doi.org/10.29333/ejmste/9727.
15. Del Conte, D. E. *Barriers to Utilization of Fare-Free Transit by Students*. M.S. Marquette University, United States -- Wisconsin, 2022.
16. Lachapelle, U., K. Manaugh, and S. Hamelin-Pratte. Providing Discounted Transit Passes to Younger University Students: Are There Effects on Public Transit, Car and Active Transportation Trips to University? *Case Studies on Transport Policy*, Vol. 10, No. 2, 2022, pp. 811–820. https://doi.org/10.1016/j.cstp.2022.02.009.

17. McDonald, N., S. Librera, and E. Deakin. Free Transit for Low-Income Youth: Experience in San Francisco Bay Area, California. *Transportation Research Record*, Vol. 1887, No. 1, 2004, pp. 153–160. https://doi.org/10.3141/1887-18.
18. Fan, Y., and K. Das. *Assessing the Impacts of Student Transportation on Public Transit*. Minneapolis, 2015, pp. 1–107.
19. Munoz, E. G., and H. H. Sandoval. The Impacts of Fare-Free Bus Programs on Educational Outcomes of K–12 Students. *Journal of Human Capital*, Vol. 16, No. 4, 2022, pp. 556–584. https://doi.org/10.1086/721376.
20. Karner, A., and S. LaRue. *RydeFreeRT Evaluation Study: User Demographics, Attitudes, and Impacts on Travel Behavior*. University of Texas at Austin, Austin, TX, 2021, pp. 1–20.
21. Brown, J., D. B. Hess, and D. Shoup. Fare-Free Public Transit at Universities: An Evaluation. *Journal of Planning Education and Research*, Vol. 23, No. 1, 2003, pp. 69–82. https://doi.org/10.1177/0739456X03255430.
22. Thistle, I., and L. Paget-Seekins. The Youth Pass: A Study of the Conflicts Between Ideal and Practical Research Design in a Pilot Social Program. *Transportation Research Record*, Vol. 2652, No. 1, 2017, pp. 116–123. https://doi.org/10.3141/2652-13.
23. Cruz, J. A. *Fareless Transit Initiatives: Does Metro GoPass Help Los Angeles Unified School District's Neediest Students?* Master thesis. Georgetown University, Washington, D.C., 2023.
24. Sullivan, V. L. *Impact of Free Transit Passes on Youth Travel Behaviour*. Master thesis. University of Waterloo, 2017.
25. Chingos, M., and K. Blagg. *Student Transportation and Educational Access: How Students Get to School in Denver, Detroit, New Orleans, New York City, and Washington, DC*. Urban Institute, 2017.
26. Cordes, S. A., and A. E. Schwartz. *Does Pupil Transportation Close the School Quality Gap?* Urban Institute, 2018.
27. Blumenberg, E., B. D. Taylor, M. Smart, K. Ralph, M. Wander, and S. Brumbagh. What's Youth Got to Do with It? Exploring the Travel Behavior of Teens and Young Adults. 2012.
28. Palm, M., and S. Farber. The Role of Public Transit in School Choice and After-School Activity Participation among Toronto High School Students. *Travel Behaviour and Society*, Vol. 19, 2020, pp. 219–230. https://doi.org/10.1016/j.tbs.2020.01.007.
29. Lenhoff, S. W., J. Singer, K. Stokes, J. B. Mahowald, and S. Khawaja. Beyond the Bus: Reconceptualizing School Transportation for Mobility Justice. *Harvard Educational Review*, Vol. 92, No. 3, 2022, pp. 336–360. https://doi.org/10.17763/1943-5045-92.3.336.
30. Appleyard, B. S., and C. E. Ferrell. The Influence of Crime on Active & Sustainable Travel: New Geo-Statistical Methods and Theories for Understanding Crime and Mode Choice. *Journal of Transport & Health*, Vol. 6, 2017, pp. 516–529. https://doi.org/10.1016/j.jth.2017.04.002.
31. Bosch, L. S. M. M., J. C. K. Wells, S. Lum, and A. M. Reid. Associations of the Objective Built Environment along the Route to School with Children's Modes of Commuting: A Multilevel Modelling Analysis (the SLIC Study). *PLOS ONE*, Vol. 15, No. 4, 2020, p. e0231478. https://doi.org/10.1371/journal.pone.0231478.
32. Burford, K., L. A. Ganzar, K. Lanza, H. W. Kohl, and D. M. Hoelscher. School-Level Economic Disparities in Police-Reported Crimes and Active Commuting to School. *International Journal of Environmental Research and Public Health*, Vol. 18, No. 20, 2021, p. 10885. https://doi.org/10.3390/ijerph182010885.
33. Vonderwalde, M., J. Cox, G. C. Williams, M. M. Borghese, and I. Janssen. Objectively Measured Crime and Active Transportation among 10–13 Year Olds. *Preventive Medicine Reports*, Vol. 13, 2019, pp. 48–51. https://doi.org/10.1016/j.pmedr.2018.11.010.

34. Flanagan, B. E., E. W. Gregory, E. J. Hallisey, J. L. Heitgerd, and B. Lewis. A Social Vulnerability Index for Disaster Management. *Journal of Homeland Security and Emergency Management*, Vol. 8, No. 1, 2011. https://doi.org/10.2202/1547-7355.1792.
35. Chakraborty, A., and S. Mishra. Land Use and Transit Ridership Connections: Implications for State-Level Planning Agencies. *Land Use Policy*, Vol. 30, No. 1, 2013, pp. 458–469. https://doi.org/10.1016/j.landusepol.2012.04.017.
36. He, S. Y., and G. Giuliano. Factors Affecting Children's Journeys to School: A Joint Escort-Mode Choice Model. *Transportation*, Vol. 44, No. 1, 2017, pp. 199–224. https://doi.org/10.1007/s11116-015-9634-x.
37. Mitra, R., R. N. Buliung, and M. J. Roorda. Built Environment and School Travel Mode Choice in Toronto, Canada. *Transportation Research Record: Journal of the Transportation Research Board*, Vol. 2156, No. 1, 2010, pp. 150–159. https://doi.org/10.3141/2156-17.
38. Aston, L., G. Currie, Md. Kamruzzaman, A. Delbosc, T. Brands, N. Van Oort, and D. Teller. Multi-City Exploration of Built Environment and Transit Mode Use: Comparison of Melbourne, Amsterdam and Boston. *Journal of Transport Geography*, Vol. 95, 2021, p. 103136. https://doi.org/10.1016/j.jtrangeo.2021.103136.
39. Rahman, M., S. Yasmin, A. Faghih-Imani, and N. Eluru. Examining the Bus Ridership Demand: Application of Spatio-Temporal Panel Models. *Journal of Advanced Transportation*, Vol. 2021, 2021, pp. 1–10. https://doi.org/10.1155/2021/8844743.
40. Larsen, K., J. Gilliland, P. Hess, P. Tucker, J. Irwin, and M. He. The Influence of the Physical Environment and Sociodemographic Characteristics on Children's Mode of Travel to and From School. *American Journal of Public Health*, Vol. 99, No. 3, 2009, pp. 520–526. https://doi.org/10.2105/AJPH.2008.135319.
41. Ewing, R., W. Schroeer, and W. Greene. School Location and Student Travel Analysis of Factors Affecting Mode Choice. *Transportation Research Record: Journal of the Transportation Research Board*, Vol. 1895, No. 1, 2004, pp. 55–63. https://doi.org/10.3141/1895-08.
42. Bree, S., D. Fuller, and E. Diab. Access to Transit? Validating Local Transit Accessibility Measures Using Transit Ridership. *Transportation Research Part A: Policy and Practice*, Vol. 141, 2020, pp. 430–442. https://doi.org/10.1016/j.tra.2020.09.019.
43. Chen, E., Z. Ye, C. Wang, and W. Zhang. Discovering the Spatio-Temporal Impacts of Built Environment on Metro Ridership Using Smart Card Data. *Cities*, Vol. 95, 2019, p. 102359. https://doi.org/10.1016/j.cities.2019.05.028.
44. Tu, W., R. Cao, Y. Yue, B. Zhou, Q. Li, and Q. Li. Spatial Variations in Urban Public Ridership Derived from GPS Trajectories and Smart Card Data. *Journal of Transport Geography*, Vol. 69, 2018, pp. 45–57. https://doi.org/10.1016/j.jtrangeo.2018.04.013.
45. Gan, Z., M. Yang, T. Feng, and H. J. P. Timmermans. Examining the Relationship between Built Environment and Metro Ridership at Station-to-Station Level. *Transportation Research Part D: Transport and Environment*, Vol. 82, 2020, p. 102332. https://doi.org/10.1016/j.trd.2020.102332.
46. Renne, J. L., S. Hamidi, and R. Ewing. Transit Commuting, the Network Accessibility Effect, and the Built Environment in Station Areas across the United States. *Research in Transportation Economics*, Vol. 60, 2016, pp. 35–43. https://doi.org/10.1016/j.retrec.2017.02.003.
47. Fischer, M. M., and J. Wang. *Spatial Data Analysis: Models, Methods and Techniques*. Springer Berlin Heidelberg, Berlin, Heidelberg, 2011.
48. Anselin, L. *Exploring Spatial Data with GeoDaTM : A Workbook*. Center for Spatially Integrated Social Science, Urbana-Champaign Urbana, 2005, p. 245.

49. Arraiz, I., D. M. Drukker, H. H. Kelejian, and I. R. Prucha. A Spatial Cliff-Ord-Type Model with Heteroskedastic Innovations: Small and Large Sample Results. *Journal of Regional Science*, Vol. 50, No. 2, 2009, pp. 592–614. https://doi.org/10.1111/j.1467-9787.2009.00618.x.
50. Arraiz, I., D. M. Drukker, H. H. Kelejian, and I. R. Prucha. CESifo Working Paper No. 2485. SSRN, , 2008.
51. LeSage, J., and R. K. Pace. *Introduction to Spatial Econometrics*. Chapman and Hall/CRC, 2008.
52. Loukaitou-Sideris, A. Fear and Safety in Transit Environments from the Women's Perspective. *Security Journal*, Vol. 27, No. 2, 2014, pp. 242–256. https://doi.org/10.1057/sj.2014.9.
53. Lubitow, A., M. J. Abelson, and E. Carpenter. Transforming Mobility Justice: Gendered Harassment and Violence on Transit. *Journal of Transport Geography*, Vol. 82, 2020, p. 102601. https://doi.org/10.1016/j.jtrangeo.2019.102601.
54. He, S. Y., and G. Giuliano. School Choice: Understanding the Trade-off between Travel Distance and School Quality. *Transportation*, Vol. 45, No. 5, 2018, pp. 1475–1498. https://doi.org/10.1007/s11116-017-9773-3.
55. Zahnow, R. Mixed Land Use: Implications for Violence and Property Crime. *City & Community*, Vol. 17, No. 4, 2018, pp. 1119–1142. https://doi.org/10.1111/cico.12337.
56. Zahnow, R., and J. Corcoran. Crime and Bus Stops: An Examination Using Transit Smart Card and Crime Data. *Environment and Planning B: Urban Analytics and City Science*, Vol. 48, No. 4, 2021, pp. 706–723. https://doi.org/10.1177/2399808319890614.
57. Barabino, B., C. Lai, and A. Olivo. Fare Evasion in Public Transport Systems: A Review of the Literature. *Public Transport*, Vol. 12, No. 1, 2020, pp. 27–88. https://doi.org/10.1007/s12469-019-00225-w.
58. Keleshian, K., and M. Prussin. MTA Ends Free Bus Routes after High Rates of Fare Evasion in NYC Transit System Found - CBS New York. *CBS News*. https://www.cbsnews.com/newyork/news/nyc-free-bus-routes-end-mta-fare-evasion/.
59. Morales-Burnett, J., and Y. Freemark. The Ways Transit Agencies Adapted during the Pandemic Can Inform an Equitable Recovery. Urban Institute, Nov 30, 2021.
60. George, J., and H. Pérez-Moreno. As Crime Rises, Fare Evasion Enforcement Signals a Desire for Civil Order. *Washington Post*, Jun 17, 2023.
61. Culross, M. Paying Our "Fare" Share: Fare Compliance and Enforcement on Muni | SFMTA. https://www.sfmta.com/blog/paying-our-%E2%80%9Cfare%E2%80%9D-share-fare-compliance-and-enforcement-muni.
62. LISNR. Are Transit Fare Evasion Crackdowns Distracting from the Need for Be In, Be Out Solutions? LISNR, May 31, 2024.
63. Dickens, M., and W. McCarragher. *Public Transit Agencies Face Severe Fiscal Cliff*. APTA, pp. 1–5.
64. Scauzillo, S. LA Metro Hopes to Manage, Not Fall off, a 'Fiscal Cliff' in Its Budget Choices. *Los Angeles Daily News*. https://www.dailynews.com/2024/01/04/la-metro-hopes-to-manage-not-fall-off-a-fiscal-cliff-in-its-budget-choices/. Accessed Oct. 23, 2024.
65. O'Toole, R. The Importance of Fare Enforcement. *Newgeography.com*. https://www.newgeography.com/content/007547-the-importance-fare-enforcement. Accessed Oct. 23, 2024.
66. Owens, D. Crime and Harassment on Public Transit. The Discourse Lounge, Aug 03, 2022.
67. City News Service. Metro 'Tap to Exit' Pilot Program Aiming to Improve Safety to Expand. NBC Los Angeles, Juy, 2024.

Data Management Plan

Products of Research
Describe the data that were collected and used for the study.

Data Format and Content
Describe the format, or file type, of the data, and the contents of each file.

Data Access and Sharing
Describe how the general public can access the data.

Reuse and Redistribution
State the restrictions on how the data can be reused and redistributed by the general public.
[Include a hyperlink to the dataset. Most PIs upload data to Dryad or Dataverse.]

Appendix

Survey of California Free or Reduced Transit Fare Programs for Students

Thank you for participating in this study.

This survey is conducted by the Institute of Transportation Studies at the University of California, Irvine (UCI), with support from the California Transit Association. Its purpose is to investigate free and reduced transit fare programs offered to students by California transit agencies. We greatly value your professional insight. The information you provide will help inform public policy about reduced transit fare programs in California.

Use of survey data and privacy

- None of your answers will be presented in any way that identifies you or your agency without your written authorization.
- Aggregate survey responses may be reported in publications or presentations in aggregate form.
- Your contact information will not be shared with anyone outside of the research team.
- Your responses will be stored only on a secure computer at the Institute of Transportation Studies at UCI.

What to expect

- This survey has 4 parts and a few closing questions. Parts I and II collect basic information about you and your agency. Part III asks about free or reduced transit pass programs offered by your agency to California students. Finally, Part IV inquires about the impact of the COVID-19 pandemic on bus ridership.
- Completing this survey may take between 5 and 15 minutes depending on the number of free or reduced transit pass programs offered by your agency.
- You do not need to finish this survey in one sitting; you can return to the survey anytime over the next 14 days.
- Feel free to skip any question that you do not want to answer, but please answer questions as best you can.

Participation, withdrawal, and questions about this survey

- Your participation in this survey is entirely voluntary, but we greatly value your professional opinion and appreciate your contributions to this research.
- You may withdraw your participation at any time.
- You are not waiving any legal rights because of your participation in this study.
- If you have any questions or concerns about this research, please contact:

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Web: http://engineering.uci.edu/users/jean-daniel-saphores

P0.1 Do you agree to participate in this study?

- ○ I agree to participate in this study [continue to next section]
- ○ I decline to participate in this study [end]

PART I: ABOUT YOU

PI.1 What is your name?
First: _____
Last: _____

PI.2 What is your email address? _____

PI.3 What is your current job title? _____

PI.4 How many years have been working in your current role? ____years

PART II: ABOUT YOUR AGENCY

PII.1 What is the name of the transit agency you are working for? _____

PII.2 For this study, we are stratifying transit agencies based on criteria used in the National Transit Database (NTD). What best characterizes the transit agency you are working for?

A. A rural NTD reporter
B. An urban NTD reporter

If answer to PII.2 is "urban NTD reporter" ask

PII.2A What type of urban NTD reporter is your agency?

A. A full NTD reporter (*your agency receives or benefits from §5307 funding, and operates either (1) more than 30 vehicles across all modes and types of service or (2) operates 30 vehicles or less across all modes and types of service and operates fixed guideway and/or high intensity busway*)
B. A reduced NTD reporter (*your agency receives or benefits from §5307 funding and operates 30 vehicles or less across all modes and types of service and does not operate fixed guideway and/or high intensity busway*)
C. A separate service NTD reporter (*your agency receives or benefits from §5307 funding, does not directly operate service, and contracts out modes that are reported by another transit agency*)
D. A build or plan NTD reporter (*your agency receives or benefits from §5307 funding, does not directly operate or contract out service, and is either building a new mode of service or planning activities using §5307 funding*)
E. Other. Please specify _____

If answer is D or E, skip to PP.1

Endif

PII.3 What best describes your agency's operating area? Please check all that apply.

- ☐ Urbanized area with a population **over** 500,000 inhabitants
- ☐ Urbanized area with a population **under** 500,000 inhabitants
- ☐ Non-urbanized area with a population **over** 500,000 inhabitants
- ☐ Non-urbanized area with a population **under** 500,000 inhabitants

PII.4 During fiscal year 2022-23, what modes did your agency operate (directly or via contracting)? Please check all that apply.

- ☐ Bus / articulated bus
- ☐ Commuter bus
- ☐ Van/minivan/vanpool
- ☐ Demand response
- ☐ Demand response - taxi
- ☐ Light rail
- ☐ Commuter rail
- ☐ Heavy rail
- ☐ Other (please specify): _____

PART III. REDUCED OR FREE TRANSIT FARE PROGRAMS

We would now like to collect data about the reduced or free transit fare programs offered by your agency.

PIII.1A How many free or reduced transit fare programs did your agency offer during the fiscal year 2022-23 for the following groups? Check all that apply.

K-12 students: ____
Post-secondary/college students: ____
Employer-based programs: ____
Seniors/disabled riders: ____
Low-income riders: ____
Other: ____

PIII.1B How many free or reduced transit fare programs did your agency offer during the fiscal year 2018-19 (just before COVID-19) for the following groups? Check all that apply.

K-12 students: ____
Post-secondary/college students: ____
Employer-based programs: ____
Seniors/disabled riders: ____
Low-income riders: ____
Other: ____

If the answer for "K-12 students" in PIII.1A < the answer for "K-12 students" in PIII.1B, or if the answer for "Post-secondary/college students" in PIII.1A < the answer for "Post-secondary/college students" in PIII.1B, then ask:

PIII.1C What was your agency's main motivations for decreasing the number of free or reduced transit fare programs for K-12 students between fiscal year 2018-19 and fiscal year 2022-23? Check all that apply.

- ☐ Insufficient funding
- ☐ Insufficient demand
- ☐ COVID-19 restrictions
- ☐ I don't know
- ☐ Other (please specify): _____

If 0 programs in PIII.1A, then go to PIII.11

If "K-12 students" in PIII.1A>0 then

Loop from i=1 to the number of programs for K-12 students

PIII.2KIDi What is the name of your K-12 reduced/free transit fare program number *i*: _____.

This name is used in questions about this program [store in *KIDi*]

PIII.3KIDi Briefly explain what discount *KIDi* offers eligible K-12 students: _____

(Please make sure to mention any time, route, or mode restrictions)

PIII.4KIDi During fiscal year 2022-23, what were the conditions of eligibility for *KIDi*? _

PIII.5KIDi During fiscal year 2022-23, approximately how many K-12 students enrolled in *KIDi*?

____K-12 students
Comments (optional): _____
☐ I do not know

PIII.6KIDi What were the sources of funding for *KIDi* during fiscal year 2022-23? Please check all that applies.

☐ Student fee
☐ School district
☐ County
☐ No funding
☐ I don't know
☐ Other source of funds (please specify): _____

PIII.7KIDi How long has your agency offered *KIDi*? _years
Comments (optional): _____
☐ I do not know

End loop

PIII.8KID During fiscal year 2022-23, how did your K-12 reduced/free transit fare program(s) impact your overall ridership?

If "Post-secondary/college students" in PIII.1A >0 then

Loop from i=1 to the number of programs for post-secondary/college students

PIII.2STUi What is the name of your post-secondary/college reduced/free transit fare program number *i*: ___. This name is used in questions about this program [store in *STUi*]

PIII.3STUi Briefly explain what discount *STUi* offers eligible post-secondary/college students: _ (Please make sure to mention any time, route, or mode restrictions)

PIII.4STUi During fiscal year 2022-23, what were the conditions of eligibility for *STUi*? _

PIII.5STUi During fiscal year 2022-23, approximately how many post-secondary/college students enrolled in *STUi*? __post-secondary/college students
Comments (optional): _____
☐ I do not know

PIII.6STUi What were the sources of funding for *STUi* during fiscal year 2022-23? Please check all that applies.

☐ Student fee
☐ School district
☐ County
☐ No funding

☐ I don't know
☐ Other source of funds (please specify): _____

PIII.7STUi How long has your agency offered *STUi*? _years
Comments (optional): _____
☐ I do not know

End loop

PIII.8STU During fiscal year 2022-23, how did your post-secondary/college students reduced/free transit fare program(s) impact your overall ridership?

If the respondent's agency has reduced or free transit fare programs in FY 2022-23 , ask PIII.9 Overall, how did **all** of your reduced or free transit fare program(s) impact your overall ridership during fiscal year 2022-23?

☐ Increased overall ridership by __%
☐ Decreased overall ridership by __%
☐ I do not know
☐ Comments (optional): _____

Endif

PIII.10 During the fiscal year 2022-23, what farebox recovery ratio requirement applied to your agency's Transit Development Act funding eligibility as defined by PUC § 99268 - 99270.8?

☐ > 20%
☐ 20%
☐ 15%
☐ 10%
☐ I don't know
☐ Other (please specify): _____

PIII.11 During the fiscal year 2022-23, what impact, if any, did your agency's reduced or free transit fare program(s) have on your farebox recovery ratios?

☐ No impact
☐ I don't know
☐ A negative impact (please explain): _____
☐ Other (please specify): _____

PIII.12 During the fiscal year 2022-23, what impacts, if any, did your agency's reduced or free transit fare program(s) have on the fiscal health of your agency?

☐ No impact
☐ I don't know
☐ A negative impact (please explain): _____
☐ Other (please specify): _____

If selected "Bus / articulated bus" or "Commuter bus" in PII.4, do Part IV.

Finally, we have a few questions about the impacts of COVID-19 on bus boardings.

PIV.1 What percentage decrease in overall bus boardings did your agency experience during the peak of the COVID-19 pandemic? _____

PIV.2 How do your agency bus boardings in 2023 compare to bus boardings in the 2019 in the following cases (please provide a percentage change)?

1. Overall: _____
2. During a normal weekday morning peak: _____
3. Off-peak, during a normal weekday: _____
4. On weekends: _____

PIV.3 Which of the following measures did your agency implement during COVID-19 (check all that applies)?

- ○ Decrease bus frequency on some lines
- ○ Stop service on some lines
- ○ Implement social distancing measures
- ○ Implement enhanced bus cleaning measures
- ○ Adopt mask mandates
- ○ Implement health screening for staff (particularly drivers)
- ○ Enhance real-time passenger information
- ○ Adopt contactless fare payments

If the answer to PIII.1D is a negative %, ask:
PIV.4 What measures did your agency implement to increase bus boardings (check all that applies)?

- ○ Increase service frequency on selected lines
- ○ Create new lines
- ○ Create new bus rapid transit lines
- ○ Offer free or discounted fare programs for specific groups
- ○ Other. Please explain briefly: _____

CLOSING QUESTIONS

PP.1 If you have any comments about this survey (and in particular about free/reduced transit fare programs), please enter them in the box below:

_____

PP.2 May we follow up with you on your responses?

- ☐ No
- ☐ Yes, please contact me at the email address I entered in Part I of this survey
- ☐ Yes, please contact me at a different email address or by phone (please include area code):

_____

PP.3 Would you like to receive an electronic copy of our findings?

- ☐ No
- ☐ Yes, please send it to the email address I entered in Part I of this survey
- ☐ Yes, please send it to a different email address: _____

Thank you for participating in this survey. Your time is greatly appreciate