CAPSTONE PROJECT REPORT

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School Transportation Equity for Vulnerable Student Populations through Ridehailing:

An Analysis of HopSkipDrive and Other Trips to School in Los Angeles County

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Client: HopSkipDrive

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16. Abstract

The Every Student Succeeds Act (2015) gave foster youth additional legal protections in school, including the right to transportation and the right to remain at their school despite any moves, similar to protections already in place for students experiencing homelessness and students with disabilities. California's compliance with this mandate was relatively more difficult than other states', as less than ten percent of students in California travel by school bus, compared with 35 percent nationally. Thus, California schools could not simply tap into their existing services to provide transportation for foster youth.

Ridehailing offers a solution to this gap. HopSkipDrive, a ridehailing company designed to transport children, engages in contracts with school districts and county governments to provide school transportation for these vulnerable student populations. In 2018–2019, HopSkipDrive provided 32,796 trips to school in Los Angeles County, with massive time savings over the logical alterative: transit. Using Google's Directions API, I determine that HopSkipDrive offers time savings of nearly 70 percent compared with the same trips simulated on transit. HopSkipDrive's trips average 28 minutes in duration, yet on transit only 30 percent would have taken less than 45 minutes. This is despite 90 percent of all origins and destinations being located within a half-mile of a transit stop. This service has important social equity implications beyond just time savings offered to vulnerable student populations, as HopSkipDrive contract trips tend to originate in neighborhoods with high percentages of low-income households and people of color.

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School Transportation Equity for Vulnerable Student Populations through Ridehailing

An Analysis of HopSkipDrive and Other Trips to School in Los Angeles County

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Applied Planning Research Project

A comprehensive project submitted in partial fulfillment of the requirements for the degree of Master in Urban and Regional Planning.

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Faculty supervisor: Dr. Evelyn Blumenberg, Professor of Urban Planning and Director of the Lewis Center for Regional Policy Studies

June 2, 2020

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List of Acronyms and Definitions

ACS	American Community Survey
AVTA	Antelope Valley Transportation Authority
CDE	California Department of Education
DCFS	Department of Children and Family Services, Los Angeles County
DoED	United States Department of Education
EHA	Education for All Handicapped Children Act of 1975
ESSA	Every Student Succeeds Act of 2015
IDEA	Individuals with Disabilities Education Act of 1990
IEP	Individualized Education Program
LACOE	Los Angeles County Office of Education
LEA	Local education agencies (or more commonly: school districts)
MaaS	Mobility as a Service
Metro	Los Angeles County Metropolitan Transportation Authority
NCLB	No Child Left Behind Act of 2001
NHTS	National Household Travel Survey (2017)
OCP	Office of Child Protection, Los Angeles County
OCTA	Orange County Transportation Authority
TAY	Transitional Aged Youth
VMT	Vehicle Miles Traveled

Disclaimer

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Additionally, I'm grateful to several people whose support of this project has been crucial to making it possible. Brian Taylor introduced me to the study of shared mobility and was a true optimist in my ability to undertake this unusual project, especially in the planning stages when I needed it most. Maddie Brozen, Juan Matute, and Danielle Maris Lacob each helped in bringing this project together logistically. David James provided technical expertise in computer programming. And at HopSkipDrive, Bob Newstadt and Aylin Cook were central parts of a team I have genuinely enjoyed getting to know and working with over the past year.

And of course, I am grateful to the UCLA Institute of Transportation Studies, the UCLA Lewis Center for Regional Policy Studies, and the Federal Highway Administration for their financial support of this project.

Executive Summary

Since the Every Student Succeeds Act became federal law in 2015, foster youth have had the legally-protected right to school transportation and to remain at the same school, regardless of any home address changes. This extended the same rights already afforded to students experiencing homelessness and students with disabilities through previous legislation, presenting logistical challenges for school districts. This was acutely true in California, where school districts do not typically provide general education transportation through yellow school bus service. So, while this legislation intended to protect vulnerable students' opportunities for a fair education, without a method of providing this transportation, this requirement would be impossible to implement.

In Los Angeles County, HopSkipDrive bridges this gap. A ridehailing service specifically designed for children, HopSkipDrive operates in eight states and has transported over a million children for over 7 million safe miles. Several school districts in Los Angeles County and the county's Department of Children and Family Services (DCFS) have entered into contracts with HopSkipDrive to provide recurring school trip service to these vulnerable student populations. In the 2018–2019 Academic Year, HopSkipDrive provided 26,706 such trips to school.

In this report, I analyze HopSkipDrive's trip data for morning trips to high school in Los Angeles County for the 2018–2019 Academic Year. I detail how these trips compare to general travel to school in California. I also examine the neighborhood traits of where these trips begin, and I compare the trips to simulated versions on public transit.

HopSkipDrive operates with a hybrid business model: one part is consumer-based, and the other part is enterprise-based. This includes three distinct types of trips:

Consumer: These are trips that parents purchase individually.

School Contract: These are trips that school districts arrange in bulk under an ongoing contract with HopSkipDrive to fulfill their legal obligations to provide student transportation (or for any reason the district would deem necessary).

Foster Contract: These are trips provided to foster youth under partnership with Los Angeles County's DCFS.

I generally analyze the three trip types separately, but at times I also group the two types of contract trips together, as they are similar in both intention and characteristics. I compare these trips with transit because school districts will often first examine transit as an option for providing federally-mandated transportation services, seeing it is as a low-price existing public system to which they already have access.

Ultimately, I find that HopSkipDrive contract trips are hugely beneficial to the students they serve. This is most prominent when comparing trip durations between HopSkipDrive and transit; HopSkipDrive trips take less than half the time of similar transit trips, with durations similar to state averages. Thus, school districts that provide HopSkipDrive rides to their vulnerable student populations are offering a more equitable method of transportation and enabling students to attain a more equitable education.

Key Findings

This report details several findings along three general analyses: first, contextualizing HopSkipDrive trips with broader California trends; second, analyzing sociodemographic traits of neighborhoods where HopSkipDrive trips begin; and third, comparing HopSkipDrive trips to public transit. I base this analysis both on HopSkipDrive's trips in the 2018–2019 Academic Year and on data from the 2017 National Household Transportation Survey. In sum, I put forth four key findings:

1. **The overwhelming majority of high school students in California travel to school by private vehicle.**

About three-quarters of high school students in California travel to school in a private vehicle, as shown in Table ES-1. This could be driving themselves, being driven by a parent, or riding in a carpool. Of the remaining quarter of students, half walk. The rest are split between taking a school bus, riding a bike, and taking transit—all in single digit percentages. Students who travel to school in a private vehicle are typically from wealthier neighborhoods than students who travel via most other modes.

Table ES-1: High School Students' Travel to School in California, 2017

Mode	Share	Average Distance (mi.)	Average Duration (min.)	Average Speed (MPH)	Average Trip End Time (AM)
Walk	12%	0.8	16.34	2.9	7:50
Bike	2%	1.58	12.68	7.5	7:43
School Bus	8%	7.84	33.55	14.0	7:45
Private Vehicle	74%	5.14	15.46	19.9	7:43
Transit	3%	7.82	42.5	11.0	8:09
Other	1%	7.01	29.58	14.2	8:02
Total/Overall	**100%**	**4.86**	**17**	**17.2**	**7:45**

n = 1,027

Source: National Household Travel Survey (2017)

This mode share distribution is unusual in the national context. Among the other 49 states and the District of Columbia, 38 percent of students make the morning trip to school on a yellow bus. California's paltry eight percent school bus mode share is the second-lowest in the nation and is the result of a 2012 policy decision to eliminate the state's funding reimbursements to school districts for providing school bus service. The Golden State is now just one of two states to neither require nor fund general education school transportation.

2. HopSkipDrive contract trips tend to be longer in both distance and duration compared with California averages and HopSkipDrive consumer-purchased trips.

Of HopSkipDrive's 260,723 trips in Los Angeles County during the 2018–2019 Academic Year, about 13 percent were trips to school. The vast majority of those—81 percent—were contract trips. Table ES-2 shows the same trip statistics as Table ES-1, but for the different HopSkipDrive trip types. Although consumer trips are generally similar to statewide figures, both types of contract trips far exceed both of those groups with regard to distance and duration.

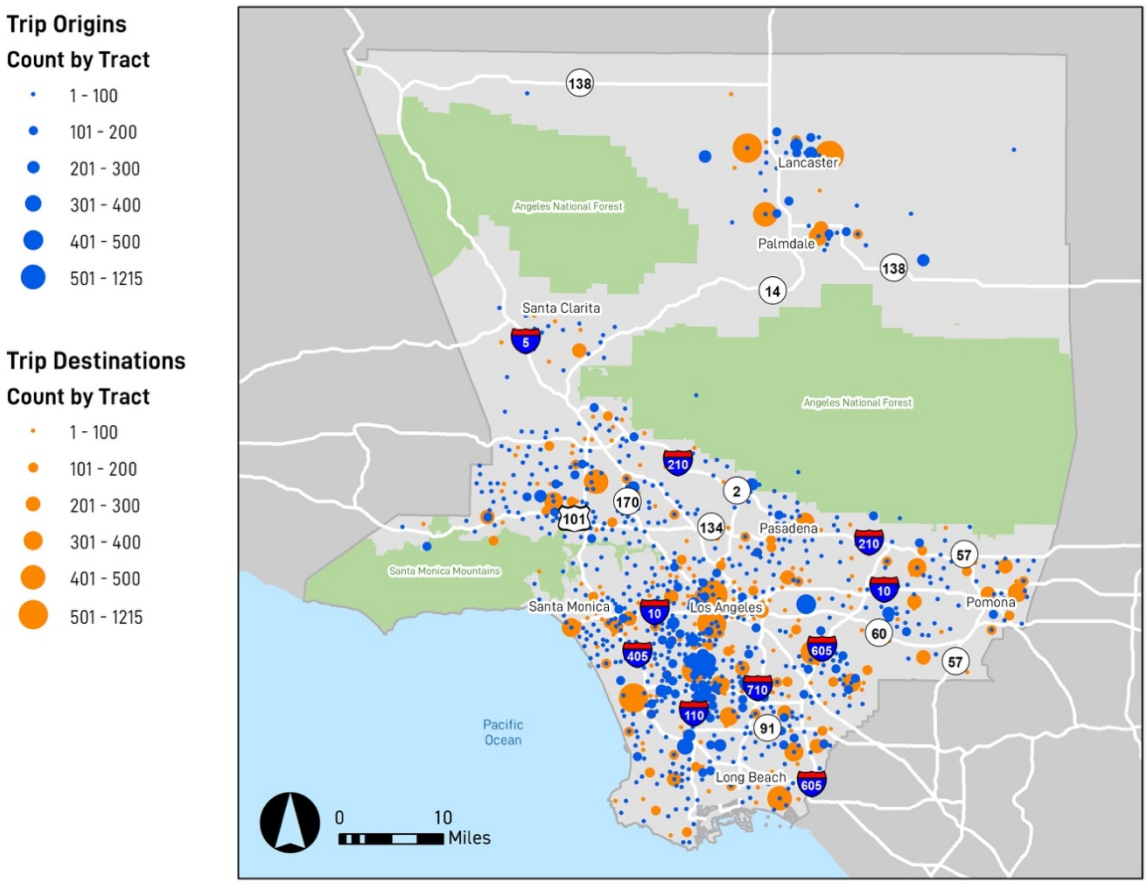
Table ES-2: High School Students' Travel to School on HopSkipDrive in Los Angeles County, Academic Year 2018–2019

Trip Type	Trip Count	Share	Average Distance (mi.)	Average Duration (min.)	Average Speed (MPH)	Avg Trip End Time (AM)
Consumer	6,090	19%	6.81	19.17	21.3	7:47
School Contract	7,562	23%	11.36	28.98	23.5	8:05
Foster Contract	19,144	58%	13.75	31.81	25.9	7:39
All	32,796	100%	11.91	28.81	24.8	7:46

3. HopSkipDrive contract trips are more likely to begin in low-income neighborhoods and neighborhoods of color.

HopSkipDrive provides transportation to school all around Los Angeles County, as shown in Figure ES-1. As expected, origins are more widely dispersed, and destinations are more concentrated, as there are many more homes than there are schools. But that does not deter either's geographic scope. HopSkipDrive transports students to origins and destinations in the remote areas of the county—for example, the Antelope Valley and the Santa Clarita area—as well as the urbanized Los Angeles Basin.

Figure ES-1: HopSkipDrive Trip Origins and Destinations



More importantly, several detailed maps within the report show what Table ES-3 summarizes: HopSkipDrive contract trips begin in neighborhoods that have, on average, lower median household incomes and higher percentages of people of color. This has major implications not just in the transportation realm but for educational equity as well, which I explain in the next section.

Table ES-3: Origin Neighborhood Sociodemographic Traits

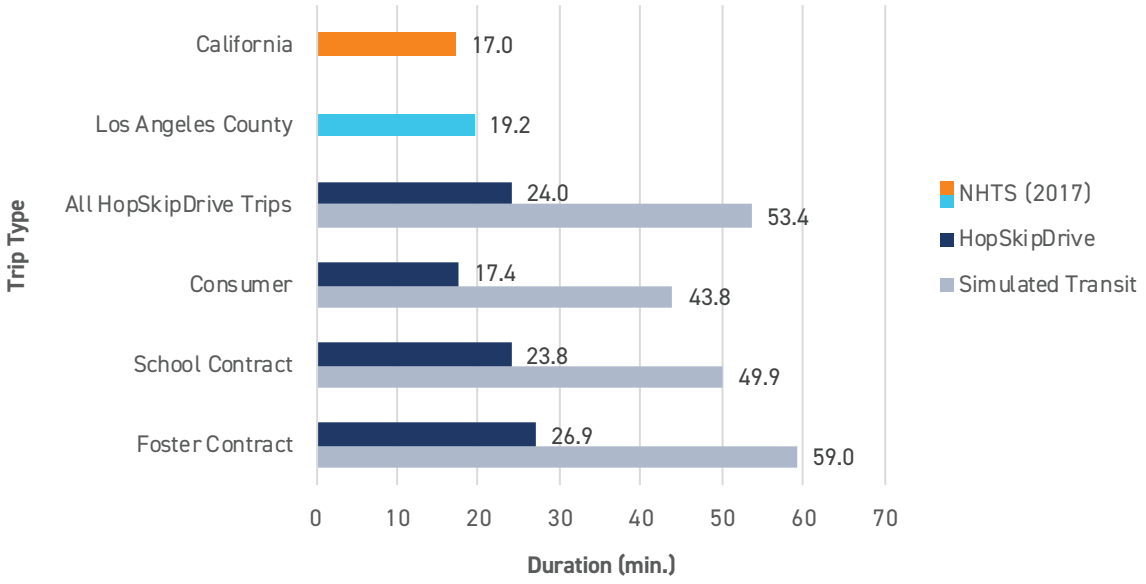
Trip Type	Avg. Median Household Income	Avg. Percent Non-White Hispanic/Latino	Avg. Percent Non-White	% HH without a vehicle	% HH Limited English Proficient
Los Angeles County*	**$68,093**	**24%**	**51%**	**9%**	**13%**
All HopSkipDrive	**$67,530**	**26%**	**79%**	**9%**	**11%**
Consumer	$94,249	13%	55%	6%	8%
School Contract	$61,129	30%	83%	12%	14%
Foster Contract	$61,119	28%	86%	8%	11%

Source: ACS 5-year Estimates, 2018.

4. **HopSkipDrive trips offer vulnerable student populations a travel-to-school option that is similar to their peers' in terms of duration and represents massive time savings over traveling by transit.**

The average trip to school in California lasts 17 minutes; in Los Angeles County it is 19 minutes. On HopSkipDrive, it is 24 minutes, but if those students who were given HopSkipDrive trips were instead given transit passes, their trips to school would have lasted 53 minutes—over triple the state average—as shown in Figure ES-2. Summing across its approximately 26,000 contract trips to school, HopSkipDrive saved Los Angeles County's vulnerable student population almost four years of worth of their time.

Figure ES-2: Duration Comparison of HopSkipDrive Trips and Simulated Transit Trips



Recommendations

Based on these findings and their implications for vulnerable high school students, I make three policy recommendations in the report:

1. **HopSkipDrive partnerships are vital for vulnerable students, and more school districts should sign on.**

HopSkipDrive contracts help to close the gap from California's lack of general education transportation service and provide a more equitable method of transportation that opens better educational opportunities for vulnerable youth. Specifically, access to a nimble and flexible transportation service enables students to reach a variety of

destinations in an efficient manner, which in turn allows vulnerable students to attend the best school for them. That is usually the school at which they began the academic year, giving them access to existing social networks, needed social services, consistent academic schedules, less exposure to police discipline, and more free time. Additionally, HopSkipDrive partnerships are mutually beneficial for both schools and the company.

2. **HopSkipDrive is not a solution for mass transportation to school for the general population.**

Although HopSkipDrive is crucial for vulnerable students in specific challenging situations, it is not suitable for scaling up to the general student population. In short, HopSkipDrive is not a substitute for general education yellow school bus service. Having thousands of independent HopSkipDrive CareDrivers traversing a city or region is inefficient, but having select CareDrivers serving specific trips for special needs is vital to ensuring student access to a consistent education and a higher quality of life.

3. **More research is needed to determine the optimal role of ridehailing services in school transportation.**

Transportation to school is a lot like plumbing and sports referees: you do not notice a problem until it fails. Unfortunately, this has led to an important and sizeable part of the American transportation system—16 percent of the United States population is enrolled in a K-12 public school—receiving very little attention in the academic and popular literature. Specifically, very little is known about the effects of transportation to school on academic outcomes. While HopSkipDrive provides a vital service to a specific group of vulnerable students, researchers must further study how transportation affects students in school before expanding HopSkipDrive's role beyond these populations or making larger-scale decisions, like resuming yellow school bus service in California.

Conclusion

This work is urgent. California's insistence on burdening parents and guardians with transporting their children to school is a practice that is inequitable and unsustainable, and it perpetuates the growing educational achievement gap. Without HopSkipDrive, vulnerable students in Los Angeles County from poor and minority neighborhoods would be faced with the decision of either spending long hours on transit buses or jeopardizing their educations by transferring schools. Ultimately, HopSkipDrive offers a needed and beneficial service that helps students efficiently get to the right school.

1. Introduction

Traveling to school is a nearly-universal experience for a child or adolescent growing up in the United States. In Fall 2018, a projected 50.8 million students enrolled in US public schools for kindergarten through grade 12, for whom expenditures projected to be roughly $654 billion (*Digest of Education Statistics*, 2017). In California alone, 6.2 million students attend public schools—a group that represents nearly two percent of the entire US population. Each day, over 10,000 schools accept these students before the first bell rings, and they seek to educate these young people until the last bell dismisses them (California Department of Education, 2018). While from an educator's perspective the school day begins at the first bell, for students the day begins when they first leave home to travel to school.

For some students, however, the burden of this travel is much steeper than it is for many of their peers. What makes travel to school unusual is that it is, by extension, compulsory. Since 1917, all 50 states have required school attendance by law (Diffey & Steffes, 2017); yet in California, the provision of general education transportation by school districts is neither funded nor required. This presents challenges for the families of students who live too far from school to walk and cannot drive themselves. More specifically, for students who are in foster care, who are experiencing homelessness, and/or who have disabilities, getting to school may well represent the greatest challenge they face in their educational journey. HopSkipDrive, a ridehailing company that serves children, is seeking to bridge this gap and to bring the travel of these students closer in line with their non-disadvantaged peers.

The purpose of this report is to explore the school travel behaviors and patterns of foster youth, homeless students, and students with disabilities, using 2017–2019 trip-level data in Los Angeles County from HopSkipDrive, a provider of ridehail services for children, and to compare those trips with travel survey data from the National Household Travel Survey California Add-on and to transit schedule data. I seek to answer the following question in this analysis: How do these vulnerable students' trips on HopSkipDrive compare to HopSkipDrive consumer school trips and to the typical travel behavior of students in Los Angeles County, and how would these trips be different if they were taken using public transit?

In this report, I first provide context on school travel policy in the United States and, more specifically, California, as well as background on HopSkipDrive and its role in this sector of the transportation field. I then conduct a literature review of existing

studies on school transportation and ridehailing services. After explaining the data source and methodology for this study, I provide a detailed analysis of trips to school in Los Angeles County, including descriptive statistics, spatial analysis, and trip modeling. I then discuss these findings and provide policy recommendations for the future of transporting vulnerable students. Ultimately, I argue that HopSkipDrive is providing an essential service to students who are in foster care, experiencing homeless, or have disabilities, and that those students deserve to travel to school in a manner that is more similar to that of their peers. Indeed, new or continued policies that use HopSkipDrive's services in Los Angeles County represent an important investment in educational equity for our most vulnerable students in Los Angeles County's public schools.

2. Background and Context

The issue of school transportation in Los Angeles County has several compounding factors. California is rather unique with regard to both its sheer volume of K-12 public school students and its methods of transporting them—or, rather, not transporting them. A 2012 shift in state policy that moved the state away from using yellow school buses and, indirectly, toward using private vehicles aligns almost exactly with the birth of ridehailing services as we known them today. In this chapter, I provide an overview of school travel policy in California, especially with regard to its differences from other states' policies, and a history of HopSkipDrive's evolution as a company since its founding in 2014.

2.1. School Travel Policy

The United States Supreme Court has ruled that schooling is not a Constitutional right and that, further, school transportation is not a Constitutional right (N. McDonald & Howlett, 2007). However, each state requires schooling. Therefore, without guiding federal policy for the general student population, decisions on how to transport children to and from school are relegated to the states. This devolution of responsibility generally mirrors much of education policy in the United States and, in both the case of broader policy and transportation policy specifically, leads to substantially different approaches across the country. Some states require districts to provide transportation; other states do not require it but will reimburse districts for part of their transportation expenses. In California, the provision of general education school transportation by local public school districts has been neither a state requirement nor a state-funded expense since 2012 (York & Watanabe, 2011). In fact, California and Indiana are the *only* two states that neither require nor reimburse school transportation (Burgoyne-Allen & O'Neal Schiess, 2017).

One area of school transportation in which federal policy does reign, however, is the transportation of specific vulnerable populations. A patchwork of legislation has led to federal mandates that school districts provide transportation for the following groups: students experiencing homelessness, students with disabilities, and students in foster care. Most of these mandates, shown chronologically in Table 1, are unfunded; that is, it is up to state and/or local jurisdictions to find the financial means to comply with these orders. In Los Angeles County, schools bear the responsibility of ensuring transportation for students experiencing homelessness and students with disabilities, while the county handles school transportation for foster youth.

Table 1: US Legislative History of Protections for Vulnerable Student Populations

Year	Acronym	Act	Protects	Description
1975	EHA	Education for All Handicapped Children Act	Students with disabilities	Required public schools to provide free education for children with disabilities; Required use of IEP
1987	Mc-V	McKinney-Vento Act	Students experiencing homelessness	Gives students right to enroll, remain at school of origin, receive transportation and other support
1990	IDEA	Individuals with Disabilities Education Act	Students with disabilities	Shifted focus from condition to individual; Required transition to adulthood plans
1997	IDEA	Individuals with Disabilities Education Act (Amended)	Students with Disabilities	Amended to expand protected student classifications
2001	NCLB	No Child Left Behind	All schools receiving US DoED funds	Required assessments and measures of Adequate Yearly Progress tied to funding
2004	IDIEA	Individuals with Disabilities Education Improvement Act	Students with Disabilities	Reauthorized IDEA to align with NCLB, requiring goals and assessments
2015	ESSA	Every Student Succeeds Act	Foster youth; Students experiencing homelessness	Reauthorized McKinney-Vento Act and expanded protections to include foster youth

The Education for All Handicapped Children Act (EHA) (1975) was the first such legislation to offer this type of protection, affording students with disabilities who have an Individualized Education Plan (IEP) with publicly-funded transportation to and from school as a "related service" in pursuit of providing a "free appropriate public education" (Education for All Handicapped Children Act, 1975, p. 775). In 1990, President George H.W. Bush signed into law the Individuals with Disabilities Education Act (IDEA), which updated EHA. IDEA, which maintained many of EHA's provisions while enhancing students' readiness for transition to adulthood (National Association of State Directors of Special Education, 1990), has since been updated in 1997 and 2004.

The McKinney-Vento Act (1987) provided a similar mandate for students experiencing homelessness or those without a permanent address, giving them the right to receive school transportation free of charge, among other protections to ensure greater chances at educational success (National Center for Homeless Education, 2018). The McKinney-Vento act is the only of these three to include direct funding through a federal program allocation. And most recently, the Every Student Succeeds Act (ESSA) (2015) expanded those protections to include children in the foster care system, including the right to be transported to school free of charge to the student and care provider. Both

McKinney-Vento and ESSA also afford the right for a student to remain at their school of origin for the entire school year, regardless of any relocations they may experience while experiencing homelessness or within the foster care system. The directive includes any moves to a new nighttime residence or foster home outside that original school's or district's regular boundary zone (US Department of Education & US Department of Health and Human Services, 2016).

In most states, the transportation services that these mandates require are absorbed into the general education transportation system. Most districts in these states maintain or contract out extensive yellow school bus operations; in fact, these operations are so pervasive that the aggregate fleet size of all school buses in the United States is *double* that of every other type of transit vehicle combined (Burgoyne-Allen & O'Neal Schiess, 2017; National School Transportation Association, 2013). But in California's metropolitan areas, there are almost no yellow school bus operations. As of 2017, only 8 percent of students rode a yellow bus to school (NHTS, 2017). Thus, transporting these vulnerable student populations is not only legally mandatory but also exceptionally difficult, because the general education transportation network consists mostly of parents driving their children to school and other informal carpools. Currently, policymakers in Los Angeles are examining the potential for the Los Angeles County Metropolitan Transportation Authority (Metro) to provide free transit passes for all Los Angeles Unified School District (LAUSD) students (Los Angeles Times Editorial Board, 2020), but as I will explain in this report, those services are inadequate for many vulnerable populations.

2.2. HopSkipDrive

Concurrent to these changes in school transportation policy, the ridehailing sector began to emerge. Lyft and Uber became nationally-recognized brands after they took their current operational form in 2012. But Lyft and Uber serve only adults (Lyft, 2020; Uber, 2020)[1]; there was still a largely vacant market for children. During this time, working mothers Joanna McFarland, Carolyn Yashari Becher, and Janelle McGlothlin

[1] Uber and Lyft do allow minors when riding with adults. However, both companies expressly prohibit minors' booking of their services and/or minors riding alone, but this ultimately does not stop such use from occurring. Several popular press articles examine this issue, including Baig (2019) and Nguyen (2019). The issue received additional attention in 2019 after a 12-year-old child used Uber to transport herself to an Orlando parking garage where she died by suicide (Baer, 2019). While this issue is important, I do not cover other ridehail companies' enforcement of age policies in this study. HopSkipDrive is designed with child users in mind, and the company prepares for, monitors, and insures its rides with the intent of transporting children without parent or guardian supervision.

were searching for a solution to their difficulties balancing their careers and roles as parents. In 2014 they co-founded HopSkipDrive, a ridehailing company that provides for-hire transportation for children ages six and older. Initially, HopSkipDrive began as a service for families, but it has since evolved into a service that simultaneously serves families and schools. Currently, HopSkipDrive operates in Arizona, California, Colorado, Maryland, Nevada, Texas, Virginia, and Washington (HopSkipDrive, 2019).

Since 2014, HopSkipDrive has transported over 1 million children for over 7 million safe miles driven. The company operates with two core business models: consumer-based, meaning a parent hires a ride for a child, and enterprise, meaning a school district or county contracts with HopSkipDrive for the larger-scale provision of rides for children it serves. In the 2018-2019 academic year, the company partnered with 37 school districts, 72 private or charter schools, and 14 counties, to provide transportation services for children to and from school in some capacity. In Los Angeles County, the partners included contracts with various public school districts, charter schools, private schools, and most notably, a contract with the county's Department of Children and Family Services as part of the Foster Youth Stability Transportation Pilot.

HopSkipDrive thoroughly vets each driver and monitors each ride through its CareDriver protocol, as compared with the laxer practices of ridehail industry leaders Lyft and Uber. CareDrivers are independent contractors who must have five or more years of childcare experience, pass a 15-point certification process, complete an in-person meeting and orientation, use a vehicle 10 years old or newer, pass a vehicle inspection annually, be over the age of 23, and undergo continuous background checks and driving record monitoring. Through its app, HopSkipDrive allows CareDrivers to set their own schedules and select rides up to six weeks in advance.

Rides are available to consumers anytime, any day, except for some major federal holidays. Consumers must have a smartphone to request a ride through the company's app; however, school districts have the ability to centrally request rides. A variety of options and safety protocols are available for each ride, including the use of flags to demark a HopSkipDrive vehicle, a uniformed shirt for CareDrivers, a safe word that only the parent, child, and driver know, and a pick-up protocol (a driver can knock on a door, honk the horn, or wait at a designated place). Additionally, HopSkipDrive's Safe Ride Team monitors each ride live, including technology that monitors driving behaviors.

Like the larger adult-serving ridehailing services were in their earlier years prior to Lyft's and Uber's IPOs in 2019, HopSkipDrive is backed by venture capital. To date, the company has raised $27 million from investors (HopSkipDrive, 2019). What sets HopSkipDrive apart from Lyft and Uber—beyond the obvious operational differences—is

that HopSkipDrive maintains both its pay-by-the-ride consumer model and its longer-term contracts with schools and counties. Leveraging these services against each other allows the company to expand and to serve a broader mission of providing both safe, quality rides and an important public service to children who need it most. HopSkipDrive is the leading company in providing mobility as a service for children; its smaller competitors include Zum, which provides a similar service portfolio to HopSkipDrive but only in the San Francisco Bay area, and Kango, which provides a combination of rides and childcare services in the Los Angeles, Phoenix, San Diego, and San Francisco areas (Heilweil, 2019).

3. Literature Review

This report analyzes the school travel behaviors of vulnerable students who have been provided with ridehail trips to and from school through partnerships or contracts with HopSkipDrive. The findings are contextualized by the travel behaviors of other students using the HopSkipDrive platform and of students across Los Angeles County. Thus, in conducting a review of the existing literature relevant to this analysis, I include both literature on school transportation and literature on ridehailing, with a specific focus on equity. Of important note, there are enormous gaps in both of these literatures.

With regard to analyzing school travel, the research is limited by three factors: lack of cross-profession analyses, lack of autonomy for children's travel actions, and lack of available datasets on children. First, school travel covers two disparate topics: education and transportation. Thinking of these two phases of the school day—travel time and instructional hours—as one entity is rare. I believe this ultimately boils down to professional skillsets. Transportation planners are good at moving people. Educators are good at teaching children. The two rarely mix. This relationship has functioned more like a relay race and less like a collaboratively-planned operation. Second, children often do not or cannot make travel decisions for themselves; that is, their parents make decisions like travel mode and school choice for them. And third, datasets on children's travel are exceptionally difficult to come by, which I will discuss more in the next chapter.

With regard to ridehailing, the literature is limited by two factors: the nascency of the ridehailing industry and the near-complete lack of available data from ridehailing operators. While the crux of this research is undoubtedly school travel, it is important to pay attention to HopSkipDrive's roots as a ridehailing company. In my review, I first delve into topics on school travel with an eye toward applications to vulnerable populations; I then explore the emerging scholarship on ridehailing with specific attention toward equity.

3.1. Travel to School

Compared with the many studies on adult travel behaviors, researchers have put forth little on school travel. Closing this gap is important from a transportation planning perspective so that we have a clearer understanding of the role these many trips play in the overall transportation system. It is also important from a human welfare and public policy perspective, as gaining better insights into school travel is central to understanding trade-offs between key outcomes: between school performance and accessibility, between student utility and school district utility, and between efficiency and equity. These issues

bear particular consequences for disadvantaged populations who may not be able to bridge on their own the gaps that transportation policies create.

3.1.1. Mode Choice

In the United States, there are five primary means of transportation to school: private vehicle, school bus, public transit, walking, and bicycling (Ewing et al., 2004; N. C. McDonald, 2008; McGuckin, 2013; *Travel to School: The Distance Factor*, 2008). It is the addition of the school bus that differentiates school trips from being the equivalent of adult commute trips to jobs. In the United States, nearly a half million school buses transport 25 million students each day to K-12 schools. This number represents a fleet size more than double the size of all other forms of mass transit combined (Burgoyne-Allen & O'Neal Schiess, 2017; National School Transportation Association, 2013). Although omnipresent—the school bus has a nationalized "glossy yellow" paint color—the school bus's modal share has fallen slightly over the past several decades, while distance traveled to school has increased (*Travel to School: The Distance Factor*, 2008).

Ewing et al. (2004) argue that students and families use a nested logit structure when choosing their mode. Rather than choosing among the four modes equally[2], families first choose between using a car or taking an alternative mode, then they make a choice among the remaining modes. Further, they are only able to confirm that commute time and built environment are factors in student modal choice; they are unable to identify which specific aspects of the built environment also play a role. McDonald (2011) confirmed similar findings in a separate study, putting forth that travel time has the strongest effect on school travel modal choice, and that dense places encourage walking. These findings are especially important for low-income students, who have limited housing options (Makarewicz, 2013). Gender and race do not appear to have large effects (N. C. McDonald, 2008). An exception to this all, as Ewing et al. (2004) notes, is school bus travel, which has a utility independent of travel time: it is more a function of parental convenience and service availability.

3.1.2. Finance and Policy

Most states require districts to provide transportation for students in some capacity and then reimburse a portion of the expenditure. California, however, does not mandate

[2] Ewing et al. (2004) omit transit as a mode because their sample size for the transit mode was too small. Only four of the 819 high school trips they evaluated used transit. Thus, they analyze only car, walk, bike, and school bus.

transportation be provided and thus has the lowest school bus modal share in the country. Only California and Indiana do not require some large-scale form of student school bus transportation, and only a dozen states even allow their school districts to charge fees for the service (Boyland, 2012; N. McDonald & Howlett, 2007; Vincent et al., 2014). The phase out of school buses in California has been gradual, beginning with a funding freeze in 1978—a consequence of Proposition 13—and culminating with Governor Jerry Brown's elimination of nearly the entire state school transportation budget in 2011 (Taylor, 2014).[3] Districts have the option of covering these costs themselves, but few have chosen to do so. Districts in Oakland, San Diego, San Francisco, and Los Angeles have all reduced their school bus service to nearly the legal minimum, providing only for those students that federal law requires (special needs and homeless students) (Freedberg, 2011; Koran, 2017).

Particularly relevant in this situation but nevertheless relevant in nearly all urban areas, federal legislation hinders districts from looking toward public transit as a means for student transportation. The "Tripper Rule," as part of the Federal Mass Transit Assistance Act of 1974, prohibits transit agencies from running service expressly for students (Vincent et al., 2014). The "Tripper Rule" dictates that public transit agencies may run additional buses on an existing route that serves a school, but it may not alter the route and it may not use any different stops.[4] This rule protects private school transportation companies from competition, and it protects transit agencies from needing to add expensive additional service at peak hours (Federal Transit Administration, 2008). Nonetheless, some urban districts like Washington, DC, and New York City still rely heavily on public transit (Burgoyne-Allen & O'Neal Schiess, 2017). These districts are less affected by the "Tripper Rule" because their regions have large transit systems with established routes that are more equipped to serve their students' needs.[5]

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[3] Brown's budget cut amount was $248 million, which the state previously used to reimburse districts for student transportation expenses. This reimbursement averaged about 40 percent for each district, but in some cases could be an extreme amount, like Los Angeles Unified School District's annual $38 million reimbursement. This amount had been set and frozen since 1978 (York & Watanabe, 2011).

[4] The Federal Transit Administration (FTA) clarified its interpretation of the "Tripper Rule" in 2005 and 2008 to allow for some small deviations in route, but only ones that would move a stop slightly closer to a school. No stops may be added for pick-up or drop-off. Additionally, it generally does not permit transit agencies to name routes or stops after the schools they may serve (Federal Transit Administration, 2008).

[5] Although transit can serve many students in New York City and Washington, DC, it cannot serve all and does not serve all adequately. Nationally, only two percent of students use transit to travel to school. I will detail transit usage among high schoolers in California and in Los Angeles County later in this report.

Gase et al. (2014) conducted a public health analysis of the potential benefits and costs of providing free transit passes to public school students in Los Angeles County. They suggest four primary benefits: increased school attendance, decreased contact with the juvenile justice system, increased available funds for local education agencies (LEAs), and healthier communities and families. They presented two striking statistics: first, that among the 75 percent of Los Angeles County school districts that reported, less than 10 percent of students had transportation provided to them; and second, that for every one percent decrease in unexcused absences in Los Angeles Unified School District, schools would receive an additional $125,000 in funding each year. Gase et al. theorize that transit passes could solve attendance issues and increase funding that LEAs receive. These particular benefits, however, need not be through the provision of transit passes alone; these benefits can be realized through providing school transportation generally and in a variety of ways.

3.1.3. School Choice, Access, and Equity

There are several case studies from around the country that examine school transportation in the contexts of innovation and school choice. Vincent et al. (2014) examine eight current US initiatives to improve student transportation and/or reduce transportation expenditures for school districts. The strategies that they studied include discounted student transit passes, family carpool encouragement, alternative fuel use, and app-based bus locating. They find that, although few districts are, the most effective way to innovate in this field is to try multiple strategies at once. Chingos (2017) et al. examine student transportation in five "choice-rich" cities: Denver, Detroit, New Orleans, New York City, and Washington, DC, and find that availability of publicly-funded transportation in each city varies, especially for students who choose a school outside of their assigned school. The amount per student that districts spend on transportation also varies across the country.

Gross and Denice (2017) focus on school transportation in Denver, which uses a school choice model that allows families to apply for admission to any school in the district. They examine the potential role of public transit in providing students access the city's highest-performing schools. As a response to increasing yellow bus costs, city leaders and district officials suggested providing discounted tr ansit to students to ensure access to a school to which the student is accepted. Their findings, however, show that public transit is unlikely to improve equal access to highly-rated schools and are unlikely to reduce neighborhood isolation, because most high-performing schools are concentrated in only a few neighborhoods. The transportation burden then falls on the parents. In a study examining school choice in both Denver and Washington, DC, Teske

et al. (2009) further this point by demonstrating that low-income parents would have chosen a better school for their child had transportation not been a barrier. This finding, along with He's (2011) assertion that school quality does not affect modal choice, suggests that families make school trip modal choices simultaneously with choosing the school, rather than making those decisions after choosing the school. Ultimately, parents are usually left with two means of sending their children to better-performing schools: by providing their children's school transportation themselves or by moving to a new neighborhood with better schools. For low-income families, both may be impossible.

The way school districts implement these policies and programs deserves careful consideration. In some cases, providing transportation to facilitate school choice may not result in the anticipated effect of attending a better-performing school. In England, Masi (2018) conducted a natural experiment after a legislative change that provided free transport to students who lived between 2 and 6 miles of any school; schools did not provide transport for students who lived within 2 miles. Students consistently enrolled at more distant schools; however, the school at which they enrolled was not always a better-performing school. They simply enrolled at the nearest school to which they could obtain free transportation, which was often a poor performing school.

3.1.4. Effects of School Travel on Students

At the heart of the existing literature on the effects of school travel on students is its effects on sleep. While Voulgaris, Smart, and Taylor (2017) connect this relationship directly, many studies (Carrell et al., 2011; Edwards, 2012; Wolfson et al., 2007) have offered conclusions that suggest more sleep and/or later school start times have positive effects on student outcomes. In Voulgaris et al.'s research, the authors use the American Time Use Survey to examine how duration of trips to and from school influence other "health-promoting activities." They find a strong inverse relationship between time spent traveling to school and time spent sleeping, and a negative relationship between time spent traveling to school and time spent exercising.[6] In short, long trips to school are

[6] Converse to their expected findings on sleep and exercise, Voulgaris et al. (2017) find that students with longer commutes are *more* likely to participate in extra-curricular activities and spend more time studying. This may seem counterintuitive, but consider a student who stays after school to play in the band: That student could have taken the school bus home at the end of the regular school day but now must take transit home later, which is likely to be a less-direct route. Similarly, students with longer commutes may study more because they self-select attending that school. In this case, it would be helpful for future research to consider whether or not the student attends a school other than their assigned neighborhood school (magnet, charter, private, or school choice program).

unhealthy for students, but no recent study in the United States has attempted to connect students' trips to school with their academic outcomes.

3.1.5. Vulnerable Student Populations

The school transportation of vulnerable populations is largely borne out in the law. As I mentioned in the background chapter of this report, Local Education Agencies (LEAs) are responsible for providing transportation to and from school for three vulnerable student populations, as required by federal law: students with disabilities, students experiencing homelessness, and students in foster care. Research in this area spans across several disciplines, including pediatrics, social welfare, public health, and urban planning. With that many different disciplines involved in this area of research, it is unsurprising that previous research in this direct subset of student travel is almost nonexistent. This is especially true for students in the foster care system. Likely because their protections are relatively new (2015), I was unable to find *any* academic studies that examined the school travel behaviors of this specific population.

For students experiencing homelessness, the most common barriers to school enrollment are transportation, immunization requirements, residency requirements, provision of birth certificates, and legal guardianship requirements (Losinski et al., 2013). The most complicated aspect of transporting these students is the school of origin. If a student without a permanent address begins to reside outside the zone of the school of origin, the LEA for the school of origin and the LEA for the school that the student would otherwise attend if not for the McKinney-Vento Act must come to a cost-sharing agreement. This requirement can span county or even state boundaries (Losinski et al., 2013).

The biggest barrier for transporting students with disabilities is the cost burden it imposes on LEAs. A study performed in a school district in Western New York finds that transporting special education students boiled down to these key differences: the need to pick up the student from the home, the need to configure buses to accommodate wheelchairs or other needs, and the need to provide a higher level of service (Caceres et al., 2019). The authors here assert that in districts where general education transportation is required, like those in New York, special education transportation can account for as much as 40 percent of LEA's transportation budgets. Additionally, once LEAs provide the transportation as they are legally required, students' travel experiences are not always seamless. Graham et al. (2014) conducted a series of interviews with parents regarding transportation problems for their children. Nearly all parents were African-American or Latino. This survey reveals five consistent concerns: problems with

bus aides, exclusion from school programing to facilitate transportation, scheduling problems, faulty equipment, and issues of physical safety.[7]

3.2. Ridehailing

Ridehailing is a nascent industry with a long history. The idea of hiring a private or semi-private ride is nothing new, but the idea of doing so with a smartphone is. HopSkipDrive is, at its core, a ridehailing company. It provides on-demand or scheduled rides for children. To date, I have not found any other academic study that examines the ridehailing behaviors of children; what little research exists focuses on Lyft, Uber, and other ridehailing companies that intend to transport adults. While HopSkipDrive provides contract service in addition to its regular consumer service, it still fits the general mold of a ridehailing company: it transports passengers—in this case children—in otherwise-private vehicles driven by hired contractors who are dispatched through technology. And ultimately, HopSkipDrive provides a vital service to a population that can otherwise not legally navigate the automobile-dominated built environment without a parent, guardian, or other trusted adult who is licensed to drive.

3.2.1. The Evolution of Ridehailing

At its base, ridehailing is a combined evolution of taxicabs and paratransit. Classic ridehail services with one passenger operate like taxicabs: a passenger calls for a ride, except instead of using a telephone to speak with a dispatcher the rider uses a smartphone app. Shared ridehail services operate more like paratransit, picking up multiple passengers at different origins and dropping each off at different destinations along a similar but variable route. Grava (2003) defines paratransit as "a service that is not quite full public transit and that has some of the convenience features of private automobile operations." The main advantage of ridehail services is those "convenience features." HopSkipDrive provides both of these types of services, although for this study I focus mostly on ridehail-type trips with a single origin and single destination, for reasons I will explain in the next chapter.

Lyft and Uber came onto the scene in their present forms in 2012. Since then, ridehailing companies have more than doubled the size of the for-hire ride services sector

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[7] While HopSkipDrive does provide transportation services for students with disabilities through its contracts with districts and counties, school districts typically provide those services in-house for students who have physical disabilities that require the use of a wheelchair or lift system, as those services require both specialized vehicles and, often, an accompanying adult aide.

(Schaller, 2018). This growth has led to a 241-percent increase in the number of for-hire trips taken, which has been largely concentrated in densely-populated metropolitan areas. Ridehailing use, as with transit use, is highly tied to households with zero-vehicles. Likewise, cities with higher transit commute shares also have higher ridehailing use rates (Schaller, 2018). While it stands to reason that younger (25 to 34), urban-dwelling, college-educated, affluent Americans have been the most-likely to adopt ridesharing apps, newer Lyft data from Los Angeles suggest that higher-income and low-income households take the majority of trips, and at a significantly higher rate than middle-income households (Anne Elizabeth Brown, 2018; Clewlow & Mishra, 2017). When choosing between driving themselves and ridehailing, users cite parking and avoiding driving while intoxicated as the primary reasons for using ridehailing companies. Whereas, when choosing between transit and ridehailing, ridehail users cite speed and availability as the primary reasons for choosing ridehailing (Clewlow & Mishra, 2017).

In the aggregate, most studies point toward ridehailing increasing vehicle-miles traveled (VMT) and traffic (Henao, 2017; Henao & Marshall, 2019; Schaller, 2018). In San Francisco, a 2017 study estimates that the share of trips taken by Lyft and Uber on a weekday can exceed 15 percent of all trips inside the city (Alemi et al., 2018). The rapid escalation of these services has begun to seep into traditional transit and paratransit markets. Several public transit agencies across the county have partnered with Lyft, Uber, or other smaller ridehailing companies to provide supplementary service to fill first- and last-mile gaps or replacement service for underperforming bus routes (Schwieterman et al., 2018). On college campuses, many universities have replaced prior in-house on-demand paratransit operations with exclusive contracts with private ridehailing companies that offer students subsidized rides within a set area (Palmer, 2019). Several other local jurisdictions have also begun using ridehailing partnerships to transport specific populations, including the Appalachian Regional Commission's "Rides to Recovery" program and Dakota (Minnesota) County's partnership with Lyft to provide rides for residents on Medicaid waivers (Zeilinger et al., 2020). The main message with all of this is that the scope of these companies' influence on the transportation system is expanding quickly.

3.2.2. Equity in Ridehailing

With the dramatic change in the transportation landscape, it is important to consider how this new sector affects disadvantaged populations, whose interests may lie outside those of private companies. Anne Brown set the standard for studying ridehailing equity in her 2018 dissertation, *Ridehail Revolution: Ridehail Travel and Equity in Los Angeles*. Brown put forth two important conclusions in this work: First, that "ridehailing

extends reliable car access" to travelers previously left out by transit, paratransit, and the taxi industry; and second, that ridehail services nearly eliminate racial-ethnic discrimination in service quality as compared with the taxi industry. Both of these findings are important to this study, in that I apply many of the same methodologies toward children using HopSkipDrive.

From a broader, nationwide standpoint, Brown's second conclusion—that ridehail services are less discriminatory than taxicab services—is the most important. School transportation companies (e.g., private school bus operators) are ultimately in control of their routes in a way that public transit operators are not. If a school needs to adjust a route to serve a particular single student, they may do so at will. But unlike transit, there is no procedure for public or user input. While there are certainly procedures for public input on school zone boundaries, bus routes are usually drawn at will, potentially exposing providers to accusations of discriminatory practices.

That is not to say that school bus companies would intentionally discriminate; the reality in urban California is that *very* few students take the yellow bus to school, meaning that inherently nearly any child whose family has the ability to transport their child privately will do so, leaving only those who have no other option and those who are legally required to have transportation provided to them by the LEA to ride the yellow bus. This brings up Brown's first conclusion, that "ridehailing extends reliable car access." As I will explain in Chapter 5 of this report, HopSkipDrive school-contract trips tend to originate in neighborhoods with a higher percentage of carless households than the Los Angeles County average. Children from a carless household are less likely to feel the effects of that disadvantage if their trips to school are provided to them through HopSkipDrive.

Several studies have identified that even among carless households, poor households, and immigrant households, travel is still predominantly by private vehicle (Blumenberg & Smart, 2014; Giuliano, 2005), whether it be by carsharing, carpooling, or other means. Giuliano (2005) puts forth two key points that can be applied to school travel for vulnerable populations: that attitudinal data show a dissatisfaction with public transit, and that regular transit users have the lowest level of mobility among all population segments. Given that school transportation is heavily biased toward the private vehicle in California as compared with other states, it is likely that without meaningful interventions the transportation of children to school would look not unlike the transportation of adults to work; only the poorest and most disadvantaged would use a transit-like service. This outcome creates immense educational inequities among students before any of them even set foot inside the school building.

3.3. Filling a Gap in the Literature

This study represents what I believe to be the first of its kind in two fields: the study of school travel behavior of children using ridehailing as a mode, and the general study of school travel behavior of children in the foster care system. The first gap exists because ridehailing is new and ridehailing for children is even newer. Simultaneously, national and California policies in school transportation have shifted. As such, studies like this one *could not* exist before 2015. A decade ago, the State of California was still reimbursing school districts for transportation expenses, and Uber and Lyft were small specialized companies that were not yet in the vernacular. The second gap is more reflective of the broader smallness of the school transportation literature. While there are studies that focus on student mode choice, on student quality-of-life outcomes, and on the viability of transit as a school travel mode, very few of these disaggregate their data to examine outcomes for vulnerable populations. None look specifically at foster youth. This report begins to fill a gap in our understanding of how schools can most effectively transport our most vulnerable students in a manner that is feasible, efficient, and equitable within the contemporary transportation framework.

4. Data and Methodology

This study uses unique confidential trip-level data from HopSkipDrive to analyze trips to school in the 2018-2019 Academic Year to analyze the following research question: How would HopSkipDrive trips be different if high school students had taken them on transit? The unit of analysis is the trip, and the area of observation for this study is Los Angeles County. To provide context for these trips, I also analyze travel survey responses from the National Household Travel Survey (2017). I disaggregate the data by HopSkipDrive trip type, which includes three distinct trip types:

Consumer: These are trips that parents purchase individually to transport their children to school.

School Contract: These are trips that school districts arrange in bulk under an ongoing contract with HopSkipDrive to fulfill their legal obligations to provide student transportation (or for any reason the district would deem necessary).[8]

Foster Contract: These are trips provided to foster youth under partnership with Los Angeles County's Department of Child and Family Services (DCFS), as part of a two-year pilot partnership.

In the forthcoming sections, I analyze the differences between these trip types' distances, durations, origins, and destinations, and I compare these statistics with how they would have differed if the trips had been taken on transit instead of HopSkipDrive.

In this analysis, I focus on high-school aged children (ages 14 to 18 as a proxy). The disparities for high school students are more apparent relative to their younger peers. In high school differences in travel behaviors materialize as wealthier students with access to private vehicles begin driving themselves. We also see the direst consequences of educational inequity begin to occur: students dropping out or not graduating on time.

As with any travel behavior study analyzing children as the actors, there are several obstacles in conducting a thorough analysis. In this chapter, I first provide an overview of these obstacles. I then describe the data and methodology I use in analyzing school travel in Los Angeles County. In doing this, I thoroughly describe HopSkipDrive's data and the various methodologies I employ in analyzing trips on their platform. I also discuss the

[8] Although I refer here to these trips as "School Contract" trips, ultimately these partnerships are always conducted at the district level. Individual schools, unless autonomous, would not enter into a contract with HopSkipDrive on their own without the district.

differences between analyzing HopSkipDrive data compared to analyzing data from adult ridehailing services.

4.1. Geographic Context

Los Angeles County is home to more than 10 million people, 1.6 million of whom attend schools in Kindergarten through Grade 12—over 16 percent of the total population (US Census Bureau, 2018). They attend one of 2,310 public schools (including charter schools) or one of 724 private schools (California Department of Education, 2019). The county is divided into 89 public school districts, the largest of which is Los Angeles Unified School District (LAUSD).[9] While much of the county is densely populated, the county's overall land area is vast—it is geographically larger than Delaware and Rhode Island combined—and substantial parts of that land area are sparsely populated. This geographical distribution of the population can present logistical challenges in moving children to school, especially for those with legal protections to remain at a school of origin that may not be geographically close to their current residence. This distance challenge is acutely applicable to foster youth. In 2018 alone, 31,533 children received services from the Los Angeles County Department of Children and Family Services (DCFS) (Los Angeles County DCFS, 2019). This number includes children from birth to age 21 in foster care, as well as Transitional Age Youth (TAY) who are between the ages of 16 and 21 in court-ordered foster care.

4.2. Obtaining School Trip Data

Obtaining true school trip data is extraordinarily challenging, as compared with other trip purpose data. The reason for this lies in two legal policies. First, educational records are protected by the Family Educational Rights and Privacy Act of 1974 (FERPA), which suppresses access to individual educational records from institutions receiving funds from the US Department of Education. This means that even if states, school districts, or individual schools maintained data on student transportation patterns, it would likely be unavailable to researchers. Such data would only be accessible with the written permission of each student's parent or guardian.

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[9] To protect the anonymity of students, this report will not divulge specific schools or specific school districts. However, it is important to note in understanding the school travel patterns across the county that there are many districts and, with the exception of foster youth provided for by the county, each has their own challenges to providing transportation for students with disabilities, students experiencing homelessness, and in some cases general education transportation.

The second reason that obtaining school trip data is difficult is that it is illegal to survey children without consent from their parents or legal guardians. The exact age of consent varies by state between 16 and 18 years of age (Lenhart, 2013); in California, individuals must be 18 to consent for themselves (UCLA OHRPP, 2011). This means that when researchers conduct travel surveys, any data they glean on children are almost always provided by proxy through parent or guardian responses.[10] This is the case for the National Household Travel Survey data I use in this analysis. The data HopSkipDrive provided circumvents both of these issues because their data are not educational but instead administrative, and they are not generated from a survey.

4.3. School Travel in Los Angeles County

To provide context for the HopSkipDrive trips, the focus of this analysis, I use the National Household Travel Survey (2017) California Add-On to examine the school travel behaviors of children in Los Angeles County. The 2017 NHTS recorded travel days between April 19, 2016, and April 25, 2017. While there is no temporal overlap period between the HopSkipDrive dataset and the NHTS dataset, the regulatory and modal transportation environments in both were similar. Most importantly, five years had passed since California's phase out of education transportation reimbursements, which allows for new modal choices to solidify after the policy shift.

In analyzing these data, I created a combined dataset containing elements from the trip, household, and person surveys. I included any weekday trip with a purpose (trip, origin, or destination) of attending school that was driven by or included a passenger between the ages of 14 and 18. I also selected trips that ended between 6:30 AM and 9:30 AM. While trips originating at school in the afternoon can end in a wide variety of destinations, trip to school in the morning originate almost exclusively at home. This selection process yielded a sample of 1,027 trips in California, with 90 in L.A. County.[11]

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[10] One notable exception to this typical deficiency is the California Household Travel Survey (2012), in which a very small subset of respondents wore GPS transmitters to record their travel behaviors. While parents would have completed the survey and granted permission to wear the GPS transmitter, the children themselves wore the transmitters. I do not use these data in this study for two key reasons: First, the CHTS data are from 2011-2012, which is immediately after Governor Brown's decision to eliminate general education transportation reimbursements to districts; and second, the vast majority of the GPS-equipped sample traveled in the San Francisco Bay area, because the Metropolitan Transportation Commission (MTC) funded additional transmitters.

[11] Although the Los Angeles County sample is too small to analyze in any depth, I include it to illustrate how that small sample is generally in line with the statewide figures.

Drawing on this sample, I analyze the trip time, duration, distance, and mode of school trips. I also bring in origin neighborhood sociodemographic and built environment variables based on origin census tracts contained in the confidential version of the NHTS, including race, household income, population density, household vehicle count, and age. I use these data to analyze school travel in California and then to inform how HopSkipDrive trips compare with the population at large, with special attention to geographic trends and differences.

4.4. HopSkipDrive Data

For this study, HopSkipDrive provided trip-level data for all trips that began or ended in Los Angeles County from August 1, 2017 through June 30, 2019. These data include all 399,197 trips that occurred on the platform in that time period. Although many trips are school trips, there are also many that are for other purposes. The list of variables included in the original dataset that I use in this analysis are listed in Table 2.

Table 2: List of Variables Provided by HopSkipDrive

Variable	Description
Unique Trip ID	Each trip was assigned a unique identifier.
Trip Type	Private Ride or Private Carpool
Account Type	Options: Consumer, School, or County Partnership
Scheduled Start	Time driver is scheduled to arrive at origin for pick-up
Scheduled End	Time driver is scheduled to drop-off passenger(s)
Origin Coordinates	Rounded to two decimal points to preserve user and school anonymity
Time Vehicle Arrived at Origin	Time driver alerts passenger(s) that pick-up is ready
Departure Time from Origin	Begins once passenger is in the vehicle
Destination Coordinates	Rounded to two decimal points to preserve user and school anonymity
Arrival Time at Destination	Ends once passenger is dropped off at final destination (including any added steps like dropping a child at door)
Distance	Distance as mapped by HopSkipDrive app
Duration	Amount of time from departure from origin to arrival at destination (does not count driver waiting time)
Route Legs	Number of stops on the trip (for pick-up or drop-off)
Passenger Count	Number of non-driver passengers
Passenger IDs	List of unique identifiers for non-driver passengers
Passenger Ages	Ages of non-driver passengers
Trip Price	Revenue generated by trip for HopSkipDrive

To provide consistency across this analysis, I narrow this dataset using the following parameters: I include only weekday morning to-school trips scheduled to end between 6:30 AM and 9:30 AM, for the same reason as I stated earlier with the NHTS data. I also restrict the data to trips without stops—roughly 93 percent of all HopSkipDrive trips had only one origin and one destination—to eliminate noise created by multiple stops. One-leg trips constitute 93 percent of all trips. I also include only trips taken only with passengers between the ages of 14 and 18, to focus the analysis on high school students. Lastly, I limit the data I analyze to the 2018–2019 academic year, because HopSkipDrive greatly expanded its service in the second year of the dataset, especially for contract trips, and I seek to most closely examine the current climate to provide timely recommendations for future policy decisions.

4.4.1. Data Limitations

The protection of user identity is of foremost concern in this study, but it does involve some trade-offs in analyzing these data. First, to preserve anonymity, the origin and destination coordinates are rounded to the hundredths decimal place. This means that the origins and destinations are approximations. The first challenge this presents is in identifying trip purpose. For trip types that are school contract trips or county partnership trips, we know that these are school trips because those contracts allow only for school trips. To identify consumer trips as school trips, I include any trip that ends between 6:30 AM and 9:30 AM within 1/3 mile of a school that serves any high school grade (grades 9 through 12).

In addition to protecting the anonymity of users, I also protect the anonymity of schools and school districts. In keeping with this protection, I do not analyze trips by a specific school or by a specific school district.

Additionally, the data are limited in that HopSkipDrive does not acquire sociodemographic data on its users, nor does the company survey its users. To address this, I connect the origin data to neighborhood variables at the Census Tract that I will describe in the coming sections, in a similar manner used by Brown (2018). This is not to say, however, that an individual student HopSkipDrive user in a neighborhood would mirror the neighborhood-level data; making this assumption would be an ecological fallacy. A student from a low-income neighborhood is not necessarily poor, nor is a student from a predominantly-white neighborhood guaranteed to be white. For this reason, I do not describe individuals in this analysis, but rather I describe the neighborhoods in which HopSkipDrive use is occurring, a method that lends a conceptual idea of the sociodemographic conditions in users' neighborhoods.

4.4.2. Spatial Analysis of HopSkipDrive Trips

To analyze HopSkipDrive trips across Los Angeles County, I loaded each of the trips into ESRI ArcGIS, with origins and destinations as distinct points. I then tabulated the number of trips that originated in each census tract and the number of trips that terminated in each census tract, averaging the distances and durations of the trips that originated and terminated in each tract. I then separated these out by trip type: consumer, school, or county partnership. I tabulated a count of high schools[12] in each tract, to understand if the concentration of origins had any relationship to the concentration of potential destinations.

4.4.3. Connecting HopSkipDrive Trips to Neighborhood Data

To gain an understanding of the sociodemographic traits of the origination neighborhoods of HopSkipDrive trips, I geocoded the census tracts of origin and destination for each unique trip ID in ArcGIS and matched those to several neighborhood variables. These variables and their sources are included in Table 3. I focus this analysis on three types of variables: sociodemographic, educational, and built environment.

Table 3: List of Census Tract Variables and Sources

Sociodemographic	Educational	Built Environment
Median household income (ACS)	Percent of population in high school (Grades 9–12) (ACS)	Population density (ACS)
Percent households with zero vehicles (ACS)	Private to public school enrollment ratio among high school student (ACS)	Number of schools per sq. mi. (derived from GIS)
Percent Hispanic/non-white (ACS)	High school dropout rate (ACS)	Commute mode share (ACS)
Race (ACS)		Transit stops (GTFS)
Percent of Limited English Speaking Households (ACS)		
Educational attainment levels (ACS)		

Source: ACS 2018 5-year estimates; CDE list of all public schools; GTFS feeds from agencies in Table 4.

[12] In this report, I refer to "high school" as any school that serves any grade between grades 9 and 12. For example, this could include a traditional high school but could also include a junior-senior high school serving grades 7-12, an intermediate school with grades 7-9, or an all-grades school serving Kindergarten-grade 12.

In this part of the analysis, I seek to understand the types of neighborhoods from which HopSkipDrive trips originate, by trip type. This develops a narrative of the difficulties a user might have incurred had HopSkipDrive not been an option for them. For example, a child from a household with no vehicle does not have the option of being driven to school by a parent. A child with few schools nearby likely does not have the option to walk to school. And a child from a household with limited English proficiency might have difficulty navigating a transit system or difficulty explaining their transportation needs to a parent.

Most of these variables I glean from the American Community Survey 2018 5-year estimates using Social Explorer. For number of schools nearby, I use the California Department of Education's School Directory data, which I geocoded and loaded into ArcGIS. I then counted the number of schools in each census tract and divided by the land area of the tract in square miles.

4.4.4. Comparing HopSkipDrive Trips to Transit Data

To compare how actual HopSkipDrive trips would have been different had they been taken using public transit, I used a two-part approach: spatial analysis in ArcGIS and route modeling using Google's Directions API.

First, I used GTFS data from each transit agency in Los Angeles County with more than one million unlinked trips per year, shown in Table 4, to identify transit stop and station locations, which I plotted in ArcGIS to assess the percentage of high schools within Los Angeles County that were within a half-mile of a transit stop.[13]

Second, I used HopSkipDrive's trip origin and destination coordinates and scheduled arrival times to recreate each of the 32,796 morning trips to high school on HopSkipDrive in the 2018–2019 academic year. I ran each trip against the weekday Google's Directions API, which uses GTFS data from local transit operators to calculate duration, distance, and number of vehicle transfers during each trip. I used HopSkipDrive's scheduled arrival time as the anchor time for the simulation; presumably, HopSkipDrive's scheduled end time represents what time a student would seek to arrive at school, so I modeled backward from that timestamp.

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[13] Google's API includes nearly all transit agencies in Los Angeles County, so there is a remote possibility that some schools may have access to a very small local agency that would potentially connect to the larger network.

Table 4: Transit Agencies in Stop Map

Agency	Unlinked Trips (2018)	Passenger Miles (2018)	Vehicles Operated at Max. Service (VOMS) (2018)
Metro	396,995,518	2,028,066,405	3458
OCTA[14]	42,476,015	216,020,949	1495
Long Beach Transit	23,983,714	74,515,978	197
LADOT	18,502,587	55,286,285	359
Metrolink	14,265,271	441,243,932	195
Santa Monica Big Blue Bus	13,288,645	49,541,679	172
Foothill Transit	12,619,722	95,927,071	296
Montebello Bus Lines	5,812,365	20,804,969	107
Culver City Bus	4,902,388	16,218,122	46
Torrance Transit	3,798,962	18,675,649	84
Gardena Gtrans	3,128,101	11,423,345	49
Santa Clarita Transit	2,791,681	21,229,782	91
Antelope Valley (AVTA)	2,503,749	29,542,027	74
Pasadena Transit	1,631,872	3,067,374	31
Glendale Beeline	1,557,533	3,571,612	34
Norwalk Transit	1,490,969	6,239,848	29

Source: National Transit Database (2018), GTFS feeds from respective agencies

As I will explain in Chapter 6, I use a hybrid approach here of excluding outliers and including outliers; thus, I sort the trips into three categories: trips for which transit is not an alternative, trips for which transit is an alternative, and trips for which transit is an alternative but the duration exceeds 90 minutes.

4.5. Differences between HopSkipDrive and other Ridehailing Analyses

It would be tempting to simply align this study entirely with other ridehailing analyses, namely Brown (2018). However, it is important to distinguish this user group from users of Lyft and Uber. Analyses of Lyft and Uber trips provides insight into consumer choice; economist Steven Levitt calls Uber "a chance to hold a demand curve in

[14] Although Orange County Transportation Authority (OCTA) is based in Orange County and not Los Angeles County, I include OCTA routes in the OSRM model to account for their eight routes that cross into and serve the southern areas of Los Angeles County, as well as the potential for a user to travel from one part of Los Angeles County to another via OCTA in Orange County. For example: a trip between Long Beach and La Mirada could be taken with a one-transfer ride using a combination of Metro and OCTA.

[his] own hand" (Dubner & Levitt, 2016). Brown extensively delves into the factors that determine Lyft use in Los Angeles, among which are household income, race and ethnicity, access to vehicles, age, and built environment factors. Those variables here are informative for the purposes of understanding the service that HopSkipDrive provides, but ultimately, do not indicate why a child might choose HopSkipDrive. That is because a child is not the chooser at all. Unlike adults, children are bound by the rules adults impose on them. This takes shape in two forms: that children must attend school, and that their mode "choice" is usually determined by their parents or schools.

4.5.1. Compulsory vs. Choice

As I explain at the outset of this report, school attendance is compulsory. While a small number of students may participate in virtual classes or homeschooling, the overwhelming majority of students physically attend school on a campus outside the home. Children do not choose to attend school, nor do they choose the school they attend—parents or guardians make that choice for them. So, while adults can choose whether or not to work, where to work, and how to get to work, children do not generally get to exercise those options. They are told where to be, when to be there, and (usually) how they will get there.

Additionally, it is unlikely or impossible that children would choose HopSkipDrive as a service by themselves. HopSkipDrive provides transportation for children ages 6 and up, but requires parental permission for all children ages 6 to 17. While the company does provide transportation for adults if called to do so, it would be atypical for a student to call their own HopSkipDrive ride. Once a student reaches age 18, they could legally and would likely call their own Lyft or Uber for a lower price—unless the price to the 18-year-old were zero because the HopSkipDrive ride was provided to them by the school district or county. The latter scenario is not as much a matter of choice as it is a matter of policy.

4.5.2. Policy vs. Preference

When HopSkipDrive is employed in enterprise contracts, schools' use of the service typically reflects policy, rather than the preference of the student or the student's family. Most enterprise contracts are to provide transportation for those whom the district would be otherwise compelled to provide services using in-house operations or other transportation contracts with more traditional school transportation providers, like yellow bus companies. As Masi (2018) showed with the natural experiment in England, socioeconomically-disadvantaged families typically chose to attend the school for which transportation was provided. While other modes of transportation may have been

available—transit, walking, carpooling, or private vehicles—ultimately the transportation mode given by the district was the one students and families used, even if it meant attending a school further away. This is to say that modal policy matters. Given HopSkipDrive at no cost to the user, students and families are likely to use it, even if other options are available. As I show in the next chapter, this particular policy is ultimately beneficial for these students and saves children—especially foster youth—a what-would-otherwise-be burdensome amount of time.

5. Descriptive Statistics and Spatial Analysis Findings

In the 2018–2019 Academic Year, HopSkipDrive operated 260,723 trips total in Los Angeles County; of these, 32,796 (13 percent) were trips to school taken by high school students. These trips are sorted into three trip types: trips taken as part of a contract with a school or school district, trips purchased by independent consumers (i.e., parents), and trips taken as part of a contract with the Los Angeles County Office of Child Protection to serve foster youth. To analyze these trips, I first place them in the context of trips to high school in California and Los Angeles County. I then analyze the spatial patterns of the trip origins and destinations. Lastly, I connect these trips by type to key sociodemographic traits of their origin neighborhoods.

5.1. Statistics for Travel to High School

The majority of studies on school travel analyzes five travel modes: bicycle, private vehicle, school bus, transit, and walk. In this section, I first analyze mode share and basic trip statistics for those five modes in California and Los Angeles County based on the 2017 National Household Travel Survey. I then use those figures to introduce and contextualize similar statistics for HopSkipDrive's trips in Academic Year 2018–2019.

5.1.1. California and Los Angeles County

In short, one trait defines California's school travel behavior relative to the other 49 states: that extraordinarily few of its students ride the yellow school bus. While a third of children in the U.S. use a school bus to get to school (Federal Highway Administration, 2019), in California this figure is just 8 percent among high school students. As Table 5 shows, the overwhelming majority of California high school students (74 percent) travel to school in a privately-owned vehicle. The next-highest share is students who walk, but at 12 percent this represents less than one-sixth of the share who travel in cars. School bus travel represents only 8 percent of to-high-school trips statewide, and bicycling and transit are just two and three percent, respectively.

Averages for distance, duration, and speed are generally intuitive: private vehicles are the fastest, followed by school buses and transit. Non-motorized travel is slower but also over much shorter distances. Across all modes, average trip end time—which can also serve as a rough approximation of school start times—is mostly consistent, with transit and other modes about 20 minutes later than the average of 7:45 AM. This potentially indicates that transit is best suited for schools with later start times.

Table 5: High School Students' Travel to School in California, 2017

Mode[15]	Share	Average Distance (mi.)	Average Duration (min.)	Average Speed (MPH)	Average Trip End Time (AM)
Walk	12%	0.8	16.34	2.9	7:50
Bike	2%	1.58	12.68	7.5	7:43
School Bus	8%	7.84	33.55	14.0	7:45
Private Vehicle	74%	5.14	15.46	19.9	7:43
Transit	3%	7.82	42.5	11.0	8:09
Other	1%	7.01	29.58	14.2	8:02
Total/Overall	**100%**	**4.86**	**17**	**17.2**	**7:45**

n = 1,027

Source: National Household Travel Survey (2017)

In Los Angeles County, trips to high school are largely consistent with the statewide figures, as illustrated in Table 6. Despite the small sample that limits in-depth analysis of these trips, it remains clear that driving or being driven to school still reigns dominant; the only other mode with a share above four percent was walking. Additionally, the average trip end time for all specified modes is consistent with the state totals within 10 minutes, and the average across all trips is nearly identical.

Table 6: High School Students' Travel to School in Los Angeles County, 2017

Mode	Share	Average Distance (mi.)	Average Duration (min.)	Average Speed (MPH)	Average Trip End Time (AM)
Walk	20%	0.87	14.44	3.6	7:43
Bike	1%	0.71	15	2.8	7:45
School Bus	4%	8.50	38.75	13.2	7:55
Private Vehicle	71%	6.12	19.17	19.2	7:43
Transit	2%	4.52	25	10.8	8:20
Other	1%	2.27	20	6.8	7:20
Total/Overall	100%	5.04	19.19	15.8	7:44

n = 90

Source: National Household Travel Survey (2017)

[15] "Private vehicle" includes NHTS trip modes car, SUV, van, pickup truck. "Transit" includes transit bus, transit rail, and commuter rail. "Other includes" all other modes not captured, including golf cart, RV, paratransit or Dial-a-Ride, taxi or ridehail, private or shuttle bus, intercity bus, and "other."

5.1.2. HopSkipDrive in Los Angeles County

HopSkipDrive operated 32,796 trips carrying high school students to school in the 2018–2019 Academic Year. Table 7 shows the share and basic trip statistics of each of HopSkipDrive's three trip types: school contract trips, consumer trips, and foster youth contract trips. Of these, the majority (58 percent) were part of the company's contract with the Los Angeles County Office of Child Protection to transport foster youth, followed by school contract trips (23 percent) and consumer trips (19 percent).

Both types of contract trips are notably longer in distance and duration compared to consumer trips, but in terms of average speed, the trip types are much more similar, ranging from 21 to 26 MPH. Additionally, the average arrival times of each trip type are within a half hour of each other.

Table 7: High School Students' Travel to School on HopSkipDrive in Los Angeles County, Academic Year 2018–2019

Trip Type	Trip Count	Share	Average Distance (mi.)	Average Duration (min.)	Average Speed (MPH)	Avg Trip End Time (AM)
Consumer	6,090	19%	6.81	19.17	21.3	7:47
School Contract	7,562	23%	11.36	28.98	23.5	8:05
Foster Contract	19,144	58%	13.75	31.81	25.9	7:39
All	32,796	100%	11.91	28.81	24.8	7:46

Compared to school trips in Los Angeles County, HopSkipDrive trips are longer in distance and duration, and faster in speed. Figure 1 shows that California and Los Angeles County trips are generally similar in average trip distance, while HopSkipDrive trips all tend to be longer—especially the contract trips. Trip duration figures follow a similar pattern, although less extreme, as shown in Figure 2. Here, consumer trips are generally in line with the county and state trips, but the contract trips are greater in duration and thus bring HopSkipDrive's overall figures up.

HopSkipDrive's overall average trip speed of 24.8 MPH is faster than both the state (19.9 MPH) and county (19.2 MPH) private vehicle speeds, figures that were already notably faster than other vehicular modes. This difference in speed is in no way explained by the times of day that the trips occurred: the average trip end times for California, Los Angeles County, and HopSkipDrive were within a minute of 7:45 AM.

Figure 1: Comparison of Average Distance (mi.)

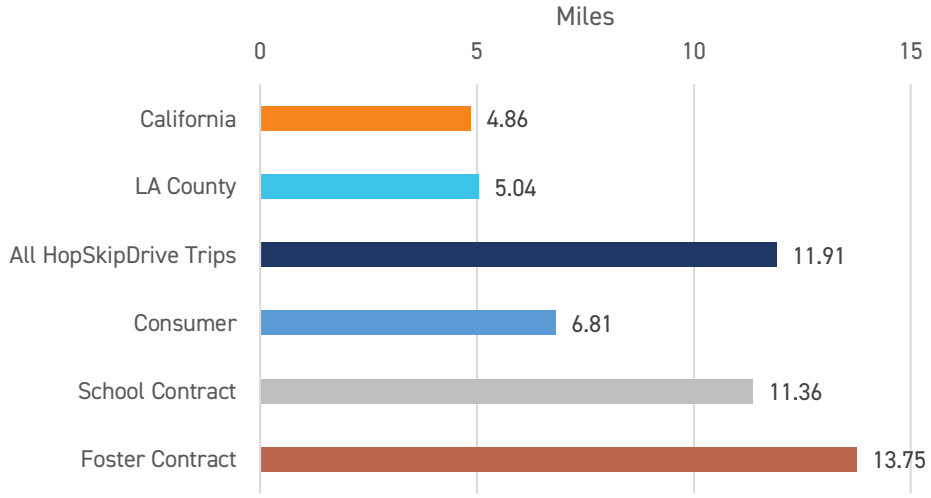
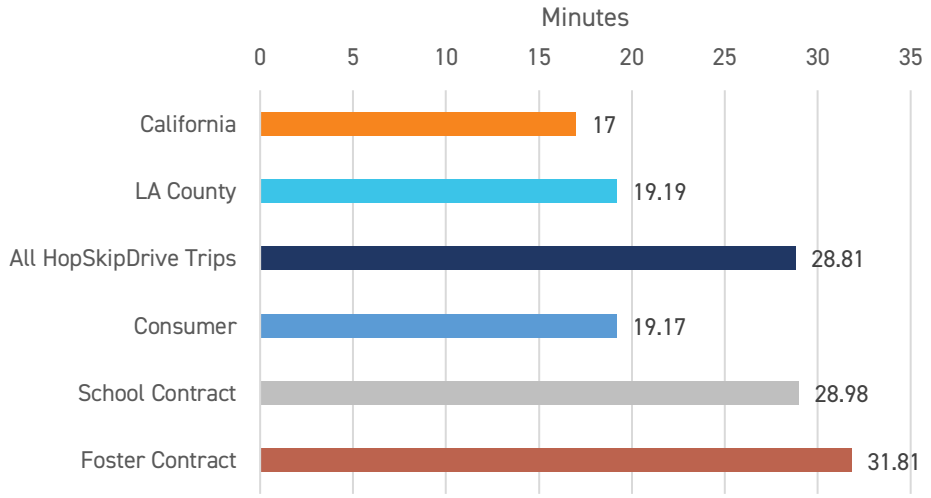


Figure 2: Comparison of Average Duration (min.)



5.2. Spatial Patterns of HopSkipDrive Trips

With over a half-million high school students in Los Angeles County (US Census Bureau, 2018) taking approximately 94 million to-school trips[16] annually, HopSkipDrive's

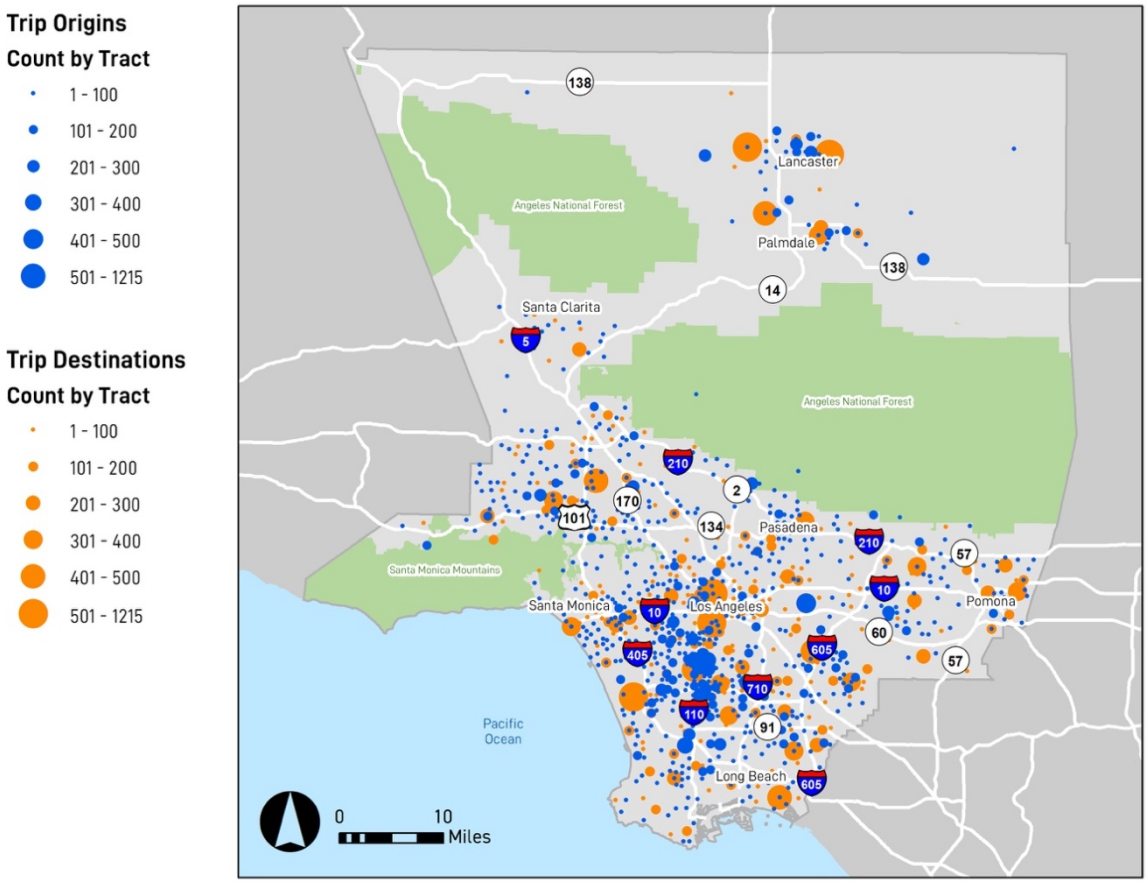
[16] To calculate this estimate, I multiplied the number of high school students in Los Angeles County (544,901) by the number of school days in an academic year (180) minus the number of absences between proficient and basic attendance levels (7), which includes 84 percent of LAUSD students. This calculation is only meant to be illustrative of HopSkipDrive's share in the county's to-school travel market.

share is less than 0.01 percent of the total market. While this emerging method of school travel is still very small as a share of school trips in the county, it represents a novel form of children traveling in a vehicle: with neither a parent/guardian nor a fixed route. More importantly, it provides practical access to schools without the aid of a parent's vehicle to children throughout Los Angeles County, especially parts of the county that are spread out and for children requiring travel across the vast county.

5.2.1. Origins and Destinations

HopSkipDrive operates its Los Angeles County services throughout the region, but their trips are especially concentrated in the Los Angeles Basin and San Fernando Valley. Figure 3 shows all HopSkipDrive to-high-school trips in the 2018–2019 Academic Year, with origins in blue and destinations in orange. Each dot is scaled to the number of trips that originate or terminate in a census tract, with the dot located at the tract centroid.

Figure 3: HopSkipDrive Trip Origins and Destinations

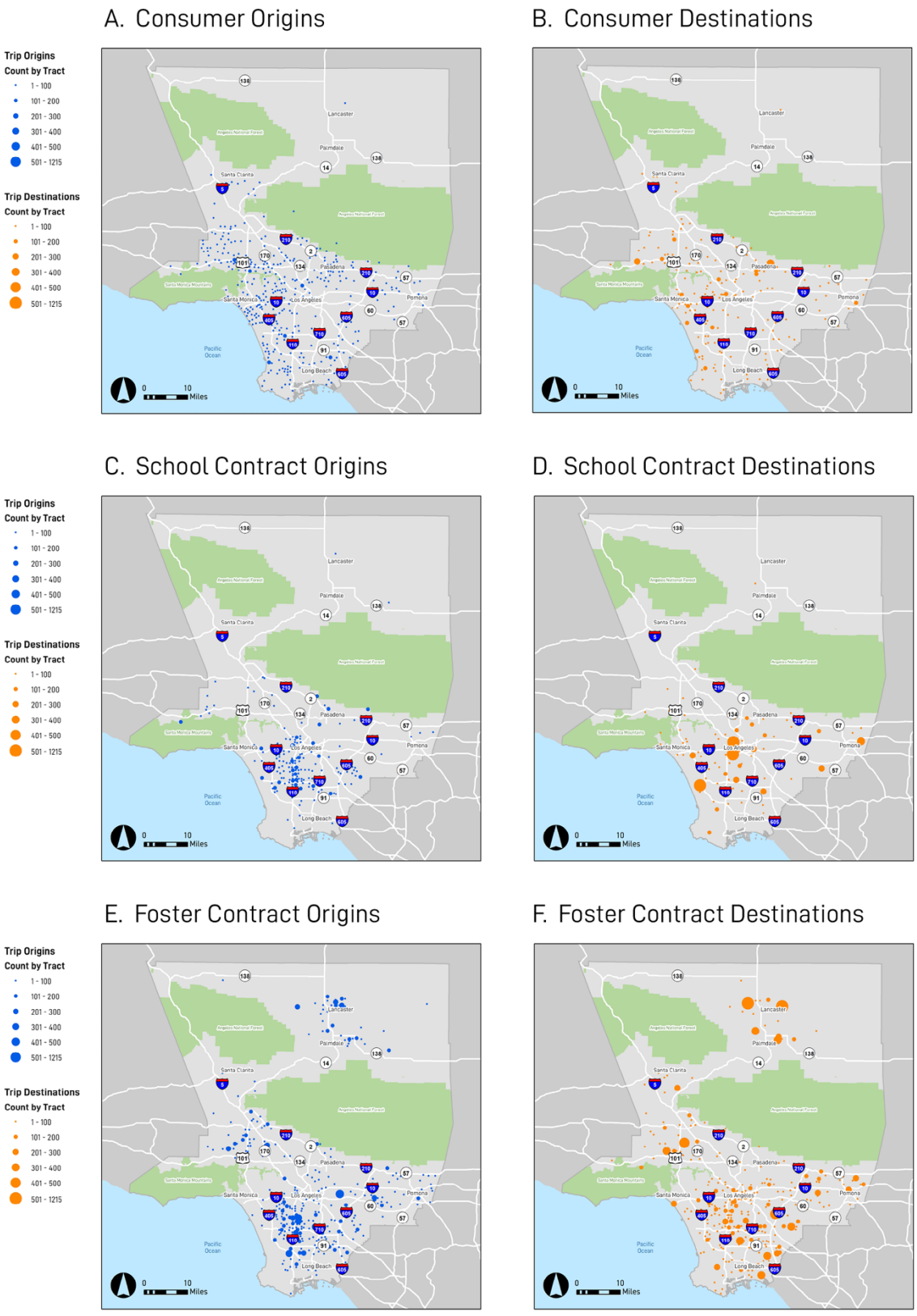


HopSkipDrive's to-school trips across Los Angeles County have distinct spatial origin patterns by trip type, illustrated in the six-part series of maps in Figure 4. Consumer trips have relatively low levels of concentration, especially for origins but also for destinations; the only noticeable concentration of destinations for these trips is near Pasadena. There are notable clusters of trip origins—but all with low trip frequencies—on the westside of Los Angeles, in the southern part of the San Fernando Valley, and in the South Bay. In sum, this means that consumer trips are taken from a variety of locations, relatively infrequently, to a variety of different destinations.

School contract trips are much more concentrated, especially for destinations. The spatial patterns of these trips are entirely routed in company action and public policy; that is, without a contract between HopSkipDrive and a specific school, these trips simply do not exist. So, the origins of these trips serve to explain from where the schools with contracts receive their students, and the destinations serve to show which schools have contracts. (As I mentioned previously, to protect the anonymity of the schools themselves, I will not delve directly into which specific schools or districts have contracts.) In the origin map, we see a few very concentrated trip destinations near downtown and El Segundo, and a few other medium-sized ones throughout the southern part of the county. Notably, the origins are clustered along the I-110 Harbor Freeway south of downtown Los Angeles, rather than radiating in all directions from the schools near downtown. The importance of this observation will become clear in the next section.

Foster youth contract trips, which comprise the majority of the trips in this dataset, cover much more of the county's geographic area, but with a notable absence of both origins and destinations on the westside of Los Angeles and in the South Bay. There are clusters of origins along the I-110 Harbor Freeway south of downtown Los Angeles—similar to the school contract trips—and other notable clusters in the west San Fernando Valley and around Lancaster in the Antelope Valley. Destinations are similarly spread out but more concentrated, which is attributable to this partnership allowing for foster youth to continue at their original schools. Notably, there are clusters of concentrated destinations in Long Beach, the San Fernando Valley, and Lancaster, the latter of which has the two most-served destinations. Also similar to the school contract trips, there are very few origins on the westside of Los Angeles and the South Bay; however, there is a spattering of destinations in those areas, likely meaning that those are high schools of origin for foster youth now living outside the area.

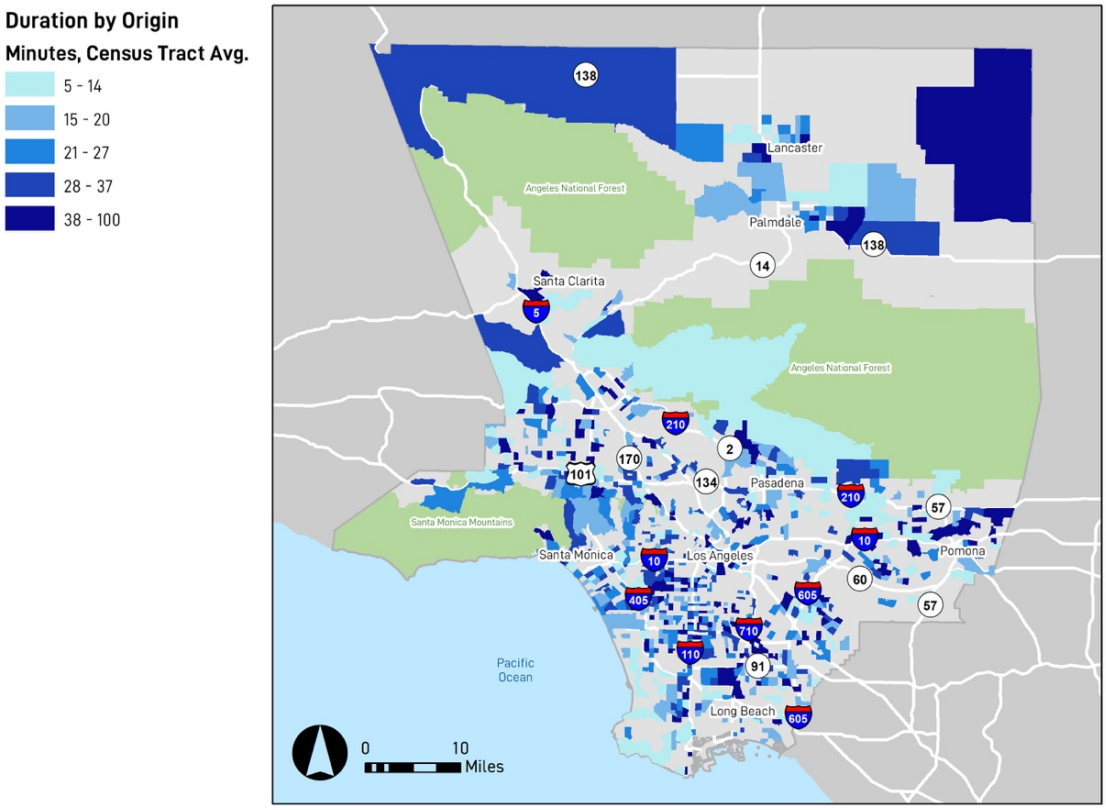
Figure 4: Maps of Origins and Destinations by HopSkipDrive Trip Type



5.2.2. Trip Duration

HopSkipDrive's most notable comparative advantage in terms of trip statistics lies in trip speed. However, of greater concern to the student passenger more than speed is the amount of time spent in the vehicle. HopSkipDrive's longest trips on average tend to begin in the sparsely-settled northern areas of the county, as well as tracts south of downtown and in the San Gabriel Valley near Pomona. This is illustrated in Figure 5, which shows the average durations of all HopSkipDrive trips by their census tracts of origin; the tracts with the longest average trips are in dark blue, and the tracts with the shortest average trips are in light blue. There are notable pockets of shorter trip durations on the Palos Verdes Peninsula and Long Beach, but overall the southern part of the county is largely a spattering when categorized by quantile of average durations.

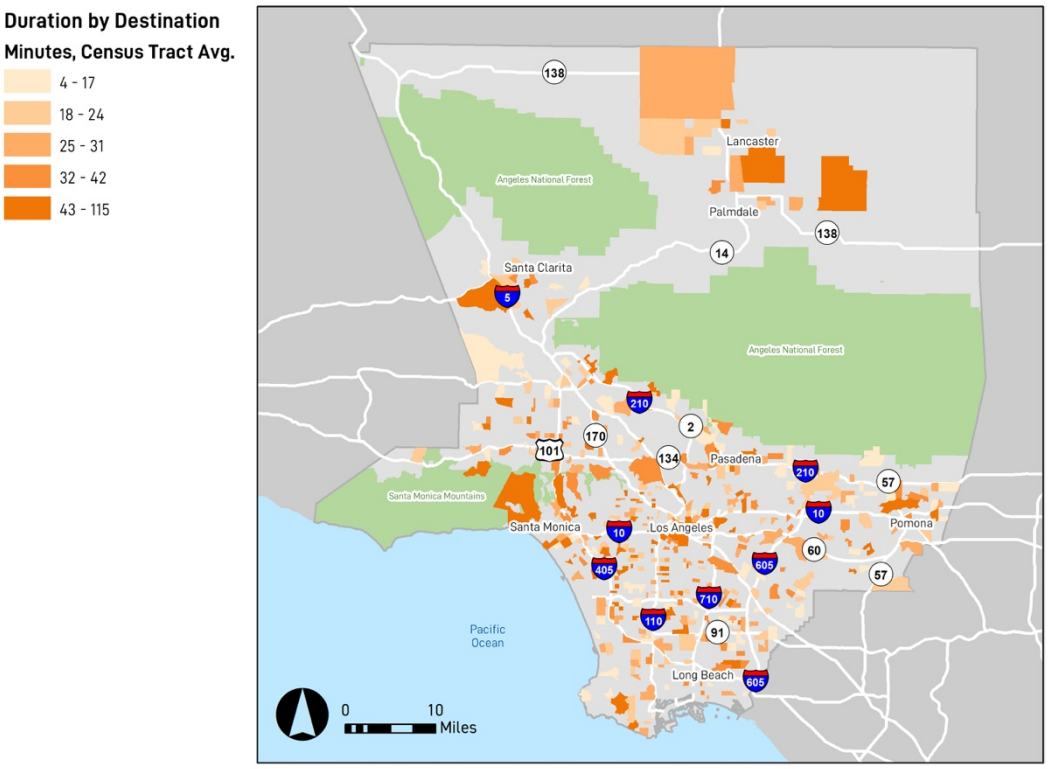
Figure 5: All HopSkipDrive Trips Average Durations by Census Tract of Origin



Average durations by destination take on a different spatial pattern. Figure 6 shows a map parallel to Figure 5 but for destinations instead of origins, with the longer durations in dark orange and shorter durations in light orange. As with origins, there are long trip durations in the Antelope Valley and in Pomona, but another notable pocket of long trip durations, however, end on the westside in Santa Monica and in the hills near

Pacific Palisades. Conversely, there are clusters of shorter destinations in the San Fernando Valley and in the foothills along the southern edge of Angeles National Forest. More broadly, there are simply fewer destination tracts as compared with origin tracts, especially in the northern part of the county. While several large origin tracts in that area generated long trips, there were no destination trips at all in those same tracts.

Figure 6: All HopSkipDrive Trips Average Durations by Census Tract of Destination

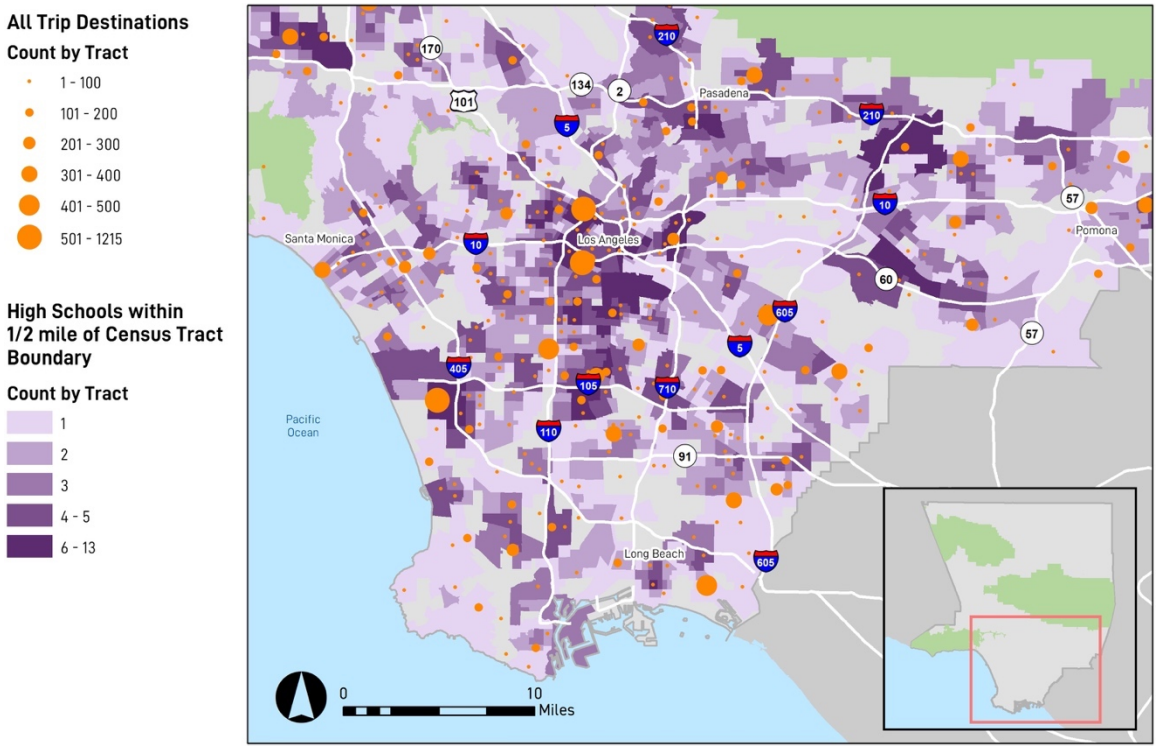


5.2.3. Destinations Related to School Location

Attempting to explain trip destination location by examining the number of schools in the area would seem to be low-hanging fruit. But graphically, as shown in Figure 7, it would seem that the number of schools has little bearing on where HopSkipDrive trips terminate. The map shows the count of destinations in each tract with orange dots as before, with a background that shows the number of schools within a half-mile of the census tract boundary in purple. While there are indeed some locations with high numbers of schools and high counts of trip destinations by tract, there are also some areas with high concentrations of destinations without many schools—like the three schools in the southeast corner of the county near Long Beach—and some areas of high school density without many trip destinations—like along the SR-60 Freeway southwest of Pomona, in Pasadena, and in some areas southeast of downtown Los Angeles.

Figure 7 zooms in on the southernmost part of the county, south of the San Gabriel Mountains and the San Fernando Valley. Here, the tracts are geographically smaller and the population density is higher, allowing for a closer analysis of both destinations and school density. In the middle and northern parts of the county, school density decreases as population density decreases, leaving trip destinations to cluster around fewer school campuses—although not necessarily with fewer individual trips.

Figure 7: All HopSkipDrive Trip Destinations and Number of Nearby High Schools



5.3. Sociodemographic and Neighborhood Traits

There is notable separation between HopSkipDrive's two contract trip types and consumer trips along origin neighborhood traits. Here I focus on only the neighborhoods of origin, because first, HopSkipDrive users in all likelihood are beginning their morning trips to high school from their homes, and second, the relevant unit of analysis for sociodemographic analysis would be the school student bodies, not the neighborhoods in which the schools are located. So, with a focus on origin neighborhoods, I compare HopSkipDrive trip neighborhood traits with NHTS trip neighborhood traits. I then examine both statistically and spatially along three themes: sociodemographic, educational, and built environment.

5.3.1. Neighborhood Sociodemographic Traits

In California, there is a clear divide between high-income and low-income modes. As Table 8 shows, wheeled modes with route autonomy—private vehicles and bikes—are both above the average neighborhood median household income, while fixed-route modes—school buses and transit—and walking are below. School bus and private vehicle trips are likelier to begin in white neighborhoods, while transit, bicycle, and walking trips are relatively more likely to begin in neighborhoods of color.

Table 8: Origin Neighborhood Sociodemographic Traits

Trip Type	Avg. Median Household Income	Avg. Percent Non-White Hispanic/Latino	Avg. Percent Non-White	% HH without a vehicle	% HH Limited English Proficient
All California Trips	**$85,204**	**9%**	**30%**	**5%**	**6%**
Walk	$76,927	12%	35%	8%	8%
Bike	$99,150	10%	36%	4%	6%
School Bus	$73,713	9%	24%	5%	7%
Private Vehicle	$87,539	9%	29%	4%	6%
Transit	$80,580	13%	39%	11%	8%
Other	$78,114	19%	41%	7%	9%
Los Angeles County*	**$68,093**	**24%**	**51%**	**9%**	**13%**
All HopSkipDrive	**$67,530**	**26%**	**79%**	**9%**	**11%**
Consumer	$94,249	13%	55%	6%	8%
School Contract	$61,129	30%	83%	12%	14%
Foster Contract	$61,119	28%	86%	8%	11%

Source: California data: NHTS, 2017. Los Angeles County and HopSkipDrive data: ACS 5-year Estimates, 2018.

*For this and the next two tables, I provide all tracts in Los Angeles County as a comparison reference, as the NHTS sample of trips in Los Angeles County is too small for this purpose, and because HopSkipDrive trips are dispersed about the county.

As with their trip statistics, HopSkipDrive's trips vary greatly between the consumer trips and contract trips across sociodemographic variables. The bottom of Table 8 illustrates this comparison. When aggregated, HopSkipDrive trips are near the county figures in household income, percent of the population that identifies as non-white Hispanic/Latino, and population density, but its trips on average start much more often in communities of color. When separated, consumer trips more closely mirror the California statistics for private vehicle trips on income and percent Hispanic/Latino, and more closely mirror the overall county average on percent people of color. School contract and foster youth contract trips are statistically very similar in neighborhood variables, even though the trips originate in notably different geographies as shown in the

previous section. Contract trips are well below the state trips' and county's median household income, higher in both percent Hispanic/Latino and percent non-white, and from denser neighborhoods. When comparing contract trips to the NHTS California Add-On along these variables, they most-closely resemble transit.

For both the California data and HopSkipDrive data, most origin neighborhoods are similar in terms of percentage of households with no vehicle access and percentage of households with limited English proficiency, with a few exceptions. The California data are largely internally consistent, except for the average share of households without a vehicle in neighborhoods where transit trips originate being more than double the sample average. HopSkipDrive trips' origin neighborhoods are roughly consistent with the Los Angeles County averages, but both of those figures are slightly higher than the state data. Among HopSkipDrive trip types along these two variables, school contract trips begin in neighborhoods that are twice as likely to have carless households and nearly twice as likely to have households with limited English proficiency as compared with consumer trips.

5.3.2. Neighborhood Educational Attainment Traits

Given HopSkipDrive's role in this context as a school transportation provider, I also bring in educational attainment variables from census tracts of origin. Table 9 illustrates six of these variables for state and HopSkipDrive data, as well as the L.A. County census tract averages for reference. In the aggregate, HopSkipDrive's statistics align closely with the overall county data and state data, but again there are major differences between the trip types. Consumer trips begin in neighborhoods where residents are more than twice as likely to have attained at least a bachelor's degree from a college or university compared to contract trips, whereas contract trips begin in neighborhoods where residents are more than twice as likely to have never finished high school. Although low in all categories, the rate of high-school dropouts (the percentage of residents ages 16 to 19 who are neither enrolled in school nor earned a high school diploma) is substantially higher in school contract trip origin tracts than in consumer trip origin tracts.

The variable with perhaps the starkest contrast is the ratio of private high school students to public school students within census tracts. In Los Angeles County, for every 10 public high school students there are about two private high school students, which is slightly higher than the average from the state sample. The same holds true for all HopSkipDrive trips when aggregated, but when separated by type the figures vary widely. Among tracts where consumer trips begin, for every 10 public high school students there are about 6 private high school students; whereas, for tracts where contract trips begin that figure is closer to one private school student per every 10 public school students.

This bears an interesting possible relationship: neighborhoods in which parents/guardians have chosen to use HopSkipDrive for their children to get to school are also neighborhoods in which parents/guardians choose three-times more frequently than average to send their children to private school.

Table 9: Origin Neighborhood Educational Variables for HopSkipDrive

Trip Type	% of Pop. in High School	% of Pop. without High School Diploma	% of Pop. with only High School Diploma	% of Pop. with Bachelor's or Greater	Dropout Rate	Ratio of Private-to-Public High School Students
All California Trips	**6%**	**13%**	**51%**	**36%**	**3%**	**0.14**
Walk	6%	17%	50%	33%	2%	0.10
Bike	5%	11%	42%	47%	1%	0.09
School Bus	5%	16%	57%	27%	4%	0.09
Private Vehicle	6%	12%	51%	37%	3%	0.14
Transit	5%	15%	47%	39%	1%	0.45
Other	5%	18%	49%	33%	2%	0.39
Los Angeles County	**6%**	**21%**	**47%**	**32%**	**3%**	**0.20**
All HopSkipDrive	**6%**	**25%**	**50%**	**26%**	**4%**	**0.21**
Consumer	5%	11%	43%	46%	2%	0.61
School Contract	7%	31%	46%	23%	6%	0.14
Foster Contract	6%	27%	54%	20%	4%	0.10

Source: ACS 2018 5-year estimates

5.3.3. Neighborhood Built Environment Traits

Lastly, I compare three built environment variables: the percentage of adults who commute to work from that tract by transit, the number of schools within a half-mile of the census tract of origin's boundary, and population density of the census tract. These variables are presented in Table 10. Among statewide trips, school buses, when used, typically operate in low-density areas.[17] Conversely, transit and walk trips are likely to take place in densely-populated areas. Other modes are generally more in line with the all-trip figures.

[17] Although school buses are extraordinary rare in California, school districts still have the option of providing general education transportation if they so choose. Based on these data and their relatively low population density figures for school bus trips, I conclude that rural districts have been more likely to retain these services than urban districts.

Table 10: Origin Built Environment Variables for HopSkipDrive

Trip Type	% Adults Commuting to Work by Transit[18]	Number of High Schools within Half-Mile of Tract[19]	Population Density (sq. mi.)
All California Trips	**3%**	**1.5**	**4,863**
Walk	4%	2.0	7,459
Bike	5%	2.1	5,907
School Bus	2%	0.9	3,630
Private Vehicle	2%	1.4	4,325
Transit	8%	2.5	10,091
Other	6%	1.8	5,825
Los Angeles County	**6%**	**1.8**	***10,728**
All HopSkipDrive	**6%**	**1.9**	**11,727**
Consumer	4%	1.7	8,327
School Contract	9%	2.1	14,930
Foster Contract	6%	1.8	11,656

Source: ACS 2018 5-year estimates, California Department of Education

The comparison between state and HopSkipDrive variables here is not as informative as the preceding two sections, as California's built environment differs wildly across the state, compared with mostly-urbanized Los Angeles.[20] Logically, the number of high schools nearby is higher for walk, bike, and transit trips at the state level. Among HopSkipDrive trips, the foster youth contract trips hold around the county average for these variables, while the consumer trips fall below (they are closer to the state level) and the school contract trips lie above. Most notably, school contract trips begin in neighborhoods where adults are twice as likely to take transit to work as compared to consumer trips, which is similar to the share for statewide school trips taken on transit.

[18] While analyzing adult workers' transit use is not a perfect corollary for transit access to schools, there is some logic to high access to jobs via transit meaning high overall level of access, particularly for students who are traveling to schools nearer their homes but outside of walking distance.

[19] Although census tracts vary in geographic area, I argue that they do still approximate access to a school. While a vast census tract in a remote rural area might have one school in it, it is unlikely that a student would access that school via any means but a vehicle. Ultimately, this comparison most serves to understand the accessibility of schools relative to the neighborhood; urban "neighborhoods" in this case would be much smaller than rural "neighborhoods."

[20] For example, census tracts' geographic areas are much more homogeneous in size in Los Angeles than they are across the state, because census tracts are determined using population figures.

5.4. Spatial Analysis of Neighborhood Traits

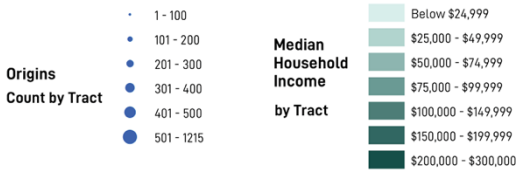
Across Los Angeles County spatially, there are prominent trends between HopSkipDrive trip types along four origin neighborhood variables: median household income, percent of the neighborhood population that identifies as people of color, percent of the population without a high school diploma, and the ratio of private high school students to public high school students. In the following maps, I do not include counts of all HopSkipDrive trips, because neighborhood variables are so different between the trip types, and here I am not comparing HopSkipDrive trips to anything but themselves.

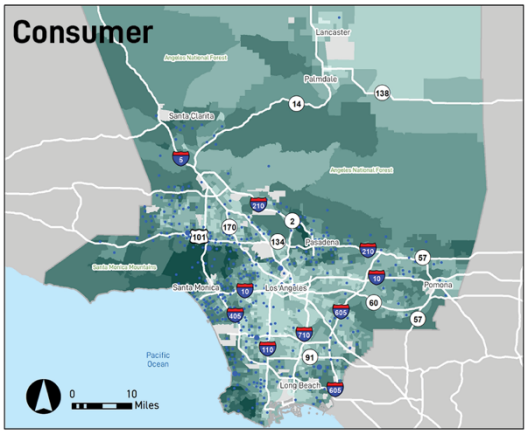
Figure 8 displays HopSkipDrive trip origins by trip type across the three maps, with census tract median household income levels categorized by quintile. The first map shows consumer trips, which are clustered clearly in high-income areas, especially on the southern parts of the San Fernando Valley, the westside of Los Angeles, and the South Bay. There are very few consumer trips that originate in low-income neighborhoods. This is in stark contrast to both types of contract trips, which both have overwhelming points of origin in the low-income areas along the I-110 Harbor Freeway. Foster youth contract trips also have substantial presence in the central and less affluent parts of the San Fernando Valley and in the Antelope Valley.

The differences between consumer trips and contract trips appear to be most different along racial lines. As Figure 9 shows, consumer trips most frequently begin in neighborhoods with high percentages of white residents, while both types of contract trips are more likely to take place in neighborhoods with higher percentages of residents of color and are almost non-existent in white neighborhoods. This is especially true for foster youth contract trips, as there are a few contract trips that begin in the western part of the San Fernando Valley that is predominantly white. This has enormous equity implications, which I will discuss in Chapter 7.

The base maps of neighborhoods with high percentages of residents without high school diplomas or equivalents, shown in Figure 10, are similar to the maps of neighborhoods of color, with notable differences in the Antelope Valley. Although much of the Antelope Valley is in the middle quintiles for percent of non-white residents, it is in the lower half for educational attainment measured by high school diploma attainment. This area is also a cluster for HopSkipDrive foster contract trips. In the southern part of the county, contract trips begin clearly in areas with lower educational attainment, while consumer trips begin largely in areas with many residents who have at least a high school diploma—although this is not quite as defined as the maps categorized by race.

Figure 8: Maps of HopSkipDrive Origins by Trip Type and Median Household Income





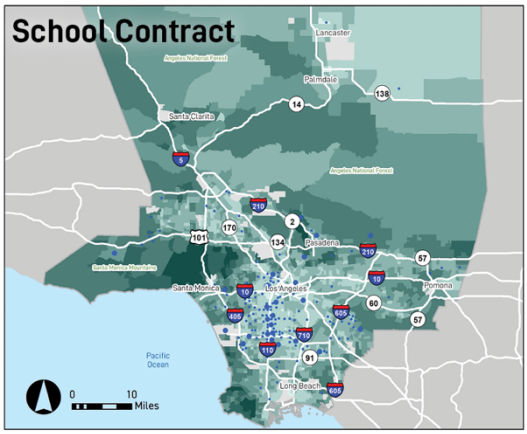
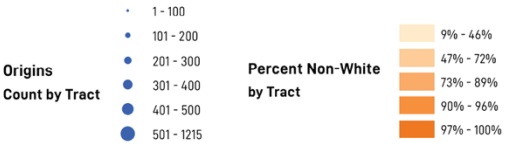
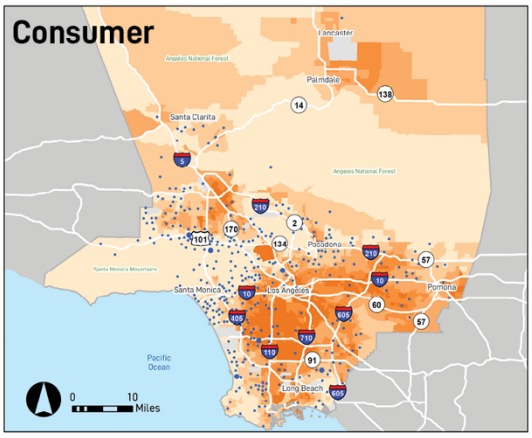
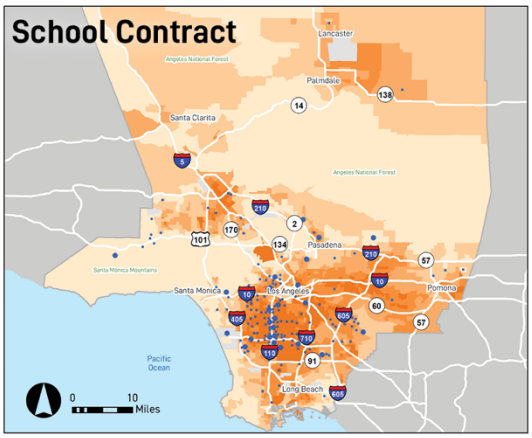


Figure 9: Maps of HopSkipDrive Trip Type and Percent Non-White Residents







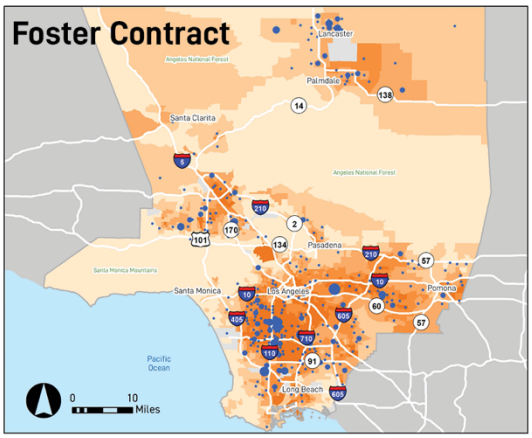
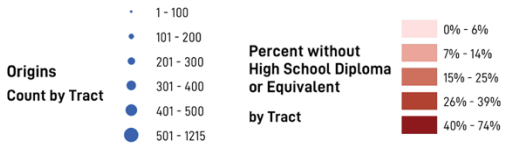
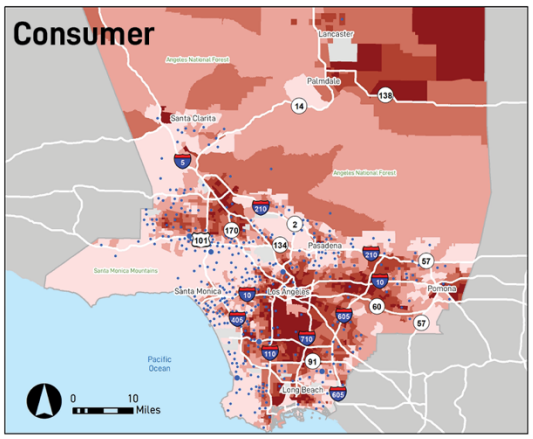
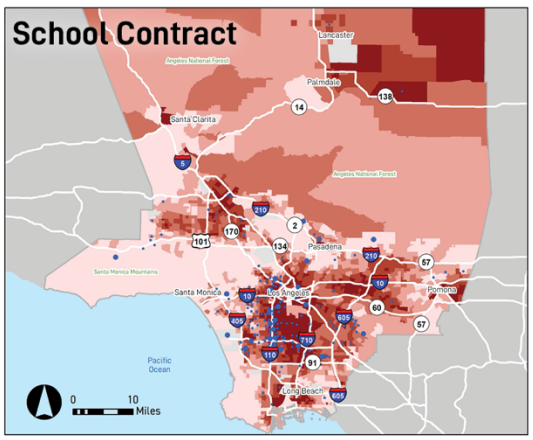


Figure 10: Maps of HopSkipDrive Trip Type and Percent without HS Diploma







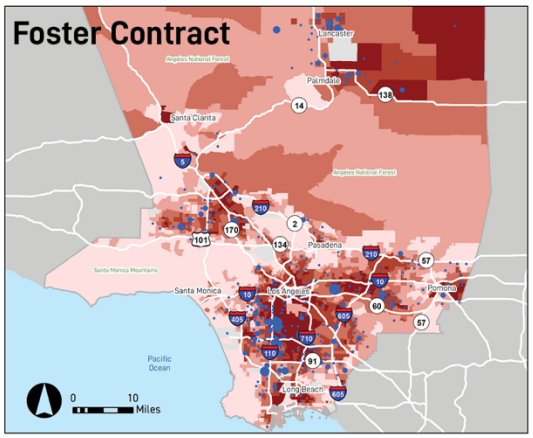
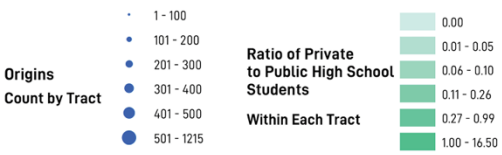
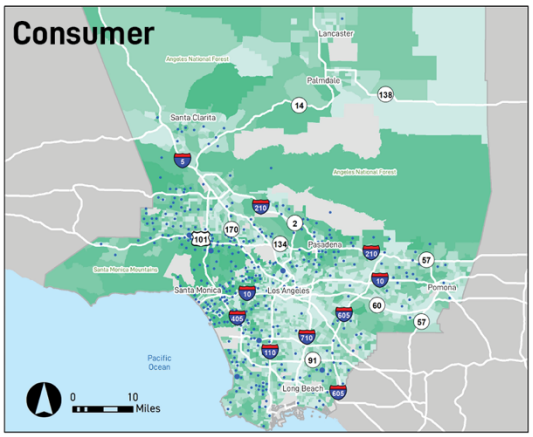
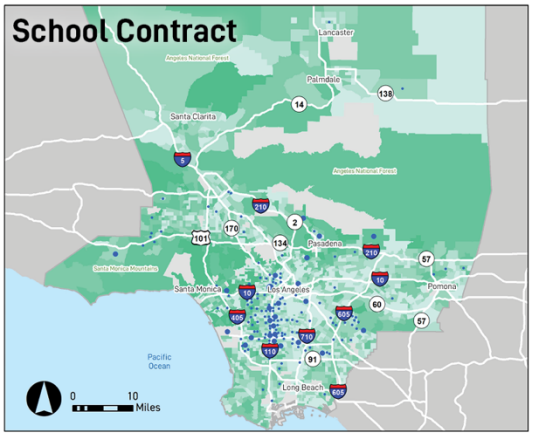
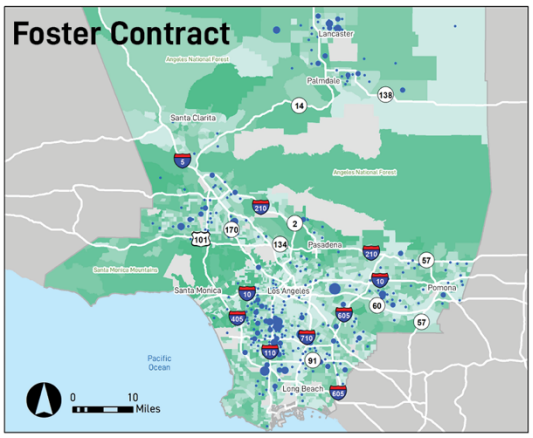


Figure 11: Maps of HopSkipDrive Trip Type and Ratio Private : Public Students









Lastly, Figure 11 shows the ratio of how many private high school students reside in each census tract per every one public high school student. The darker the shade, the higher the relative number of private school students. The darkest shade means there are more private school students than public school students. The most striking contrast here is the low number of contract trips that begin in areas with higher ratios of private school students; nearly all of these trips begin in tracts with higher ratios of public-school students. Consumer trips are more heterogeneous along this variable; while there are certainly many trips that originate in neighborhoods with relatively more private school students—like those around the Santa Monica Mountains—there are also many trips that originate in neighborhoods with relatively more public school students, like some tracts on the westside, the South Bay, and greater Long Beach.

In sum, the key takeaways from the neighborhood data of HopSkipDrive trips center on the comparison between consumer trips and contract trips. On one hand, consumer trips tend to begin in neighborhoods that are wealthier, whiter, and better educated. On the other hand, contract trips—for both schools and foster youth—tend to begin in neighborhoods that are poorer, have higher percentages of residents of color, and less educated. Additionally, contract trips tend to begin in neighborhoods with nearly all public-school students. Combining these observations, it is reasonable to conclude HopSkipDrive consumer services are being used by those who have the ability to choose and pay for them, while HopSkipDrive contract services are either being provided to the poorest and most vulnerable students, or that these students are overwhelmingly more likely to use this service. Regardless of which of the latter two scenarios is most true, these services are crucial to vulnerable students' abilities to attend school.

6. Modal Comparison Findings

As school districts in California grapple with how to transport children to and from school as part of federal mandates, many districts, including LAUSD, have turned to the idea of providing students transit passes. Transit is relatively inexpensive, and having students on transit at a young age breeds hope for transit advocates that students who use transit at a young age will become lifelong users (Smart & Klein, 2018).[21] And if you were to look at stops in the Los Angeles transit network without considering routes and transfers, you might think that this idea is a no-brainer. What this fails to consider, however, is the enormous price that students would pay in the form of a crucial nonrenewable resource: their time.

On average, both high schools in Los Angeles County and trip origins and destinations on HopSkipDrive are well connected to the county's transit network. As Table 11 shows, HopSkipDrive trip origins and destinations are a combined 90 percent accessible within a half-mile of a transit stop, with no meaningful separation between the trip types. This falls generally in line with the 95 percent of all county high schools that have similar transit accessibility.[22]

Table 11: Access to Transit for High Schools and HopSkipDrive Trips

Trip Type	Total	Origins within half-mile of transit stop		Destinations within half-mile of transit stop	
		Count	Percent	Count	Percent
All Los Angeles County High Schools	**668**			**632**	**95%**
All HopSkipDrive	**32,796**	**30,165**	**92%**	**29,314**	**89%**
Consumer	6,090	5,951	98%	5,399	89%
School Contract	7,562	6,352	84%	6,585	87%
Foster Contract	19,144	17,862	93%	17,330	91%

[21] Although this common-sense hope is widely observed, Brown et al. (2016) find that "such an outcome is far from assured" (p. 49).

[22] Here I use coordinates from the CDE list of schools, which are geocoded from school addresses. But measuring distance from schools is not always a conclusive task. Schools can have many entrances, students can be originating a trip from a variety of locations on a school campus (e.g. the baseball field, or the music room, or the front office), and school entrances can be located far from their street addresses. However, with such a high percentage of school addresses near transit, I find it reasonable to believe that the percentage would not change drastically in one direction or the other.

At first glance, it would seem that simply providing a student a transit pass to get to school would be not only feasible but even prudent and advantageous. Transit routes already run past these schools without needing school-specific tripper service, and schools would need not be involved in students' transportation plans beyond possibly financing a transit pass. But this does not consider the implications of time spent traveling within Los Angeles's transit network. This is where HopSkipDrive's advantage is abundantly clear. In this chapter, I first compare how HopSkipDrive trips compare had they been hypothetically taken on transit. Then, I illustrate spatial trends in duration and in unfeasible trips.

6.1. Trip Statistics Comparison

The number of HopSkipDrive trips is roughly consistent with the number of origins and destinations accessible to transit stops. Of all HopSkipDrive trips to high schools in Academic Year 2018–2019, over 90 percent would have been feasible on transit. As Table 12 illustrates, this figure is generally consistent across all three trip types.

Table 12: Transit Trip Feasibility for HopSkipDrive Trips

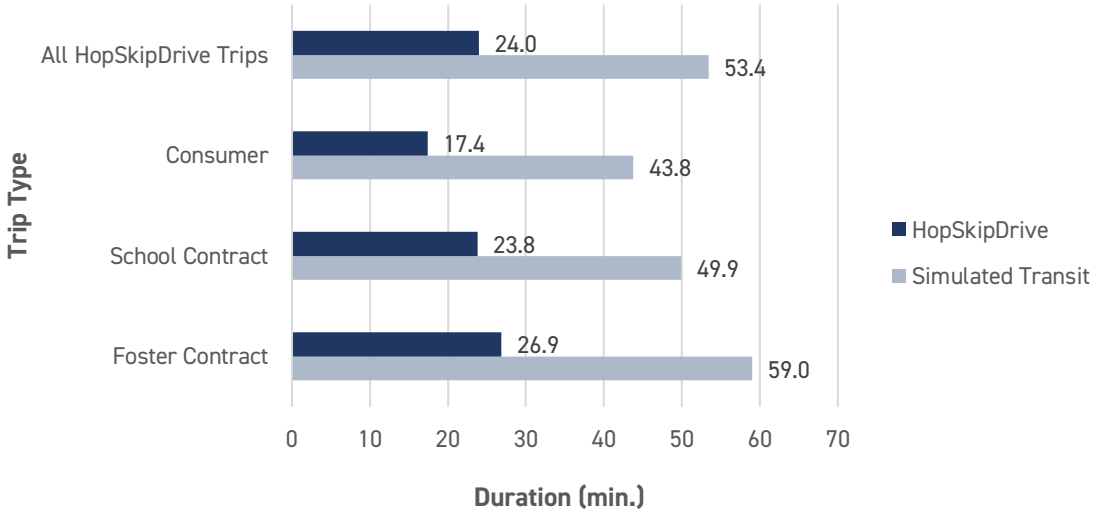
Trip Type	Feasibility	Count	Percentage
Consumer	No Trip Possible	473	8%
	Trip Possible (≤90 min)	4,977	82%
	Trip Possible (>90 min)	640	11%
	Total	6,090	
School Contract	No Trip Possible	598	8%
	Trip Possible (≤90 min)	5,415	72%
	Trip Possible (>90 min)	1,549	20%
	Total	7,562	
Foster Contract	No Trip Possible	1,102	6%
	Trip Possible (≤90 min)	12,030	63%
	Trip Possible (>90 min)	6,012	31%
	Total	19,144	
All Trips Total	No Trip Possible	2,173	7%
	Trip Possible (≤90 min)	22,422	68%
	Trip Possible (>90 min)	8,201	25%
	Total	32,796	

But the factor I also begin to consider here is time spent traveling. Los Angeles Unified School District (LAUSD), the nation's second-largest school district and by far

the largest in Los Angeles County, self-imposes a limit of 90 minutes of in-vehicle travel time for students to whom they provide yellow bus service—typically students in school choice and magnet programs (Los Angeles Unified School District, n.d.). Thus, I use the same cut-off in this analysis, also shown in Table 12. When accounting for trips that would have taken over 90 minutes using transit, 82 percent of consumer trips were feasible, but that number drops to 72 percent for school contract trips and just 63 percent for foster youth contract trips.

Of the trips that qualify as feasible in 90 minutes of less, there are dramatic savings across all trip types. Figure 12 shows this disaggregated by trip type. The durations for transit follow roughly the same proportions as they did on HopSkipDrive, but for all trips (top pair of bars) and all three trip types, the average duration on transit is more than *double* that of HopSkipDrive.

Figure 12: Duration Comparison of HopSkipDrive Trips and Simulated Transit Trips



A further examination of trip duration statistics reveals a much more notable disparity between these two modes. In this analysis, I consider two versions of these data, each shown in Table 13: First, I calculate trip averages excluding any trips over 90 minutes in duration. While this is the primary analysis and serves a clearer statistical purpose, I believe it is also important here to consider those outliers. Students and their families tend to take the transportation options that schools give to them (Masi, 2018), so in scenarios where schools and policymakers suggest partnerships with transit agencies rather than HopSkipDrive, the message students would be receiving would be to take the bus and/or train—regardless of how long it took.

Table 13: Simulated Transit Trip Duration Statistics for HopSkipDrive Trips

Trip Type	Feasibility by Duration	Transit Duration (min.)	Number of Transfers	% ≥2 Transfers	Actual HSD Duration	Minutes Saved on HSD	% Time Saved on HSD
Consumer	Only ≤90 min.	43.8	1.5	50%	17.4	26.4	60%
	All Transit Trips	51.5	1.7	55%	19.3	32.3	63%
School Contract	Only ≤90 min.	49.9	1.7	64%	23.8	26.1	52%
	All Transit Trips	83.3	2.0	72%	29.0	54.31	65%
Foster Contract	Only ≤90 min.	59.0	1.9	73%	26.9	32.1	54%
	All Transit Trips	108.4	2.3	82%	31.8	76.6	71%
All Trips Total	**Only ≤90 min.**	**53.4**	**1.8**	**65%**	**24.0**	**29.4**	**55%**
	All Transit Trips[23]	**92.3**	**2.1**	**75%**	**28.8**	**63.4**	**69%**

Across the three trip types, HopSkipDrive offered between 52 and 60 percent time savings compared to transit trips 90 minutes or less. In this scenario, consumer trips actually gain the highest percentage of time back. But here I offer these trips' statistics simply for comparison; it is highly unlikely that a family paying for a HopSkipDrive trip out of pocket would decide independently to shift their child to transit for their school trips. While both types of contract trips see lower percentage gains among these 90-minute-restricted trips, they see similar or greater savings in absolute time.

Related to duration, traveling on transit often requires transfers between vehicles, routes, agencies, and/or modes during the course of travel, potentially also requiring multiple methods of payment. Whereas HopSkipDrive offers a one-seat ride direct from origin to destination, transit would require an average of between 1.5 (consumer) and 1.9 (foster contract) transfers. Of those 90-minute-or-less feasible trips, half of consumer trips would require two or more transfers; that number jumps to three-quarters for foster youth contract trips. While transfers are indeed an important and necessary aspect of traveling by transit, it bears importance here to remember why students traveling on contract trips are on those trips in the first place: they may be experiencing homelessness without a consistent address, they may have a disability, or they may be shifting foster homes with some regularity. For a regular transit user, a transfer can be an opportunity to access a greater portion of the network; for vulnerable youth, a transfer is an

[23] The maximum duration in this dataset was 12 hours and 16 minutes. Obviously, no student would *ever* take a bus or train for that amount of time in traveling to school; in fact, when accounting for a round trip, it would be factually impossible. The family or care provider would have to find other means for transportation, which may present substantial hardship, or the student would need to change schools.

opportunity to make a mistake in unfamiliar territory that could prove time-consuming and dangerous.

Now I want to bring attention to the data inclusive of outliers—the second row of each trip type in Table 13. The consumer trip duration average increases only slightly, but both types of contract trips nearly double. The average for foster contract trips jumps to nearly two hours—an effect coming from only about a quarter of the trips counted. In fact, this average exceeds the *maximum* amount of time that LAUSD would allow a student to be on a school bus they operate internally. Accordingly, there are further increases in transfers, percentage of trips with two or more transfers, time saved, and percentage of time saved, such that HopSkipDrive trips provided nearly 70 percent time savings over transit for all transit-feasible trips. This sums to just under four years in total student time saved over the 2018-2019 Academic Year.

This dramatic time savings cannot be meaningfully explained away by distance. Table 14 details the differences between simulated transit trips and actual HopSkipDrive trips in distance traveled. HopSkipDrive does indeed reduce passenger miles traveled—it is, after all, a direct point-to-point service—but its margin of savings is far lower than in duration. For trips with durations of 90 minutes or less, contract trips average less than a 10 percent savings on distance; inclusive of the longer trips, that savings is still less than 20 percent. This confirms that, in general, students are not taking wildly indirect routes on these transit trips; where they would lose time is on the vehicle and in transferring.[24]

Table 14: Simulated Transit Trip Distance Statistics for HopSkipDrive Trips

Trip Type	Feasibility by Duration	Transit Distance (mi.)	Actual HSD Distance	Miles Saved on HSD	% Dist. Saved on HSD
Consumer	Only ≤90 min.	6.4	5.5	1.0	15%
	All Transit Trips*	8.3	6.8	1.5	18%
School Contract	Only ≤90 min.	8.3	7.6	0.8	9%
	All Transit Trips*	13.7	11.4	2.3	17%
Foster Contract	Only ≤90 min.	10.5	9.7	0.9	8%
	All Transit Trips*	16.5	13.5	3.1	18%
All Trips Total	**Only ≤90 min.**	**9.1**	**8.2**	**0.9**	**9%**
	All Transit Trips*	**14.4**	**11.8**	**2.6**	**18%**

[24] Google's Directions API does not provide specific data on time spent waiting at a transfer. Further research could use an Open Source Route Model (OSRM) to perform this task, but OSRM is less flexible and intuitive with regard to scheduled arrival times.

6.2. Spatial Analysis of Simulated Transit Trips and Modal Differences

Simulations of HopSkipDrive contract trips using transit begin and end throughout Los Angeles County. For the purposes of this section, I have excluded the analysis of consumer trips. By focusing on only the school and county foster youth contract trips, I can focus the analysis on those who are receiving this mobility service rather than choosing it. I also elect to include the outliers in these figures, because it is important to consider long hypothetical trip distances, such as the Antelope Valley to the San Fernando Valley, or Long Beach to Pasadena.

In terms of trip durations, spatial trends for the simulated transit trips fall more in line with conventional wisdom regarding a centralized transit hub. Indeed, there are clear clusters of shorter trip durations in neighborhoods near Downtown Los Angeles. Figure 13 illustrates the average duration for all contract trips that fall in a given census tract at the trip's origin, and Figure 14 illustrates the same but for the destination census tracts. As expected, trip durations are notably longer in the Antelope Valley around Palmdale and Lancaster, but there are also pockets of longer durations east of Los Angeles, especially near Pomona, for both origins and destinations.

Figure 13: Map of Simulated Transit Trip Durations by Origin Census Tract

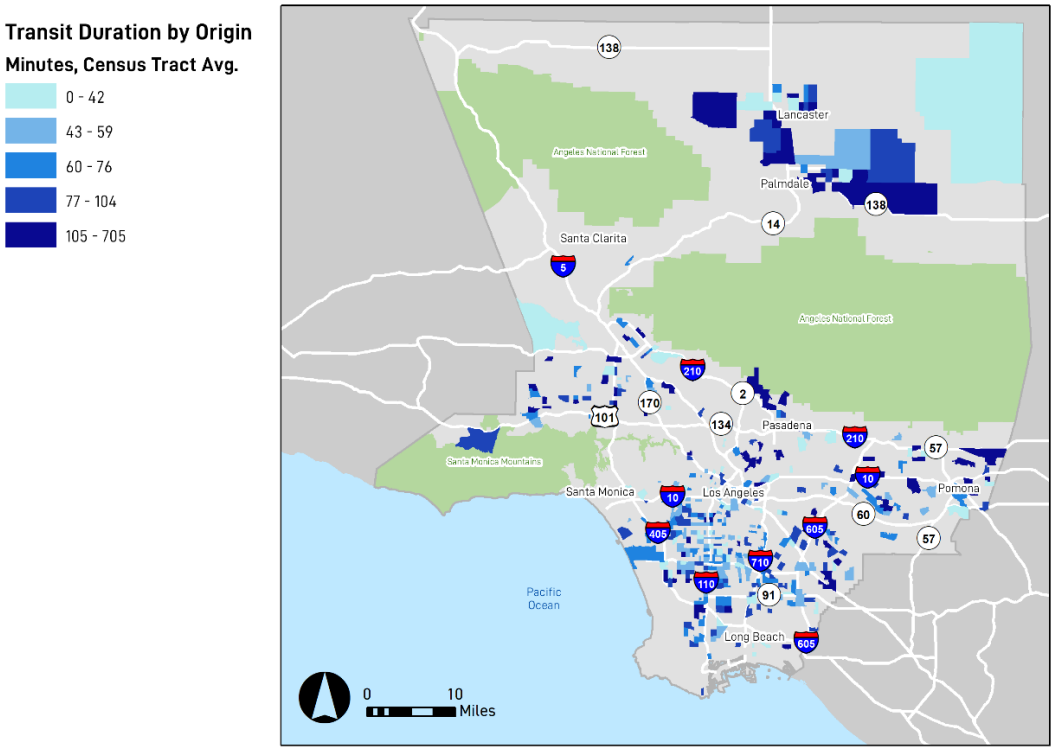
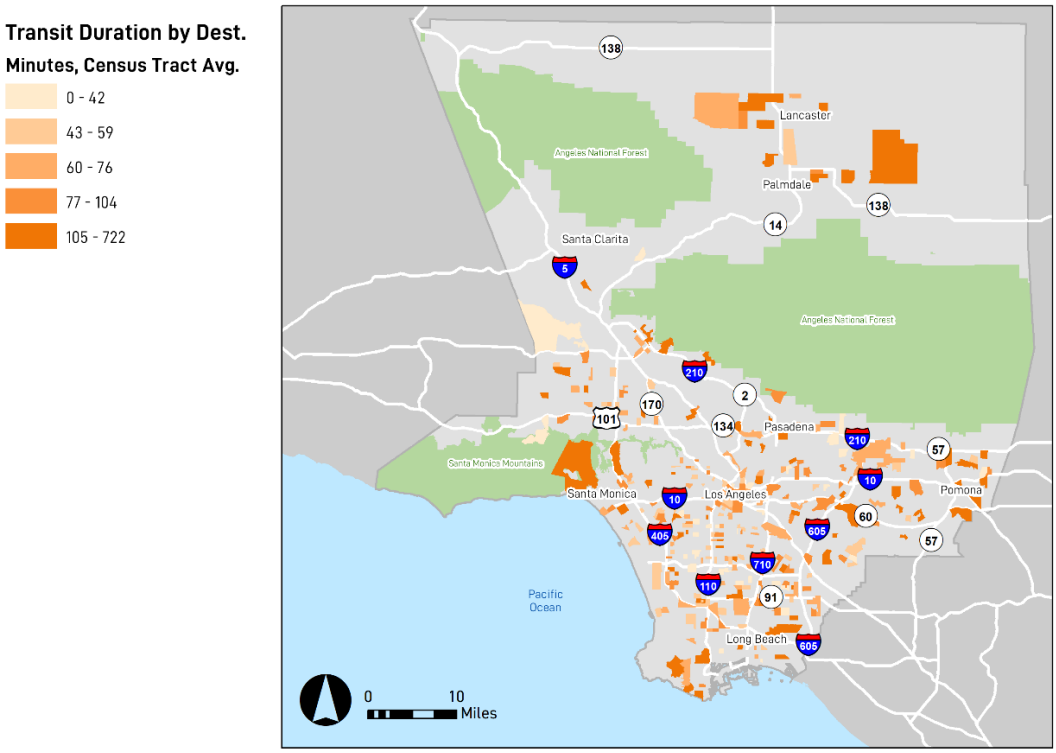


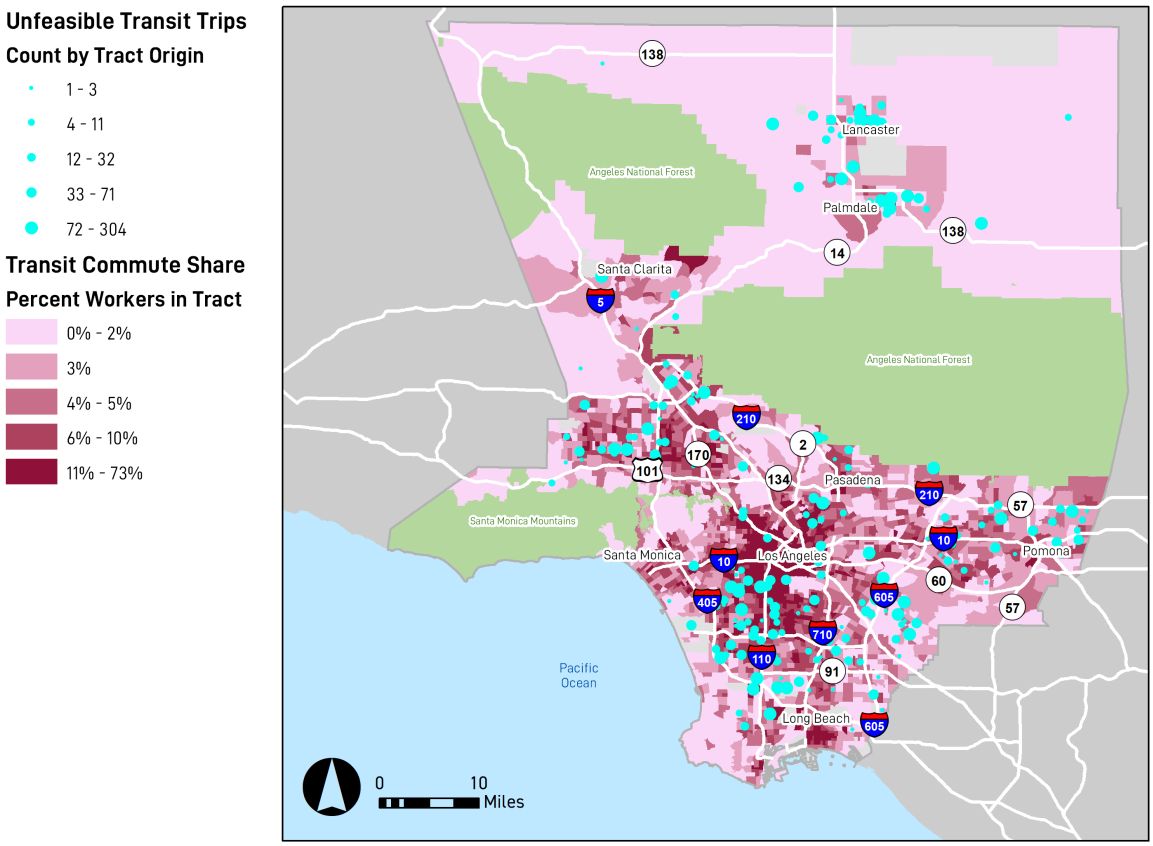
Figure 14: Map of Simulated Transit Trip Durations by Destination Census Tract



For origin tracts, there are pockets of high-duration trips in the San Fernando Valley, the foothills north of Pasadena, and the southern areas of the county just northwest and northeast of Long Beach. There are fewer destination tracts, but among those there is more dispersion. There are high-duration destination tracts along the coasts in wealthy areas, including Santa Monica, Pacific Palisades, and Palos Verdes, as well as in San Pedro and Long Beach. There are clearly fewer destinations in both the San Fernando Valley and in South Los Angeles, suggesting that there is a net outmigration each day from those areas to schools in other regions of the county.

Unsurprisingly, there is little spatial relationship between unfeasible transit trips, given the low percentage of such trips. Here, I consider a trip "unfeasible" if it could not be made on transit at all, or if its transit duration exceeded 90 minutes. Figure 15 illustrates the number of unfeasible trips in each census tract as varying-sized dots. There are a number of these non-trips in all key areas of the county, with the only notable exception being the Westside and Mid-City regions of Los Angeles. Here, there are high levels of transit commuters, as shown in the background of Figure 15, and the combination of Metro and local transit systems appears to also serve students adequately.

Figure 15: Map of Unfeasible Transit Trips and Percent of Census Tract Workers who Commute via Transit



Transit-unfeasible trips are otherwise dispersed across the county, further suggesting that it is the configuration of the trip rather than access to the transit network that determines whether or not a HopSkipDrive trip could have been alternatively taken using transit.

This spatial analysis serves as a reminder that without HopSkipDrive contract trips, there would potentially be no other option for some of these students to remain at their schools of origin, which is at the heart of what ESSA provides foster youth and what the McKinney-Vento Act provides students experiencing homelessness. Students with disabilities may also require extraordinary transportation to access special services offered only at one school within a district. While the simulated transit trip duration outliers may border on ridiculous, they also illustrate a message that schools would be sending to students: either that their trips to school will be unbearably long, or despite federal legislation protecting them, they will need to change schools.

7. Discussion of Findings and Implications

For students taking HopSkipDrive contract trips, they are in all likelihood doing so because they *need* those trips. Whether those trips were provided as a yellow school bus, a transit pass, a taxi (as many school districts still do in dire situations), or HopSkipDrive, the students involved need to get to school, and being driven by a parent or a carpool is simply not an option. For students in the foster system, HopSkipDrive offers a further layer of autonomy, in that they need not rely solely on their caregiver for school transportation, which is especially important if their school of origin is far from home.

What separates HopSkipDrive contract trips—both school-based and county-based for foster youth—as compared with consumer trips, is choice. Consumer trips represent a choice that a student's parent/guardian makes for them: instead of the parent driving their student themselves, or instead of the student walking, or instead of the student taking public transit, the parent decides to pay HopSkipDrive to perform the trip for them.

The differences between these trip types, and the differences between HopSkipDrive trips and trips in the general population, are informed heavily by local policy and norms. In this chapter, I cover why this is acutely true in California. I also explain some of the social and educational equity benefits surrounding HopSkipDrive and the implications for the use of alternative modes of transportation. Ultimately, this all leads to mutually-beneficial partnerships between school districts/local governments and HopSkipDrive.

7.1. The California Context

Undoubtedly, this study cannot be separated from the larger context of California school transportation in which HopSkipDrive operates for its Los Angeles contracts and partnerships. As I mention previously, only California and Indiana neither legally mandate nor reimburse from the state budget school districts to provide transportation services to general education students.

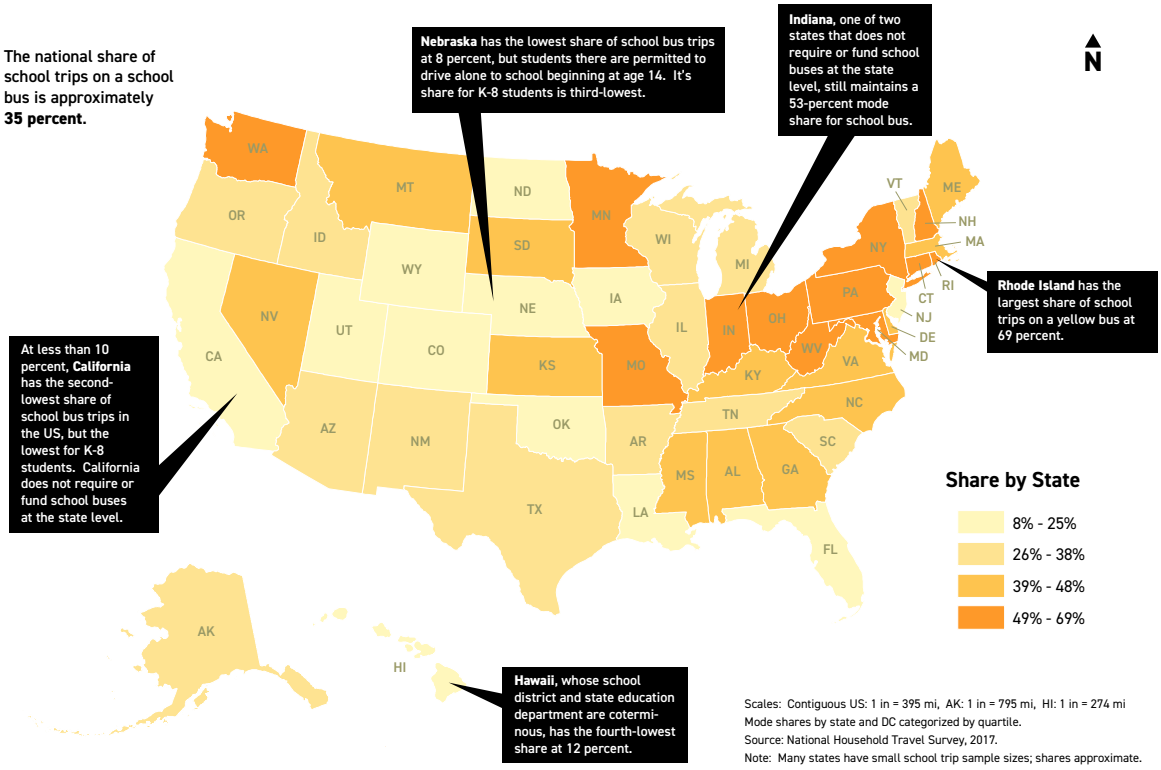
Consequently, as Figure 16 shows, California has the second-lowest share of trips to school taken on a school bus among the 50 states at just 9 percent. Only Nebraska has a lower percentage, but that can be largely explained by the state's extraordinarily low minimum driving age for students to drive themselves to school; in Nebraska, a student may begin driving themselves to and from school in their own vehicle at age 14—two years younger than in California. California and Nebraska join other states that are generally rural and/or agrarian, like Iowa, Oklahoma, Wyoming, Colorado, and Utah. The other states along the coasts tend to have higher school bus mode shares, including

Rhode Island, which at 69 percent has the highest mode share. Meanwhile, the only other state without a mandate or reimbursement, Indiana, has a share of about half.

Given California's massive population, its lack of school bus use has an outsize effect on the national mode share. Among all 50 states weighted for percent of the national population of children in school, about 35 percent of all trips to school occur on a school bus. These same estimates among the other 49 states (with California excluded) moves that figure up to 38 percent, leaving California about 30 percentage points below the rest of the country.

This report does not seek to profess the importance of school buses. That is a much larger issue that far exceeds the scope of this project. But, it is important to understand the unique context of California's school travel behaviors and to realize that looking to other states for inspiration, validation, or verification is not an option—to some degree even within HopSkipDrive itself. HopSkipDrive's role in a state with a higher school bus mode share—for example, Virginia at 48 percent—will be different than its role in Los Angeles. In those states, school buses can absorb some of those federally-mandated trips for vulnerable students; in Los Angeles, in spirit no such system exists.

Figure 16: Percentage of Trips to School Taken on a School Bus, United States 2017



Scales: Contiguous US: 1 in = 395 mi, AK: 1 in = 795 mi, HI: 1 in = 274 mi
Mode shares by state and DC categorized by quartile.
Source: National Household Travel Survey, 2017.
Note: Many states have small school trip sample sizes; shares approximate.

7.2. Racial and Socioeconomic Transportation Equity

School contract and foster contract trips in Los Angeles County are likely to begin in neighborhoods of color. These neighborhoods are more likely to be poor, and on average they have lower levels of educational attainment compared to both county averages and HopSkipDrive consumer trips, as I show in Chapter 5. Additionally, contract trips are generally longer in distance and duration, meaning they are bridging a greater gap than for their higher-income peers. But this also means there is a greater gap to begin with. This is borne out in the simulated transit trips, too. Contract trips are far less likely to be practically feasible (90 minutes or less), far more likely to have longer trip durations, and far more likely to have multiple transfers.

These findings are consistent with the wider Los Angeles transportation system on two fronts. First, transit is more frequently used in neighborhoods of color and low-income neighborhoods (Giuliano, 2005), as are HopSkipDrive contract trips. These are populations who more-often lack access to private vehicles and for whom transit is a natural transportation alternative to select. Transit can provide access to a variety of work opportunities, especially in some of the neighborhoods in South Los Angeles and other areas surrounding downtown, shown shaded darkest in Figure 15. These areas tend to have lower income, tend to have higher percentages of people of color, and also have higher transit commute mode shares. But a key difference here is that adult job selection is somewhat flexible; if an adult is unable to reach a job by transit when transit is the only option, the adult has the ability to select a different job that is accessible. A high school student, however, may not have this same choice. If they do have the ability to choose a different school, it may cause a significant disruption to their academic trajectory.

The second way these trips are consistent with the trends of the greater Los Angeles transportation system is in practicality of and resulting preference toward personal vehicle trips. Despite the relative attractiveness of transit for disadvantaged or vulnerable populations, they are still overwhelmingly likely to take most trips in a private vehicle (Blumenberg & Smart, 2014). With adults, this often occurs through informal carsharing and carpooling, but ridehailing use is also becoming important for mobility in low-income neighborhoods (Brown, 2018). However, these options are much less available to children, who are either not of driving age or not old enough to use traditional ridehailing services unsupervised. Even for students who might be of driving age, vehicles are scarce resources that have more pressing utilities than sitting parked outside a high school all day. HopSkipDrive is able to close these accessibility gaps for students who need it, which also brings them closer in line with the way their middle- and higher-income peers travel to school.

7.3. Educational Equity

That there is an achievement gap in education between wealthier students and poorer students and between white students and students of color has long been well established (Bradbury et al., 2015; Harackiewicz et al., 2016; Reardon et al., 2019). The students who are provided HopSkipDrive services for school travel are more likely to reside in neighborhoods comprised of people on the short side of the gap. Much of the achievement gap literature focuses on direct academic interventions, such as teacher quality, learning hours, budgets and resource allocation, and academic support structures (Childs & Shakeshaft, 1986). HopSkipDrive provides benefits that exist largely outside of this realm, in part because ridehailing to school allows students on contract trips to gain normalcy in their educational experiences as compared with their peers. This happens in three arenas: academic scheduling, student time use, and student discipline.

7.3.1. Academic Scheduling

The ability to maintain a consistent academic schedule is one of the primary reasons ESSA provides students in the foster care system and students experiencing homelessness to remain at their schools of origin (Olmos et al., 2019). Particularly for high schoolers, course offerings and daily schedules can vary dramatically from school to school and district to district.

Here is a hypothetical scenario that a student moving schools mid-year might face: The first school district might operate on a semester-based block schedule, wherein four classes meet every day in 90-minute blocks for half the year and then switch in the middle of the year; whereas a second school district might operate an eight-course schedule on a seven-period day with a rotating drop-period, with courses running the full year. So, in this scenario a junior in high school could begin the year at a high school with the first schedule, enrolled for the fall semester in English III, Spanish III, Algebra II, and an elective, with Chemistry, US History, Band, and Computer Science scheduled for the spring semester. Now, imagine that in the middle of the year that student is reassigned to a new foster home in the second school district. If the student transfers schools, her schedule suddenly shifts to all eight of those classes at once, but now she is far ahead in English, Spanish, and Algebra, but half a year behind in Chemistry and US History. This would have even more dire consequences for students who are in courses with standardized tests, state-administered or wider (e.g. AP tests and IB tests).

Allowing students to remain at their schools of origin avoids these types of major disruptions. Students are able to finish out the school year, or their high school careers, in the sequence they started. This is additionally consequential for students who move

multiple times per year, a challenge that many foster youth and students experiencing homelessness often face.

7.3.2. Student Time Use

Once the structural hurdle of scheduling and course sequencing is cleared by providing continuous access to the same school, student time use and time availability moves to the center of this argument. As I show in the previous chapter, HopSkipDrive offers enormous time savings for students who are provided with their services, compared to the time it would take to use transit in traveling to and from school. Take for example a foster youth student whose school day begins at 7:30 AM and ends at 2:15 PM. Applying average travel times (outliers excluded), on HopSkipDrive that student might leave their residence at 6:55 AM, allowing them 10 minutes of time to get to class upon arriving at school; they then leave school at 2:20, and arrive back home around 2:50.[25]

On transit, that same student would leave for school at 6:20 AM and would not return until about 3:25 PM. That student goes from spending 50 minutes each day in two different passenger vehicles driven by a CareDriver to spending two hours each day on four to six different transit vehicles and in time waiting for those vehicles. How important is this extra hour and ten minutes to students? According to Voulgaris et al. (2015, 2017), longer commutes to school are terrible for teenagers. Long commute times (45 minutes or more) to school are associated with less time spent studying, sleeping, exercising, and participating in extracurricular activities. Similar to this report, Voulgaris et al. find that teens with long commutes tend to come disproportionately from low-income and minority households. For HopSkipDrive's trips, 86 percent of trips are 45 minutes or less; had those trips been taken on transit, only 30 percent of them would be within that same window of time.

This is not to say that no one should use transit in any scenario; transit provides an important, necessary service and is well-equipped to transport adults. But transit is not a panacea for solving the gap in education transportation. In this scenario, based on data for California, over 70 percent of this student's peers are being driven to school in private vehicles. Already, we know they are likely to be wealthier, and we know that wealthier students are likelier to be on the positive end of the achievement gap. Asking poor

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[25] This report only analyzes morning trips to school. Here, I am applying similar timings to the afternoon trip and rounding up to 30 minutes. Further research should examine afternoon school trips that return students home.

students to spend more than double the amount of time traveling on transit is asking them to grow that gap wider; they do not owe us the use of this option simply because it is what already exists.

7.3.3. Student Discipline

An additional, indirect drawback to students using transit for school transportation is the disciplinary consequences for misbehavior. Part of any educator's role at the primary and secondary levels is to address and redirect misbehavior. In its most benign form, student discipline occurs between the local authority figure—the teacher, school bus driver, or coach—and the student. For more severe infractions, the incident escalates to the school administration. In only the most severe incidents—typically those that are both against the law and harmful to other students' safety— are police involved, often with specially-trained school resource officers. In all of these scenarios, students' educational outcomes are considered along with safety and punitive measures.

Transit buses are entirely different territories. Even if the school district provides a student with a transit pass, the bus is functionally the property of the transit agency. Its operations are governed by the agency's guidelines, not a school's. If a student misbehaves on a transit bus, their misbehavior is not addressed internally by an assistant principal or dean of students; rather, their misbehavior is first addressed locally by a bus operator, or if the operator deems the misbehavior severe enough, by the police. On any Los Angeles Metro bus or train, a special unit of the Los Angeles County Sheriff's Office has jurisdiction. In a scenario where two students fight on a school bus or in a school parking lot, the school's administrators might issue a short-term suspension and/or revoke school bus privileges. If the same two students were to fight on a Metro bus, they would likely be arrested and have charges brought on their external records.

Student discipline is undoubtedly part of the achievement gap. Students of color, especially black males, are significantly more likely to be suspended from school (Gregory et al., 2010). In this case, asking vulnerable student populations—who are more likely to be students of color—to take transit instead of a school-sponsored mode is opening these students to not only harsher but also more permanent disciplinary practices.

7.4. Mutually-Beneficial Partnerships

For the above reasons, the partnerships into which HopSkipDrive has engaged with school districts and local governments are certainly beneficial to the students. In turn, this becomes beneficial to school districts. These benefits are acutely true for foster youth. According to CDE data compiled by *EdSource*, only 53 percent of foster youth in

California finished high school in 2017–2018 (Olmos et al., 2019). Two scenarios can be common here: one is for these students to drop out, which 28 percent did; another is that students stall on their path to graduation and take longer than four years to graduate high school. Both of these scenarios present financial consequences for school districts. If students drop out or are chronically absent, school districts risk having their state funding reduced (Los Angeles Unified School District, 2017). If students do not graduate on time, they incur an additional year of per-pupil expenditures.

The average per-pupil expenditure in California varies between about $8,500 and $11,500 (Fensterwald, 2017), depending on statistical methods, but supporting vulnerable students often costs more than the average marginal cost, as they require additional support services like social workers and social services.[26] When appropriate, one of those services should be HopSkipDrive. While a HopSkipDrive partnership is an added cost to school districts, so too would be an additional year of instruction for a student who would otherwise fall behind.[27] Worse, the costs for students who do not finish high school play out over their entire lives in reduced earnings potential (Tamborini et al., 2015).

Additionally, contracting with school districts and local governments becomes beneficial for HopSkipDrive as a company. Beyond simply a source of revenue, contracts for school transportation provide HopSkipDrive with some financial stability. The Mobility as a Service (MaaS) industry has been far from immune to financial whirlwinds and downfalls. Most of these services—ridehailing companies like Uber and Lyft and micromobility providers like Bird and Lime—all generally operate on a consumer-based model. These companies face surges and obstacles from the economy, the weather, and other outside forces. HopSkipDrive, however, has leveraged its original consumer-based approach to provide partnership contract services branching out from that model. The company is able to use its software and CareDriver infrastructure already in place from consumer trips and extend it to cover institutions. Contracts also give the company and its CareDrivers predictable, reliable work, which in turn could be what allows them to offer drivers the ability to pre-select trips up to a week in advance, unlike their adult-serving counterparts.

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[26] Often, these are funded through US DoED's Title I program, which provides additional funding for schools with high concentrations of low-income students. But ultimately, this funding must come from somewhere, as compared with the student being in post-secondary school or in the workforce.

[27] The data use agreement for this report specifies that school district contracts cannot be revealed or evaluated, so I do not expressly address price in this report, as price.

8. Policy Recommendations and Conclusion

The State of California has created a gap in its transportation system through policy, or, more accurately, through the removal of policy. This gap is disproportionately harmful to minority students and students from low-income families; it is further cruel to students who come from vulnerable situations like homelessness and foster care. This policy gap should be closed not through a shifting of responsibility onto students' families but rather through new policy interventions that put students first.

8.1. Recommendations

HopSkipDrive Partnerships are vital for vulnerable students, and more school districts should sign on.

As a society, we ask a lot of our most vulnerable children. We ask kids who do not have homes to come to school every day, ready to learn alongside their peers who know where their bed will be that night. We ask children in foster care to adjust to another new home outside of school, but to focus on their studies while in school. And we ask children with disabilities to keep pace with their peers with services that cannot fully equalize that field. The last thing we should ask of these students is to spend more than double the amount of time they otherwise could—and double the amount of time their peers likely would—simply getting to school.

For vulnerable students, schools can be a safe haven, a place where they can find consistency, social support, nutrition, and critical services. But investing in these resources is all for naught if students never make it to school at all. With lives that are already challenging, adding an additional barrier in transportation to and from school could be the final deterrent for many young people in these situations. By providing transportation services that are customizable, nimble, and vastly more efficient than the alternative, HopSkipDrive partnerships remove an important obstacle to student achievement for students who face the largest and greater number of barriers.

HopSkipDrive is not a solution for mass transportation to school for the general education population.

With all that said, HopSkipDrive is not is a solution for mass transportation to school. HopSkipDrive should not replace school buses, nor should these types of partnerships fill the general education transportation gap in California. Obviously, having thousands of independent HopSkipDrive CareDrivers traversing a city or region

to provide general education transportation is not efficient. HopSkipDrive excels at replacing trips that would be practically or actually unfeasible on transit, but school buses can provide a more efficient means of moving large groups of students along common routes and corridors. Compared with transit, school buses also offer more-direct, more-equitable transportation for students, and they keep travel to school part of the educational process by confining management of student behavior to the education disciplinary system and not the legal disciplinary system.

Additionally, there is evidence to suggest that ridehailing increases VMT and greenhouse gas emissions when compared with transit use or direct car travel (Henao, 2017). An idealistic solution to this in California would be to reinstate state reimbursements and/or introduce a mandate for school bus service provision and to require school bus fleets to be Zero Emissions Buses (ZEBs), in alignment with the California Air Resources Board (CARB)'s requirement that all transit bus fleets be comprised entirely of ZEBs by 2040. HopSkipDrive partnerships would fit well in a complementary role to this service, and in theory could actually reduce overall VMT when compared with the alternative of parents driving their children. Unlike direct private vehicle trips, parents who drop off their children at school must then turn around and either complete their tour by returning home or continue their linked trip to work or other destinations. In this circumstance, VMT may actually be *less* with HopSkipDrive than with parents shuttling their children themselves. Further research could examine this, too.

More research is needed to determine the optimal role of ridehailing services in school transportation.

Clearly, there are huge advantages in time savings with HopSkipDrive, and I argue that these advantages outweigh any potential externality costs for vulnerable students. For general students (and for all students), further research is crucially needed to understand where the trade-off point is for time spent traveling to school and associated academic outcomes, specifically with regard to academic performance and participation in optional educational ventures like Advanced Placement courses, extracurricular activities, and after-school tutoring.

Understanding this trade-off point is also critical to understanding the costs and benefits to students in school choice programs. An obvious example of this is the ESSA and McKinney-Vento provision allowing covered students to remain in their schools of origin, but this example is clear-cut. What is less clear is the student who opts to travel across Los Angeles to a specific magnet school, or another student who opts to travel to the third-closest school instead of the school to which she was zoned to seek out a higher-

achieving school. HopSkipDrive is well-suited to provide essential services in this middle ground, but it is unclear if the added burden of travel time washes out potential benefits from attending choice schools.

8.2. Conclusion

In Los Angeles County, HopSkipDrive operates in a middle ground. This middle ground—between large-scale school transportation provision and individual family-based school transportation—has gone largely unnoticed, but also has been practically impossible to address holistically until the advent of ridehailing technology. HopSkipDrive's ability to operate at a scale larger than the school district level but still provide individualized services that are easily adjustable solves a key obstacle for students in vulnerable situations. For students experiencing homelessness, students with disabilities, and students in the foster system, HopSkipDrive represents a tremendous increase in efficiency and practical accessibility. For school districts, HopSkipDrive partnerships represent a proven way to care for their students in challenging situations and satisfy the federal mandates that protect those students.

Without a general education school transportation system for districts to tap into, students needing specialized transportation services could only rely on their families to provide transportation or find their way on public transit. Indeed, for most students in Los Angeles County, this is an adequate buffet of options. But for a 14-year-old high school freshman who is experiencing homelessness, this task would seem gargantuan. That student's parents are likely already pressed to capacity trying to find stable housing, so they are unable to provide school transportation; and transit could impose a two-hour time cost. Or for a senior who is trying to finish high school in South Los Angeles but whose foster home has suddenly moved to the San Fernando Valley, the hour-plus commute on a subway and two buses to school each day might be enough to say "enough." With HopSkipDrive, those two students—and thousands of others—arrive at school similarly to the way their peers do, and they can go about their education with one fewer barrier to overcome.

9. Appendix

The following is a description of the methodologies used in map figures and a larger-sized version of small maps within the report:

Base Map

Sources: California Geoportal (state and county boundaries), Caltrans (Freeways), Los Angeles County GIS Data Portal (county boundary and Santa Monica Mountains), US Department of the Interior (national forest), ESRI (north arrow and scale bar)

Figure 3: HopSkipDrive Trip Origins and Destinations

Source: HopSkipDrive trip data

Data for both origin and destination counts are categorized in quantities of 100, with all values greater than 500 in one category.

Figure 4: Maps of Origins and Destinations by HopSkipDrive Trip Type

Source: HopSkipDrive trip data

Data for both origin and destination counts are categorized in quantities of 100, with all values greater than 500 in one category, to match Figure 3.

Figure 4A: Consumer Trip Origins

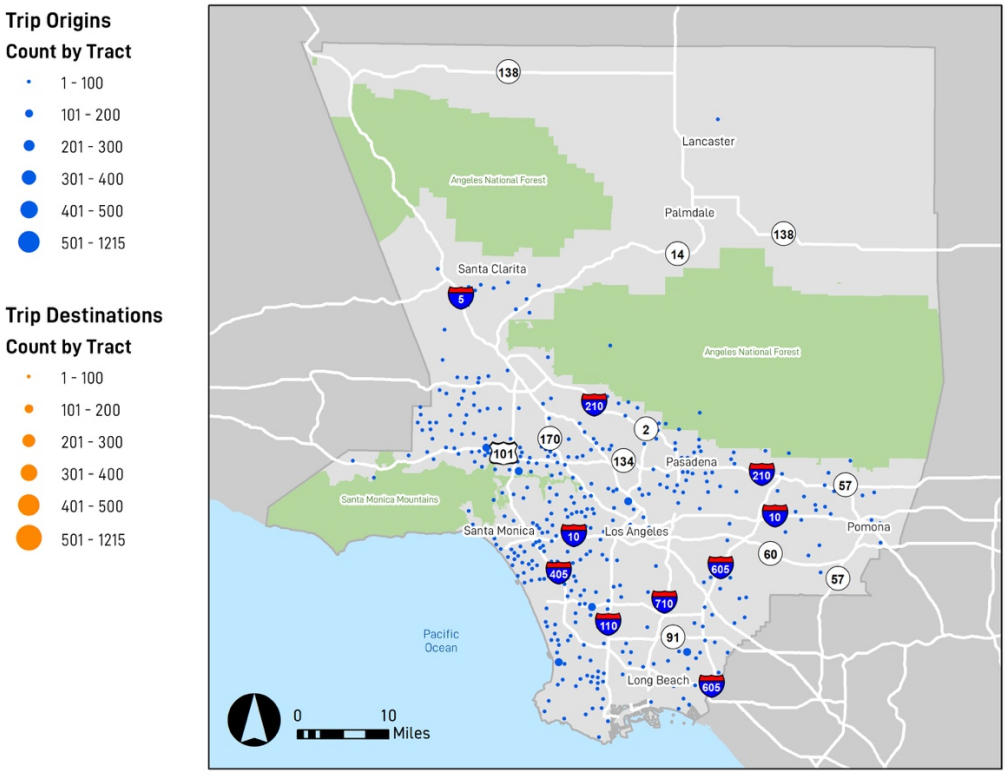

Figure 4B: Consumer Trip Destinations

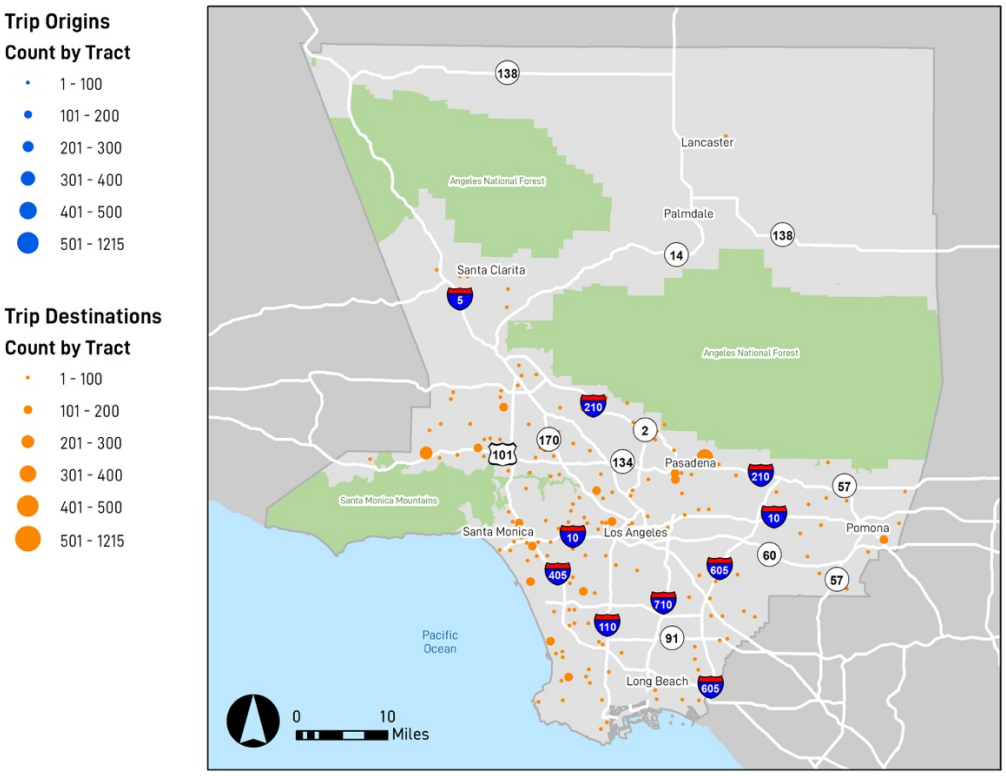

Figure 4C: School Contract Trip Origins

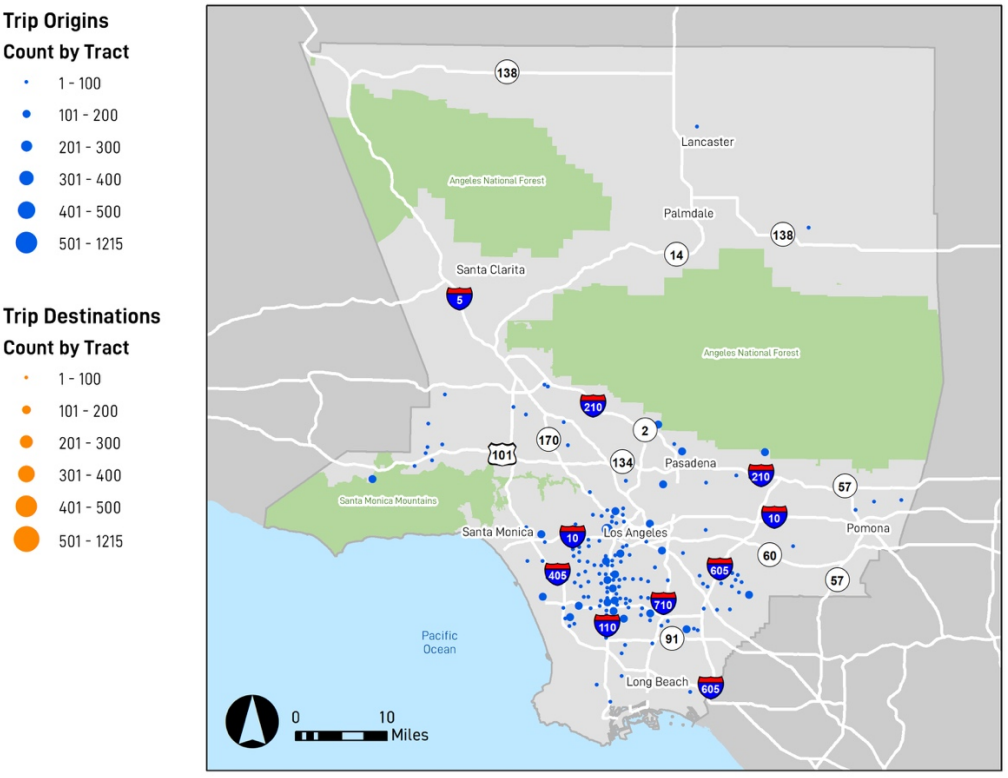

Figure 4D: School Contract Trip Destinations

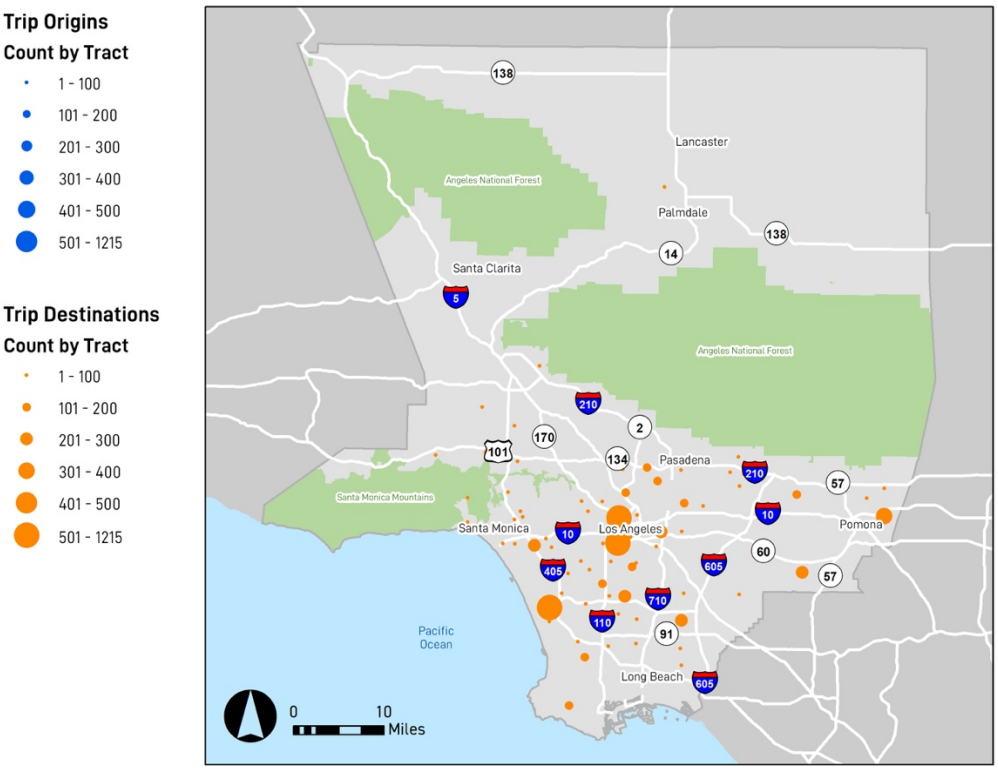

Figure 4E: Foster Contract Origins

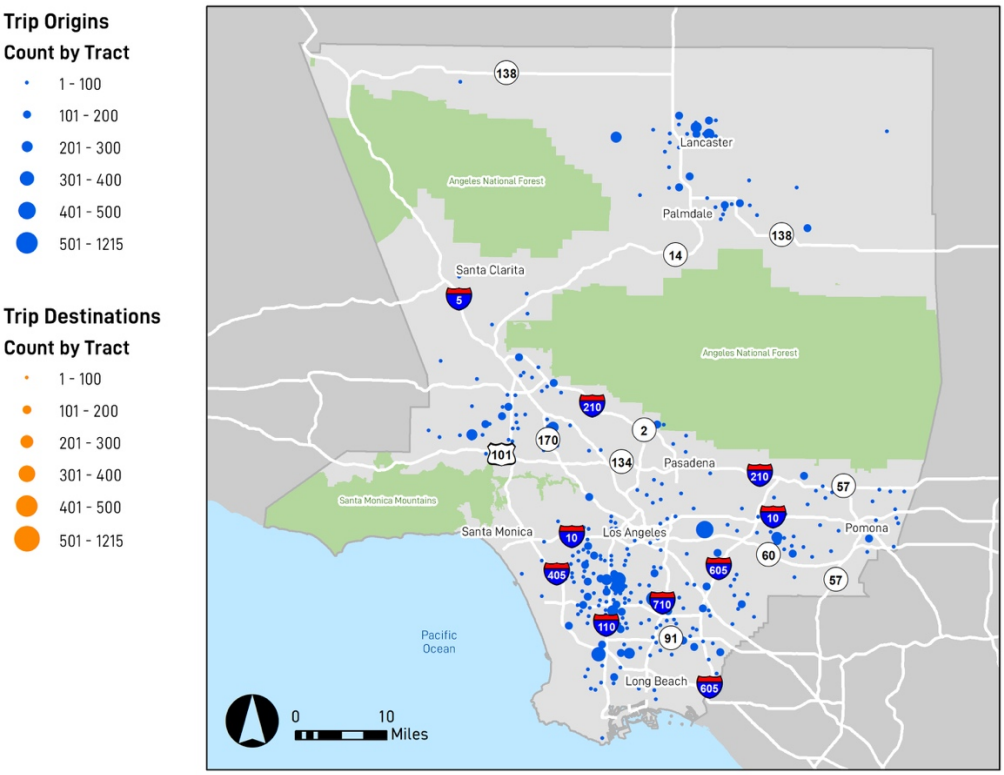

Figure 4F: Foster Contract Destinations

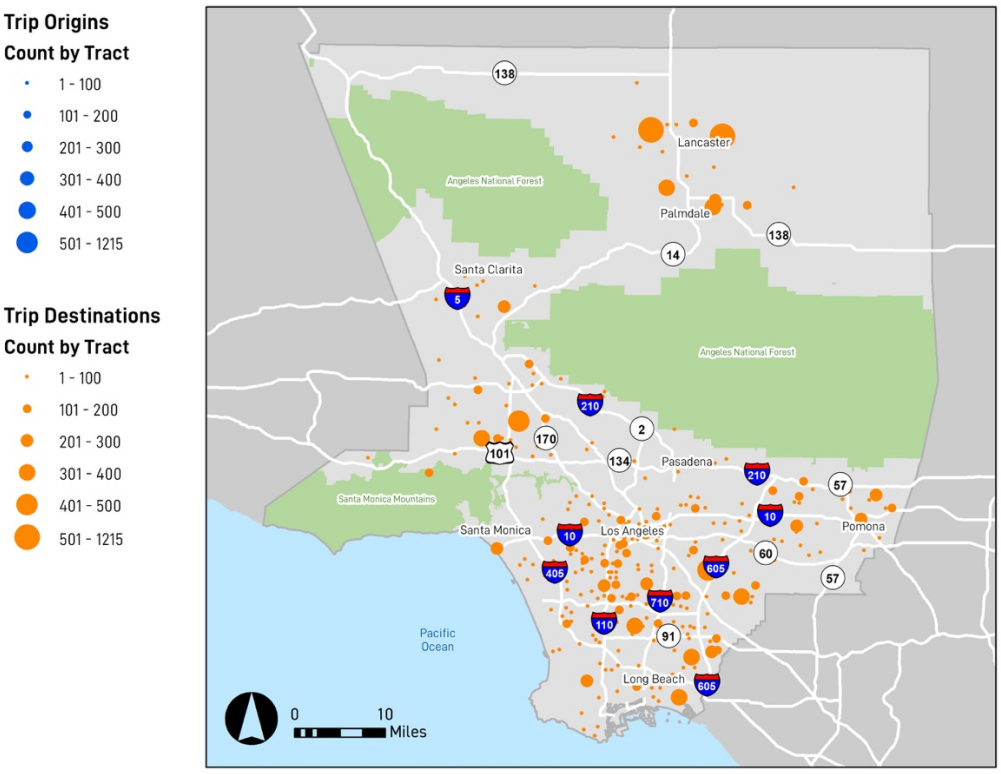

Figure 5: All HopSkipDrive Trips Average Durations by Census Tract of Origin

Source: HopSkipDrive trip data

Trip durations are averages among trips that originate in that census tract. Tracts are categorized by quintile.

Figure 6: All HopSkipDrive Trips Average Durations by Census Tract of Destination

Source: HopSkipDrive trip data

Trip durations are averages among trips that originate in that census tract. Tracts are categorized by quintile.

Figure 7: All HopSkipDrive Trip Destinations and Number of Nearby High Schools

Source: HopSkipDrive trip data, California Department of Education list of high schools (geocoded)

Data for both destination counts are categorized in quantities of 100, with all values greater than 500 in one category, to match Figure 3. Count of high schools within a half-mile of the census tract extends the boundaries of the tract by one-half-mile and counts any public or private high school with over 100 students within its boundaries, which I then categorize by quintile.

Figure 8: Maps of HopSkipDrive Origins by Trip Type and Median Household Income

Source: HopSkipDrive trip data, American Community Survey (2018) 5-year estimates

Data for both destination counts are categorized in quantities of 100, with all values greater than 500 in one category, to match Figure 3. Median household income data reported by census tract and categorized into household income buckets used by the National Household Travel Survey.

(Larger maps on following pages.)

Figure 9: Maps of HopSkipDrive Trip Type and Percent Non-White Residents

Source: HopSkipDrive trip data, American Community Survey (2018) 5-year estimates

Data for both destination counts are categorized in quantities of 100, with all values greater than 500 in one category, to match Figure 3. Percent non-white is the summation of all percentages of tract residents who reported a race other than "white" and is categorized by quintile.

(Larger maps on following pages.)

Figure 10: Maps of HopSkipDrive Trip Type and Percent without HS Diploma

Source: HopSkipDrive trip data, American Community Survey (2018) 5-year estimates

Data for both destination counts are categorized in quantities of 100, with all values greater than 500 in one category, to match Figure 3. Percent without a high school diploma is the percent of residents who are 19 and over who are not enrolled in school and do not possess a high school diploma; these data are categorized by quintile.

(Larger maps on following pages.)

Figure 11: Maps of HopSkipDrive Trip Type and Ratio Private : Public Students

Source: HopSkipDrive trip data, American Community Survey (2018) 5-year estimates

Data for both destination counts are categorized in quantities of 100, with all values greater than 500 in one category, to match Figure 3. Ratio Private:Public Schools is the number of high school students living in a census tract who are enrolled at private schools divided by the number of high school students living in that same census tract enrolled in public schools, and is categorized by quintile.

(Larger maps on following pages.)

Figure 8A: Origin Tracts and Median Household Income for Consumer Trips

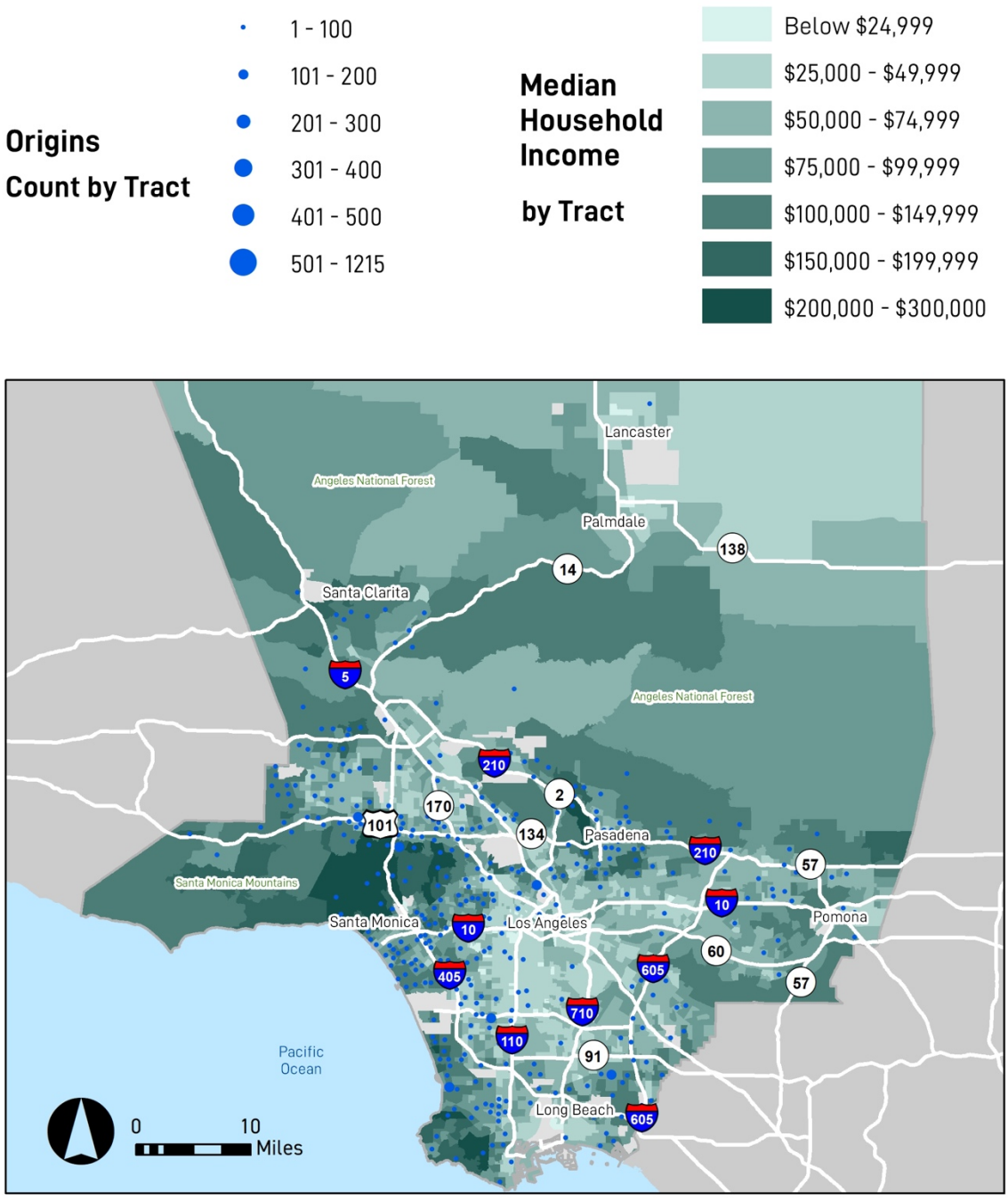

Figure 8B: Origin Tracts and Median Household Income for School Contract Trips

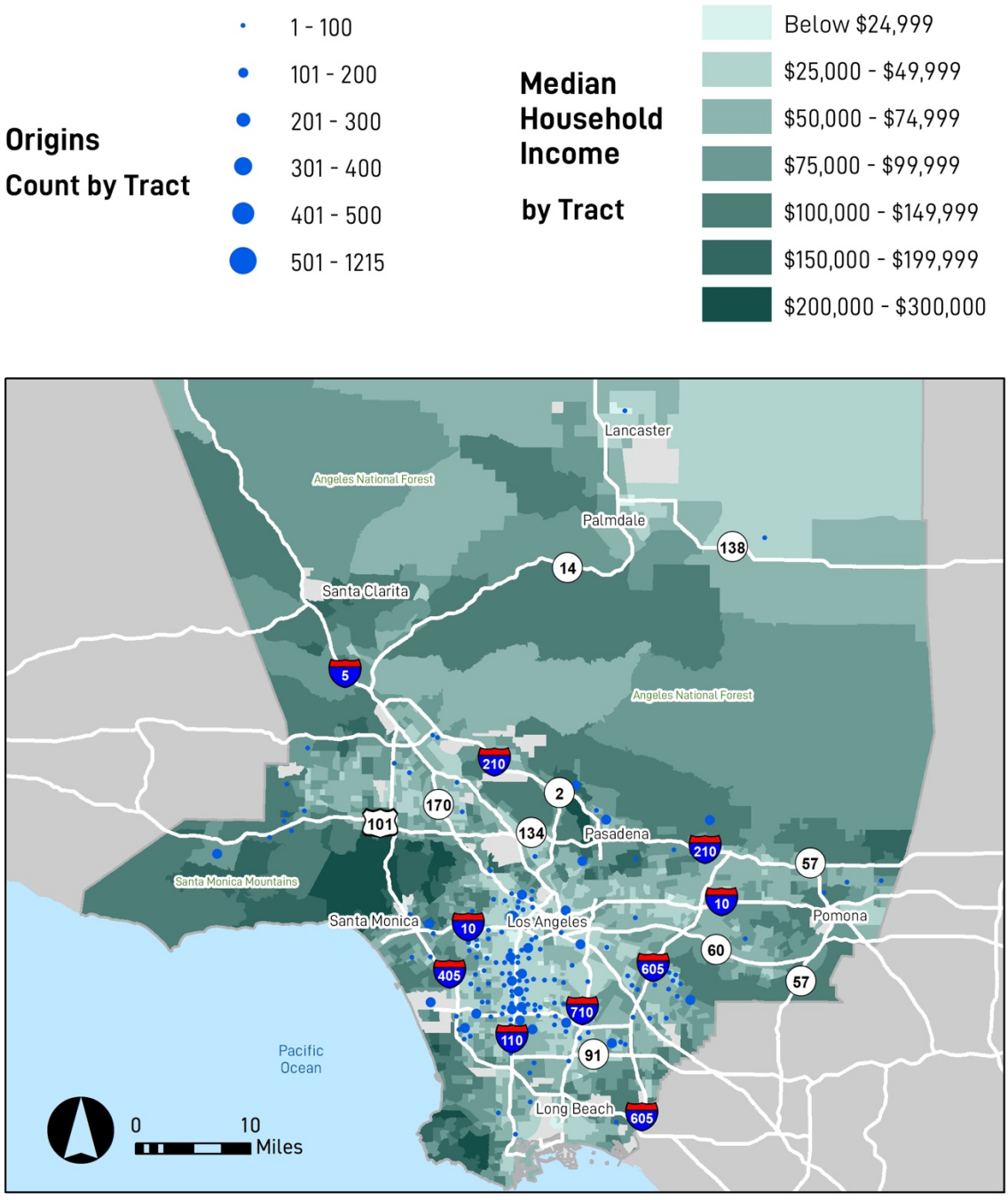

Figure 8C: Origin Tracts and Median Household Income for Foster Contract Trips

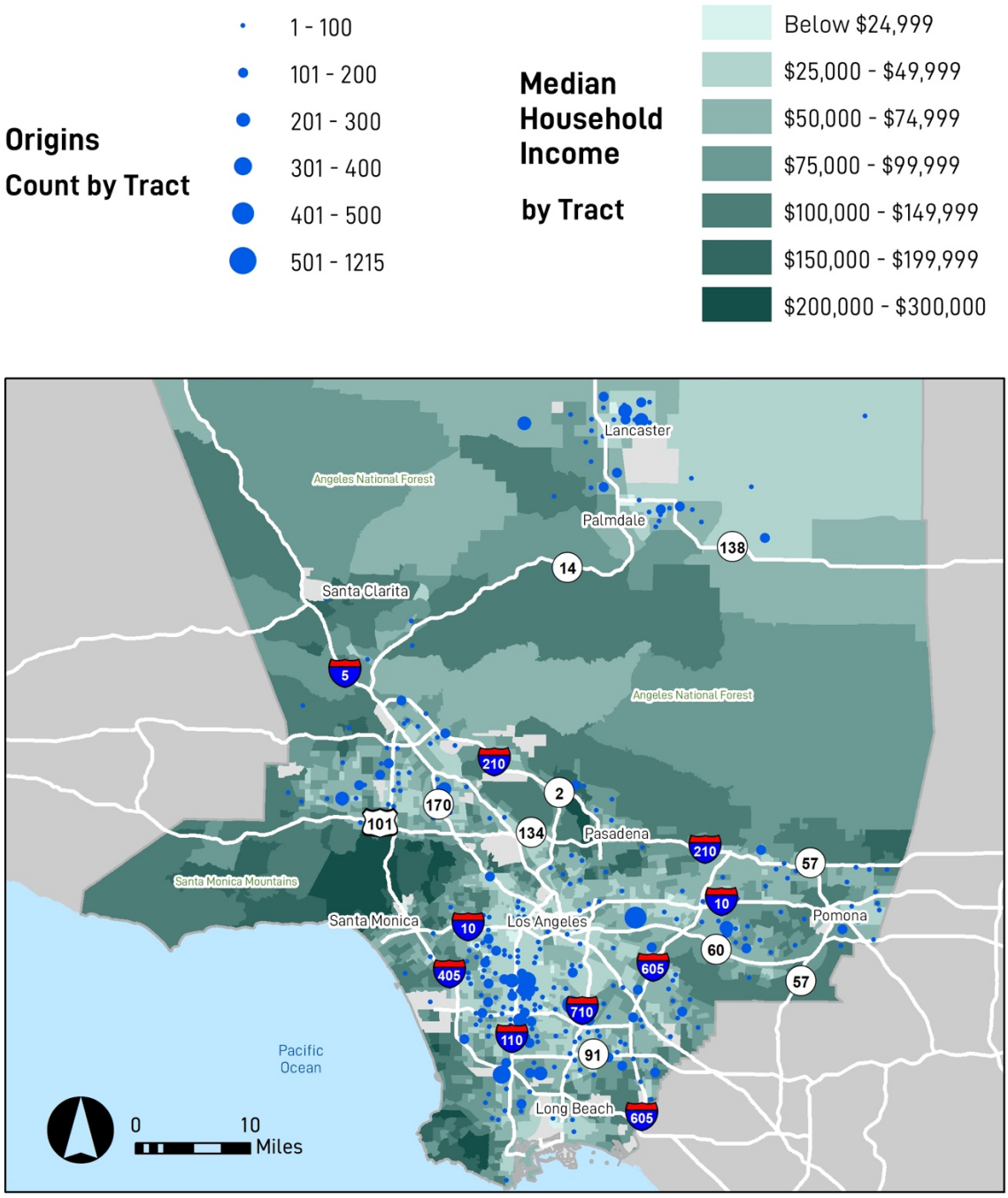

Figure 9A: Origin Tracts and Percent of Population Non-White for Consumer Trips

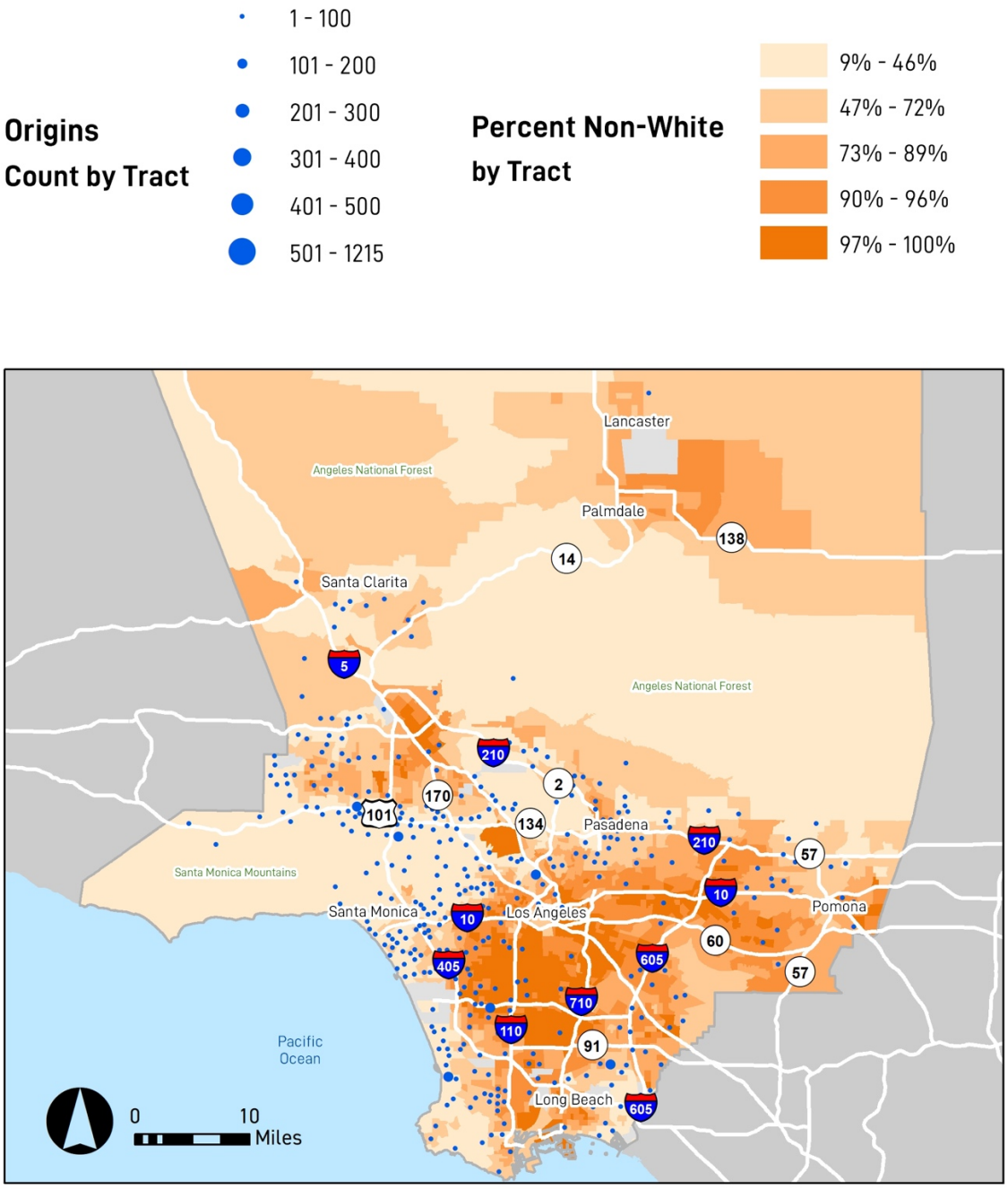

Figure 9B: Origin Tracts and Percent of Population Non-White for School Contract Trips

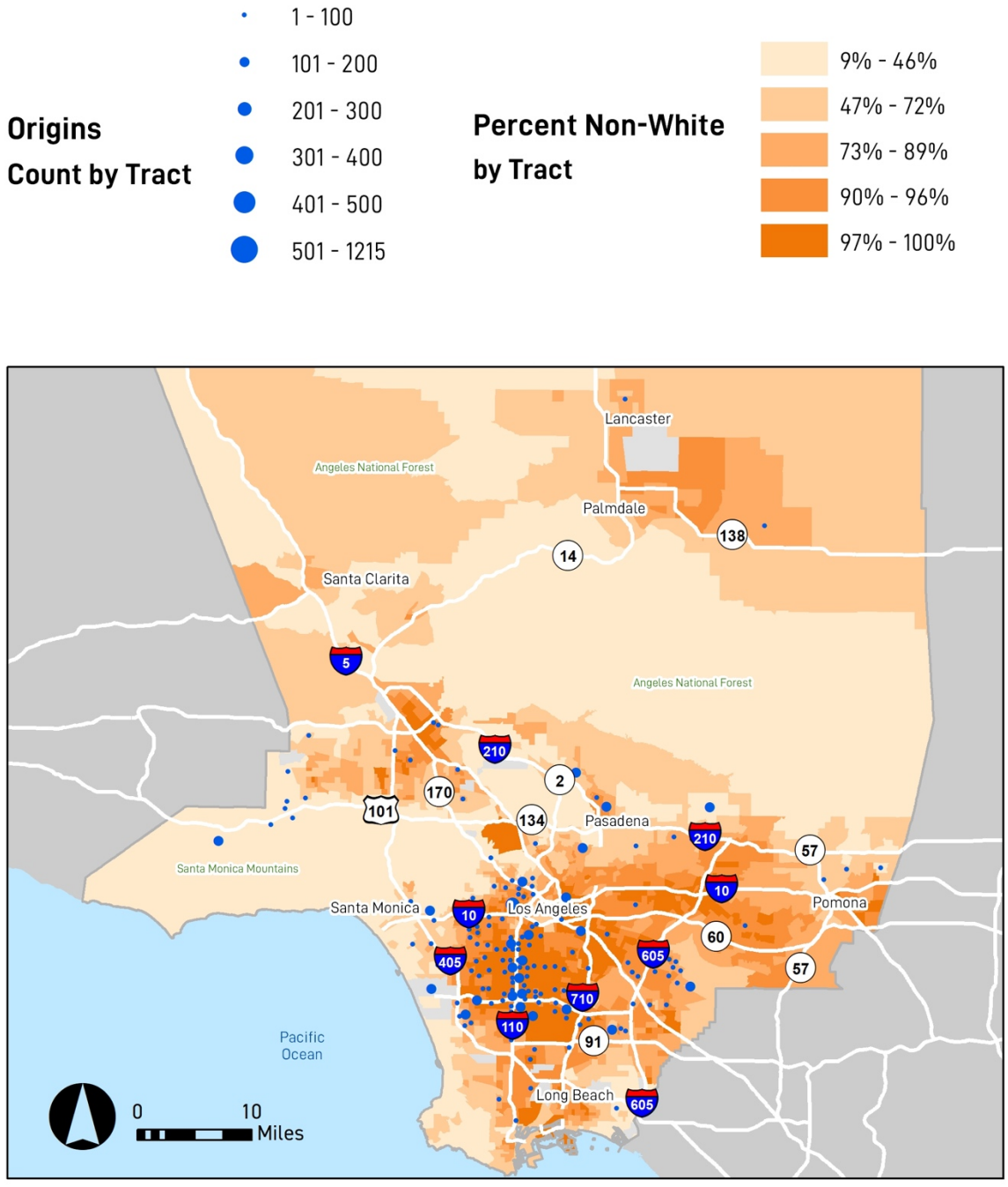

Figure 9C: Origin Tracts and Percent of Population Non-White for Foster Contract Trips

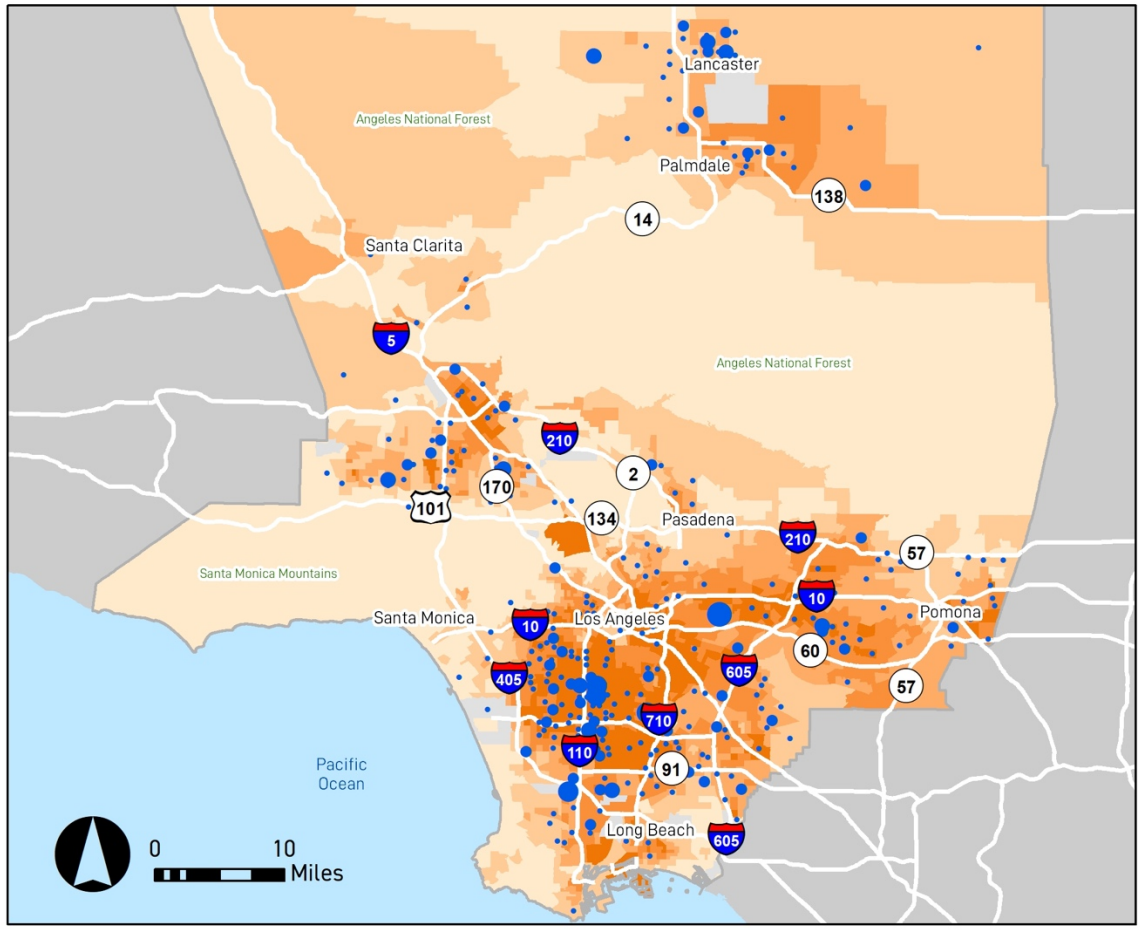

Figure 10A: Origin Tracts and Percent without HS Diploma for Consumer Trips

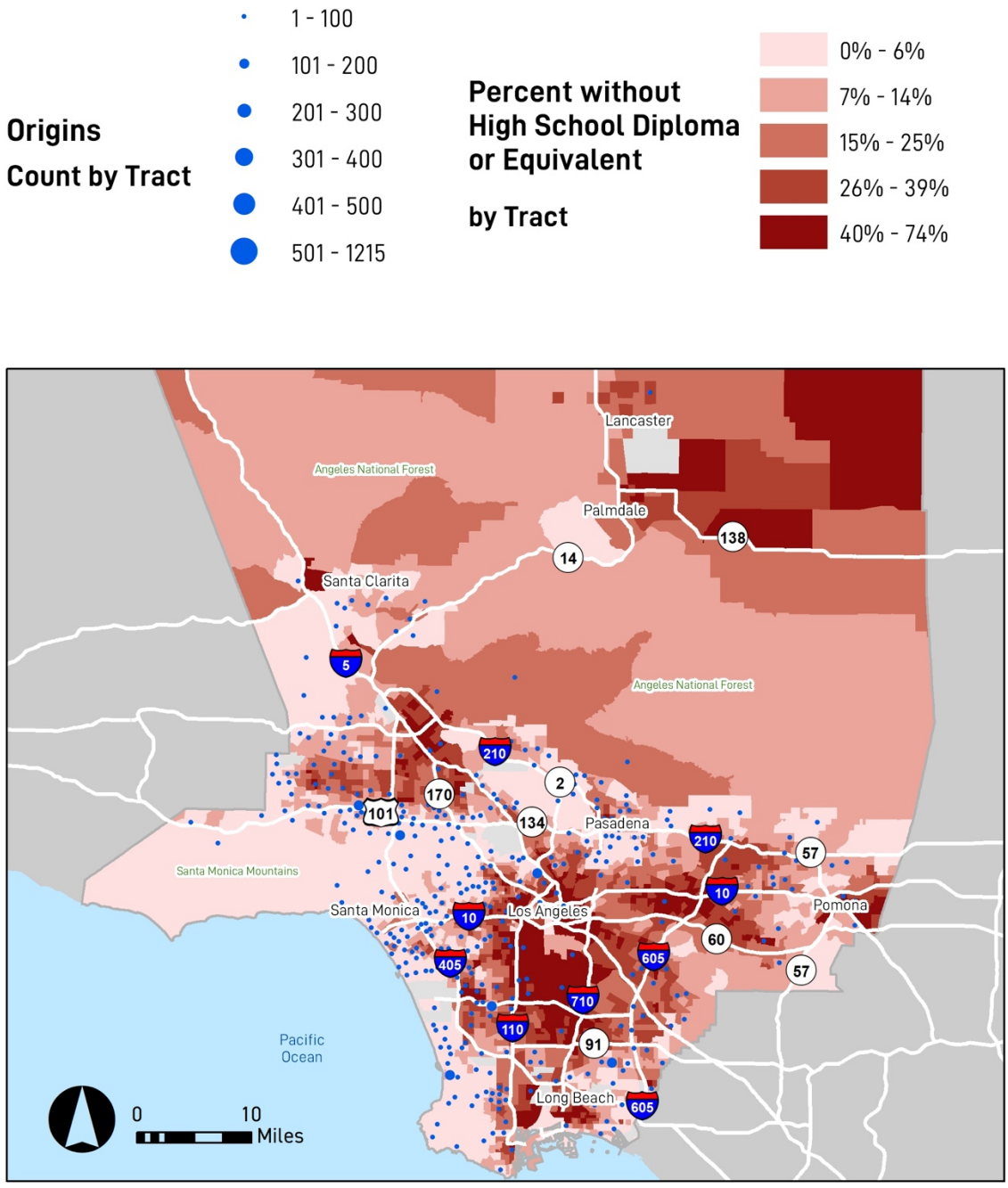

Figure 10B: Origin Tracts and Percent without HS Diploma for School Contract Trips

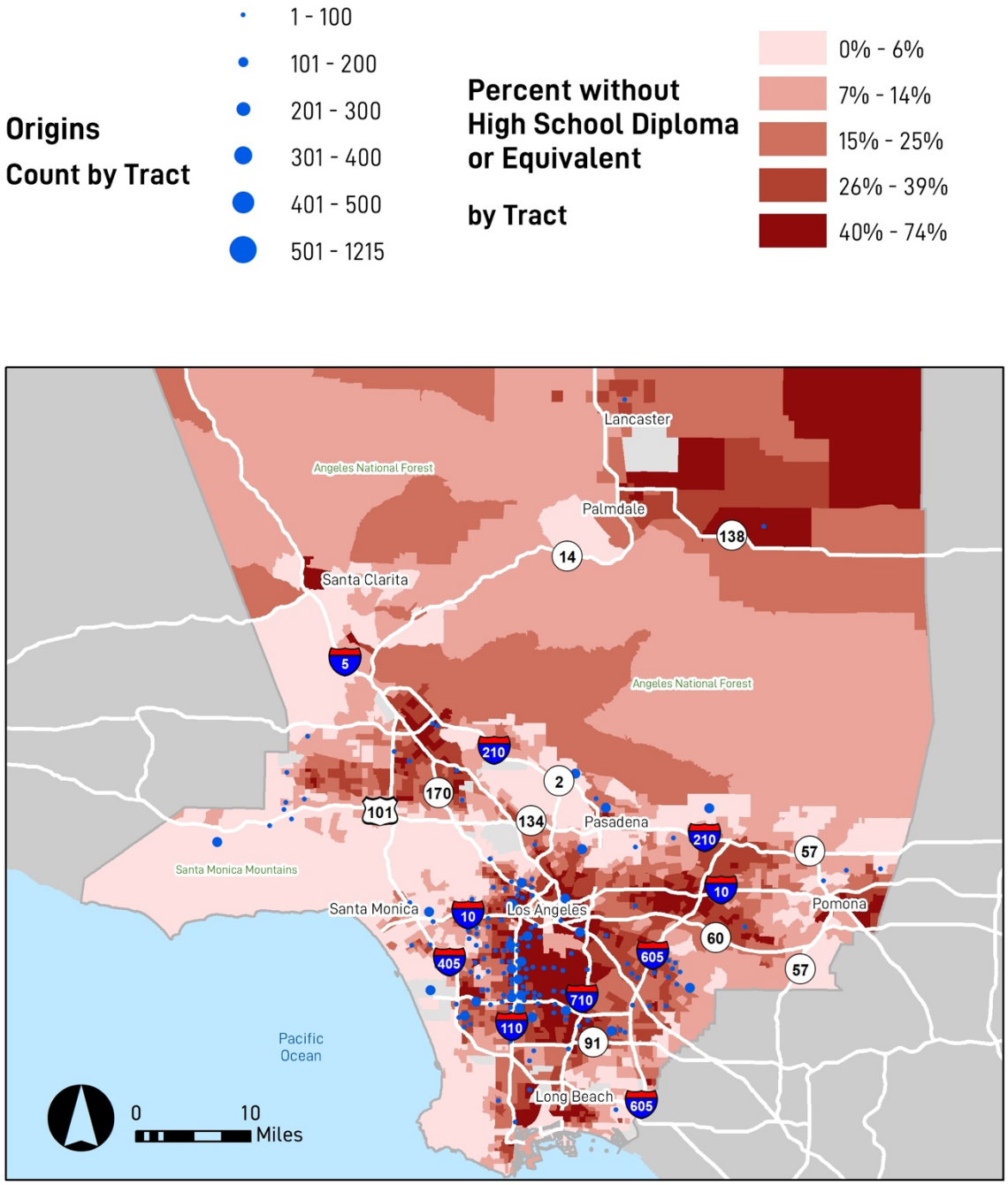

Figure 10C: Origin Tracts and Percent without HS Diploma for Foster Contract Trips

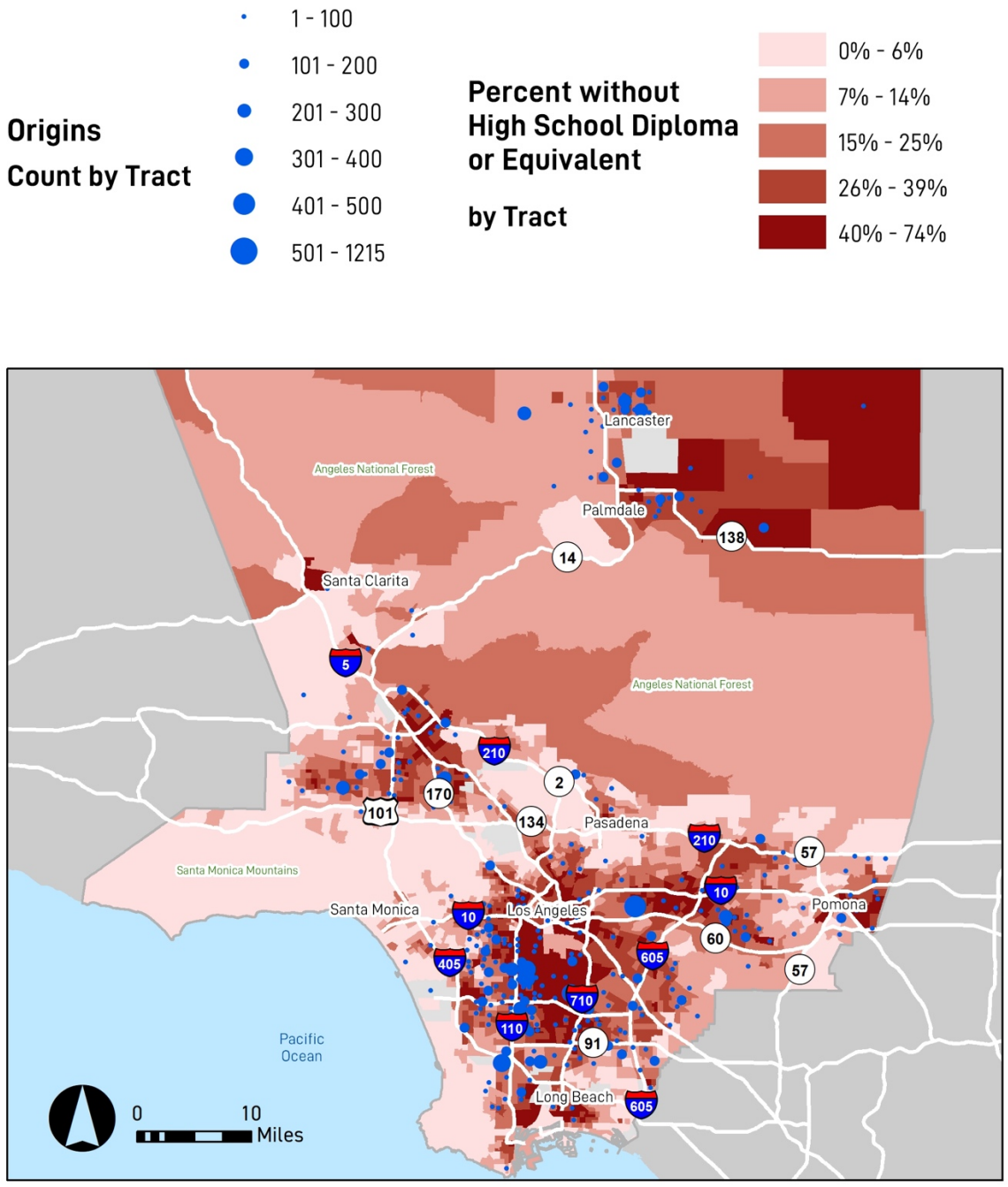

Figure 11A: Origin Tracts and Private-to-Public Student Ratio for Consumer Trips

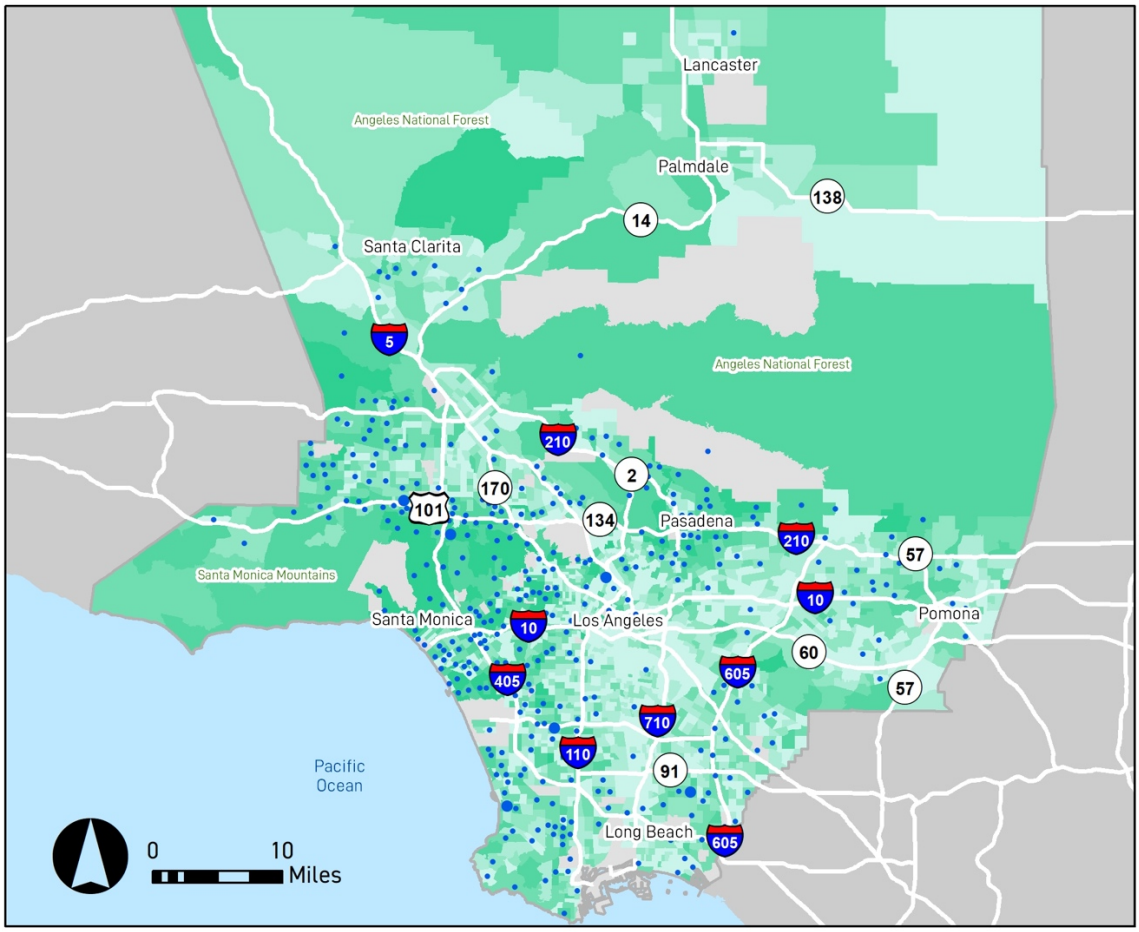

Figure 11B: Origin Tracts and Private-to-Public Student Ratio for School Contract Trips

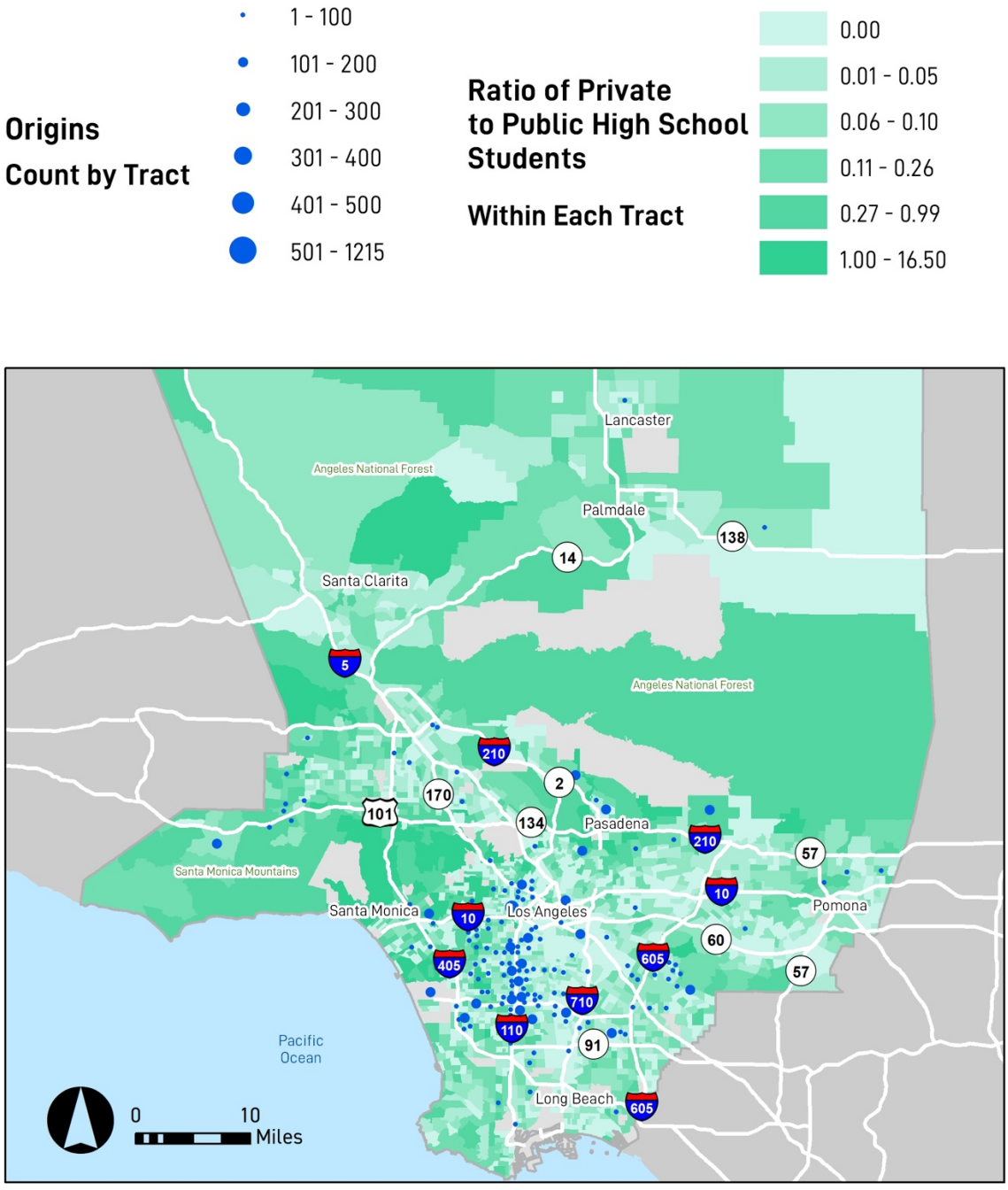

Figure 11C: Origin Tracts and Private-to-Public Student Ratio for Foster Contract Trips

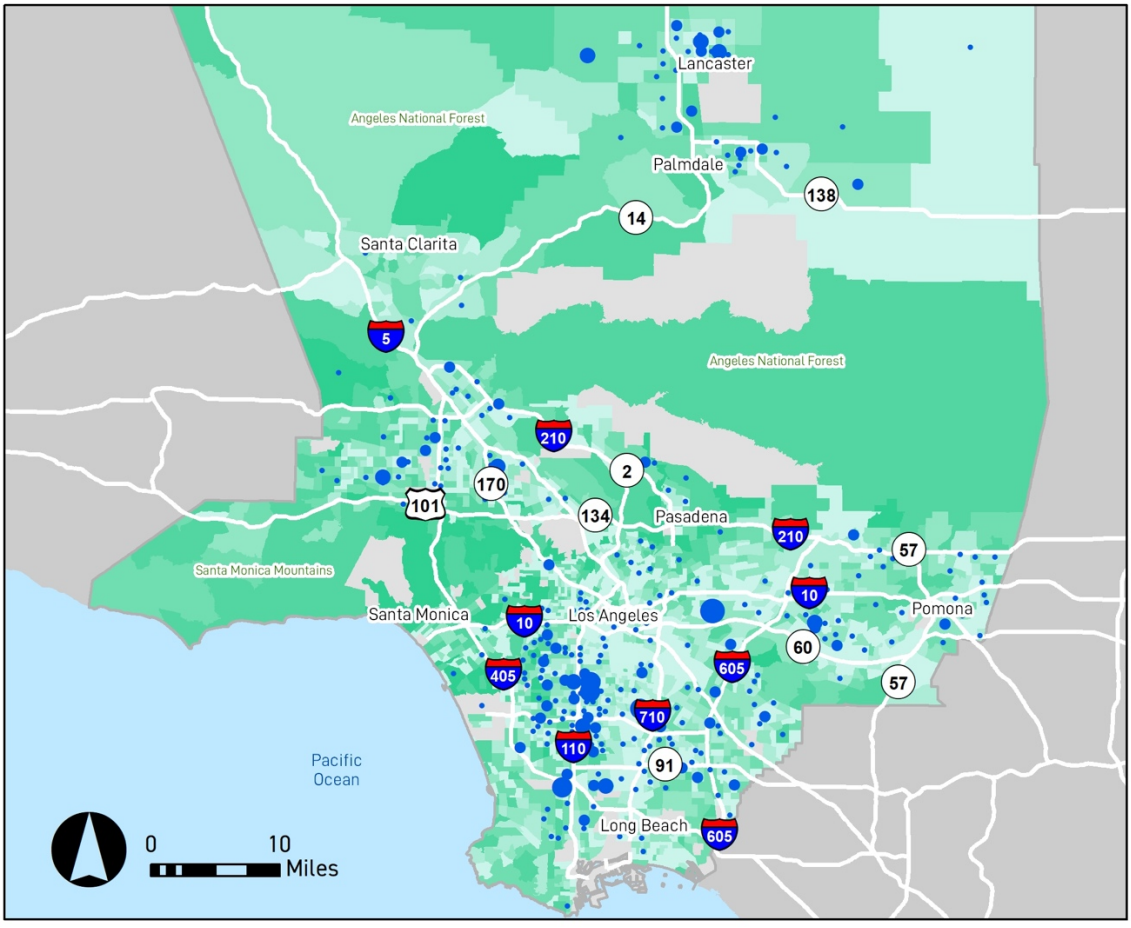

Figure 13: Map of Simulated Transit Trip Durations by Origin Census Tract

Source: Google Directions API

Trip durations are averages among trips that originate in that census tract, using Google Directions API outputs for transit duration based on HopSkipDrive origin and destination pairs. Tracts are categorized in the same manner as HopSkipDrive durations by origin tract in Figure 5.

Figure 14: Map of Simulated Transit Trip Durations by Destination Census Tract

Source: Google Directions API

Trip durations are averages among trips that originate in that census tract, using Google Directions API outputs for transit duration based on HopSkipDrive origin and destination pairs. Tracts are categorized in the same manner as HopSkipDrive durations by destination tract in Figure 6.

Figure 15: Map of Unfeasible Transit Trips and Percent of Census Tract Workers who Commute via Transit

Source: Google Directions API, American Community Survey (2018) 5-year estimates

Unfeasible transit trips are those that are either not possible or that are longer than 90 minutes in duration; the counts of these trips by origin census tract are categorized by quintile and symbolized by graduated circles. The percent of workers who commute by transit is reported by census tract and categorized by quintile.

Figure 16: Percentage of Trips to School Taken on a School Bus, United States 2017

Source: National Household Travel Survey (2017)

Each state's school bus mode share calculated by percentage of trips in NHTS taken on school bus mode out of total morning and afternoon school trips, for passengers and/or drivers ages 5 to 18. Data for each state and DC are categorized by quartile. Because some states have oversamples in the NHTS, national mode share calculated by weighting each state's number of school bus trips and total school bus trips based on the number of K-12 students enrolled in the state according to ACS 2018 5-year estimates and taking the weighted national percentage of morning and afternoon school trips taken by school bus.

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