

Closing the Gap: A Comparative Study of Transportation Accessibility for Adults with Disabilities in Urban and Rural California

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About the Pacific Southwest Region University Transportation Center

The Pacific Southwest Region University Transportation Center (UTC) is the Region 9 University Transportation Center funded under the US Department of Transportation's University Transportation Centers Program. Established in 2016, the Pacific Southwest Region UTC (PSR) is led by the University of Southern California and includes seven partners: Long Beach State University; University of California, Davis; University of California, Irvine; University of California, Los Angeles; University of Hawaii; Northern Arizona University; Pima Community College.

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

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Disclosure

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Abstract

This research addresses the critical issue of transportation accessibility for individuals with disabilities. Approximately 25.5 million Americans face disabilities that impede their ability to travel outside the home. These individuals engage in less frequent travel compared to the general population. Reduced travel adversely affects healthcare, employment, and social opportunities. We conduct case studies of Los Angeles and Tulare counties to estimate the accessibility gap faced by individuals with disabilities across three transport modes: driving, public transit and paratransit. We simulate total travel time for census tract level origins and destinations, considering walking, vehicle travel, waiting, transit transfers, and demand-responsive routing constraints. For short trips (under 2 miles), paratransit imposes the greatest time penalty: about 56 minutes relative to the car. Additionally, a significant share of neighborhood-based support services and adult day facilities cannot be reached at all by paratransit – about 20% in Los Angeles and 48% in rural Tulare County. We conducted 17 in-depth interviews to understand how individuals manage these mobility constraints. We find heavy dependence on others and extensive "trip triage," where elective social and community travel is systematically abandoned to preserve basic survival needs. People with disabilities experience extensive mobility constraints in both urban and rural areas. Results suggest that comprehensive paratransit eligibility reform, localized on-demand mobility supplements, and the structural integration of caregiver support into regional transportation equity policies are needed to reduce the accessibility gap.

Executive Summary

Project Overview and Research Objectives

This research addresses the critical issue of transportation accessibility for individuals with disabilities in both urban and rural settings, with a focus on Los Angeles County and Tulare County, California. Approximately 25.5 million Americans with disabilities face significant barriers to travel outside their homes, impacting essential aspects of life such as healthcare, employment, housing, and social interactions. People with disabilities – those who have hearing, visual, cognitive, or physical limitations – make fewer trips and travel fewer miles than the general population (Brumbaugh, 2018). Despite the prevalence of disabilities, there is little research on the challenges faced by these individuals, particularly in considering the difference in accessibility in urban and rural settings.

Evaluating accessibility and mobility constraints for individuals with disabilities is a challenge due to a lack of granular, multi-modal data. Large-scale public datasets provide broad overviews but obscure individual constraints, while trip-level paratransit routing and scheduling data are largely unavailable to the public. Many conventional transportation planning models rest on the flawed assumption that geographic proximity equals access. For a driver, a 30-minute window signifies actual movement; for a paratransit user, that same duration can be fully consumed by administrative, waiting, or operational overhead before a trip even begins.

This research addresses these gaps by implementing a mixed-methods approach across two disparate geographic settings: dense Los Angeles County and the agricultural landscape of Tulare County, California. The study is guided by four objectives:

1. Quantify the true temporal cost of access across private driving, fixed-route transit, and complementary paratransit modes by modeling the total travel experience (including pedestrian access, pre-trip wait times, and transfer penalties).
2. Assess how urban density versus rural fragmentation mitigates or intensifies these temporal costs.
3. Measure how travel burdens vary across three essential, non-substitutable destination categories: hospitals/medical facilities, disability support services, and adult day facilities.
4. Understand how people with disabilities negotiate these travel burdens and how mobility limitations affect daily life.

Methodology

The research has two parts. The first is a quantitative analysis that addresses the first three objectives. The second is a series of in-depth interviews to address the fourth objective.

The quantitative phase simulated 1.3 million potential origin-destination pairs mapping all regional census tracts and block groups to localized care facilities. Total travel times, including walking, vehicle travel, waiting, transit transfers, and demand-responsive routing constraints, were estimated for driving, public transport, and paratransit. Estimates were calculated as follows:

- **Baseline Driving:** Use street networks via OSMnx in Python, adjusting free-flow times with localized Travel Time Index traffic multipliers (1.5 for Los Angeles; 1.15 for Tulare) plus a 5-minute parking/egress penalty.
- **Fixed-Route Transit:** Constructed via GTFS data incorporating a walking speed of 1.3 meters per second, a 5-minute penalty per transfer, a 2-minute minimum boarding cushion, and a standardized 10-minute first mile and last mile walking time buffer.
- **Paratransit:** Los Angeles paratransit is based on the current service provided by Los Angeles County Access Services. Travel time is based on distance weighted by a route deviation penalty at a rate that decreases as travel distance increases. A 58-minute baseline delay represents pickup buffers and scheduling uncertainty. Tulare County was split into Scenario 1 (Integrated Transfer to inter-city fixed-route transit with a 45-minute penalty) and Scenario 2 (Siloed No-Transfer where inter-city paratransit is structurally unprovided).

The qualitative analysis cross-referenced these models with 17 semi-structured individual interviews conducted with disabled travelers and primary caregivers. The interviews elicited information on the cognitive, administrative, and social mechanisms that explain choices to travel or not.

Key Findings

- **The Local Mobility Gap:** The most severe proportional disparity occurs at the shortest distance band (0–2 miles). Due to the high fixed cost of scheduling and waiting for a ride, as well as the added costs of route deviation. Local paratransit travel times exceed fixed-route transit by 20 minutes and private vehicles by 56 minutes.
- **Modal Convergence and Time Losses:** For mid-range trips (10–20 miles), transit and paratransit travel times converge at an average of 1 hour and 48 minutes, nearly quadruple the driving baseline. At 30+ miles, the absolute time lost reaches 104 minutes compared to driving.
- **Geographic Exclusion:** Not all destinations can be accessed by transit or paratransit. In Los Angeles, support services and adult day facilities face transit exclusion rates of 12.9% and 19.5%. In Tulare County, exclusion is dramatically higher: 25% of hospital trips are structurally impossible via public networks, rising to 29% for day facilities and 48% for disability support services, and leaving users fully isolated within their local municipalities under Scenario 2.
- **Administrative challenges:** Using paratransit requires certification of eligibility and has complex rules regarding ride requests. Service is limited to a fixed number of monthly rides. These requirements can lead to unintentional disqualifications and discourage use of the service.
- **Wayfinding and safety:** Using paratransit carries the risk of delayed pickups, and sometimes a failed pickup. Passengers face rigid boarding rules, while operators maintain a flexible 20-minute "on-time" late buffer, often stranding vulnerable individuals to wait for vehicles outside in the elements. Safety and reliability concerns further discourage paratransit use.
- **Physical labor:** Transit use requires cognitive and physical capacity to negotiate the system. Even wheelchair accessible buses require that the connecting infrastructure also be accessible. Paratransit similarly requires being physically able to access the vehicle and respond if something goes wrong.

- **Behavioral Trip Triage:** The combination of limited access to critical services, unreliable scheduling, broken infrastructure, and safety fears forces travelers into "trip triage", abandoning elective social, recreational, and community travel to preserve limited energy and funds for mandatory survival needs.

We conclude that the transportation options available to those with disabilities are inadequate. If the person does have access to a private vehicle or cannot drive, they must depend on others for rides or try to use public transport systems that are poorly suited to their needs. The result is severe limitations on travel that greatly reduce social or recreational travel and often limit even essential travel. To mitigate these disparities, we suggest some targeted interventions: streamlining paratransit eligibility to reduce pre-trip administrative friction, building comprehensive regional service directories, deploying localized on-demand micro-transit options to fill short-trip gaps, and structures that formally support caregiver networks.

1. Introduction

This research addresses the critical issue of transportation accessibility for individuals with disabilities in both urban and rural settings, with a focus on Los Angeles County and Tulare County, California. Approximately 25.5 million Americans with disabilities face significant barriers to travel outside their homes, impacting essential aspects of life such as healthcare, employment, housing, and social interactions. People with disabilities – those who have hearing, visual, cognitive, or physical limitations – make fewer trips and travel fewer miles than the general population (Brumbaugh, 2018). Despite the prevalence of disabilities, there is little research on the challenges faced by these individuals, particularly in considering the difference in accessibility in urban and rural settings.

This report evaluates the structural and social constraints of the multi-modal transportation system for individuals with disabilities across two contrasting environments: the dense urban basin of Los Angeles County and the rural, agricultural landscape of Tulare County. Physical mobility underpins access to essential resources, including medical care, specialized support services, and community-based adult day facilities. However, conventional transportation planning frameworks frequently rely on geographic proximity as a proxy for opportunity, assuming that a short spatial distance equals an accessible destination. For individuals navigating travel-limiting conditions, physical proximity tells us very little about whether a destination is actually reachable. By combining a multi-modal spatial simulation of 3.7 million potential trips with seventeen in-depth, semi-structured individual interviews, this study captures the comprehensive travel experience—incorporating pedestrian access, pre-trip wait times, operational scheduling buffers, and transit transfer friction, as well as in vehicle time. This mixed-methods approach uncovers the hidden operational and social dimensions of travel, establishing how alternative transit networks fail to meet basic needs regardless of geographic setting.

The remainder of this report is organized as follows. Section 2 presents a literature review on the theoretical and empirical literature on mobility and accessibility of individuals with disabilities. Section 3 introduces the case study areas. Section 4 presents an accessibility analysis. Section 5 discusses the qualitative interviews. Finally, Section 6 concludes the report.

2. Literature Review

It is estimated that 42.5 million Americans, constituting 13 percent of the population, are living with a disability in the United States (Leppert & Schaeffer, 2023). Other estimates, using broader definitions of disability, estimate prevalence as high as 28.7 percent of the adult population (CDC, 2025). Among them, approximately 25.5 million Americans face disabilities that impede their ability to travel outside the home. Consequently, individuals with disabilities often engage in less frequent travel compared to the general population, with a significant proportion abstaining from travel altogether. According to the 2017 National Household Travel Survey, over one-third of individuals aged 18 to 64 with disabilities made zero trips on the day of the survey (Brumbaugh, 2018). By 2022, that figure had risen to 40.2 percent (Bureau of Transportation Statistics, 2024). Access to crucial services such as healthcare,

employment, housing, and social interactions relies heavily on physical mobility. Disability is also highly correlated with poverty, leaving many with limited access to resources to meet their basic needs (Okoro, 2018).

Accessibility has been a central discussion of transportation planning for decades, yet the frameworks developed to measure and improve it rest on a foundational assumption that has gone largely unquestioned: that proximity equals opportunity. For the general population with access to a private vehicle, this assumption may hold. However, for the millions of Americans whose disabilities limit their ability to travel, proximity to a destination tells us almost nothing about whether that destination is actually reachable. We argue that conventional accessibility frameworks, built around spatial distance and travel time, are ill-equipped to capture the barriers faced by people with disabilities.

2.1 Health, Well-Being, and Social Exclusion

There is limited work exploring the impacts of poor transportation access on individuals with disabilities, particularly in the urban planning and transportation literature. To gain insights into this issue, we can turn to research on other demographic groups, particularly aging populations, which may shed light on how inadequate transportation options affect access to basic needs.

Those who are constrained in their mobility choices risk social exclusion. Social exclusion has multiple definitions, though for the purposes of this paper, will be adapted from the work of Rajé (2003), who defines it as, “a process, which is understood to be multi-dimensional, and prevents individuals or groups from participating in normal activities of their society. It is linked to inaccessibility of goods and services, which contributes to a feeling of not belonging.” (Rajé, 2003, pg. 322). This definition contains three key components that are important for theorizing the concept. Firstly, individuals are being prevented from participating in activities, meaning that there is a desire to be included. Secondly, it is linked to an inaccessibility of goods and services (in this case, transportation), which is outside of the control of the individual. Finally, the definition implies that there is a minimum level of participation; “normal activities” within a society.

The unpredictability of transportation for people with disabilities, such as paratransit, can lead individuals to avoid social travel. Pyer and Tucker (2014) found that teenagers in wheelchairs were limited in their participation in spontaneous social outings due to reliance on wheelchair-accessible vehicles. Planning and attending a social event may involve booking an accessible taxi days in advance, requiring excessive time and money. Such costs, and transportation-related stressors, can cause individuals with disabilities to opt out of social travel, which is known to be a stress reliever (Crudden et al., 2017). This can contribute to feelings of exclusion and isolation.

Those with disabilities are more likely to self-report being in worse health than those without disabilities (Krahn et al., 2015). Additionally, disability frequently emerges as a predicting factor in an increased likelihood of delayed or missing health appointments (Lyeo et al., 2023; Wolfe et al., 2020). Challenges are compounded for those living in rural areas. Significant associations between physical health and perceived social isolation have been found in rural residents with disabilities (Repke & Ipsen, 2020).

Those with disabilities and health issues may require frequent travel to primary care doctors or specialists. A study of older adults with chronic conditions in rural areas found that frequent travel to specialists was extremely prohibitive, resulting in compromised access to essential health services and worsening physical health outcomes (Krasniuk & Crizzle, 2023). These health consequences are compounded by the dependence on others that inadequate transportation often creates.

2.2 Mobility Dependence

With available services being insufficient to meet basic needs, many with disabilities become mobility dependent, relying on friends, family, neighbors, or strangers to assist in travel. In areas with few alternative transportation options, this likely involves receiving rides from others. Being dependent on others likely does not allow one to meet all transportation needs, as noted by Cvitkovich and Wister (2001), whose survey of older adults found that 54.4 percent of mobility-dependent respondents self-identified unfulfilled transportation needs due to a lack of transportation. The ability to travel independently can contribute to self-confidence and overall well-being in individuals with disabilities (Blais & El-Geneidy, 2014). Social participation is also shown to positively impact self-efficacy among those with mobility challenges (Sundar et al., 2016).

Asking for rides can be a source of discomfort for those with and without disabilities. Research suggests that asking for and accepting rides from family and friends is more challenging for men, who may be more socialized to be independent and self-sufficient (Burkhardt et al., 2011). Those who are forced to ask for help with getting around, whether on transit or getting a ride, may be more reluctant to travel altogether (Cochran, 2020). Willingness and comfortability asking for help may also relate to the length of time one has had their disability. Research suggests that adults with lifelong disabilities travel differently than those with acquired disabilities, having developed strategies and mechanisms for successfully navigating the world that those with recently acquired disabilities may not have (Henly & Brucker, 2019). Those who have lived with their disability for longer may have greater resilience, with the ability to “bounce back” more quickly than those who are newer to living with a disability (Silverman et al., 2015). These individuals may also have more confidence in asking for help and a more robust network willing and able to assist with travel (Cochran, 2020). Consequently, travel behaviors, patterns, and navigation comfort levels vary considerably among individuals with disabilities.

Inadequate transportation can have a rippling effect on caregivers who are the sole proprietors of rides for those with severe disabilities. Families of individuals with severe disabilities and those who act as caretakers face emotional, physical, and economic costs. Caretakers themselves may suffer from social isolation as a result of their caretaking duties (Edwards, 2009; Reichman et al., 2008). Yet, the labor involved in arranging and facilitating transportation for a family member with disabilities remains largely understudied, representing a significant gap in the literature.

2.3 Existing Infrastructure & Modes

Individuals with disabilities face barriers to access to all modes of transportation. Common challenges and barriers to access for four modes of transportation (car, public transit, paratransit, ridehailing) will be discussed.

2.3.1 Auto-access and Driving

For many individuals with disabilities, driving may not be feasible due to physical or cognitive limitations. However, given the predominantly car-centric development of cities, particularly in the United States, auto-vehicle travel often becomes the sole viable option in many situations. Personal vehicle travel dominates the transportation landscape in the United States, with the 2022 National Household Travel Survey (NHTS) indicating that 86.9 percent of all surveyed person-trips were made by private vehicles. Consequently, individuals with disabilities heavily rely on private vehicles for transportation, as highlighted by the Bureau of Transportation Statistics, which identified being a passenger in a personal vehicle as the most commonly used mode of transportation for people with disabilities of all ages (Rosenbloom, 2007; Sweeney, 2004). However, people with disabilities aged 18-64 are also much more likely to live in a zero-vehicle household (14.3 percent compared to 4.9 percent for those without disabilities) (Bureau of Transportation Statistics, 2024). Those with disabilities who cannot drive likely do not have many options for accessing essential needs other than relying on friends and family who may be outside of their household.

Although 56% of the 25.5 million Americans with travel-limiting disabilities are licensed drivers (Venkataram, 2023), challenges with mobility persist. Those with disabilities may alter their driving habits by engaging in self-regulating behavior, including driving less often, avoiding driving in poor weather, and avoiding driving during peak hours (Rosenbloom, 2007). These adjustments may leave them unable to meet their needs, despite having a license and a vehicle. Additionally, those with physical disabilities may require vehicle adaptations to drive. These can include hand controls, foot controls, assistance straps, seatbelt modifications, ramps, and other adjustments. Without financial assistance, vehicle adaptations can cost tens of thousands of dollars, adding to the already high cost of vehicle ownership (*Adapted Vehicles* / NHTSA, n.d.). Vehicle adaptation may not be feasible for those with financial constraints or the time to explore available options. Additionally, adaptations do not help those whose disabilities are not physical.

Conventional accessibility analyses typically model car access as the default mode, yet for a significant portion of people with disabilities, private vehicle travel is either unavailable, financially out of reach, or requires modifications and behavioral adjustments that limit when and where they can go. Proximity to a destination means little when the assumed mode of getting there is itself a barrier.

2.3.2 Public Transportation

Those with disabilities are found to use transit at a greater rate than the general population (Brumbaugh, 2018), making it a critical mode for this population. Yet public transportation in the US is known to be much less efficient than driving. There is a major body of literature in the US that focuses

on differences in accessibility across travel modes, particularly in accessing jobs by car and by transit (Blumenberg & Ong, 2001; Shen, 1998). Research indicates that job access via car surpasses that of public transit by as much as thirty times (Boarnet et al., 2017). For people with disabilities, who navigate additional physical and social barriers, the gap is likely even wider. Despite the passage of the Americans with Disabilities Act (ADA) — a civil rights law safeguarding the rights of individuals with disabilities across employment, public services, and transportation — significant barriers remain

The ADA has substantially improved the usability of public transportation for people with disabilities. However, there are still existing barriers to usage for the fixed-route system that may limit accessibility. The National Council on Disability periodically conducts a review of the state of transportation services for individuals with disabilities, the most recent being in 2015. While the quality of services of fixed-route public transit services has improved, there are still reported accessibility issues. This includes physical maintenance of bus accessibility equipment, such as wheelchair lifts and ramps; poor accessibility at stations, such as inoperable elevators; and driver noncompliance, such as failing to provide stop announcements. (National Council on Disability, 2015). These failures can render public transportation unusable for those with physical disabilities or visual impairments, who require these services to navigate the transit system independently.

Barriers in the built environment can pose issues for those with disabilities in accessing transit altogether. People with mobility challenges and those with visual impairments are more sensitive to issues with sidewalks, including missing sidewalks, uneven surfaces or breaks, and missing curb cuts at crossings (Liu et al., 2023; Park & Chowdhury, 2018). It may not matter how close an individual is to a transit station if they are not able to access it via the provided sidewalk network. This is likely a significant barrier for those with disabilities; it has been found that improved infrastructure is more likely to increase transit usage by those with disabilities than non-disabled individuals (Kwon & Akar, 2022).

Additionally, personal safety concerns and fear can significantly restrict travel, especially for individuals with disabilities who may feel vulnerable in shared spaces. Intersectional identities can compound these fears, with harassment and assault posing significant barriers. An example of this is women with intellectual disabilities who may struggle to navigate boundaries or fear repercussions for reporting incidents on transit (Iudici et al., 2017). Encounters with others on transit pose potential barriers for people with disabilities. Bezyak et al. (2017) identified driver actions and behavior as major obstacles, including failure to announce stops, lack of knowledge about disability equipment, and inappropriate attitude. Additionally, a significant portion of respondents cited inappropriate driver attitude as a barrier to transit use. Bus drivers may lack training in respectful engagement with individuals with disabilities, with 40 percent identifying those with intellectual disabilities as a challenging passenger group (Tillmann et al., 2013). Difficulty in interpreting social cues or responding appropriately to interactions, particularly for those with autism or cognitive disabilities, further exacerbates these challenges, potentially leading to misunderstandings or feelings of isolation. Those with certain intellectual disabilities, like autism, may have trouble navigating and responding to unexpected situations and stimuli that may arise from taking

public transit. The unpredictability of public transportation increases anxieties, such as what to do in the instance of a late bus, losing a ticket, or not having the correct fare to board (Kersten et al., 2020).

Beyond these social and cognitive barriers, the physical demands of using transit can themselves be prohibitive. Walking to a stop, enduring the elements outside, waiting for a bus, boarding the vehicle, and finding seating (potentially while the vehicle is moving) can be physically demanding.

2.3.3 Paratransit

Per the ADA, transit agencies are mandated to offer complementary paratransit services for those who are unable to utilize traditional fixed-route public transportation. These demand-responsive transportation services are to provide rides within three-quarters of a mile of an existing bus route or rail station, and must provide a comparable level of service to the fixed route equivalent. ADA-compliant paratransit services are only required to be available at the same times as the existing bus or train route it is supplementing (Federal Transit Administration, 2007). Paratransit is intended to operate as a safety net for those who are unable to use traditional fixed-route services. The ADA outlines three eligibility categories for paratransit: individuals unable to navigate the public bus system, those unable to reach points where they could access the public bus system, and those with a temporary need for services because of injury or a limited-duration disability (*ADA Complementary Paratransit Requirements*, 2021). Rural areas without fixed route services are not required to provide paratransit service, though states and local government can receive money to provide transportation for seniors and persons with disabilities under FTA's Section 5310 and 5311 (Federal Transit Administration, 2022).

Despite the efforts to develop an alternative transportation option that is accessible for those with disabilities, there are many barriers to paratransit. The federal mandate requiring agencies to offer complementary paratransit is unfunded, often posing challenges for agencies striving to meet service requirements without overburdening their budgets. While federally mandated guidelines assert that demand should not regularly exceed supply, the high operational costs of paratransit services often lead to such imbalances.

One potential barrier to paratransit access is the eligibility process. Because ADA is a federal mandate administered at the local level, eligibility is determined by local transit operators. As such, there is significant variability in requirements across jurisdictions. Eligibility frequently requires an interview and functional assessment to assess the capabilities of an individual and to determine if they meet one of the categories of paratransit eligibility as defined by the ADA. Determining eligibility for individuals with cognitive or intellectual disabilities can be more complex than for those with physical limitations. While public safety is generally not a consideration in paratransit eligibility, individuals must possess certain decision-making and safety skills to travel independently (Disability Rights Education & Defense Fund, 2010; National Council on Disability, 2015). This can create ambiguity in eligibility assessments, as decisions are left to the discretion of the transit agency or the individual conducting the interview and assessment.

A majority of paratransit services do not offer same-day rides, but next-day service is to be expected (Jacob et al., 2015). However, transit agencies are allowed to negotiate trip times with passengers, though they are not permitted to request that a passenger take a trip more than one hour before or after their requested pick up time (*ADA Complementary Paratransit Requirements*, 2021). Many paratransit providers use "curb-to-curb" service, with drivers not obligated to assist riders beyond getting them from the curb into the vehicle. Difficulties are compounded for those traveling with children. Paratransit agencies often lack specific policies on traveling with children, leaving those seeking to travel with children uncertain (Jacob et al., 2015). Barriers and complications with using paratransit result in some registering for the service and never using it, as noted by Rosenbloom (2007), who found that most paratransit systems provide most trips to a small number of riders.

The requirements for paratransit service are demanding and can be resource-intensive for riders, requiring ample time, information, and patience, beginning with the eligibility process. Advance booking requirements can prevent spontaneous travel, and even when rides are secured, they may not align with the originally requested time. For people with disabilities, paratransit is a system of requirements, negotiations, and constraints — none of which are visible in a conventional accessibility analysis that measures only distance to services.

2.3.4 Ride-hailing and Taxi

Other options for transportation include transportation network companies (TNC) such as Uber and Lyft, as well as taxis. While ride-hailing services are relatively new, there is a growing number of accessibility studies that incorporate ride-hailing access as part of the analyses (see de Oliveira Souza et al., 2021, for discussion). Such work has been done with taxis as well (Jiang et al., 2018).

Those with disabilities have been found to use ridehailing services less frequently when compared to the general population, though they use taxicabs at almost twice the rate as the general population (Brumbaugh, 2018; Schaller, 2018). The reasons as to why this may be are still to be explored in the literature, though it may have to do with the treatment of disabled riders on the TNC platform. A recent survey of wheelchair users' perceptions of ridehailing found that almost 40 percent of respondents were denied service due to their wheelchairs. (Casey, 2016, p. 20). Other issues facing wheelchair users include long waiting times to access an accessible vehicle and a shortage of accessible vehicles altogether (Gebresselassie, 2023). Similar issues have been reported for those with service animals, with drivers refusing service due to reluctance to have animals in their vehicles.

Research by Cochran (2020) examined the lived experiences of people with disabilities using ridehailing services. Findings from the study suggest that individuals with disabilities often rely on ridehailing services as a more reliable and convenient means of travel than other services, such as paratransit. Ridehailing can also foster newfound independence and empowerment for those who previously depended on others for transportation. Participants highlighted that technology, including GPS tracking, payment, and driver ratings, were major benefits of using the services, though the cost of travel is prohibitive to use as frequently as desired. However, perceptions of ridehailing and experiences vary depending on the disability one has. Those with visual impairments may have trouble identifying a driver

as they arrive, leading to frustrations and complications with driver and rider matching. Older adults with disabilities expressed frustration with using the app-based services and challenges with smartphone technology.

Ridehailing presents a paradox for people with disabilities, offering greater independence and convenience than paratransit for some, while presenting new barriers of discrimination, cost, and technological access for others. Whether ridehailing expands or restricts access depends less on the platform itself than on the individual using it and how the service chooses to respond to them.

3. Case study area

We use case studies for our quantitative and qualitative analysis. The quantitative analysis estimates accessibility by car, transit and paratransit. The qualitative analysis conducts in-depth interviews to understand the travel choice process for individuals with disabilities. Los Angeles and Tulare were selected to represent two very different contexts for the modes of transportation being studied. Los Angeles County is served by a large multi-agency transit network and one primary paratransit operator (although there are many local dial-a-ride services). Tulare County has limited fixed-route coverage and fragmented paratransit service. This variation allows us to examine not only urban vs. rural, but also how federally mandated paratransit requirements manifest in transit-rich vs. sparse environments.

Although LA County and Tulare County are less than 200 miles apart, the differences are stark. Tulare County is known for its agricultural production, having been declared the top agricultural-producing county in the country in 2022 (Heemstra, 2023). Conversely, LA County is known for its world-class, diverse, and creative economy, including the entertainment industry, higher education, technology, and tourism. Figure 1 shows the location of both counties in California.

Demographics for both counties are included in Table 1. Compared to LA County, Tulare County has a lower median household income, a higher percentage of households in poverty, and an elevated percentage of individuals living with disabilities. Additionally, Tulare County has a higher Latino population and a lower Black population compared to LA County. This intentional selection of counties with diverse economic and demographic profiles enriches the urban-rural comparison and provides valuable insights into transportation accessibility for individuals with disabilities.



Figure 1: Map of case study counties

Table 1: Comparison of LA and Tulare Counties

	LA County	Tulare County	Source & Year(s)
Population Estimates	9,757,179	483,546	ACS Estimates, July 1, 2024
Median Household Income	\$90,112	\$71,300	ACS 5-Year Estimates (2020–2024) (inflation adjusted for 2024)
Percent Hispanic or Latino	48.8%	67.7%	U.S. Census Bureau (2020)
Percent Black or African American	8.9%	2.4%	U.S. Census Bureau (2020)
Percent in Poverty	13.3%	19.9%	ACS 5-Year Estimates (2020–2024)
Percentage with a disability	7.3%	9.1%	ACS 5-Year Estimates (2020–2024)
Land Area (Square Miles)	4,059.28	4,823.90	U.S. Census Bureau (2020)

All data retrieved from the U.S. Census Bureau QuickFacts (2026). Demographic and geographic data (Race, Ethnicity, Land Area) are from the 2020 Decennial Census. Social and economic data (Poverty, Disability) are from the 2020–2024 American Community Survey (ACS) 5-Year Estimates. Note: Income and poverty data are from the 2020–2024 ACS 5-Year Estimates and are expressed in 2024 inflation-adjusted dollars.

The geography of the two counties is also very different. Los Angeles County is situated within an urban basin, bounded by the Pacific Ocean to the west, the Santa Monica and San Gabriel Mountains to the north, and the Santa Ana Mountains to the east. It is one of the largest and most densely populated regions in the United States, with a continuous fabric of services, employment, and transit infrastructure throughout the region. Peripheral areas, such as Lancaster in the Antelope Valley, are more than 60 miles from the urban core of downtown Los Angeles and are separated by the San Gabriel Mountains, posing a unique challenge for transportation connectivity to and from the area.

Tulare County is located in the San Joaquin Valley, a flat, agricultural region between the Sierra Nevada to the east and the Coast Ranges to the west. The county is situated between the cities of Fresno and Bakersfield. The population is primarily concentrated in a handful of cities (Visalia and Porterville being the biggest), separated by miles of unincorporated farmland. Unlike Los Angeles, where urban density creates a relatively continuous fabric of services and transit infrastructure, Tulare's settlement pattern is dispersed, with significant distances between population centers and limited connectivity between them, primarily accessible via Highway 99 and Highway 65. The eastern half of Tulare County includes the Sierra Nevada mountain range and is mostly national forest with little population.

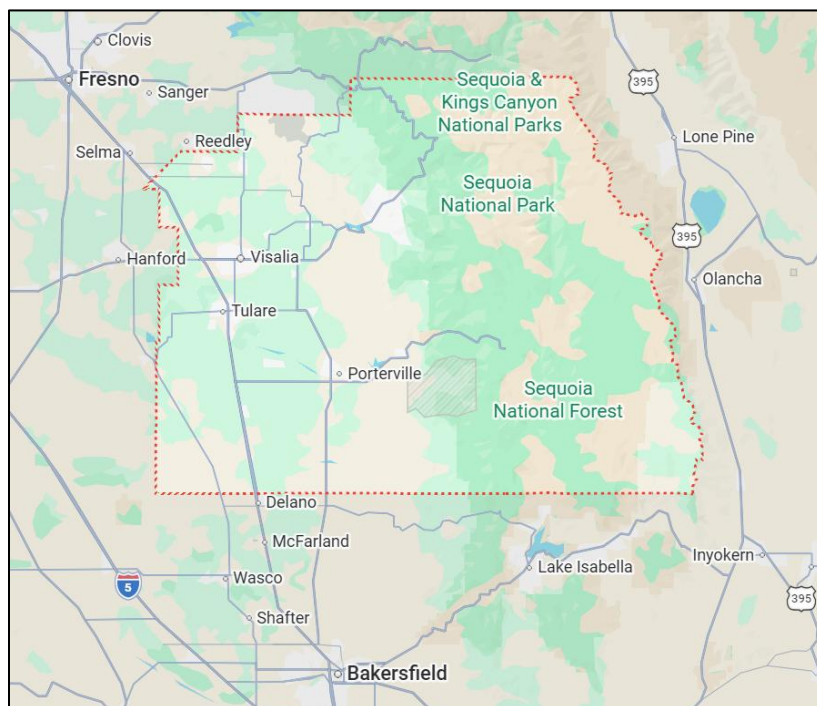


Figure 2: Map of Tulare County Boundary

4. Accessibility Analysis

We develop a model to compare simulated travel times by car, transit, and paratransit in Los Angeles and Tulare Counties, with a goal of understanding structural constraints to travel in two disparate contexts.

A primary barrier to understanding disability-based exclusion is the lack of granular, multi-modal data. While existing literature acknowledges that individuals with disabilities travel significantly less and for shorter distances than the general population, the specific mechanisms underlying this phenomenon remain understudied. There is limited data on the travel behavior of people with disabilities relative to the size of the population. Large-scale surveys give us a general understanding, but since disability is so heterogeneous, our understanding of specific disability-related travel behaviors is limited.

Simultaneously, data on paratransit services are scarce in the literature. As a demand-responsive service, there is no routing or scheduling available, unlike with transit and GTFS data. Additionally, paratransit availability, eligibility, and service areas vary by operator and by region, making standardization of modeling a challenge. This means that the most critical mode to understanding the travel behavior of people with disabilities is also the most challenging to model.

We address this gap by developing a simulation of 3.7 million potential trips to provide a comprehensive “lay of the land” across three modes. Unlike traditional models that prioritize in-vehicle time, this research attempts to model the total travel experience, incorporating pre-trip waiting, pedestrian access (walking), and transit transfers. Therefore, we focus on three questions:

1. What is the actual temporal cost of access for disabled travelers versus non-disabled travelers when accounting for the total travel experience (walking, waiting, and in-vehicle time) across three different modes of transportation (car, transit, paratransit)?
2. To what extent do disparate geographies, the dense urban infrastructure of Los Angeles and the rural landscape of Tulare County, mitigate or exacerbate these temporal costs?
3. How do these costs vary across destination types essential to the disabled population, specifically medical facilities, disability support services, and adult day facilities?

4.1 Travel Behavior of People with Disabilities

Despite the size of the population of adults with disabilities, what we know about how this group travels is relatively limited. Large surveys, such as the National Household Travel Survey (NHTS), can give us an insight into trends of the overall population. The NHTS includes information on those who self-reported a travel-limiting disability or those with a temporary or permanent condition that makes it difficult to travel outside of the home. Compared to those reporting no disabilities, this group was less likely to travel, took fewer trips, and were more likely to ask others for rides or to use special transportation services like Dial-A-Ride. From the 2022 NHTS, 40.2 percent of people aged 18 to 64 with travel-limiting disabilities did not travel on the survey day, compared with 21.2 percent of those without disabilities in the same age group. This number is higher for rural (48.3 percent) than for urban (38.6 percent) residents. Trip lengths for disabled travelers were also noticeably shorter; workers with disabilities traveled an average of 8.0 miles per trip, compared with about 12.2 miles for those without disabilities. (Bureau of Transportation Statistics, 2024).

The 2017 NHTS California add-on dataset includes data for Los Angeles County, where the average trip length for someone with a travel-limiting disability is 6.5 miles compared to 8.3 miles for those without disabilities (Brozen et al., 2021). Comparable localized analysis for Tulare County and the Central Valley was beyond the scope of this study.

Fewer trips, shorter trip distances, and higher rates of trip abstinence confirm that populations with disabilities do travel differently. However, we still know relatively little about the mechanisms underlying this pattern, particularly among those who rely on paratransit services. What is missing from the literature is not an argument that these modes are unequal, but a direct, empirical measurement of how unequal they are, and under what geographic and operational conditions. This paper provides that measurement, applying a consistent framework across three modes.

4.2 Paratransit Background

The Americans with Disabilities Act requires that public entities providing fixed-route services must also provide complementary paratransit for persons whose disabilities prevent them from using traditional services. Complementary services must be origin-to-destination, though it is at the agency's discretion whether they are door-to-door or curb-to-curb. This service must be provided within $\frac{3}{4}$ mile of the equivalent fixed-route service on either side and must operate on the same days and hours as the fixed-route service equivalent. Individuals must be able to book next-day service; that is, someone calling on Monday afternoon should be able to book a ride for Tuesday morning. Agencies cannot charge more

than double the price of an equivalent fixed-route trip for a paratransit trip (*ADA Complementary Paratransit Requirements*, 2021).

To use complementary paratransit, individuals must go through an eligibility process determined by the local transit agency. The ADA outlines three eligibility categories: those who are unable to navigate the transit system without assistance (including being unable to board, ride, or disembark a fixed-route vehicle); those who are unable to reach a transit stop due to their disability; and those who require an accessible vehicle when one is not available. Because eligibility is determined locally, the process can vary significantly by jurisdiction, and can include interviews, functional assessments, and documentation requirements.

At least 17 paratransit or local dial-a-ride services operate in Los Angeles County, each with its own restrictions and regulations. The largest operator is Access Services, which provides the ADA-mandated paratransit service within $\frac{3}{4}$ of a mile of local fixed-route bus and rail routes in Los Angeles County and into portions of San Bernardino, Orange, and Ventura Counties. The service area for Access Services is given in Figure 3.

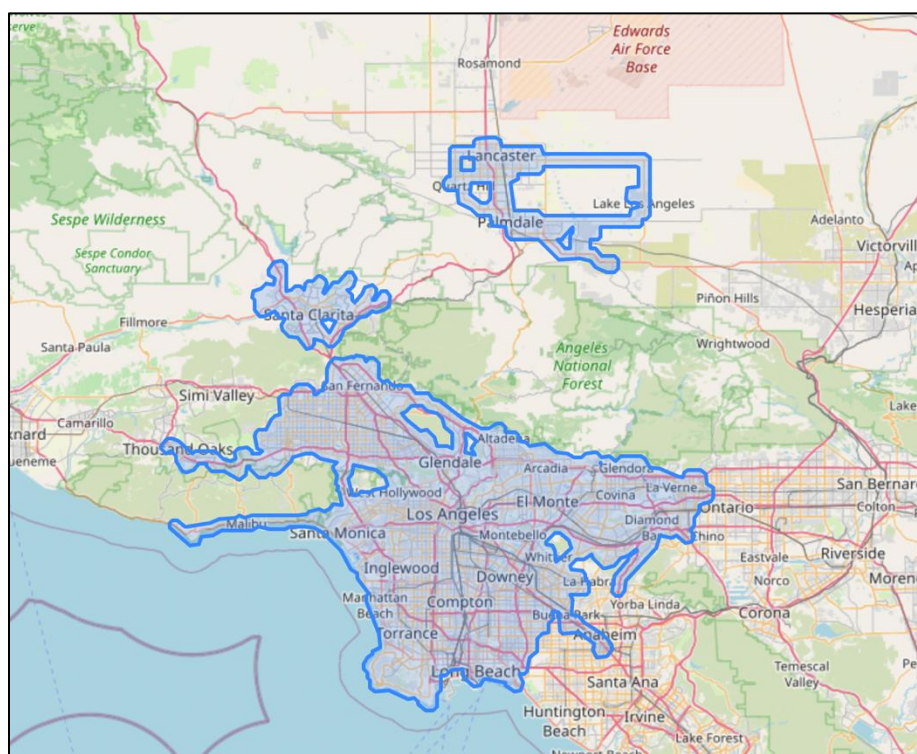


Figure 3: Access Service Area in Los Angeles County

There are operational constraints specific to Access Services that are worth noting for modeling purposes. In addition to planning one day in advance, a “one-hour reservation window” is permitted under federal law. This means a rider requesting a 9 am pickup may be scheduled anywhere between 8:00 and 10:00 am. Vehicles can arrive up to 20 minutes after that assigned time and still be considered

“on time”. Passengers must be ready at the curb and picked up within 5 minutes of the vehicle's arrival at the given location.

An implication of the ¾-mile service requirement is that paratransit availability is entirely dependent on the presence of fixed-route transit. In Los Angeles County, where fixed-route coverage is relatively extensive, the Access Services boundary captures most of the county's population. However, in low-density, rural areas like Tulare County, fixed-route service is primarily concentrated in larger population centers. This requirement effectively excludes unincorporated and agricultural areas from any federally mandated transportation alternative. This gap is a key motivator for the two-county comparative design of this study; it allows for an examination of how the same federal mandate produces different coverage outcomes across urban and rural contexts.

Tulare has a smaller network of formal services, with three transit providers (Tulare County Regional Transit Authority(TCRTA), Visalia Transit, and Porterville Transit) providing fixed-route and ADA-complementary paratransit services within ¾ of a mile of fixed-route bus services. TCRTA was developed to consolidate transit systems across the county, though Visalia and Porterville maintain their own independent agencies. TCRTA organizes paratransit service into five geographic zones: Dinuba/North County, Woodlake, Visalia/Tulare Metro, Tulare/South County, and Lindsay/Strathmore. Each zone operates independently, with varying hours (some offering no weekend service). Inter-zone paratransit travel is not documented as an available service, and Porterville and Visalia operate independently within their own jurisdictions. This structural siloing informed the two-scenario modeling approach used in this analysis.

Unlike Access Services, which provides detailed estimates of wait times and performance metrics, Tulare County paratransit providers offer little information on pickup windows or scheduling uncertainty. For local trip characteristics, assumptions relied primarily on qualitative evidence from interviews with Tulare paratransit users, who described local service as operating with relatively minimal scheduling delays.

Although paratransit agencies are required to report operational data to the Federal Transit Administration's National Transit Database (including total unlinked passenger trips, vehicle revenue miles, and operating costs), trip-level data such as origin-destination pairs, individual travel times, and routing information are not publicly available. Unlike fixed-route transit, for which GTFS feeds provide detailed stop-level schedule data, paratransit operates as a demand-responsive system with no equivalent public data standard. This absence of trip-level data requires a simulation approach that estimates travel time components from documented service standards, available literature, and qualitative evidence from interviews with paratransit users.

4.3 Research Design

While accessibility can have a variety of meanings, this study defines it as the time required to complete a travel experience across three modes – car, fixed-route transit, and paratransit. Rather than relying on proximity as a proxy for access, this approach captures a more comprehensive measure of travel burden, including pre-trip waiting, walking, and in-vehicle travel time. Being physically close to a

destination is only as useful as your ability to reach it. For those using paratransit, there are additional temporal barriers that proximity-based measures alone cannot account for.

Rather than modeling specific neighborhoods or corridors, both counties were modeled in their entirety. This was done to better understand the complete spatial picture across the two contexts. The geographic landscape, coupled with the distribution of transportation modes and destinations, allows for a more comprehensive understanding of access to opportunity at a larger scale. This analysis models all possible origin-destination pairs, calculating travel times from every origin tract to every destination of each type. Destinations are not weighted by size or capacity; each facility is treated as a single point regardless of how many facilities are within a census tract.

Traditional accessibility analyses often use employment opportunities as destinations. For this population, employment is a less relevant destination type – only one-third (33.9%) of adults aged 18-64 with travel-limiting disabilities worked full or part-time in 2022, compared to 78.3% without disabilities (Bureau of Transportation Statistics, 2024). Three destination types were selected for this analysis: hospitals/medical facilities, disability support services, and adult day care facilities. These destination types represent critical care for individuals with disabilities, with hospitals and medical facilities providing urgent and acute care, and support services and day facilities providing day-to-day support. It is also important to note that the closest medical facility, support service, or day facility may not be relevant to all disability types, meaning they are often not substitutable destinations (unlike, for example, grocery stores). As such, all origin locations were mapped to all destination locations, again to provide a comprehensive understanding of access, and to simulate what the full context of potential trips may look like rather than a neighborhood-based subset.

Due to the limited availability of trip-level paratransit data, a simulation approach is the most appropriate for comparing modes. With paratransit being a demand-responsive system, a combination of public service standards, relevant research estimates, and interview data are necessary to inform the model.

4.4 Methodology

Origin data were obtained from the open GIS portals of Los Angeles County and Tulare County. Census tracts were used as origins in Los Angeles County, while block groups were used in Tulare County to account for differences in spatial scale between the two counties. Adult day facility data were retrieved from the California Department of Social Services care facility search database for each county. For the Los Angeles study area, medical facilities and disability support services were retrieved directly from the LA County ArcGIS Hub. For Tulare County, support service locations were derived from the County Facilities layer within the Tulare County GIS portal; this dataset was manually filtered to include only relevant care sites, such as community centers, libraries, and senior centers. Medical facility locations for Tulare County were manually geocoded.

4.4.1 Baseline (Driving)

Driving networks were downloaded from OSMnx for Python for both counties. Speeds were assigned to each graph edge based on the California Vehicle Code for each roadway type. In instances where roadway classification was unavailable, a default speed of 25 mph (consistent with residential standards)

was applied. Origin and destination locations were “snapped” to the nearest nodes (network intersections). The minimum-weight travel time was then computed between each origin and destination node using Dijkstra’s shortest path algorithm. It is important to note that this calculation is time-agnostic, free-flow travel time.

To approximate actual travel conditions, multipliers were added to each county. Because trips in this simulation are not tied to specific times of day, a time-agnostic, average traffic condition was estimated. For Los Angeles, a multiplier of 1.5 was applied to free-flow travel time to represent a blended average between free flow and peak hour traffic. This value is grounded in the Travel Time Index (TTI) by the Texas Transportation Institute. Large urban area estimates for peak hour conditions are approximately 1.4, whereas Los Angeles’s peak hour conditions are estimated between 1.71 and 1.90. A value of 1.5 was chosen to provide a conservative estimate of average traffic conditions, while still reflecting the pervasive nature of Los Angeles traffic (Schrang et al., 2025).

The congestion multiplier was adjusted to reflect traffic patterns in Tulare. To approximate realistic travel conditions, a multiplier of 1.15 was applied, aligned with the small urban area estimates from TTI. Reducing this further to account for average traffic conditions was deemed unnecessary, since the multiplier is already relatively small. Finally, five minutes were added for both counties to account for parking and navigating to/from the vehicle. Equations for free-flow travel time and the adjusted model are included below:

Equation 1: Free-Flow Travel Time

$$T_{\text{free}} = \frac{d_{ij}}{v_{\text{limit}}}$$

Equation 2: Adjusted Private Vehicle Time

$$T_{\text{auto}} = (T_{\text{free}} \times \delta_{\text{friction}}) + t_{\text{terminal}}$$

Where:

T_{free} = Network-calculated free-flow travel time

d_{ij} = Network distance between origin i and destination j

v_{limit} = Posted speed limit of the road segment

T_{auto} = Adjusted private vehicle travel time (minutes)

δ_{friction} = Congestion Friction Multiplier (1.50 for LA; 1.15 for Tulare)

t_{terminal} = Terminal Penalty (fixed at 5.0 minutes)

4.4.2 Fixed Route Transit

Transit network graphs were created using General Transit Feed Specification (GTFS) data for both counties and processed in Python. Due to the segmented nature of Los Angeles County and the many transit systems across the jurisdiction, only agencies with 10 or more routes were included in this analysis. This resulted in the following agencies being included: Los Angeles Metro, Long Beach Transit, Big Blue Bus (Santa Monica), Foothill Transit, LADOT Transit (Dash, Commuter Express), Antelope Valley Transit Authority, City of Santa Clarita Transit, Culver CityBus, and Torrance Transit.

To contextualize the scope of this sample, Table 1 presents annual vehicle revenue hours (VRH) for all included agencies, alongside excluded operators. VRH measures the total hours vehicles spend in active passenger service, excluding deadhead time. VRH is used here as the measure of operator size because it captures service intensity more accurately than fleet size or route count; two agencies with the same number of routes may provide different levels of service depending on frequency and span of service. Included transit agencies account for 96.9% of total county vehicle revenue hours.

Table 2: Annual VRH For Los Angeles Transit Providers

Agency	Annual VRH (2024)
LA Metro	8,780,003
City of LA (LADOT)	902,659
Foothill Transit	828,639
Long Beach Transit	685,375
Big Blue Bus	436,091
Antelope Valley	234,954
Santa Clarita	168,273
Torrance Transit	151,513
Culver CityBus	132,885
Study total	12,320,392
Excluded operators	396,099
County total	12,716,491
Coverage	96.9%

Source: Federal Transit Administration, National Transit Database Agency Profiles (2024).

For Tulare County, the three existing transit agencies, Tulare County Regional Transit Authority, Visalia Transit, and Porterville Transit, were included. The OSMnx street network for each county was matched with GTFS stop data. Transit stops were mapped to their nearest network nodes, and the walking distance between each stop and its corresponding node was calculated. Any stop located more than 1,000 meters from the nearest network node was excluded; these filtered points were manually verified to be located outside the boundaries of the study area.

The transit network was modeled as a weighted, directed graph, with nodes representing individual transit stops and edges representing in-vehicle travel segments between consecutive stops. Edge weights were derived from scheduled travel times sourced from GTFS stop_times.txt. To account for travel that may involve multiple transit routes and agencies, transfer edges were generated between nearby stops using a KDTree nearest neighbor algorithm. To determine transfer feasibility, the 10 nearest stops within a 1,000-meter radius were identified for each node. For each potential transfer, the walking time between stops was calculated using a walking speed of 1.3 meters per second (less than 3

miles per hour) which provides a conservative estimate representative of travelers with mobility-related disabilities. A 5-minute fixed overhead was applied to each transfer to account for navigation, and a 2-minute minimum transfer time was established to account for boarding and alighting.

To calculate travel times between origins and destinations, each location was matched to its nearest transit stop using a cKDTree spatial indexing algorithm. This process established the primary “boarding” stop and the final “alighting” stop.

To account for the “First/Last Mile” friction, which Boarnet et al. (2017) identify as a dominant determinant of transit accessibility, a standardized 10-minute value was applied to both the beginning and end of all fixed-route trips. While actual walking times vary by density, this 10-minute value (representing roughly a 0.5-mile catchment or a 0.25-mile walk with buffer time) establishes a necessary “temporal floor” for the fixed-route model. Additionally, because origins represent census tract and block group centroids rather than actual home locations, calculating variable walk times to individual transit stops would introduce false precision inconsistent with the spatial resolution of the underlying data. A standardized buffer is therefore more methodologically transparent than a computed one in this context.

In sum, total travel time (T) is the sum of access and egress buffers, the in-vehicle travel time (IVT), and the calculated expected wait times (EWT) at each boarding point:

Equation 3: Transit Travel Time

$$T_{\text{transit}} = t_{\text{access}} + t_{\text{IVT}} + t_{\text{EWT}} + t_{\text{egress}}$$

T_{transit} = Total fixed-route transit travel time (minutes)

$t_{\text{access}}, t_{\text{egress}}$ = Standardized First/Last Mile buffers (10 minutes each)

t_{IVT} = In-Vehicle Travel Time (network schedule)

t_{EWT} = Expected Wait Time at all boarding/transfer points

Consistent with the driving model, the transit model uses a time-agnostic approach, focusing on scheduled travel segment durations rather than explicit travel times. By calculating the difference between arrival and departure times for all consecutive stops in the GTFS dataset, the model identifies the minimum possible travel time given the transit network's infrastructure. This isolates the structural accessibility between modes, essentially modeling a “best case” scenario for transit connectivity.

4.4.3 Paratransit

In Los Angeles County, the paratransit model used an adjusted composite multiplier based on distance to capture the additional inefficiency of demand-responsive services. The multipliers applied follow a stepped decay based on trip lengths: 3.6 for short trips (≤ 10 miles), 3.2 for medium trips (10–20 miles), 3.0 for long trips (20–30 miles), and 2.7 for regional trips (>30 miles). To simulate specific operational delays inherent to paratransit, three additional temporal constraints were integrated: a flat 20-minute pickup buffer, a 30-minute penalty applied as a conservative estimate of scheduling uncertainty within

the ADA one-hour reservation window, and an 8-minute boarding and alighting penalty. These cumulative penalties result in a baseline delay of 58 minutes added to each paratransit trip.

To assess the extent of accessibility options in Tulare County, two scenarios are presented. Scenario 1 (The Integrated Transfer Model) assumes a rider is physically and cognitively capable of transferring to the fixed-route system for regional travel, applying a local multiplier of 1.3 with a 30-minute local administrative floor for local trips, and a regional multiplier of 2.5 with a fixed 45-minute transfer penalty for inter-city trips. Scenario 2 (The Siloed No-Transfer Model) recognizes that for users unable to navigate these constraints, paratransit service is entirely confined to the local level, modeling regional trips as structurally infeasible (null values).

4.5 Findings

This research analyzes access to care across 1.3 million unique origin-destination pairs in Los Angeles and Tulare Counties.

4.5.1 Travel times

Figure 4 gives total travel time by distance for all destinations and all three modes, a total of 3.7 million OD pairs. Both transit and paratransit have a high initial time cost due to their walking and waiting times. Paratransit has a higher penalty (56 minutes vs 36 minutes). For short trips, travel by transit or paratransit is many times longer than by car. This mobility gap is a direct result of high temporal fixed costs—the operational costs of pickup windows, boarding, and ride negotiation. For trips between 5 and 20 miles, the addition of multiple transfers causes transit travel times to degrade significantly, eventually reaching a point of convergence with paratransit between 10 and 20 miles, where both modes average approximately one hour and 48 minutes. The absolute time gap between transit/paratransit and the car gradually widens as distance increases; ultimately, a 30-mile trip across Los Angeles County may result in a travel duration 104 minutes longer than an equivalent trip by car.

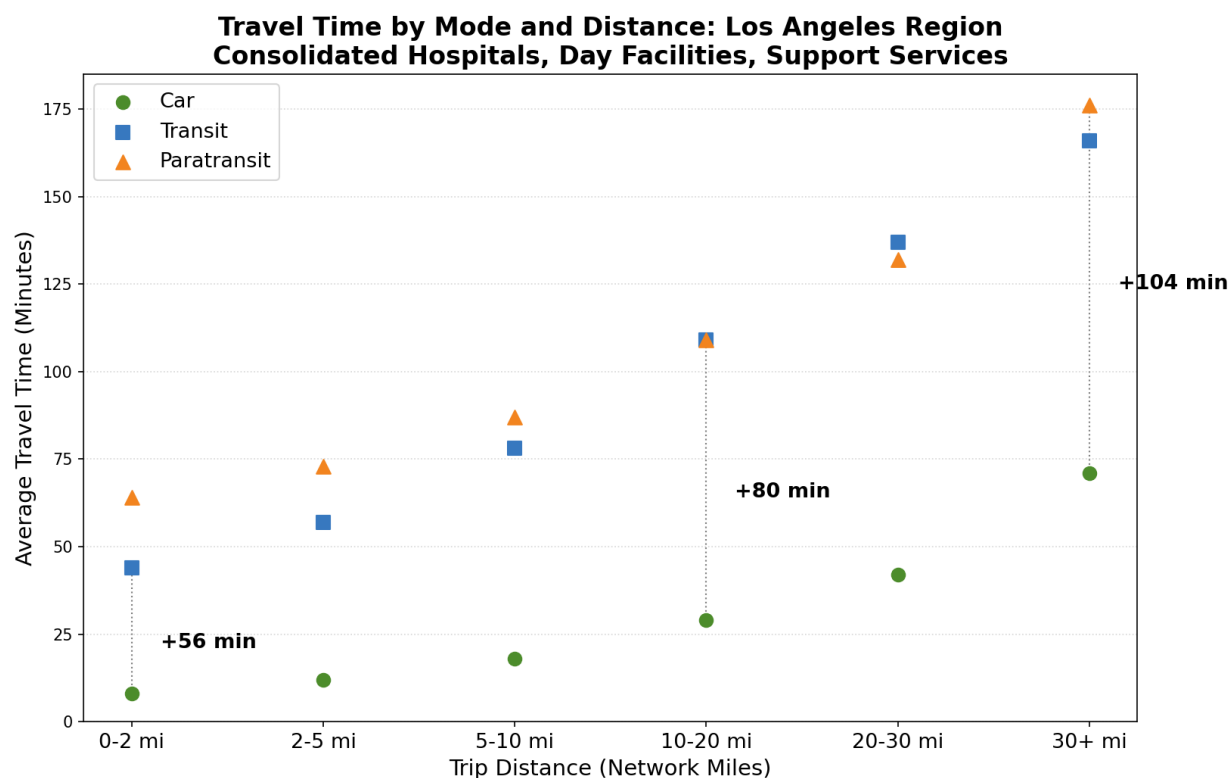


Figure 4: Travel Time by Mode and Distance, Los Angeles

The 2017 NHTS gives an average distance of 6.3 miles for travelers with disabilities. Thus the differences for trips up to 10 miles are most relevant. The ratio of paratransit and transit to car time for trips within these categories is given in Table 3. The ratio ranges from 2.5 to 8.5. Users of both modes pay a large travel time penalty, with paratransit particularly high for the shorter trips.

Table 3: Ratio of transit, paratransit total travel time to car

	Trip time (minutes)			Ratios	
Trip distance (mi)	Car	Transit	Paratransit	Transit/car	Paratransit/car
0 – 2	7.5	44.5	64.0	5.9	8.5
2 – 5	11.4	57.6	73.4	5.1	6.4
5 – 10	17.6	78.2	88.4	4.4	5.0
10 – 20	28.8	108.8	108.9	3.8	3.8
20 – 30	42.4	136.3	132.7	3.2	3.1
30+	71.4	166.2	176.3	2.3	2.5

4.5.2 Trip Exclusion & Geographic Restrictions

Sometimes paying the time penalty is not enough, because not all medical, day care facilities or support services are accessible by transit or paratransit, since paratransit service is limited to within $\frac{3}{4}$ mile of a

transit route. In Los Angeles, 5.5% of medical facilities do not have access and therefore are excluded from one's accessibility choice set. The exclusion rate for support services and adult day facilities is much larger: 12.9 and 19.5 percent, respectively. Effectively, one in eight trips to support services and one in five trips to day facilities are outside the transit route boundaries, making them functionally infeasible given the existing network. In Tulare County, the proportion of modeled trips that cannot be made by paratransit is much higher, as the system serves a much smaller portion of the county and is generally limited to the larger cities. In Scenario 1 roughly 25% of hospital trips are excluded, while 29% of adult day care trips and 47.7% of disability support services are excluded. Under Scenario 2, relying solely on paratransit completely cuts the individual off from any services outside their local municipality. The primary barrier in the Central Valley is not the difficulty or duration of the trip, but the lack of the service itself.

The difference in access options between Scenario 1 and Scenario 2 are shown in Figure 5. The dots are locations of facilities. They are color coded by the average travel time required to access them. The color code range is from zero (dark green) to 160 (dark red) minutes. Scenario 1 is presented on the left, representing the best case scenario of access with the possibility to transfer to a fixed route service. An individual may access services throughout the county, but the travel time is extremely high. Scenario 2 is presented on the right, demonstrating that for an individual who is limited to only paratransit services, they are effectively isolated to their home city because there is no service between cities.

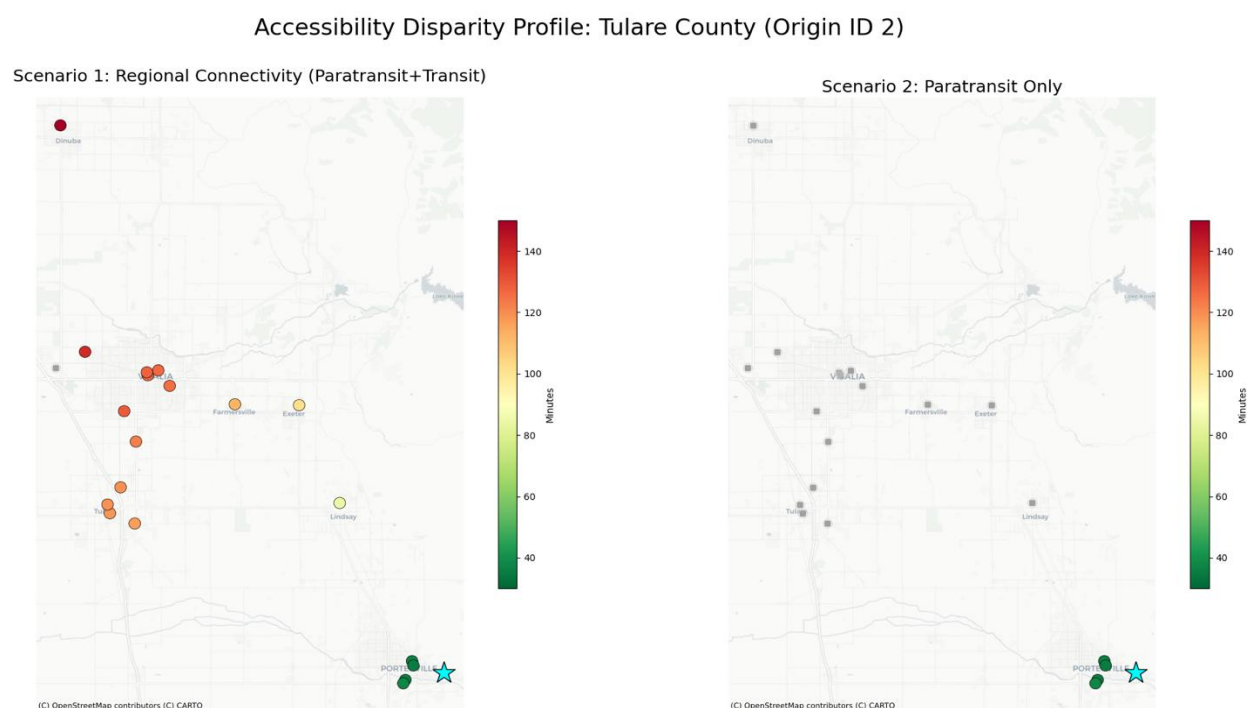


Figure 5: Spatial Fragmentation in Tulare County

Our accessibility analysis shows there are substantial disparities in access to key facilities for those dependent on transit or paratransit. When access is possible, transit and paratransit users incur large travel time penalties associated with waiting, walking and transferring. These disparities are greatest for shorter trips, and most trips are shorter trips. Those dependent on transit or paratransit face the additional burden of exclusion of potential destinations, because not all medical, day care and support services are served by transit. How do individuals negotiate travel under these circumstances? The next section provides some insights.

5. Qualitative Analysis

Quantitative measures of transportation access capture trip frequency and travel time, but cannot account for trips that never happen, or the labor required to complete the ones that do. Understanding the specific mobility constraints, concerns, and experiences of individuals with disabilities requires a person-based, qualitative approach. Individual interviews were selected over focus groups or small group interviews for this study to ensure key details and experiences were not lost amidst a larger group. A semi-structured interview format was chosen to maintain consistency in conversational topics across interviews but allow for personalization and deviation as necessary to capture the experiences of the participants. Interview topics included daily travel patterns, experiences with specific modes of transportation (especially transit, paratransit, and ride hailing), challenges and barriers encountered, and social and emotional dimensions of mobility.

This section draws on semi-structured interviews conducted with disabled travelers and their caregivers in Los Angeles and Tulare Counties. A total of seventeen interviews were conducted – ten in Los Angeles, and seven in Tulare. Participants were recruited through local non-profit and government connections, including Human Services Association in Bell Gardens, CA, and the City of Santa Monica Human Services Commission for Los Angeles, and Resources for Independence Central Valley in Tulare. Snowball sampling and participants sharing study information with others in their network was the primary recruitment method. Interviews were between 30 minutes and one hour in length. This study was approved by the University of Southern California Institutional Review Board. All participants provided informed consent prior to the interview. Interviews were audio-recorded and transcribed. Participants had diverse backgrounds and disability types, including individuals with physical, cognitive, acquired, and lifelong disabilities, as well as caregivers supporting family members with complex needs.

Participants had diverse backgrounds and disability types, including individuals with physical, cognitive, acquired, and lifelong disabilities, as well as caregivers supporting family members with complex needs. Data were analyzed using a constructivist grounded theory approach, characterized by an inductive process in which theory emerges from the data rather than being imposed upon it. To preserve confidentiality, respondents are identified only by a numerical code.

5.1 Navigating Everyday Transportation Barriers

5.1.1 Administrative Challenges and Information Gaps

The eligibility process for paratransit exemplifies the administrative friction of the system. Eligibility for paratransit is not a neutral medical assessment. Despite being determined eligible by the paratransit service provider assessment, the last step in the process is getting a signature from a doctor. In one case the doctor was unwilling to sign. The respondent stated, "I had to explain so much things [to the doctor], but she was like, but you're not crippled. I said, I don't have to be crippled." (5A) The doctor considered this participant's disability as invalid because it was not visible. This example demonstrates that the administrative burden of paratransit begins much before the first ride is booked; it is pre-trip labor in which the rider must navigate a minefield of "correct" and "incorrect" ways to be considered disabled.

Rationing of transport services poses another barrier. High medical needs quickly exhaust these allotments. One participant, an older man who was physically disabled and partially blinded in a car crash, described navigating his needs through Uber trips: "I have eye appointments, I have diabetes history too. So I often go to the doctor to have blood tests, have my eye examination, and go to the pharmacy to pick up medicines. So [I go to the doctor] many times. Even the hospital, you know, the insurance company gives me 32 trips a year. Okay, I've already spent all this. Not enough." (1A) This "trip ceiling" leaves individuals in a vulnerable position of having to choose to use personal funds or deciding to forgo medical care altogether.

5.1.2 Wayfinding and Safety Assessments

Wayfinding is a high-stakes activity where a misunderstood connection or a poorly marked sign can leave someone stranded. There are several ways that navigation and wayfinding can be a point of contention for someone with a physical or intellectual disability, depending on the physical environment, the resources one has available, and how that information is processed. As Participant 8A noted regarding a transfer at the Purple Line in Los Angeles: "The sign is chronically broken. And so if you don't carry around a handheld device, you just stand there wondering. 'Well, I don't know, is a bus coming?', or you start to ask people... But for somebody that's not carrying a handheld device, you kind of wonder." (8A)

For many participants, the cognitive labor of travel begins with a safety audit and risk assessment, both preemptive and ongoing assessments of the social and physical environment and the risks associated with taking a trip. Whether it is the time of day, the mode being taken, or traveling alone or with others, when this audit fails to meet a baseline of security, the labor results in strategic withdrawal: "If I don't feel safe... I won't go. And it's a lot of places I don't go. I just try to keep things simple and stay home." (4A)

The safety audit was almost entirely split along gendered lines, with all eleven women interviewed treating it as a major concern. For the male participants, safety was often thought of as mechanical or systemic – like wearing a seatbelt or trusting one's driver. Women in the study described a persistent fear of being watched or judged, and reported a range of hostile interactions, including verbal

harassment, being physically assaulted, and sexual heckling. While women expressed a much more pervasive level of fear and behavioral adaptation—such as setting a personal curfew to avoid being out in the dark—the fear of being targeted by a bad actor while traveling is not exclusively determined by gender; it can also be a result of feeling physically defenseless. A male wheelchair user described a pervasive fear of being robbed, fueled by videos he had seen online: "What if I was kicked off my wheelchair? How do I get to stand up? What do I do? Would I call for help?" (4B)

5.1.3 Physical Labor & Punctuality Asymmetry

For those with chronic pain, sitting for hours in a paratransit van simply does not work as an option due to the physical toll it takes on their bodies. This was found to be more common in Los Angeles than in Tulare, due to the sheer length of paratransit journeys required to navigate the city. Even reaching the starting point of a journey, the system's rigid timing forces participants to push their bodies. One participant explained the physical stress of this rush: "I'm kind of a slow walker, but I try to walk as fast as I can, because I don't want to miss the bus" (8A). The willingness to risk physical injury through over-exertion highlights the high stakes of a single missed connection. This "sprint" is a direct response to the asymmetry of punctuality: passengers are held to an extremely high standard (seconds to board a bus, and only minutes for paratransit), whereas the system itself is not.

For Access Services, a rider is expected to be ready at the curb at the time of pickup, while paratransit vehicles can be up to 20 minutes late and still be considered "on time". This can force a passenger to rush and then perpetually wait in limbo for their vehicle. One participant shared their frustration waiting for paratransit: "Now, if I'm more than five minutes late, they won't wait. But they can be up to 20 minutes late, and they'll still be on time, they claim... I needed to be picked up from a music center, and they were like 40 minutes late. But I can't leave the spot, you know, I need to be picked up." (3A) This participant was 91 years old, visually impaired, and sitting on the curb in his walker for 40 minutes.

5.1.4 Trip Triage & Social Rationing

Elective activities are let go first, survival last. This process often results in the systematic elimination of "non-essential" travel, leading to social isolation. Some individuals decide to attend events and not fully participate, or to leave early, to accommodate their transportation schedule or personal boundaries regarding travel. One participant describes her decision-making process before attending an event: "I size it up according to necessity. If it's a dental appointment, that's a necessity. If it's just to go and socialize. I'm like, Okay, will I be stuck all day? Then I'll just probably say no" (4A). What is lost is the unstructured social time that surrounds it; the lingering, the spontaneous conversation, the informal community that forms after the event ends.

For others, the desire to connect remains even after their capacity to do so has eroded: "I don't do a lot of stuff, you know. I really, really wish to hang out with my friends, you know, because you know, when everything was fine, I actually did hang around with friends most of the time." (4B) The phrase "when everything was fine" echoes the before/after language heard throughout this study. Given a disability, leaving home has become rare, conditional, or dependent entirely on another person. Lacking employment or structured programs, the motivation to navigate the system disappears entirely. When the psychological cost of a trip includes not just getting there, but the dread of getting home, the

calculus of what is “worth it” shifts. Over time, that calculus tips toward staying home — not because the destination doesn't matter, but because the system has made the price of going too high to pay.

Our interviews show that individuals with disabilities pay a high price for mobility, and this price goes beyond simply the travel time penalties of using transit or paratransit. This price creates a rationing of social life in which destinations are let go in a predictable order, referred to earlier as “trip triage”. Elective activities are let go first, survival last. Across participants, this retreat to essentials follows a discernible hierarchy, which could be thought of as a mobility ladder: a spectrum ranging from survival-level trips at the floor to spontaneous leisure at the ceiling. This framework mirrors Maslow’s 1943 pyramid of needs, which suggests that biological needs for survival must first be fulfilled before pursuing higher order needs, such as love and belonging, self-respect, and finally, self-actualization (Maslow, 1943). We see a similar dynamic of prioritization, with essential trips for survival, like medical care and groceries, existing at the bottom, and social participation and leisure existing at the top. Although social connection and social outings provide health benefits, particularly for those with disabilities (Giummarra et al., 2022), these trips are the first to go when the cumulative cost of travel becomes too high to pay.

6. Conclusions and policy recommendations

By approaching this subject from three perspectives, using the capabilities approach, quantitative modeling of travel modes, and qualitative interviews, this research provides new insights into how transportation systems fail individuals with disabilities, what that failure demands of them, and what it costs them over time. The quantitative modeling of travel modes considers travel constraints for people with disabilities from a quantitative perspective, using and expanding on traditional accessibility measurement approaches to examine the entire trip process across three modes. By including waiting, walking, and transfer costs, as well as modeling paratransit, we can more clearly see how the system fails structurally for those who rely on paratransit services. The qualitative work builds on this in a qualitative setting by conducting semi-structured interviews with adults with disabilities and their caregivers. Through conversations about the struggles of daily mobility, the work finds that this tax being paid repeatedly over months and years can lead to erosion of identity, sense of self, and mental health impacts. Pairing the empirical modeling with qualitative insights demonstrates convergent validity – both the qualitative and quantitative work independently arrived at the conclusion that the system fails regardless of geographic setting.

This research has several policy implications. First, paratransit eligibility reform is needed. The administrative burden of paratransit begins not at the point of booking but at the point of proving one is qualified to book: a process that this study found to be opaque and inconsistently applied. Streamlining eligibility, extending it to social and psychological barriers to fixed-route transit, and reducing recertification burdens would reduce a major barrier.

Second, information on available services should be more readily accessible at the regional level. Currently, no comprehensive database of paratransit and disability transportation services exists for these counties or California — providers operate within their own jurisdictions with little coordination or

consolidated information. This presents a challenge for those with disabilities and caretakers who may be overburdened and not know where to look for the most appropriate services. Development of a comprehensive regional directory of services, information sessions on available resources, and proactive outreach to disability-serving organizations would meaningfully reduce this barrier.

Third, supplemental on demand services should be considered. Some participants do not use paratransit because of the physical cost of a two-hour shared ride and the anxiety of an uncertain return trip.. Additionally, filling gaps in rural areas to make transferring between disparate services more feasible or allowing for more overlap would decrease the burden on those travelers.

Finally, caregiver infrastructure is transportation infrastructure. When the system fails, one person, whether a mother, a partner, or a sibling, often functions as the entire mobility system for a disabled individual. They absorb the scheduling, the safety auditing, the medical knowledge, and the emotional labor that formal systems cannot or will not provide. When that person is unavailable, mobility collapses entirely. Policies that support caregivers, such as respite care, transportation subsidies, and recognition of the labor they perform, are transportation equity policies, even though they may not look like it.

The participants in this study represent a population that is large, growing, and underrepresented in transportation policy conversations. Failure to meet their needs reflects a persistent gap between the services that nominally exist and what people can actually convert into mobility. This gap is not a byproduct of insufficient funding or inadequate coverage alone. It is the lived experience of a system that has not yet asked the right question: not whether services exist, but whether the people who need them most can actually use them.

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Data Management Plan

Products of Research

This study collected and generated both quantitative spatial data and qualitative behavioral data to measure transportation accessibility in Los Angeles and Tulare Counties. The study did not generate proprietary network data; instead, it compiled entirely open-access, public-domain sources to execute the travel-time simulations. The quantitative input infrastructure consists of public census boundaries, public GIS files of destinations, public-domain roadway networks, and publicly available General Transit Feed Specification (GTFS) transit schedules. The qualitative data consists of text transcripts from seventeen semi-structured individual interviews conducted with disabled travelers and their primary caregivers.

Data Format and Content

Simulated output matrices and travel-time data graphs are stored in csv formats. These files contain simulated origin-destination coordinates and calculated minimum travel durations (in minutes) across private vehicle, fixed-route transit, and paratransit models.

Qualitative Transcripts: Interview files are stored as txt files, containing verbatim transcriptions of participant responses regarding administrative, spatial, physical, and social navigation barriers.

Data Access and Sharing

No proprietary data are shared by the researchers for this project. Because the quantitative analysis was built entirely on open-source libraries (such as Python's OSMnx) and publicly available public transit feeds (GTFS), external researchers can freely replicate the network parameters by downloading the identical public-domain web assets used in this study. Due to the sensitive nature of personal lived experiences and IRB protocol, the raw interview transcripts are strictly confidential and will not be shared publicly; anonymized quote selections embedded in the final report text provide the sole public record for qualitative findings.

Reuse and Redistribution

Members of the general public and external researchers seeking to replicate or adapt this work may freely access, reuse, and redistribute the original, public-domain data feeds directly from the primary open data portals utilized in this study:

- **Roadway Network Data:** Publicly accessible via the open-source [OSMnx Portal](#).
- **Los Angeles Spatial & Transit Data:** Available via the [LA County ArcGIS Hub](#) and [LA Metro Developer Portal](#).
- **Tulare County Spatial Data:** Available via the [Tulare County GIS Open Data Portal](#).
- **California Care Facility Data:** Publicly registered via the [California Department of Social Services Care Facility Search](#).

Appendix A

Interview Guide

Pre-interview: "Thanks for taking the time to talk with me today. Before we begin, I want to go over a few things. This interview is part of a study about how people with disabilities get around. We want to understand what challenges you may face when using transportation.

You can skip any question or stop the interview at any time. Everything you share will stay private, and we won't use your name or any details that could identify you in any reports. Only the research team will have access to the information.

I'd like to record this conversation so I can focus on what you're saying and make sure I don't miss anything. The recording will be stored safely, and only my team will listen to it. The interview will take about 30 to 60 minutes.

Do you have any questions before we start? Do you agree to do this interview and to let me record it? [Wait for response.] For the record, participant [use pseudonym or ID] has agreed to take part and have this conversation recorded on [insert date]."

Pre-Interview Questions:

- What is your name?
- How old are you?
- How would you describe your disability or disabilities? (Feel free to share as much or as little as you're comfortable with.)
- What is your mailing address so I can send you the gift card?

Interview Questions:

1. On a typical day, do you usually travel outside your home?
 - a) If so, where do you go? How often do you go there? How do you get there?
 - b) Are there other trips that you make on a regular basis? Where else do you go? How do you get there?
2. You said you usually travel using **insert mode they said**. How did you decide to use this means of travel? Do you have other options for getting to that place?
 - a) Are there any options you avoid, and if so, why?
3. Are there places you would like to go, and what are they? Why don't you go to these places?
4. How easy or difficult is it for you to make your daily trip to ***insert place***? How easy or difficult is it for you to make your daily trip to **place**?
 - a) Can you describe any specific difficulties you encounter?
5. Now let's talk about healthcare. Do you travel to the doctor or other health services on a regular basis? How often do you travel to the doctor?
 - a) Are there times you have not been able to get to a medical appointment? If so, why?
6. Do your friends and family help you get where you need to go?
 - a) If so, how important is this?
7. How often do you engage in social activities like seeing your friends and family or attending community events?
 - a) How do you get to these events or activities?
8. Have you ever missed an outing because you weren't able to get there? Have you ever not been able to visit your friends because you weren't able to get there?
9. Do you feel safe in your daily travels? Have you ever not felt safe traveling?
10. That's all the questions I have. Is there anything else you'd like to share before we end?