DEPARTMENT OF TRANSPORTATION

Enhancing Managed Lanes Equity Analysis

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Planning and environmental studies involving managed lanes still have difficulty determining how to effectively evaluate project alternatives from an equity perspective. To most people, “equity” is ubiquitous with income, but this is a narrow focus that limits the scope of what can be considered equity, and indeed this can be true when it comes to managed lanes. As the Minnesota Department of Transportation analyzes the expansion of E-ZPass corridors, it is imperative it evaluates project alternatives from an equity perspective. The results of this study suggest that E-ZPass lane users are more racially diverse than users in the travelsheds. In two out of the four E-ZPass lane corridors, a higher proportion of E-ZPass lane users have household incomes below $100,000 compared to the travelsheds. Overall, there is a lower percentage of people with disabilities among E-ZPass lane users than those in the travelsheds. These results are driven by the makeup of E-ZPass lane users. In addition, this research project demonstrates the feasibility of incorporating quantitative and qualitative equity measures into the alternatives analysis process. The demonstration shows that the quantitative measures are all feasible with existing tools, provide meaningful information to the alternatives analysis process, and can be put into practice immediately.

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Enhancing Managed Lane Equity Analysis

FINAL REPORT

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LIST OF ABBREVIATIONS

AA	Alternatives Analysis
AASHTO	American Association of State Highway and Transportation Officials
ABM	Activity-Based Model
ACS	American Community Survey
AFV	Alternative Fuel Vehicle
BCA	Benefit-Cost Analysis
Caltrans	California Department of Transportation
EA	Environmental Assessment
EIS	Environmental Impact Assessment
EJ	Environmental Justice
ESDA	Exploratory Spatial Data Analysis
EV	Electric Vehicle
FHWA	Federal Highway Administration
HOT	High Occupancy Toll
HOV	High Occupancy Vehicle
MnDOT	Minnesota Department of Transportation
MPCA	Minnesota Pollution Control Agency
MVTA	Minnesota Valley Transit Authority
NEPA	National Environmental Policy Act
OD	Origin-Destination
PEV	Plug-in Electric Vehicle
PHT	Person-Hours Traveled
RET	Racial Equity Toolkit
ROD	Record of Decision
SOV	Single Occupancy Vehicle
TAZ	Transportation Analysis Zone
TBI	Travel Behavior Inventory
VHT	Vehicle-Hours Traveled
VMT	Vehicle-Miles Traveled
WSBLE	West Seattle Ballard Link Extension

EXECUTIVE SUMMARY

Planning and environmental studies involving managed lanes still have difficulty determining how to effectively evaluate project alternatives from an equity perspective. To most people, “equity” is ubiquitous with income, but this is a narrow focus that limits the scope of what can be considered equity, and indeed this can be true when it comes to managed lanes. The context into which an equity lens is applied is important, as race and ethnicity, gender, age, educational attainment, languages spoken, and disability must be accounted for when looking through the equity lens.

As the Minnesota Department of Transportation analyzes the expansion of E-ZPass corridors, it is imperative it evaluates project alternatives from an equity perspective. This research project produced information to develop a better understanding of potential equity concerns associated with project alternatives, identified the actions needed to address the needs of all populations that have been historically underrepresented in planning efforts, and developed better and more consistent methods for improving equity and environmental justice analysis during planning and environmental studies.

Social-Economic differences between E-ZPass lane users and the users of corridors with E-ZPass lanes

Researchers used data from the American Community Survey (ACS), Travel Behavior Inventory (TBI) 2018-2019 household survey, and TBI 2016 transit on-board survey to illustrate the profile of E-ZPass lane users including transponder owners, carpoolers, and users of transit services along these corridors. The results suggest that E-ZPass lane users are more racially diverse than users in the travelsheds. In addition, the proportion of females using E-ZPass lanes is higher than the proportion of females in the travelsheds. In two out of the four E-ZPass lane corridors, a higher proportion of E-ZPass lane users have a household income below $100,000 compared to the travelsheds. Overall, there is a lower percentage of people with disabilities among E-ZPass lane users than those in the travelsheds. These results are driven by the makeup of E-ZPass lane users given that approximately 80 percent of the people who use E-ZPass lanes are carpooling or riding a bus.

Among E-ZPass lane users, transponder owners are associated with higher-income zip codes and areas where a higher percentage of the population identifies themselves as white. Generally, carpoolers are more racially diverse than the travelshed population and transponder owners. Transit users are more racially diverse than the travelshed population and transponder owners in two E-ZPass corridors. Among those who carpool and use transit services, the percentage of people with disabilities is almost half the percentage of people with disabilities in the travelshed at large.

Overall, socio-economic differences between the E-ZPass lane users and the users of corridors where E-ZPass lanes are located were very similar and need to be monitored as commuting patterns change due to the COVID-19 pandemic. Total E-ZPass lane users decreased by more than half between 2018 and 2021. Transit use was the most negatively affected, accounting for no more than 8 percent of users in any E-ZPass corridor. Carpoolers also declined but were the least affected, accounting for approximately 75 percent of users systemwide. As hybrid work models and increased telecommuting change daily

traffic patterns and the demand for E-ZPass lanes, it is crucial to continue assessing for equity implications.

Alternatives Analysis

To incorporate these findings into the process of developing and implementing future managed lanes, the research reviewed and outlined traditional alternatives analysis methods of managed lanes, compared them with innovative cases from around the country, and summarized the current literature discussing transportation disparities.

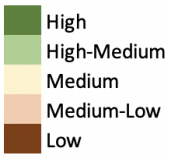
The federal National Environmental Policy Act (NEPA) lays out steps that have been established for assessing the environmental impacts of proposed projects. This process has evolved over time to include social impacts and equity. These steps arose through several different methods and sources, such as executive orders, but none of these steps were amendments to the NEPA law itself. As a result, NEPA creates a framework on which individual policy changes can further influence the environmental review process, and policy changes currently underway may result in equity consideration becoming part of the federal environmental review process. As a result, agencies are left to their own resources to discern the best process for incorporating equity considerations into their projects. Possibly the most applicable guidance for managed lanes would be the *Road Pricing Equity Guidebook* from Federal Highway Administration (FHWA), but other examples of influential sources include *Executive Order 12898*, a set of federal actions designed to address environmental justice in minority and low-income populations, and the Racial Equity Toolkit developed by Sound Transit and the city of Seattle in 2019. Finally, the principles and guidelines included in the Reconnecting Communities Pilot Program, which was included in the 2021 Infrastructure Investment and Jobs Act, provide additional insight regarding federal priorities in this area.

Consequently, it appears that federal guidance as interpreted by the Federal Highway Administration (FHWA), including those mentioned above, may be evolving to provide MnDOT with greater latitude and discretion in formulating and applying equity criteria on top of the current alternatives analysis (AA) considerations mandated by NEPA, with several resources available. The subsequent tasks assess how such a process might move forward.

Demonstration of the refined alternatives evaluation process

Lastly, the research team selected a set of measures — from an initial inventory of more than 30 — and demonstrated the feasibility of incorporating them into the alternatives analysis process. Nine measures were demonstrated, including eight quantitative measures and a qualitative measure (see table below). The demonstration showed that the quantitative measures were all feasible with existing tools, provided meaningful information to the alternatives analysis process, and could be put into practice immediately. Additional coordination with FHWA should be pursued to refine methodologies for the planning and environmental program areas to ensure measures are objective, repeatable, and defensible.

Equity Metric	Feasibility	Sensitivity	Risk	Value	Score
Transit Advantage					15
New Transit Trips					14
Transit Travel Time Savings					15
Change in Air and Noise Impacts					15
Job Accessibility by Auto					16
Local Road Safety					16
Corridor Person Throughput					14
Project Benefits					16
Input and Involvement from EJ Communities					15



Recommendations

The research team developed the following recommendations for MnDOT based on the research findings:

1. Consider collecting more demographic data from transponder owners
2. Continue redistribution of toll revenues to support transit services in E-ZPass lane corridors
3. Continue to explore strategies to reduce entry barriers to managed lanes
4. Include equity measures on ongoing and upcoming projects that involve managed lane alternatives
5. Consider project enhancement opportunities to improve transportation and non-transportation outcomes in disadvantaged communities
6. Elevate underrepresented voices

CHAPTER 1: INTRODUCTION

Planning and environmental studies involving managed lanes still have difficulty determining how to effectively evaluate project alternatives from an equity perspective. To most people, “equity” is ubiquitous with income, but this is a narrow focus that limits the scope of what can be considered equity, and indeed this can be true when it comes to managed lanes. The context into which an equity lens is applied is important, as race and ethnicity, gender, age, educational attainment, languages spoken, and disability must be accounted for when looking through the equity lens.

As the Minnesota Department of Transportation analyzes the expansion of E-ZPass corridors, it is imperative it evaluates the alternatives from an equity perspective. This research project produced information to develop a better understanding of potential equity concerns associated with project alternatives, identified the actions needed to address the needs of all populations that have been historically underrepresented in planning efforts, and developed better and more consistent methods for improving equity and environmental justice analysis during planning and environmental studies.

This research project was divided into two phases. The first phase helped to determine whether there were any significant differences between the demographics of E-ZPass lane users and users of the overall corridor where managed lanes were located. In the second phase, this information was used to evaluate methods for improving equity and environmental justice during planning and environmental studies that involve managed lane alternatives.

This report is organized as follows. The first chapter is a review of existing literature. Then, Chapter 3 and 4 present a spatial analysis for demographic evaluation and the demographics of E-ZPass lane users, respectively. Chapter 5 presents a policy review for alternatives analysis, and Chapter 6 demonstrates an alternative analysis. The last chapter presents conclusions and recommendations.

CHAPTER 2: LITERATURE REVIEW

2.1 MANAGED LANES AND EQUITY

Managed Lane facilities provide an efficient and reliable congestion management model for urban highway networks. These include High Occupancy Vehicle (HOV) lanes, High Occupancy Toll (HOT) lanes, bus-only and truck-only lanes, and traditionally tolled roads & turnpikes. The Federal Highway Administration defines managed lanes as "highway facilities or a set of lanes where operational strategies are proactively implemented and managed in response to changing conditions" (FHWA, 2008).

Managed lanes in the U.S. date back to 1795, when the first toll road in the country was opened in Pennsylvania (FHWA, 2021). The modern era of managed lanes began on a temporary basis in 1962, when a bus-only lane was established on the San Francisco-Oakland Bay Bridge during reconstruction of the bridge. The first permanent managed lane facility in the country opened in 1969, on I-395 in the Washington, D.C. metropolitan area as a bus-only lane, which was converted to an HOV lane that same year (Caltrans, 2021; FHWA, 2021). In 1995, the first HOT lane facility was opened on California State Route 91 (FHWA, 2021). As of 2021, there are 97 HOV lane facilities in 12 states and 31 HOT lane facilities in 6 states, including Minnesota. In total, there are currently 502 total managed lane facilities in 39 states and Puerto Rico (FHWA, 2021).

Several studies highlight the advantages of managed lanes, including better utilization of the transportation infrastructure, providing a choice to drivers, and providing time savings to all drivers. Studies have found that, under certain conditions, toll-managed lanes can make better use of underutilized HOV lanes and ease the traffic in regular lanes (Supernak, et al., 2001; Konishi & Mun, 2010). In addition, they provide choice to drivers, regardless of their socioeconomic status. Drivers have the option to not pay the toll and continue their travels in general-purpose lanes (Weinstein & Sciara, 2006; HNTB Corporation, 2010; Hallenbeck, et al., 2019). Lastly, all drivers may enjoy time savings. For instance, drivers in a Texas study consistently cited travel time reliability and the ability to travel faster as cited reasons for using the managed lanes (Mahlawat, 2007). Similarly, Gomes-Ibañez, et al. (2018) analyzed seven toll-managed lane projects and found that motorists who switch to the managed lane have significant time savings per trip but there are also smaller per-trip savings for those who continue using the general-purpose lanes.

Despite these benefits, there are some equity concerns with regard to these facilities. The question of who bears the burden and who benefits from the construction and use of managed lane projects can be analyzed from a demographic and geographic perspective. In terms of demographics, income has been at the top of the discussions. Studies have shown that managed lanes are used by people from all income levels, but income and residential location contributed to high use of HOT lanes by high-income households and thus to the share of benefits derived from the use of the facility (Shaheen, Stocker, & Meza, 2019).

The potential to encounter economic barriers to use of managed lanes remains for drivers who cannot afford to use express or toll lanes (Shaheen, Stocker, & Meza, 2019). Managed lane facilities in the U.S. have seen increasing implementation rates of dynamic pricing,[1] which is more effective at reducing peak period congestion than flat rate tolling by incentivizing drivers to change the time of day that they travel (Shaheen, Stocker, & Meza, 2019). However, since toll prices fluctuate throughout the day, they can rise to relatively high levels during peak commute hours disproportionately affecting low-income commuters. Low-income drivers may face barriers to using the lanes during these times, and may be forced to bear the cost of travel at inconvenient times of day if no alternative routes exist (Shaheen, Stocker, & Meza, 2019).

Although managed lanes are not price-discriminate (every user pays the same for the same travel benefit), higher-income users pay less than lower-income users as a proportion of their income. This is inherently a regressive pricing scheme (HNTB Corporation, 2010). Whether or not toll prices are burdensome for low-income drivers may not be the determining factor in their choice to use the lanes. Travel time reliability may be a more important factor than cost for drivers who choose to pay the toll, regardless of price (Shaheen, Stocker, & Meza, 2019).

Gender and race are equally important lenses through which equity can be considered, but there is a lack of research in these areas. In terms of gender, for instance, studies of two HOT lane corridors in Southern California noted that women make greater use of managed lanes than men. While this suggests that women benefit more from the lanes than men, the tolls charged could be considered regressive for women, who have lower average incomes than men (Shaheen, Stocker, & Meza, 2019). Studies have found that women are significantly less likely to have flexible work hours, and that low-income women are particularly less likely to commute during peak hours (Shaheen, Stocker, & Meza, 2019), limiting the benefit provided by managed lanes.

While income is often the focus of equity discussions, another relevant equity lens is geographic equity. HOT lane users on longer trips stand to gain more benefit from using the lanes than those with shorter travel distances, through the time they save on each trip. The HOT Lane distributes benefits unevenly across a certain geographic area, which can be a source of consternation within communities. Evidence of this can be seen in the Washington, D.C. area, where residents and officials were divided on a proposed HOT lane that would have connected D.C. with its eastern suburbs, due to the disparate benefits for suburban commuters as compared to residents of downtown Washington (Weinstein & Sciara, 2006). Geographic equity concerns can also evolve as regions grow and change, or as managed lane facilities are altered to meet the needs of the community.

Certain neighborhoods may be affected by managed lanes while others remain unaffected. Drivers living outside the central city may be able to use the managed lane to quickly commute from their suburban neighborhood to their downtown office, while a resident of a neighborhood adjacent to a managed lane

[1] Congestion pricing schemes in which toll prices fluctuate along with the level of congestion. If congestion is high, toll prices will rise. As of 2021, 40 of the 54 priced lanes in the U.S. utilize dynamic pricing (FHWA, 2021).

facility may suffer health impacts from automotive exhaust pollution. Managed lane systems often traverse multiple regions with a metropolitan area, and the mobility enhancements and consequences of construction affect a wide range of income levels, racial groups, and neighborhoods (HNTB Corporation, 2010).

Historically, highway construction in the U.S. has had a disproportionately negative impact on minority groups, and on African Americans in particular. Neighborhoods across the country have been split in two and communities have been displaced due to highway construction (Gioielli, 2011). These same highways now house managed lane facilities. While the historical equity implications of highway construction are clear, the contemporary equity concerns surrounding the geographic distribution of highways and managed lane facilities are less clear. Increased road capacity has the potential to reduce spatial and temporal barriers, particularly for households in suburban and rural areas and those with personal vehicles, but it is also historically interwoven with environmental and social injustice issues (Shaheen, Stocker, & Meza, 2019).

On a cumulative basis, the social equity benefits of managed lanes are increased reliability for private vehicles and public transit, and the option to avoid congestion. The mere existence of the managed lane provides a form of travel time insurance, as lower income drivers have the option of utilizing the HOT lane at any time (Patterson & Levinson, 2008; Ginn, Pryor, & Meyers, 2018). While managed lanes provide a number of benefits, potential economic barriers remain for drivers who cannot afford to use managed lanes (Shaheen, Stocker, & Meza, 2019). Managed lanes may not be distributed equitably across a geographic area, resulting in increased positive or negative impacts for certain demographic groups. Women and men may have different experiences with managed lanes, and more broadly one's socioeconomic status may play a major role in how they are affected by managed lanes.

2.2 MANAGED LANES USAGE, BENEFITS, AND FAIRNESS

The literature on users of managed lanes has focused on four main topics: Their demographics, the use of the facility, the net benefits accrued for the use of the facility, and the perceptions of fairness. This section presents findings in these areas, most of which looked at equity issues from an income perspective.

2.2.1 Demographics of Managed Lane Users

Several studies comparing the demographics of managed lanes users with the demographics of the areas where managed lanes are located have found differences in terms of income level. For instance, Khoeini et al. (2012) found that 50 percent of HOV lane users of the I-85 corridor in Atlanta had an income of less than $69,999, while 50 percent of Georgia residents had an annual household income of less than $51,250. Toor & Salisbury (2014) also found that around 45 percent of the I-25 Express Lane users in Denver had a household income of more than $100,000, while more than 40 percent of the general population had a household income below $50,000. A recent study based on the I-405 facility in Washington yielded similar results. Hallenbeck, et al. (2019) estimated the median annual household

income of managed lane users to be around $101,000, which is 20 percent higher than the median annual household income of King and Snohomish counties (with a median household income of $84,000).

Other studies comparing paying customers with other users of managed lane corridors also found differences in terms of income levels and other demographic characteristics. By comparing FasTrak program customers in the I-15 corridor with other I-15 users (including solo drivers and carpoolers) in San Diego, Supernak, et al. (2001) found that FasTrak customers were from higher-income households, were more highly educated, were more likely to be 35-54 years old and homeowners, were more likely to be middle-aged females, and came from two-vehicle households among others. Similarly, for the I-394 MnPass lane in Minnesota, Zmud & Simek (2006) found that transponder owners tend to have higher educational attainment, to be employed full-time, to be between 35 and 54 years of age, and more likely to be white.

2.2.2 Managed Lanes Usage

Studies have found that managed lanes are used by people from all income levels, although there is some variation in their use. Studies in Minnesota and Washington found that those with high income use them more frequently than those with low income (Zmud & Simek, 2006; Hallenbeck, et al., 2019). Zmud & Simek (2006) found in Minnesota that high-income households were more likely to use managed lanes as a paying single driver than mid- and low-income households, while low-income households were more likely to use managed lanes as carpoolers than mid- or high-income households. In a recent research conducted by University of Washington, Hallenbeck, et al. (2019) found in the Seattle area that one-time users had the lowest incomes ($66,000), while monthly users had the highest incomes ($107,000). In terms of the time of day and direction of travel, AM and PM peak time users of the HOT lanes had notably lower incomes than off-peak users, with a median AM peak income of $78,000 and a median PM peak income of $96,000, compared to a median off-peak income of $117,000 (Hallenbeck, et al., 2019).

The studies have also analyzed toll payment by income level and provide evidence of mixed results. In an earlier study on the I-394 MnPass lane, Patterson & Levinson (2008, p. 11) found that wealthier residents paid larger average tolls, paid more in total tolls, and traveled further than those with lower incomes. At the same time, those living further from Minneapolis also paid larger average tolls, more in total tolls, and traveled a greater total distance than those living closer to Minneapolis. Contrarily, Hallenbeck et. al. (2019) found in Washington that high-income drivers travel more often during low-toll periods. Median household income was $128,000 for $1 tolls and $61,000 for $10 tolls.

Overall, researchers have found that low-income individuals are as likely to support the implementation of HOT lanes and are as interested in using them as high-income individuals, even though low-income individuals are less likely to actually use the lanes when compared to those at other income levels (Shaheen, Stocker, & Meza, 2019). However, the literature is inconclusive on the root of this disconnect between support and use.

2.2.3 Net Benefits Received

The distribution of benefits among users of HOT lane facilities has often been thought to favor wealthier users (Patterson & Levinson, 2008; Poole, 2021). For instance, according to Patterson & Levinson (2008), individuals with higher incomes do receive more direct benefit from managed lane usage than those with lower incomes, but lower-income drivers still derive some benefit from the lanes. Those with higher incomes save more time on their commutes and have a more reliable travel experience simply by taking more trips.

A recent study of I-405 HOT lanes in Washington State found that high-income households accrue more net benefits than low-income households, but lower-income users obtain higher net benefits per trip than high-income users (Hallenbeck, et al., 2019). Net-benefit was measured as the value of time savings minus the cost of the toll. In terms of net benefit per household, higher-income households accrue far more net benefit than lower-income households due to their increased usage of the facility. A household with an income of $200,000/year takes in 86 percent more benefits and uses the facility 133 percent more than a $50,000/year household. When net benefits are considered on a per-trip basis, lower-income households gain more. In the same example, the wealthier household gains 21 percent less in net benefit than the lower-income household. The distribution in net-benefit is fairly even, as all drivers can expect a per-trip net benefit between $1.50 and $2.50. While the average net benefit for users of the I-405 facility was $1.58 per trip, users in the 20th percentile of income in the region have an average net benefit per trip of around $2.25. Overall, there is substantial geographic variation in the distribution of benefits among low-income users, possibly attributable to commuting patterns in the region, and route choice in particular (Hallenbeck, et al., 2019).

For Hallenbeck, et al. (2019) the net benefit per trip analysis ignored the effects of frequency of usage, and solely analyzed the net benefit for a user from a single trip, regardless of income. Thus, the fact that lower-income drivers stand to gain more net benefit per trip than higher-income drivers indicates that the “Lexus-lane” argument is not entirely valid. For the authors, high-income people use the facilities more often, but low-income people use them more strategically.

2.2.4 Perceived Fairness of Managed Lanes

Managed lanes are perceived as fair by users of the facilities and users of general-purpose lanes. Surveys conducted in managed lane corridors in San Diego show that users of the I-15 corridor believed managed lanes to be fair to travelers in non-managed lanes and express lanes. The perceptions were similar after the implementation of dynamic toll pricing and when considering an extension of the HOT lane program (Mahlawat, 2007).[2] The increase in solo drivers in the managed lanes did not worsen the

[2] After dynamic toll pricing was implemented, telephone surveys indicated that 87 percent of respondents felt the program was fair to both Express Lane users and general-purpose lane users. Similarly, when considering an extension of the HOT lane program, survey results indicated that 75 percent of respondents felt that the FasTrak program was fair to HOT lane travelers, and 71 percent felt it was fair to general-purpose travelers (Mahlawat, 2007).

commute experience for carpoolers, and commuters broadly felt that there were no significant negative equity effects from the facility (Supernak, et al., 2001). In addition, a number of factors played into the positive reception of the I-15 project, including the nature of the program as a win-win for all parties, a non-elitist per-trip pricing system that allowed virtually anybody to become a subscriber, and a solution that did not involve removing any lanes, but instead converting them from HOV to HOT lanes, which was viewed as a logical improvement (Supernak, 2005).

2.3 IMPACTS OF THE COVID-19 PANDEMIC ON MOBILITY AND MANAGED LANES

The COVID-19 pandemic has changed commuting and traffic during peak periods. The pandemic normalized alternative work arrangements[3] that provide commuters more flexibility to travel throughout the day, thus changing travel demand. Data shows a drastic reduction in congestion during the beginning of the pandemic due to stay-at-home restrictions. More recent studies have found reduced congestion during peak hours (StreetLight, 2020; Shearston, Martinez, Nunez, & Hilpert, 2021; Texas A&M, 2021; Cherry, et al., 2021; Descant, 2020) while overall traffic volumes almost recovered to pre-pandemic levels (BTS, 2021; Liu & Stern, 2021; Metro Transit MN, 2021; AASHTO, 2020). StreetLight (2020), for instance, analyzed hourly travel in 2019 and 2020 for Los Angeles, New York City, Chicago, San Francisco, and Washington D.C. and found a year-over-year drop in peak morning travel, a gradual travel increase throughout the day, and an increase in peak afternoon travel. They also found that the afternoon congestion began earlier and ended sooner.

The long-term impacts of the pandemic on travel demand are yet to be realized as restrictions ease and commuters return to work in their offices. On one hand, there is increased support to work from home (Dahik, et al., 2020; JJL, 2020), which may translate into less travel during regular peak hours. This raises some equity concerns as many individuals cannot work from home due to the nature of their job. Only 12.7 percent of households with earnings below $25,000 reported teleworking (Marshall, Burd, & Burrows, 2021). On the other hand, there are concerns about increased traffic and congestion due to the decreased use of public transit (Hu & Chen, 2021; EBP US, Inc, 2021) and the anticipated modal shifts towards increased car use (Hu, Barbour, Samaranayake, & Work, 2021; Bohman, Ryan, Stjernborg, & Nilsson, 2021; Metropolitan Council, 2021). Changes in travel demand also entail changes for the demand of managed lanes. Studies on this matter are limited as people continue to re-evaluate their transportation decisions. Cherry, et al. (2021) analyzed data for the National Capital Region of Washington, D.C., Maryland, and Northern Virginia and found a reduction in willingness to pay for travel time savings and travel time reliability, particularly for drivers making trips to or from work.

[3] Alternative work arrangements are more flexible in terms of location (such as working from home and working from other locations remotely) and in terms of schedule (including flextime, compressed workweek, and shift work).

2.4 EQUITY ENHANCEMENT METHODS FOR MANAGED LANES

States have used several strategies to address equity concerns within their HOT lane planning and project design. These include providing methods to reduce entry barriers and redistributing toll revenues. Means-based pricing is a promising strategy to address equity issues but is yet to be implemented. Overall, the current system of unpriced roads is generally viewed as not equitable by most experts and incorporating an intentional focus on social equity at the outset of any congestion reduction program would help achieve equitable outcomes (Shaheen, Stocker, & Meza, 2019).

2.4.1 Reducing Entry Barriers

Some programs provide methods to reduce entry barriers including a cash payment option or providing credits or fee waivers to specific populations. Toll programs work as a prepaid system and require users to have a credit or debit card to open an account and automatically charge the replenishment amount to have resources to pay for the use of the HOT lanes. However, accessing these programs is difficult for those that do not have access to traditional financial services. Such as those who do not have a bank account (unbanked), or those that are deprived of banking services (such as credit cards) or prefer using cash for all transactions (underbanked) (Fleming, 2021).

In recent years, some programs have introduced a cash option to lessen entry barriers. For instance, programs such as the FasTrak in the San Francisco Bay Area, the E-ZPass in New Hampshire Cash Reload Card, and the SunPass in Florida allow customers to replenish their accounts by purchasing Reload Cards at participating retailers[4] (NHDOT, 2021; SunPass, 2021; FasTrak, 2021). The North Texas Tollway Authority also offers a cash option where customers receive monthly invoices that can be paid online, by mail, phone, or in-person at a customer service center or participating location. However, customers using the cash option (ZipCash users) pay at least 50 percent more than other customers (TollTag users) (NTTA, 2021).

Another strategy used by toll programs to reduce entry barriers consists in providing credits or fee waivers to make HOT lanes available to low-income drivers (Gulipalli, Kalmanje, & Kockelman, 2008). Los Angeles County, for instance, put these strategies into practice with its Low-Income Assistance Plan. The plan provides drivers who are residents of the county and have annual household income below an income threshold (roughly twice the federal poverty level) with a one-time $25 credit and account maintenance fee waivers when they set up their FasTrak account. The credit could be applied to the transponder deposit or prepaid toll deposit (Cohen & Hoffman, 2019; Metro ExpressLanes, 2021).

Credits to other groups may jeopardize equity enhancements. As part of a strategy to encourage the use of fossil fuel alternatives in travel, some transportation authorities have granted plug-in electric vehicles (PEVs) and alternative fuel vehicles (AFVs) exemptions from HOT lane restrictions. Multiple states allow

[4] Retailers collect a separate convenience fee for each transaction. The fee is $1.50 for the E-ZPass in New Hampshire and the SunPass in Florida.

these vehicles to use HOT lane facilities at a discounted price, or exempt them from pricing programs altogether. While these discounts fill the capacity of lanes, they displace users that would have valued that capacity more (Gomez-Ibanez, Casady, Fagan, Foote, & Marsh, 2018). This brings about its own equity concerns as the most common demographics of EV owners in 2019 were middle-aged white men with at least a college degree who made over $100,000 per year (Fuels Institute, 2021). As of May 2020, such discounts or exemptions exist in 13 states: Arizona, California, Colorado, Florida, Georgia, Hawaii, Maryland, New Jersey, New York, North Carolina, Tennessee, Utah, and Virginia (FHWA, 2020).

2.4.2 Redistributing Toll Revenues

When programs generate more revenues than the costs of constructing and operating the lanes, the excess could be used to fund some alternative benefits or services for those who cannot afford the toll. Studies have suggested that toll revenue from managed lanes can be used to fund transit enhancements, thereby redistributing the transportation benefits to a wider section of the population and reducing transportation inequities (HNTB Corporation, 2010; FHWA, 2008). Transit enhancements could occur at the community level or at the facility level. At the community level, the Port Authority of New York and New Jersey, for instance, uses surplus toll revenue to subsidize transit services (FHWA, 2008). At the facility level, in San Diego and in Minnesota the revenue was used respectively to fund a new express bus service (Inland Breeze) and support transit services in the corridors where managed lanes are located (Weinstein & Sciara, 2006).[5]

2.4.3 Means Based Pricing

Lastly, a means-based pricing system is a promising strategy as it is arguably the least regressive form of pricing (Shaheen, Stocker, & Meza, 2019). Means-based pricing is designed to be intentionally non-regressive by charging travelers based on their income. This approach, however, has not been implemented yet. Some argue that there are two main problems with this pricing system (Poole, 2021). First, it would undercut the effectiveness of variable pricing: Low prices increase congestion in the facility and limit the benefits promised to users. Second, it may significantly reduce the revenue needed to pay back the managed lane project.

2.5 MANAGED LANES IN MINNESOTA

Managed lanes started in Minnesota with the opening of I-394 MnPASS lanes in 2005. These lanes converted previous high-occupancy vehicle lanes into high occupancy toll lanes. Later MnDOT opened MnPASS lanes along I-35W between 2009 and 2011 and along I-35E in 2015. As of 2021, MnDOT

[5] In addition, research suggests that users of transit services in the corridors where managed lanes are located enjoy travel time savings and benefit from improved traffic flow (Pessaro, Turnbull, & Zimmerman, 2013).

replaced the MnPASS program with the E-ZPass that is fully compatible with the E-ZPass network that includes E-ZPass facilities in 18 other states (Harlow, 2021).

Lanes are generally open in only one direction at a time, depending on the time of day and the direction of travel. During weekday morning (6-10 a.m.) commute times, inbound (towards the urban core) lanes are open and during evening (3-7 p.m.) commute hours, outbound (away from the urban core) lanes are open. At all other times, the E-ZPass lane is a general-purpose lane and is open to all motorists. During E-ZPass hours, fees are charged to solo drivers based on traffic levels in the E-ZPass lane. Vehicles with two or more occupants, buses, and motorcycles use the facility for free. Fees rise and fall as traffic increases or decreases -the heavier the traffic, the higher the price- ranging between $0.25 and $8.00 to keep traffic moving at 50 to 55 miles per hour. In 2020, the average fee was $1.05 (MnDOT, 2021).

Solo drivers use the facilities with an E-ZPass account and tag. E-ZPass accounts function essentially as debit cards. A minimum $25 deposit is required to open the account, and tolls are deducted directly from the account when solo drivers use the E-ZPass lane during peak hours. The system automatically replenishes the account balance when it falls below a certain threshold. E-ZPass tags are electronic devices placed on the inside of the car windshield and are used to transfer information to readers on the roadway. The tag is switchable, allowing the driver to choose between driving as an SOV or driving as an HOV. When the driver uses the lane, overhead tag readers record the tag ID and determine the length of trip and price, which is then deducted from the customer's prepaid account (MnDOT, 2021).

According to MnDOT, approximately 80 percent of the people that use the E-ZPass lanes are carpooling or riding a bus. Single occupant vehicles makeup 22 percent of the total vehicles moved in the lanes but are only 12 percent of the people moved. Carpoolers make up 60 percent of vehicles using the lanes and 69 percent of the people moved. Transit buses are only 2 percent of the total vehicles moved using the lanes, but 10 percent of the total people moved in the lanes (MnDOT, 2021). Routes operated by Metro Transit, Minnesota Valley Transit Authority, SouthWest Transit, Plymouth Metrolink, and Maple Grove Transit utilize the lanes on I-394 and/or the south metro portion of I-35W.

As of October 2021, there are four operational E-ZPass facilities in Minnesota. Existing facilities include I-394 from Wayzata to Minneapolis, I-35W from Burnsville to Minneapolis in the South Metro, I-35E from White Bear Lake to St. Paul, and I-35W from Roseville to Blaine in the North Metro. In addition, there are plans for potential E-ZPass lanes in several corridors. Table 2-1 provides more details on each corridor.

Table 2-1 Managed lanes in Minnesota

Facility	Year Opened	Length (miles)	Inbound Terminus	Outbound Terminus	Notes
Existing E-ZPass Lanes					
I-394	2005	11	Minneapolis	Wayzata	Originally HOV lanes prior to conversion to HOT lanes. Reversible lanes in the freeway median.
I-35W (South Metro)	Opened in 3 phases between 2009 and 2011	16	Minneapolis	Burnsville	METRO Orange Line (Bus Rapid Transit) will run on E-ZPass lanes and utilize new I-35W & Lake Street Station
I-35E	2015	9	St. Paul	White Bear Lake	First E-ZPass lane in the East Metro
I-35W (North Metro)	2021	10	Roseville	Blaine	Lane runs between suburbs rather than to central city
Potential E-ZPass Lanes					
I-94	TBD	15	Minneapolis	St. Paul	Part of the *Rethinking I-94* project
I-494	TBD; construction set to start in 2023	9.5	MSP International Airport	Eden Prairie	To be constructed in phases due to funding
MN 77	TBD; construction tentatively scheduled for 2026	8	Richfield	Apple Valley	
MN 252/I-94	TBD; construction tentatively scheduled for 2026	9	Minneapolis	Brooklyn Park	
I-35W (North Gateway)	TBD	5.5	Roseville	Downtown Mpls	

Source: *E-ZPass Website (Feb, 2023).*

Equity enhancement strategies in Minnesota include the redistribution of toll revenues, allowed per statute. Minnesota Statute 160.93 (Subd. 2) dictates the use of the revenue collected from the authorized fee. According to the it, the revenues collected must deposited in a high-occupancy vehicle lane user fee account in the special revenue fund, and a separate account must be established for each trunk highway corridor (unless there is an exception). The appropriations shall be first used to repay the trunk highway fund and any other fund source for money spent to install, equip, or modify the corridor, and then pay all the costs of implementing and administering the fee collection system for that corridor. Of the remaining resources, half must be spent for transportation capital improvements within the corridor, and the other half must be transferred to the Metropolitan Council for expansion and

improvement of bus transit services within the corridor (beyond the level of service provided on the date of implementation) (Minnesota Legislature, 2021).[6]

The E-ZPass program does not currently have a cash option. However, offering such an option might be permitted per Minnesota Statute 160.93 (Subd. 1) (Minnesota Legislature, 2021), which specifies that the fees "may be collected using electronic or ***other toll-collection methods***". This could be interpreted as including cash and other options.

Lastly, the E-ZPass program offers incentives to users of EVs. MnDOT will be giving one-time E-ZPass Minnesota credits to people who purchase or lease a new or used battery electric or a plug-in hybrid electric vehicle between November 2019 and October 2022. Users of battery electric vehicles receive a $250 credit, while users of plug-in hybrid electric vehicles receive a $125 credit. As mentioned earlier, such a credit may jeopardize equity enhancement of managed lanes.

[6] There is an exemption for the use of resources collected from the I-35W corridor, but a percentage of the resources must be transferred to the Metropolitan Council for the improvement of bus transit services within the I-35W corridor (including transit capital expenses) (Minnesota Legislature, 2021).

CHAPTER 3: SPATIAL DATA ANALYSIS FOR DEMOGRAPHIC EVALUATION

This report discusses the methodology and the findings of the spatial analysis we conducted to illustrate the profile of users of the overall corridors where managed lanes are located.

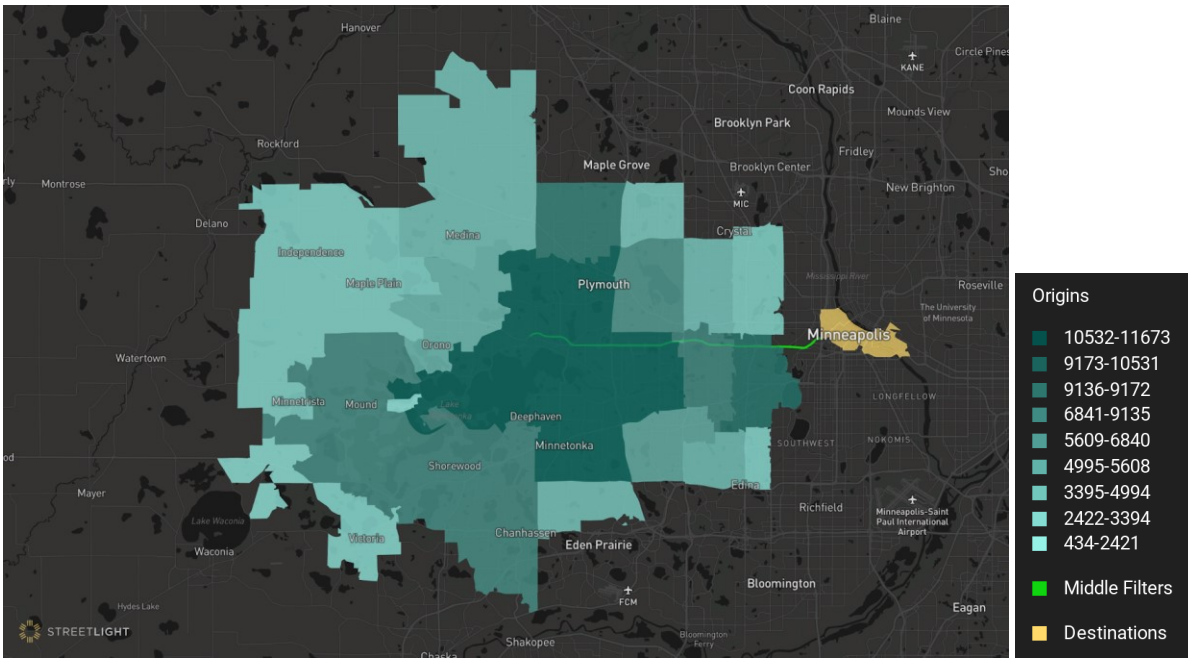
3.1 METHODOLOGY AND DATA

The research team conducted a spatial analysis of the travel shed as well as adjacent areas of the corridors of Interstates 394, 35W, and 35E with E-ZPass lanes in Minnesota. Researchers used Exploratory Spatial Data Analysis (ESDA) techniques to visualize demographic patterns and to examine clusters of spatial intercorrelation.

The research team used several data sources for the analysis including the Minnesota Geospatial Commons, the American Community Survey (ACS), and StreetLight. We used geospatial data from the Minnesota Geospatial Commons including Census 2010 Geography, Fee Base Roads in Minnesota, National Highway System, and ZIP Code Tabulation Areas, 5-digit (ZCTA5), Minnesota, 2010. We synthesized geospatial data with demographic data from the ACS using 5-year estimates for 2019 (information also available at the Minnesota Geospatial Commons - American Community Survey 5-Year Summary File). Demographic data included population, income, poverty, race, education, disability status, head of households, age, and mode of travel. Lastly, the research team utilized transportation analytics data from Streetlight to construct travelsheds of the four E-ZPass corridors in the Twin Cities Metropolitan Area.

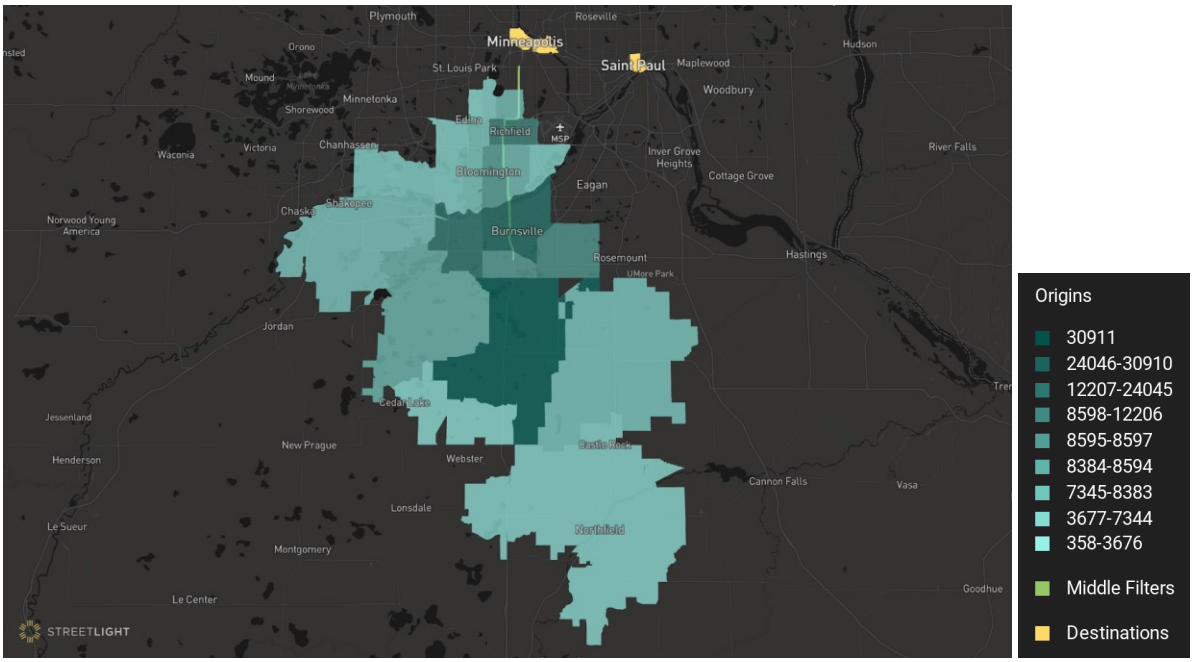
Travelshed Identification

We constructed travelsheds for each of the four E-ZPass facilities in the metro area by combining StreetLight data and E-ZPass transponder ownership data provided by MnDOT. In StreetLight data we used Origin-Destination through middle filters as the analysis model (2021 data). For this, we used E-ZPass transponder ownership information available by zip code (as of October 2021) as the selection category for origin zones, and U.S. census tracts as the selection category for destination zones. Criteria for preliminary addition of a zip code to the travelshed included any zip code immediately adjacent to or containing a portion of the E-ZPass facility and any adjacent zip code with a transponder ownership share over one percent. The following figures present the identified travelshed for corridors with an E-ZPass lane: I-394 (Figure 3-1), I-35W – South Metro (Figure 3-2), I-35E (Figure 3-3), and I-35W – North Metro (Figure 3-4).



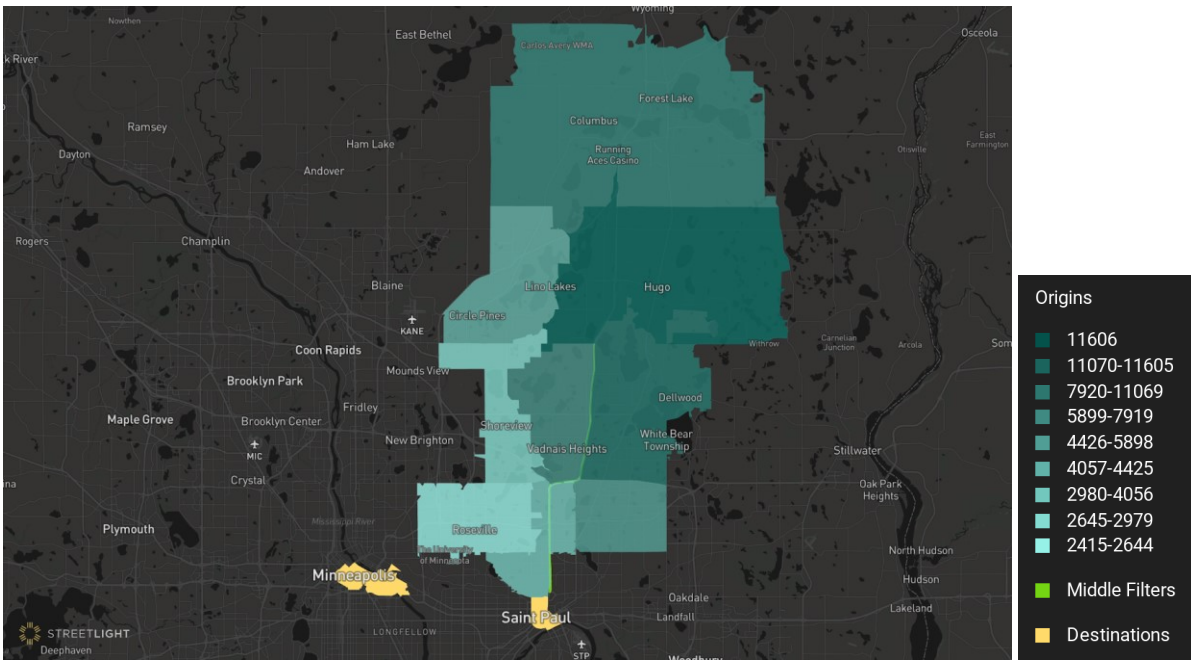
Notes: *The blue areas represent origin zones (zip codes) for trips starting within the travelshed, shaded by the number of trips. The yellow areas are destination zones for trips beginning in the origin zones. The green line represents the corridor where the E-ZPass lane is located.* ***Source:*** *Authors' calculations using StreetLight Data*

Figure 3-1 Travelshed for the I-394 Corridor



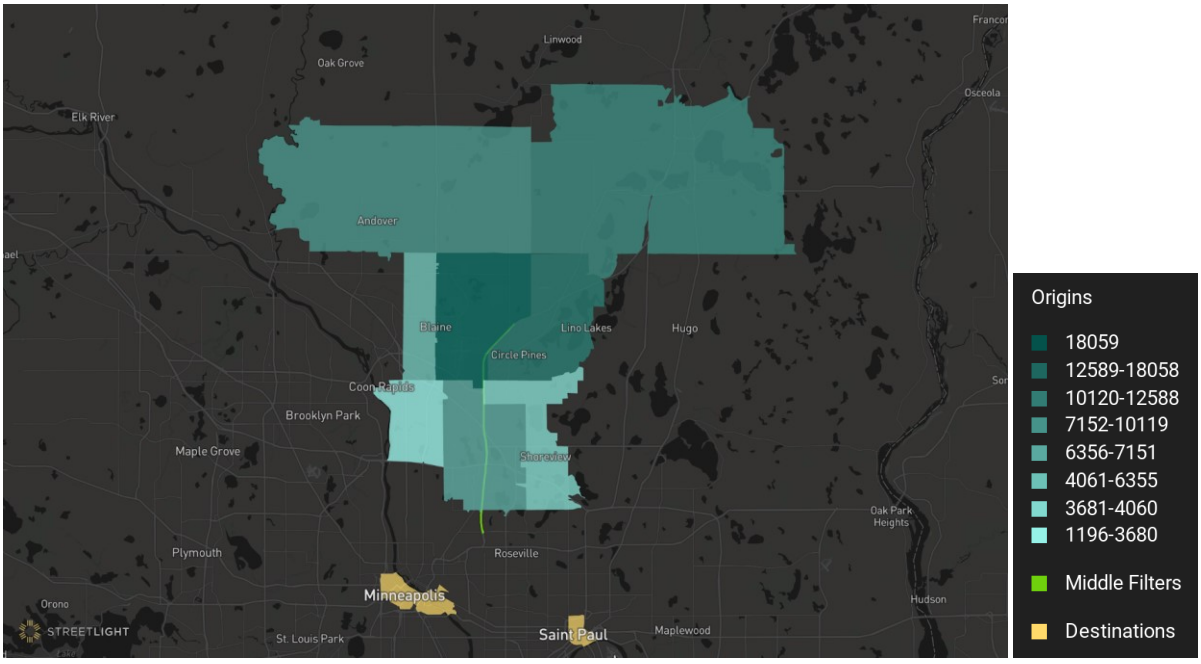
Notes: *The blue areas represent origin zones (zip codes) for trips starting within the travelshed, shaded by the number of trips. The yellow areas are destination zones for trips beginning in the origin zones. The green line represents the corridor where the E-ZPass lane is located.* ***Source:*** *Authors' calculations using StreetLight Data*

Figure 3-2 Travelshed for the I-35W (South Metro) Corridor



Notes: *The blue areas represent origin zones (zip codes) for trips starting within the travelshed, shaded by the number of trips. The yellow areas are destination zones for trips beginning in the origin zones. The green line represents the corridor where the E-ZPass lane is located.* ***Source:*** *Authors' calculations using StreetLight Data*

Figure 3-3 Travelshed for the I-35E Corridor



Notes: *The blue areas represent origin zones (zip codes) for trips starting within the travelshed, shaded by the number of trips. The yellow areas are destination zones for trips beginning in the origin zones. The green line represents the corridor where the E-ZPass lane is located.* ***Source:*** *Authors' calculations using StreetLight Data*

Figure 3-4 Travelshed for the I-35W (North Metro) Corridor

Following the construction of travelsheds for each of the corridors, we analyzed and aggregated the ACS 2019 demographic data of the zip codes contained within each travelshed (see subsection 3.2). In addition, we also present demographic data for the seven-metro county area as a point of comparison following the methodologies used in other managed lanes studies (HNTB Corporation, 2010; Hallenbeck, et al., 2019). The seven counties are: Anoka, Carver, Dakota, Hennepin, Ramsey, Scott, and Washington.

3.2 SPATIAL ANALYSIS FINDINGS

3.2.1 Summary of Results

The travelsheds for the I-394, I-35W (South Metro), I-35E, and I-35W (North Metro) corridors with E-ZPass lanes had a higher median household income compared to the seven-county metro area. The I-394 travelshed had the highest median household income among the four studied areas, followed by the I-35W (South Metro) travelshed. Consistent with this, a higher percentage of the population had a graduate or professional degree in the I-394 and I-35W (South Metro) travelsheds than in the I-35E and I-35W (North Metro) travelsheds.

The percentage of the population identified as white (non-Hispanic) was slightly higher in the four identified travelsheds compared to the seven-county metro area. The I-35E travelshed that had a higher percentage of population identifying as Asian American, while the other three travelsheds had similar percentages of populations identifying as African American and Asian American. In addition, the I-35W (South Metro) travelshed had a higher percentage of the population identifying as Hispanic (6.6%) while in the other travelsheds less than 5 percent of the population identifying as Hispanic.

The percentage of older adults was higher in the four travelsheds compared to the seven-metro county area -- especially in the I-394 and the I-35E travelsheds. Similarly, the percentage of the population with a disability in the I-35E travelshed was the highest among the studied areas (even compared to the statistics of the seven-county metro area). Lastly, the I-394 travelshed presented the lowest percentage of households headed by a single person or unmarried people across all areas.

In terms of commuting patterns, the majority of workers drive alone (around 80%). Among the studied travelsheds, I-35E had the highest percentage of workers carpooling to work and the lowest percentage of workers working from home (even compared to the statistics for the seven-country metro area). Contrarily, the I-394 travelshed had the lowest percentage of workers carpooling and the highest percentage of workers working from home. Table 3-1 presents summary demographics for the seven-county metro area and the travelsheds for each of the corridors with E-ZPass lanes.

Table 3-1 Summary of demographics

Demographics	7-county metro area	I-394	I-35W South Metro	I-35E	I-35W North Metro
Population	3,065,147	406,065	580,659	284,089	265,576
Median Household Income (1)	$78,167	$107,426.7	$99,231.2	$82,823.9	$86,524.5
Percentage of population living below the poverty threshold	9.0%	4.5%	5.7%	6.9%	5.9%
Percentage of people identified as white alone	72.7%	82.3%	77.0%	75.6%	80.2%
Percentage of female					
Percentage of people with a disability	9.8%	8.6%	8.4%	11.0%	9.51%
Percentage of adult people (with ages between 18-64)	62.9%	62.0%	61.5%	61.0%	61.4%
Percentage of adults with bachelor's degree or higher	44.4%	58.3%	48.4%	40.3%	38.4%
Percentage of households headed by single parents	13.6%	5.8%	8.3%	8.8%	9.2%
Percentage of population (5 and older) who speak English at home					
Percentage of population born outside the U.S.					
Percentage of employed population carpooling	8.1%	7.0%	7.6%	8.9%	7.9%
Percentage of employed population working from home	5.9%	7.7%	7.3%	5.2%	6.1%
Percentage of households with zero vehicles					

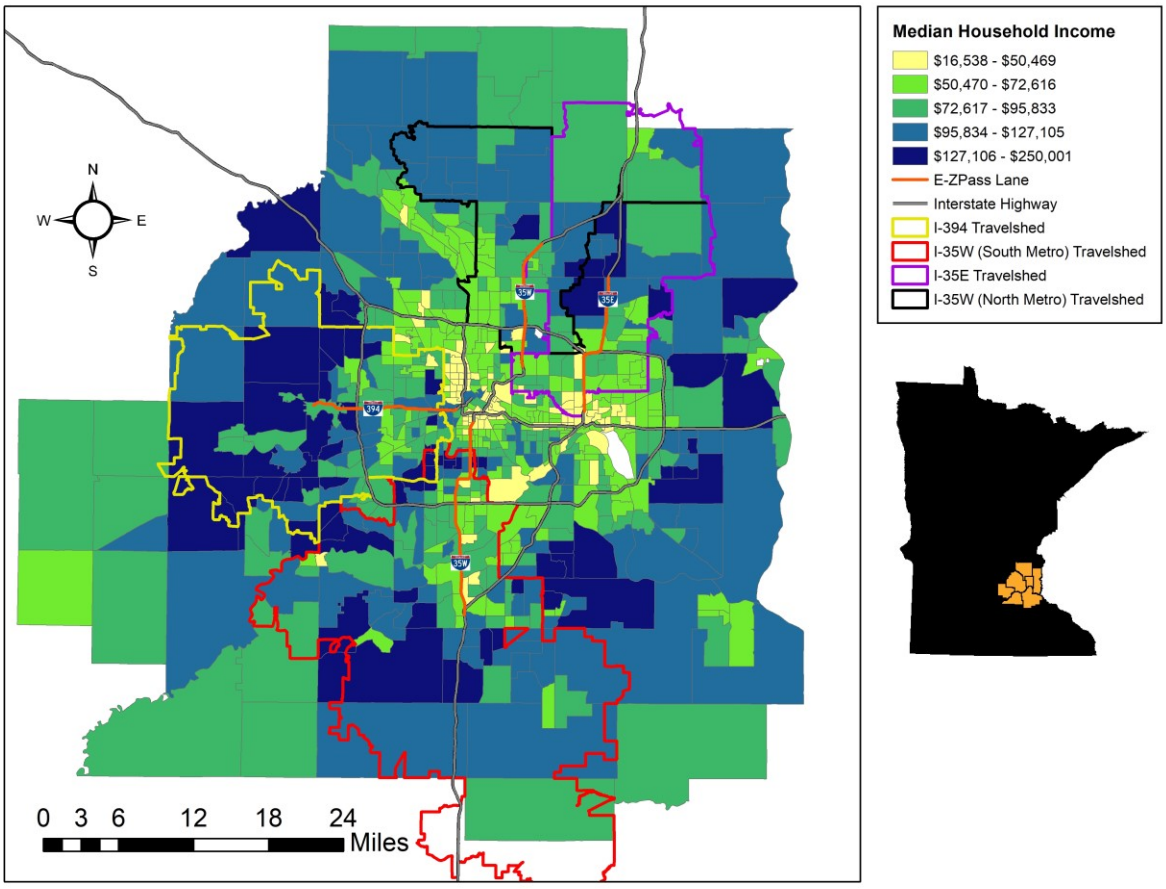
Notes: *(1) Information for the travelsheds corresponds to the average median household income of the area.* ***Sources:*** *Information retrieved from Census Bureau (2019) and MN Compass (2019).*

3.2.2 Detailed Results

3.2.2.1 Income

In terms of income, we looked at the median household income in 2019. There were approximately 1.2 million households in the seven-county metro area with an annual median income of $78,167. Approximately 20 percent of households made less than $35,000 per year, while just under 40 percent of households made more than $100,000 annually (MN Compass, 2019).

The average median household income in the identified travelsheds was higher than the median household income in the seven-county metro area. In the I-394 travelshed, the average median household income was $107,426.71. In the I-35W (South Metro) travelshed, the average median household income was $99,231.17. In the I-35E travelshed, the average median household income was $82,823.89. Lastly, the travelshed for the I-35W (North Metro) corridor had an average median household income of $86,524.50. Figure 3-5 presents the median household income in 2019 by census tracts for the seven-county metro area and the identified travelsheds for the four E-ZPass corridors.



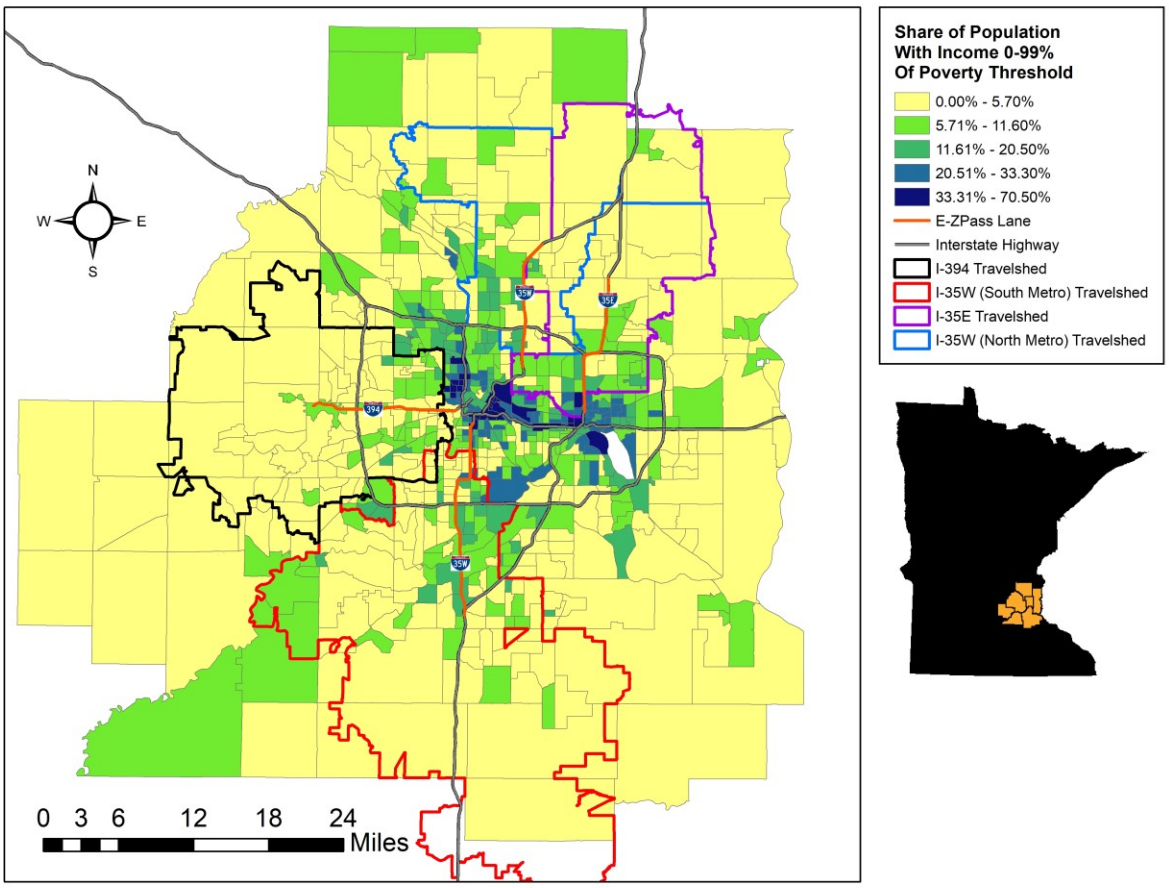
Notes: *Census tracts in white did not have median household income information.* ***Source:*** *American Community Survey 5-year estimates, and StreetLight Data.*

Figure 3-5 Median household income

3.2.2.2 Poverty

The Census Bureau classifies families and unrelated individuals as being above or below the poverty level using poverty thresholds (Census Bureau, 2021). Poverty thresholds are identified by size of family and number of related children under 18 years. In 2019, the average poverty threshold for unrelated individuals was $13,011 (Census Bureau, 2021). In the seven-county metro area, 9.0 percent of the population were living below the poverty level, and an additional 12.4 percent were living below 200% of the poverty level in 2019 (MN Compass, 2019).

Poverty in the identified travelsheds was lower than the poverty in the seven-county metro area. In the I-394 travelshed, 4.53 percent of the population were estimated to be living below the poverty threshold, and 11.26 percent of the population were estimated to be living below 185% of the poverty threshold. Similarly, in the I-35W (South Metro) travelshed, 5.67 percent of the population were estimated to be living below the poverty threshold, and 13.24 percent of the population were estimated to be living below 185% of the poverty threshold. In the I-35E travelshed, 6.88 percent of the population were estimated to be living below the poverty threshold, and 17.43 percent were estimated to be living below 185% of the poverty threshold. Lastly, 5.89 percent of the population were estimated to be living below the poverty threshold, and 15.20 percent were estimated to be living below 185% of the poverty threshold in the travelshed of the I-35W (North Metro). Figure 3-6 presents the percentage of people living below the poverty threshold in 2019 by census tracts for the seven-county metro area and the identified travelsheds for the four E-ZPass corridors.



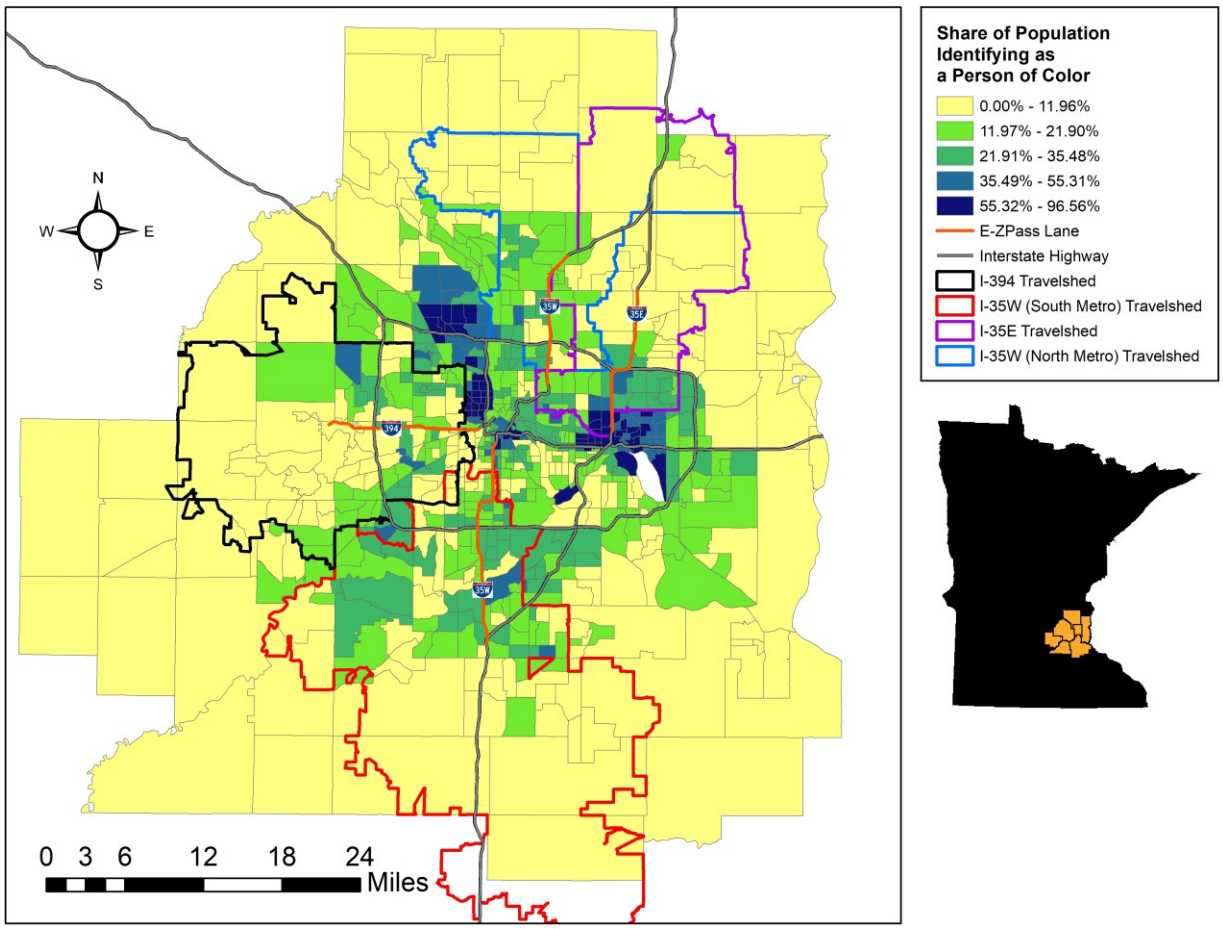
Notes: *Census tracts in white did not have poverty information.* ***Source:*** *American Community Survey 5-year estimates, and StreetLight Data.*

Figure 3-6 Percentage of people living below the poverty threshold

3.2.2.3 Race

According to 2019 American Community Survey estimates, 72.7 percent of the population within the seven-county metro area identified as white alone. In addition, 9.6 percent of the population identified as African American, 7.5 percent as Asian, 6.4 percent as Hispanic or Latino, and 3.1 percent with two or more races (Census Bureau, 2019).

A large percentage of the population in the identified travelsheds identified as white. Overall, the percentage of the population identified as white was slightly higher in the identified travelsheds than in the seven-county metro area. In the I-394 travelshed, non-Hispanic whites made up about 82.3 percent of the population in 2019. Similarly, in the travelsheds of the I-35W (South Metro) and I-35W (North Metro), non-Hispanic whites made up 77 and 80.2 percent of the population, respectively. Lastly, non-Hispanic whites made up just over 75 percent of the population in the I-35E travelshed. Figure 3-7 presents the percentage of people of color in 2019 by census tracts for the seven-county metro area and the identified travelsheds for the four E-ZPass corridors.



Notes: *Census tracts in white did not have race information.* ***Source:*** *American Community Survey 5-year estimates, and StreetLight Data.*

Figure 3-7 Percentage of people of color

Figure 3-8 presents the race distribution by travelshed. Overall, the travelsheds for the I-394, the I-35 (South Metro), and the I-35 (North Metro) have similar percentages of populations identifying as African American and Asian American (around 6 percent of the population in each area) and as Multiracial (around 3 percent of the population in each area). The percentage of people identified as Asian American in the I-35E travelshed was slightly higher (around 10 percent of the population).

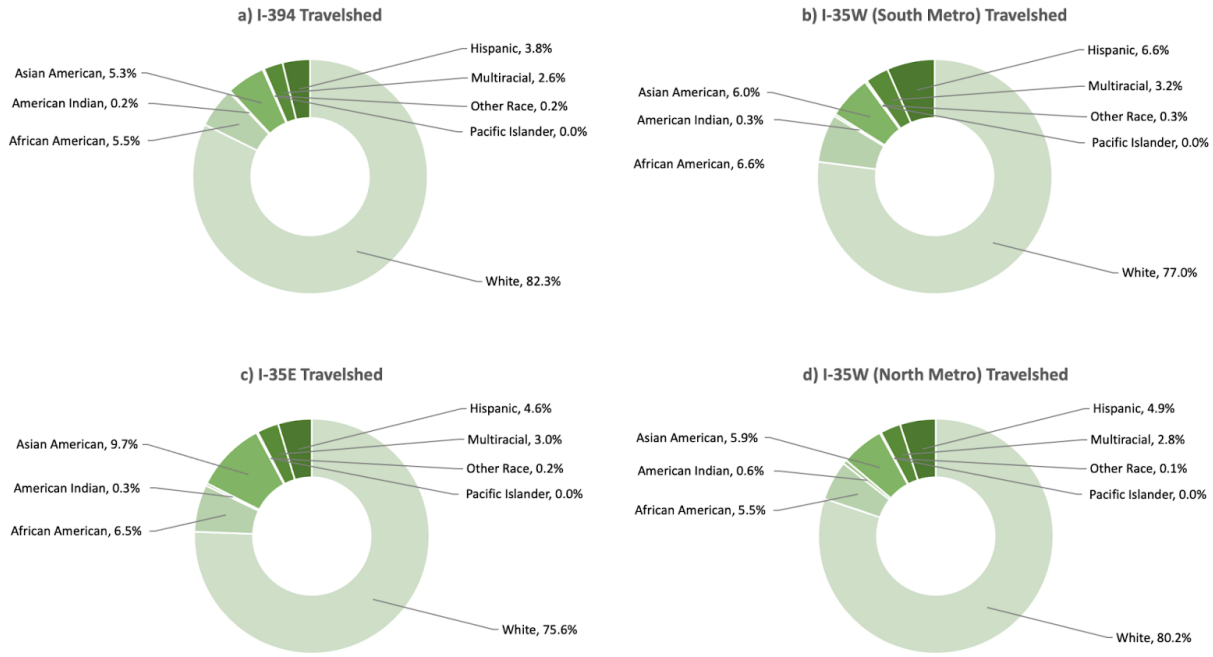
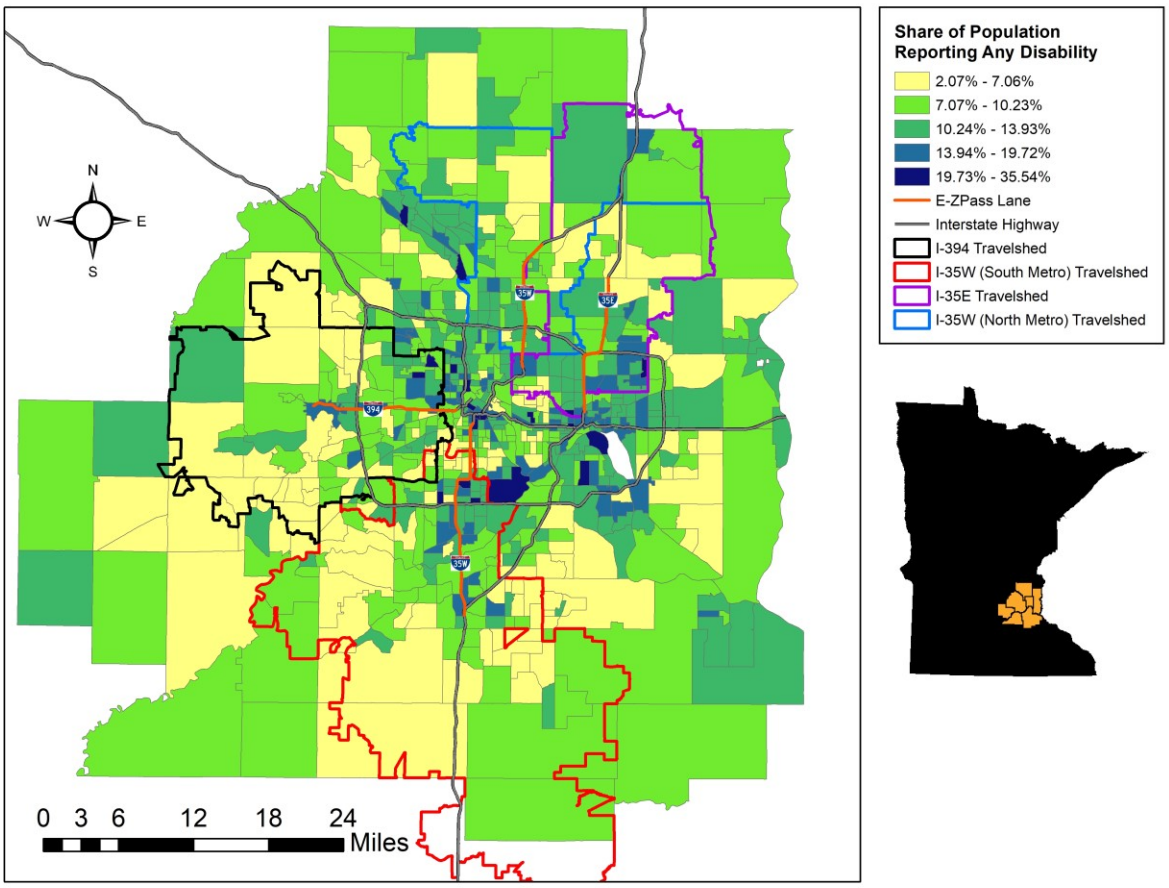


Figure 3-8 Race by travelshed

3.2.2.4 Disability

In 2019, 9.8 percent of the population in the seven-county metro area reported having a disability — roughly 300,000 people (MN Compass, 2019).

The percentage of population with a disability in the I-394, I-35W (South Metro), and I-35W (North Metro) travelsheds was lower than in the seven-county metro area in 2019. Of the total population, 8.63, 8.42, and 9.51 percent reported having any type of disability in the I-394, I-35W (South Metro), and the I-35W (North Metro) travelsheds, respectively. On the contrary, the percentage of population with a disability in the I-35E travelshed was higher than in the seven-county metro area, with 11 percent of the population reporting having any type of disability. Figure 3-9 presents the percentage of people with any disability in 2019 by census tracts for the seven-county metro area and the identified travelsheds for the four E-ZPass corridors.



Notes: *Census tracts in white did not have population information.* ***Source:*** *American Community Survey 5-year estimates, and StreetLight Data.*

Figure 3-9 Population with any disabilities

3.2.2.5 Age

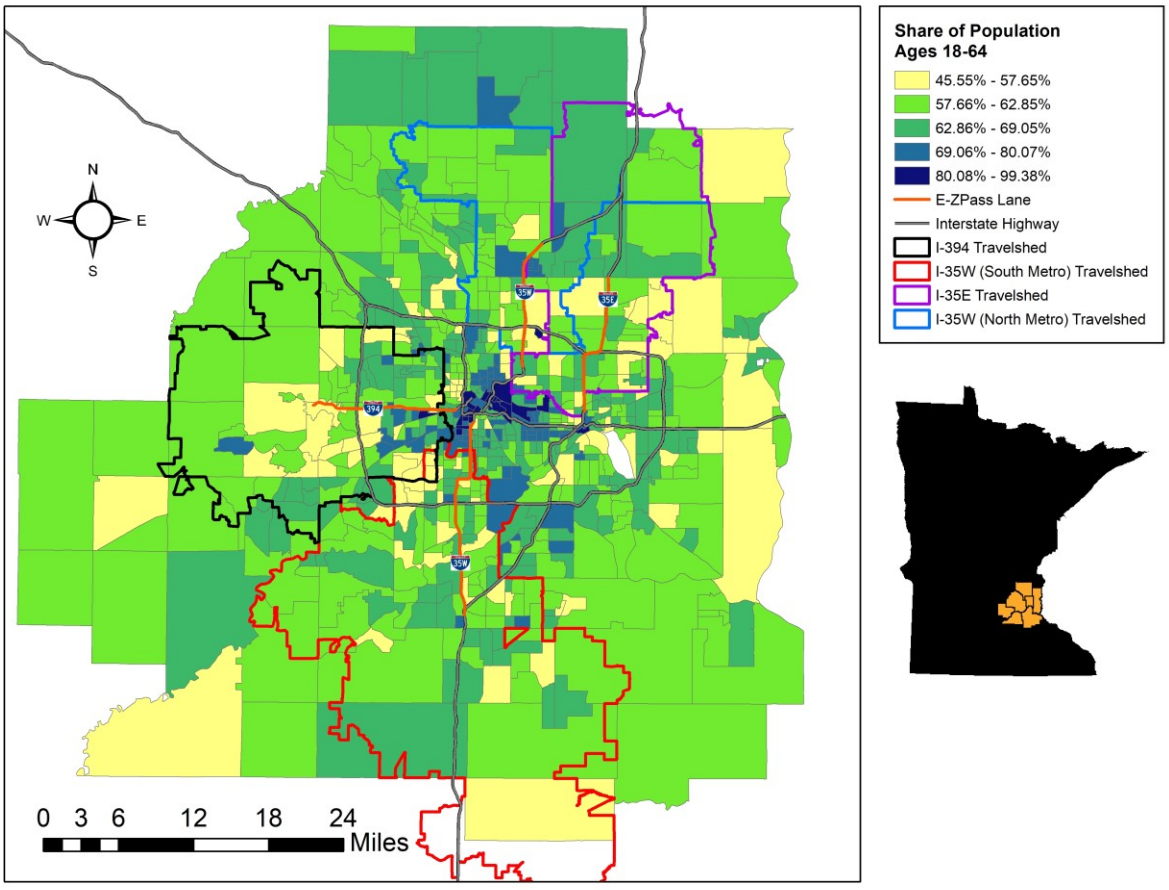
Roughly 63 percent of the population was between the ages of 18 and 64 in the seven-metro county area in 2019. About 23.5 percent of the population were children (under the age of 18), while approximately 13.5 percent were older adults (people 65 and older) (MN Compass, 2019).

The percentage of population between the ages of 18 and 64 was higher in the seven-metro county area than in the four travelsheds identified. In addition, the percentage of older adults was higher in the four travelsheds than in the seven-metro county area -- especially in the I-394 and the I-35E travelsheds. Table 3-2 presents the age distribution for the four travelsheds.

Table 3-2 Age distribution by travelshed

Age Group	I-394	I-35W (South Metro)	I-35E	I-35W (North Metro)
Under 18	21.8%	24.7%	22.9%	24.2%
Between 18-39 years	27.5%	28.1%	27.8%	27.1%
Between 40-64 years	34.5%	33.4%	33.2%	34.3%
65 years and older	16.2%	13.8%	16.2%	14.4%

Figure 3-10 presents the percentage of population with ages between 18 and 64 in 2019 by census tracts for the seven-county metro area and the identified travelsheds for the four E-ZPass corridors



Notes: *Census tracts in white did not have population information.* ***Source:*** *American Community Survey 5-year estimates, and StreetLight Data.*

Figure 3-10 Adult population

3.2.2.6 Educational Attainment

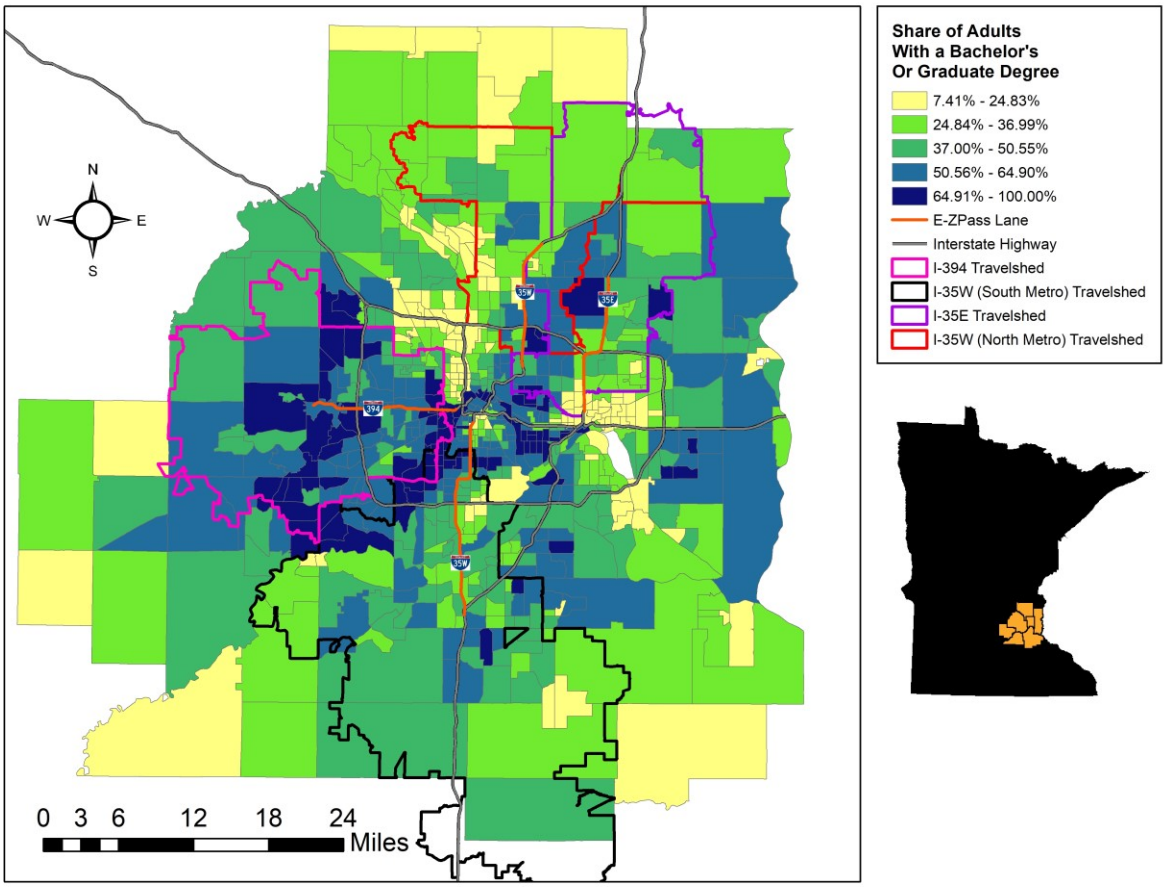
Among the adult population (25 and older) in the seven-county metro area, 93.5 percent had at least a high school diploma, and 44.4 percent had at least a bachelor's degree in 2019 (MN Compass, 2019).

The percentage of adults in the I-394 and the I-35W (South Metro) travelsheds with a bachelor's degree or higher is larger than in the seven-county metro area. Conversely, the percentage of adults in the I-35E and the I-35W (North Metro) travelsheds with a bachelor's degree or higher is lower than in the seven-county metro area. Table 3-3 presents the educational attainment for the four travelsheds.

Table 3-3 Educational attainment by travelshed

Educational Attainment	I-394	I-35W (South Metro)	I-35E	I-35W (North Metro)
Less than High School	2.77%	5.25%	6.33%	5.28%
High School	13.79%	17.41%	22.36%	23.84%
Some college	16.91%	18.51%	20.61%	20.94%
Associate degree	8.20%	10.46%	10.38%	11.50%
Bachelor's degree	36.90%	31.88%	25.72%	25.74%
Graduate or professional degree	21.44%	16.49%	14.59%	12.69%

Figure 3-11 presents the percentage of adults with at least a bachelor's degree in 2019 by census tracts for the seven-county metro area and the identified travelsheds for the four E-ZPass corridors.



Notes: *Census tracts in white did not have population information.* ***Source:*** *American Community Survey 5-year estimates, and StreetLight Data.*

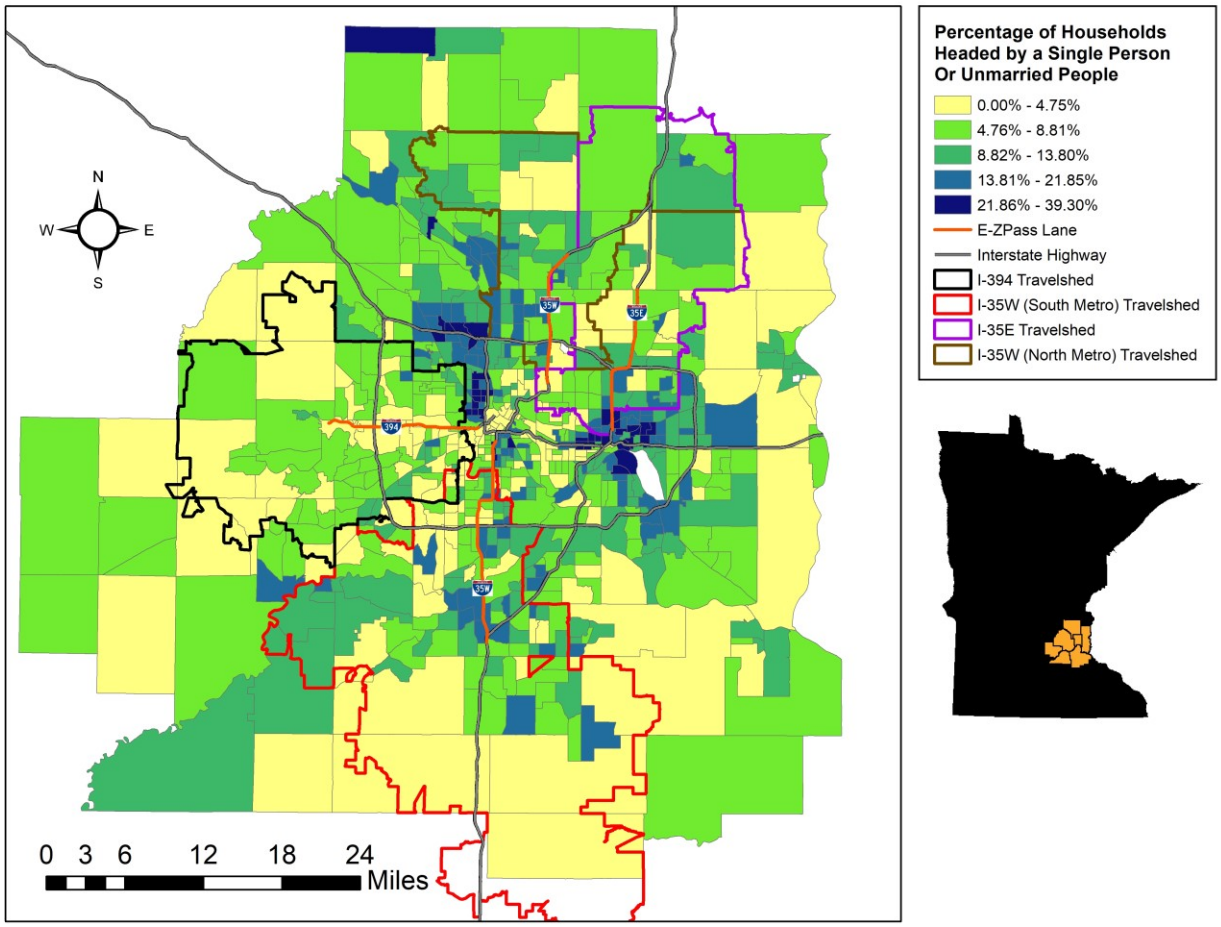
Figure 3-11 People with at least a bachelor's degree

3.2.2.7 Single Parent Households

Of the households in the seven-county metro area, 13.57 percent are headed by a single person (no spouse present). On average, 70 percent of these households are headed by a female (Census Bureau, 2019).

Across the four travelsheds, around 35 percent of the households were family households with no children, and less than 10 percent were family households headed by a single person or unmarried

people with children.[7] The share of households headed by a single person or unmarried people was lower in the I-394 (5.83%) than in the three other travelsheds. In the I-35W (South Metro), I-35E, and I-35W (North Metro) travelsheds, the percentages were 8.31, 8.75, and 9.23 percent, respectively. Figure 3-12 presents the percentage of households headed by a single person or unmarried people in 2019 by census tracts for the seven-county metro area and the identified travelsheds for the four E-ZPass corridors.



Notes: *Census tracts in white did not have population information.* ***Source:*** *American Community Survey 5-year estimates, and StreetLight Data.*

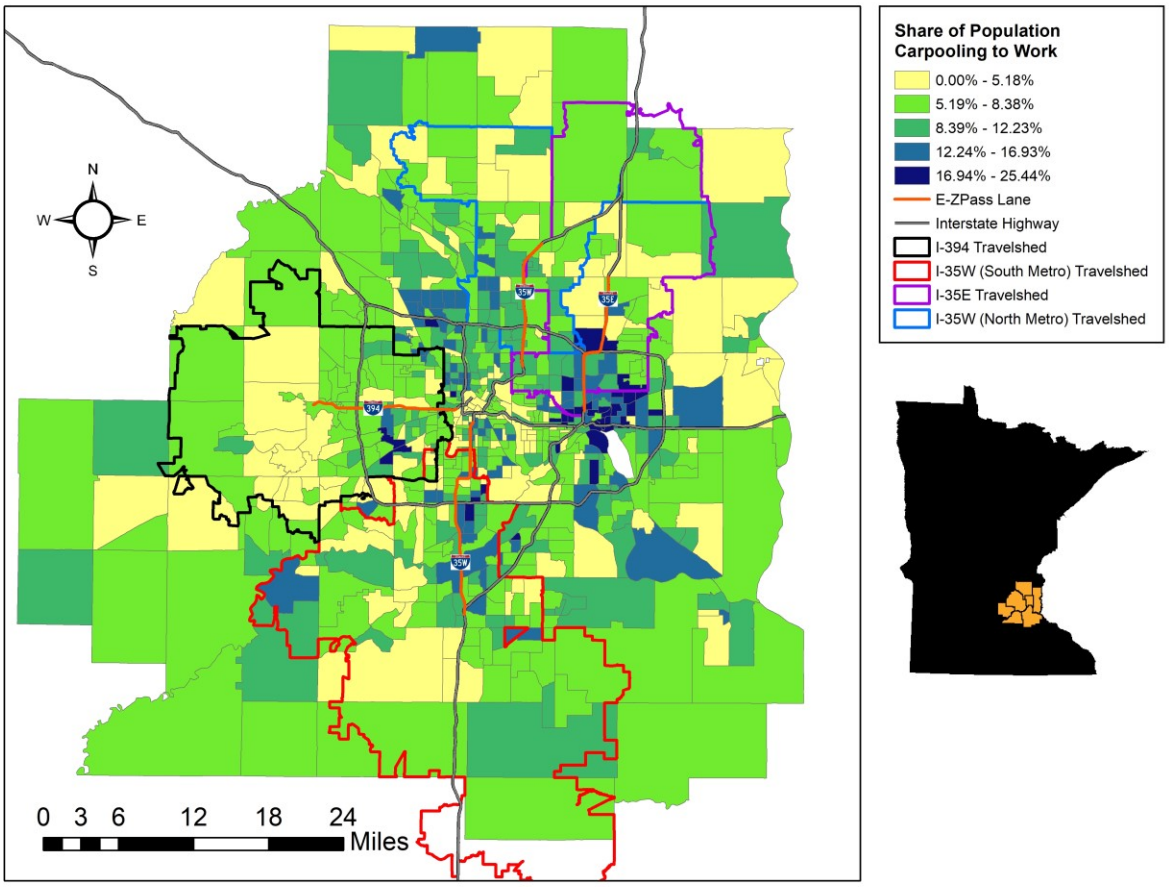
Figure 3-12 Single parent households

[7] In the I-394 and I-35W travelshed around 30 percent of the households were households with one person, while in the I-35W (South Metro) and I-35W (North Metro) around 25 percent of the households were family households with children and headed by a married couple.

3.2.2.8 Carpoolers

Workers (16 years and over) commute primarily driving alone followed by driving or riding with others or carpooling. In the seven-county metro area in 2019, 76.52 percent of workers drove alone to work, and 8.11 percent carpooled (Census Bureau, 2019).

The percentage of workers carpooling in three of the identified travelsheds was lower than the percentage of workers carpooling in the seven-county metro area. The percentage of workers carpooling in the travelsheds for the I-394, I-35W (South Metro), and I-35W (North Metro) are 6.96, 7.60, and 7.94 percent, respectively. In the I-35E travelshed, however, the percentage of workers carpooling was higher than in the seven-county metro area. Among those commuting, 8.90 percent reported carpooling to their place of employment. Figure 3-13 presents the percentage of workers carpooling in 2019 by census tracts for the seven-county metro area and the identified travelsheds for the four E-ZPass corridors.



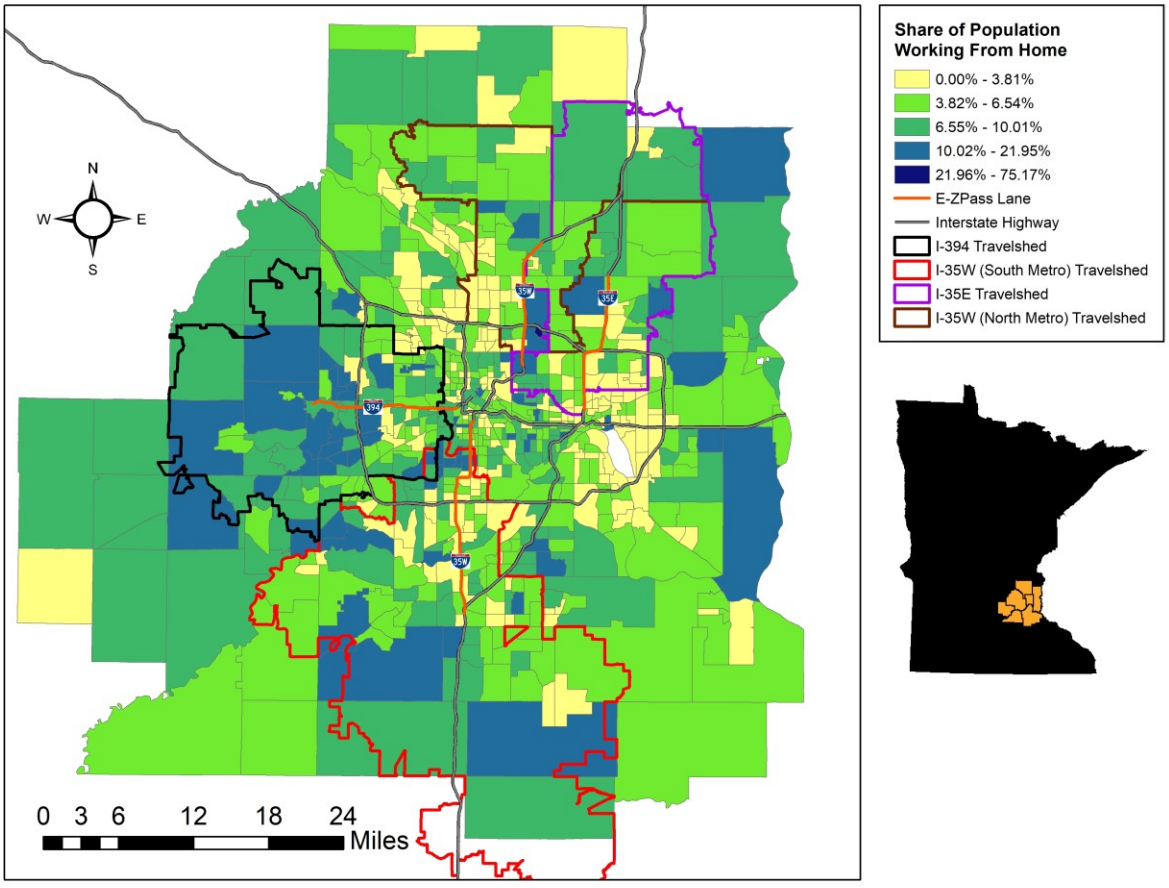
Notes: *Census tracts in white did not have workers information.* ***Source:*** *American Community Survey 5-year estimates, and StreetLight Data.*

Figure 3-13 Workers carpooling

3.2.2.9 Working from Home

The COVID-19 pandemic normalized alternative work arrangements, including working from home. Although the long-term impacts of the pandemic on this regard are yet to be realized, it is important to keep track of changes in these patterns. As of 2019, 5.9 percent of workers in the seven-county metro area worked from home (Census Bureau, 2019).

The percentage of workers working from home in three of the identified travelsheds was higher than the percentage of workers working from home in the seven-county metro area. The percentage of workers working from home was 7.69, 7.33, and 6.06 percent for the I-394, I-35W (South Metro), and I-35W (North Metro) travelsheds, respectively. In the I-35E travelshed, however, the percentage of workers working from home was lower than in the seven-county metro area. Among workers, 5.16 percent reported working from home. Figure 3-14 presents the percentage of workers working from home in 2019 by census tracts for the seven-county metro area and the identified travelsheds for the four E-ZPass corridors.



Notes: *Census tracts in white did not have workers information.* ***Source:*** *American Community Survey 5-year estimates, and StreetLight Data.*

Figure 3-14 Workers working from home

CHAPTER 4: DEMOGRAPHICS OF E-ZPASS LANE USERS

This report discusses the methodology and the findings of the analysis we conducted to illustrate the profile of users of E-ZPass lanes in Minnesota including transponder owners (tolling payers), carpoolers, and users of transit services that travel along these corridors.

4.1 METHODOLOGY AND DATA

The research team conducted a quantitative approach analysis to illustrate the profile of users of E-ZPass lanes in Minnesota. Users of the E-ZPass managed lanes include transponder owners (or tolling payers), carpoolers (users traveling in a vehicle with two or more people - HOV 2+), users of transit services that travel along these corridors, and violators.[8] Researchers present demographics of E-ZPass lane users and the users of the overall corridor. In particular, researchers present the profile of users in terms of household income, race, gender, age, education level, disability status, heads of households, primary language status, foreign-born population, and vehicle ownership.

First, the research team used the number of E-ZPass accounts by zip code provided by MnDOT and paired it with demographic data from the American Community Survey to illustrate the profile of transponder owners (U.S. Census Bureau , 2019). As of October 2021, there were 53,024 E-ZPass accounts, of which 52,232 were associated with a zip code in Minnesota (the remaining 792 were associated with a zip code outside Minnesota). The number of accounts by zip code was used to create a weighted average of the demographics in each travelshed. Researchers also present demographic data (such as age, race, and family income) from the MnPASS Customer Survey conducted in Feb/March 2017 (the results are in Appendix A in Table A.1). This information was collected by MnDOT. There was a total of 2,926 respondents.

Second, the research team used the Travel Behavior Inventory (TBI) 2018-2019 Household Interview Survey to illustrate the profile of carpoolers. The TBI collected information from approximately 13,000 households in the greater Twin Cities region, which includes the seven-county area and the twelve adjacent counties. The TBI is available at the Minnesota Geospatial Commons (Metropolitan Council , 2019). The research team used the individual database and the household database in the analysis as each dataset contained different demographic characteristics analyzed in this study.[9]

Workers in the greater Twin Cities region commute primarily by driving alone followed by carpooling. According to the 2019 TBI, 78.53 percent of the individuals that are 16 years old and above, employed

[8] Violators are solo motorists who do not have a valid E-ZPass account and use the lanes illegally. An E-ZPass citation can cost up to $300 depending on the county (MnDOT, 2022).

[9] Demographic characteristics such as race, age, education level, disability, and gender were available in the individual database, while income was available in the household database. Head of household was built from information in the household database.

(excluding those that work at home only), and live in the greater Twin Cities region drive alone to work, while 7.92 percent carpool. Of them, 6.16 percent carpooled with a household member (77.8% as a share of all carpoolers), and 1.76 percent carpooled with at least one person outside the household (22.2% as a share of all carpoolers). The percentage of carpoolers in the greater Twin Cities region is slightly higher compared to the percentage of carpoolers in the identified travelsheds, which ranges between 6.95 percent (in the I-394 travelshed) and 7.83 percent (in the I-35E travelshed), but it serves as a reference of the demographics of carpoolers in the studied areas.

Third, the research team used the TBI 2016 transit on-board survey to illustrate the profile of users of transit services along corridors with E-ZPass lanes. The TBI 2016 on-board survey included records for 30,605 transit trips across all regional routes and providers. Transit services providers included in the survey are the Minnesota Valley Transit Authority (MVTA), Maple Grove, Met Council, Metro Transit, Plymouth, Southwest, and the University of Minnesota. The dataset is available at the Minnesota Geospatial Commons (Metropolitan Council , 2016). For the analysis, researchers used demographic information of those using services along corridors with E-ZPass lanes from Southwest, Plymouth Metrolink, VMTA, and Metro Transit (the services selected are presented in Appendix B in Table B.1).

4.2 SUMMARY OF FINDINGS

Table 4-1 presents a summary of the demographics of users of the travelshed and users of E-ZPass lanes. The demographics of E-ZPass lane users are a weighted average of the demographics of tolled users, carpoolers, transit users, and violators using the proportion of each type of user in 2018 and 2021.[10] We present both years to account for changes in travel patterns due to the COVID-19 pandemic. Overall, users of E-ZPass lanes are more racially diverse than those of the travelshed and there is a higher proportion of females using these lanes. In addition, a higher proportion of users of E-ZPass lanes on the I-394 and the I-35W (South Metro) corridors have a household income below 100,000 compared to the travelshed. There is a lower percentage of people with disabilities and households with zero vehicles among E-ZPass lane users than on those in the travelshed. Among E-ZPass lane users, transponder owners are associated with higher-income zip codes and areas where a higher percentage of the population identifies themselves as white. Carpoolers and transit users are more racially diverse than the travelshed population and transponder owners in the I-394 and I35W (South Metro) corridors. Females are around 50 percent of the population in all travelsheds but are a higher percentage among those carpooling in the greater Twin Cities region (56%) and those using transit services along the I-35W (South Metro), I-35E, and I-35W (North Metro) corridors. Among those who carpool and use transit services, the percentage of people with disabilities is almost half the percentage of people with disabilities in the travelshed at large.

[10] Violators were assumed to have demographics similar to those in the travelshed.

Table 4-1 Summary of demographics: Travelshed population and E-ZPass lane users in 2018 and 2021

Demographic Variable	I-394		I-35W (South Metro)		I-35E		I-35W (North Metro)		Systemwide	
	Travelshed	E-ZPass Lane Users	Travelshed	E-ZPass Lane Users	Travelshed	E-ZPass Lane Users	Travelshed	E-ZPass Lane Users	Travelshed	E-ZPass Lane Users
2018										
Households with incomes below 100K (%)	51.8%	54.3%	53.9%	56.3%	62.4%	59.3%	-	-	56.0%	56.6%
People identified as person of color (%)	17.7%	23.2%	23.0%	23.5%	24.4%	22.3%	-	-	21.7%	23.0%
Female (%)	51.0%	53.4%	50.8%	54.7%	51.3%	55.7%	-	-	51.0%	54.6%
People with disability (%)	8.6%	4.6%	8.4%	5.3%	11.0%	5.4%	-	-	9.3%	5.1%
HH with zero vehicles (%)	5.5%	2.4%	4.8%	2.2%	6.2%	-	-	-	5.5%	2.3%
2021										
Households with incomes below 100K (%)	51.8%	54.3%	53.9%	55.3%	62.4%	56.6%	58.6%	56.1%	56.0%	55.4%
People identified as person of color (%)	17.7%	22.9%	23.0%	24.4%	24.4%	24.3%	19.8%	23.4%	21.7%	23.9%
Female (%)	51.0%	54.8%	50.8%	55.9%	51.3%	55.8%	50.6%	56.0%	51.0%	55.5%
People with disability (%)	8.6%	5.4%	8.4%	4.8%	11.0%	5.6%	9.5%	5.2%	9.3%	5.3%
HH with zero vehicles (%)	5.5%	2.2%	4.8%	1.6%	6.2%	-	4.1%	1.6%	5.5%	1.9%

Notes: *The last column presents average demographics for all travelshed.*

4.3 DETAILED FINDINGS

This section provides detailed demographic information of the users of the E-ZPass managed lanes in Minnesota. The users include tolled users, carpoolers, transit users, and violators. Table 4-2 presents the percentage of people moved daily in each E-ZPass lane corridor in 2018 and 2021.

Table 4-2 Summary of average daily E-ZPass lane users in 2018 and 2021

	2018			2021			
	I-394	**I-35W (South Metro)**	**I-35E**	**I-394**	**I-35W (South Metro)**	**I-35E**	**I-35W (North Metro) (2)**
Tolled users	15.60%	9.80%	11.63%	22.02%	6.69%	8.52%	6.23%
Carpoolers	43.15%	56.80%	64.72%	65.47%	78.06%	79.35%	77.23%
Transit users	37.97%	25.71%	12.38%	7.52%	5.62%	0.18%	4.77%
Violators (1)	3.28%	7.69%	11.27%	4.99%	9.63%	11.95%	11.77%
Total	**41,591**	**33,277**	**18,200**	**9,121**	**17,779**	**9,306**	**6,488**

Notes: *(1) For 2018, data based on the violation assessment conducted in 2017. For 2021, data based on the violation assessment 2019. (2) Based on August 2021-December 2021.* ***Source****: MnDOT* (2018) *and information provided by MnDOT.*

Carpoolers made up a majority of users in the corridors available in 2018, ranging from about 43 percent in the I-394 corridor to nearly 65 percent in the I-35E corridor. Transit users were the second largest subset of users, ranging from 12 percent in the I-35E corridor to 38 percent in the I-394 corridor. Tolled users made up between 10 and 15 percent of users in the corridors, while violators were a relatively small portion of total users in the I-394 corridor, though they made up about the same percentage of users as tolled users in the I-35W and I-35E corridors.

In 2021, carpoolers were the highest share of users in all four corridors, ranging from about two-thirds of users in the I-394 corridor to almost 80 percent of users in the other three corridors. All corridors experienced an increase in the share of users carpooling. Transit usage rates in 2021 dropped dramatically compared to the 2018 rates, accounting for no more than eight percent of users in any corridor. This may be attributable to changes in demand and commuter bus service cuts brought about by the COVID-19 pandemic. The share of tolled users also dropped from 2018 in the I-35W (South Metro) and I-35E corridor, though there was an increase in the I-394 corridor. The share of violators also increased in all corridors. Overall, total users in 2021 had decreased dramatically from 2018 levels, which similarly may be also attributable to the increase in teleworking brought about by the pandemic.

4.3.1 I-394 Corridor

The population in the I-394 corridor has the highest average median household income among the four travelsheds. In addition, the corridor has a higher percentage of the population identified as white compared to other travelsheds. Compared to the travelshed population at large, transponder owners have higher median household incomes, and are more likely to identify as non-Hispanic White. Carpoolers and transit users in the corridor have relatively lower incomes compared to the travelshed population and transponder owners. In addition, these users are more racially diverse, although a high percentage identified as white. Table 4-3 presents the demographic characteristics of users of the I-394 corridor.

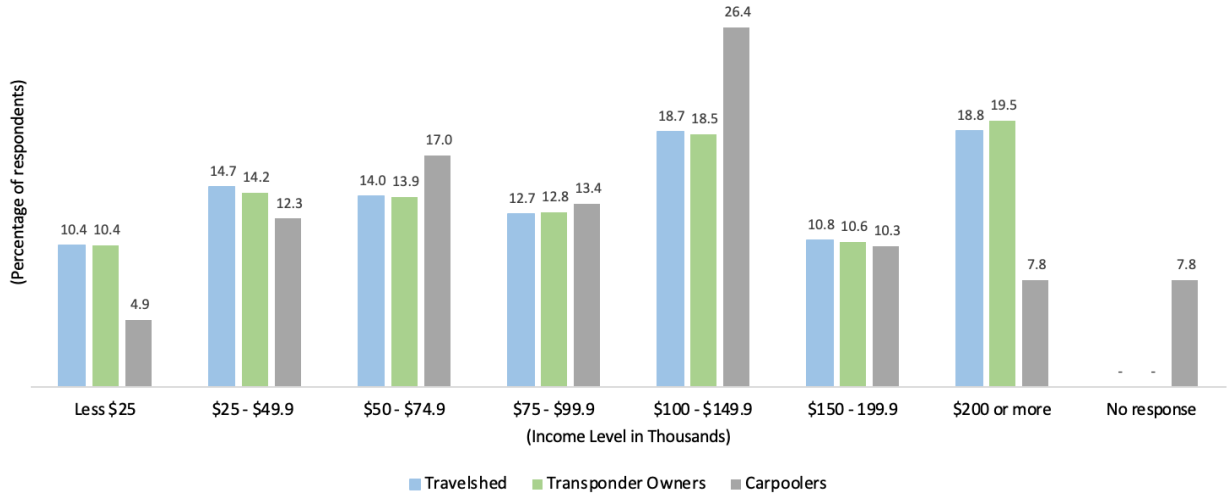
Table 4-3 Demographics of the I-394 corridor users

Demographic Variable	I-394 Travelshed	E-ZPass Managed Lane Users		
		Transponder Owners (1)	Carpoolers (2)	Transit Users (3)
Median Household Income	$107,426.7	$108,126	55.5% with HH income below $100K	52.5% with HH income below $100K
Pop. living below the poverty threshold	4.5%	4.63%	N.A.	N.A.
People identified as person of color	17.7%	17.14%	25.01%	24.15%
Female	51.00%	50.85%	56.90%	50.73%

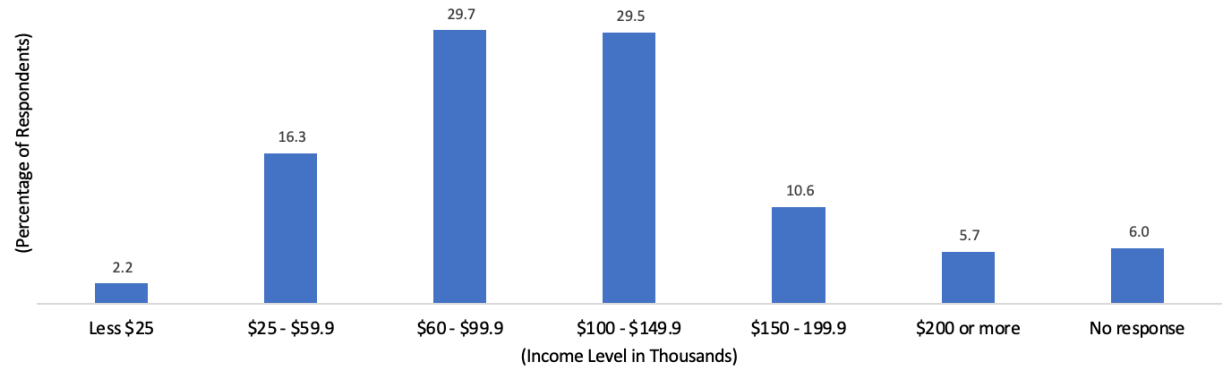
People with disability	8.6%	8.61%	4.33%	2.88%
Adult people (with ages between 18-64)	62.0%	61.73%	92.34% (4)	95.34% (5)
Adults with bachelor's degree or higher	58.3%	60.16%	57.48%	N.A.
HH headed by single parents	5.8%	5.54%	8.87%	N.A.
Pop. (5 and older) who speak English at home	88.28%	88.09%	N.A.	89.71%
Pop. born outside the U.S.	9.71%	9.94%	N.A.	N.A.
Employed population carpooling	7.0%	6.95%	-	-
Employed population working from home	7.7%	7.80%	-	-
HH with zero vehicles	5.05%	5.16%	0.89%	2.81%

Notes: *(1) Using weighted average. (2) Information for carpoolers in the greater Twin Cities region. (3) Information for users of transit services along the corridor. (4) As a percentage of workers. (5) As a percentage of transit users.*

Those carpooling and using transit services along the I-394 corridor have lower income levels compared to the travelshed population and transponder owners. About 57 percent of those who carpool have a household income between $50,000 and $149,999 and 60 percent of those using transit services along the corridor have incomes between $60,000 and $149,000. While almost 50 percent of the travelshed population and transponder owners have household incomes of $100,000 and above. Figure 4-1 presents the income distribution for the travelshed population, transponder owners, carpoolers (panel A), and transit users (panel B) of the I-394 corridor.



Panel A: Income distribution for the travelshed, transponder owners, and carpoolers

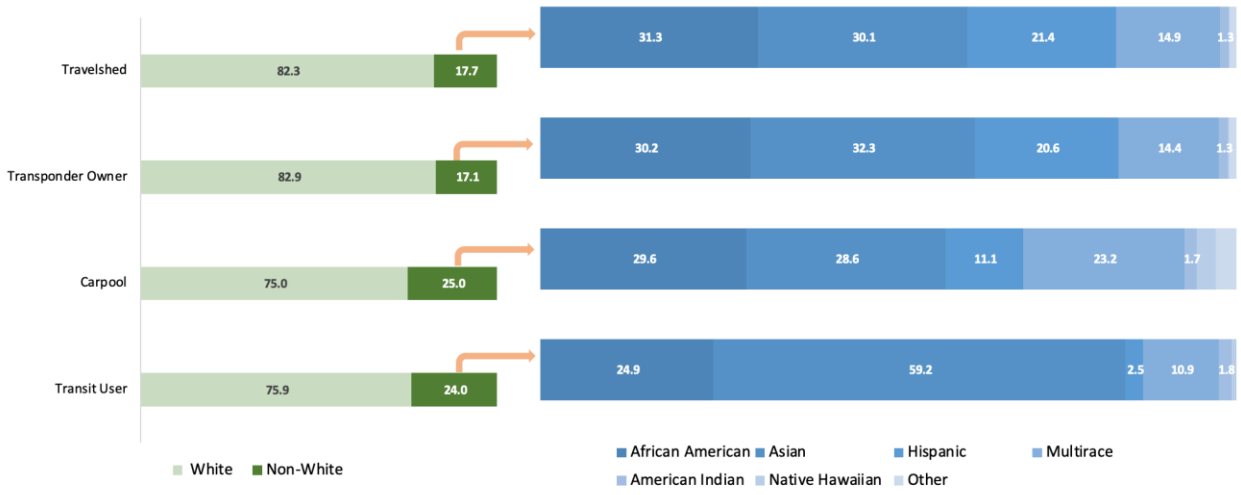


Panel B: Income distribution transit users

Source: *U.S. Census Bureau* (2019)*; Metropolitan Council* (2019)*; Metropolitan Council* (2016).

Figure 4-1 Income distribution of users of the I-394 corridor

The percentage of people identified as white is lower among carpoolers and users of transit services along the I-394 corridor than among the travelshed population and the transponder owners. About 14 percent of users of transit services along the I-394 corridor identified as Asian, which is more than double compared to those who identify themselves as Asian among the travelshed population and transponder owners. Figure 4-2 presents the race distribution for the travelshed population, transponder owners, carpoolers, and transit users along the I-394 corridor.



Source: *U.S. Census Bureau* (2019)*; Metropolitan Council* (2019)*; Metropolitan Council* (2016)*.*

Figure 4-2 Race of users of the I-394 corridor

4.3.2 I-35W (South Metro) Corridor

The population in the I-35W South Metro corridor has the second-highest median household income among the four travelsheds. When accounting for transponder ownership, the average median household income slightly increases as well as the percentage of the population identified as white. Among the four travelsheds, the I-35W (South Metro) corridor has the highest percentage of travelshed population identified as African American and Hispanic. About 6.6 percent of the population identified as African American and an additional 6.6 percent identified as Hispanic. The percentage of those who identify themselves as African American increases among carpoolers and users of transit services, but the percentage of those identified as Hispanic decreases among carpoolers and users of transit services when compared to the travelshed population. Lastly, the percentage of female carpoolers and transit users is higher than the percentage of females in travelshed. Table 4-4 presents the demographic characteristics of users of the I-35W (South Metro) corridor.

Table 4-4 Demographics of the I-35W (South Metro) corridor users

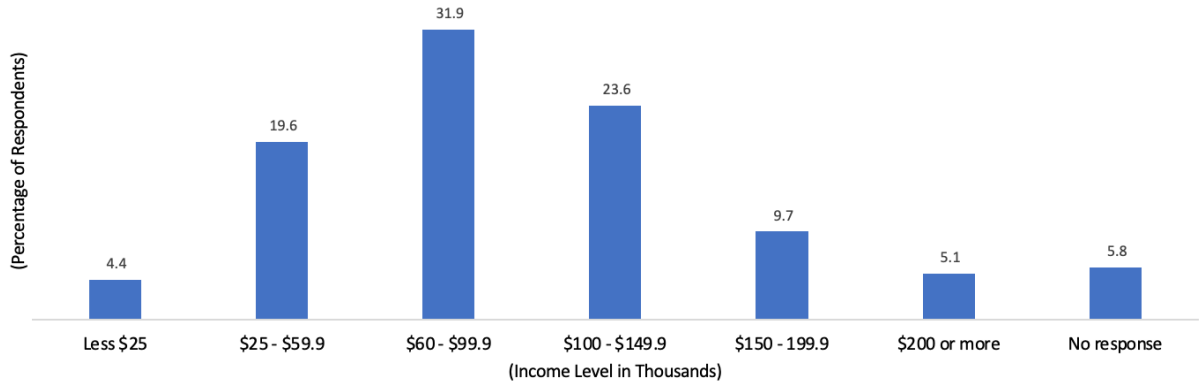
Demographic Variable	I-35W South Metro Travelshed	E-ZPass Managed Lane Users		
		Transponder Owners (1)	Carpoolers (2)	Transit Users (3)
Median Household Income	$99,231.2	$104,267	55.5% with HH income below $100K	55.85% with HH income below $100K
Pop. living below the poverty threshold	5.7%	5.13%	N.A.	N.A.
People identified as person of color	23.0%	20.29%	25.01%	23.40%
Female	50.80%	50.46%	56.90%	55.64%
People with disability	8.4%	7.50%	4.33%	2.54%
Adult people (with ages between 18-64)	61.5%	61.42%	92.34% (4)	95.94% (5)
Adults with bachelor's degree or higher	48.4%	49.71%	57.48%	N.A.
HH headed by single parents	8.3%	8.66%	8.87%	N.A.
Pop. (5 and older) who speak English at home	84.67%	86.70%	N.A.	85.88%
Pop. born outside the U.S.	11.58%	10.36%	N.A.	N.A.
Employed population carpooling	7.6%	7.26%	-	-
Employed population working from home	7.3%	7.34%	-	-
HH with zero vehicles	4.79%	4.04%	0.89%	3.70%

Notes: *(1) Using weighted average. (2) Information for carpoolers in the greater Twin Cities region. (3) Information for users of transit services along the corridor. (4) As a percentage of workers. (5) As a percentage of transit users.*

Just over 30 percent of the travelshed population and carpoolers have income levels between $50,000 and $99,999, while a slightly lower percentage of transponder owners have incomes in that range. Similarly, 32 percent of those using transit services along the corridor have incomes between $60,000 and $99,999. Approximately 25 percent of the travelshed population has a median household income over $150,000, while 28 percent of transponder owners have incomes higher than $150,000. Notably, only about 18 percent of carpoolers have incomes in that range. Figure 4-3 presents the income

distribution for the travelshed population, transponder owners, carpoolers (panel A), and transit users (panel B) of the I-35W (South Metro) corridor.

Panel A: Income distribution for the travelshed, transponder owners, and carpoolers



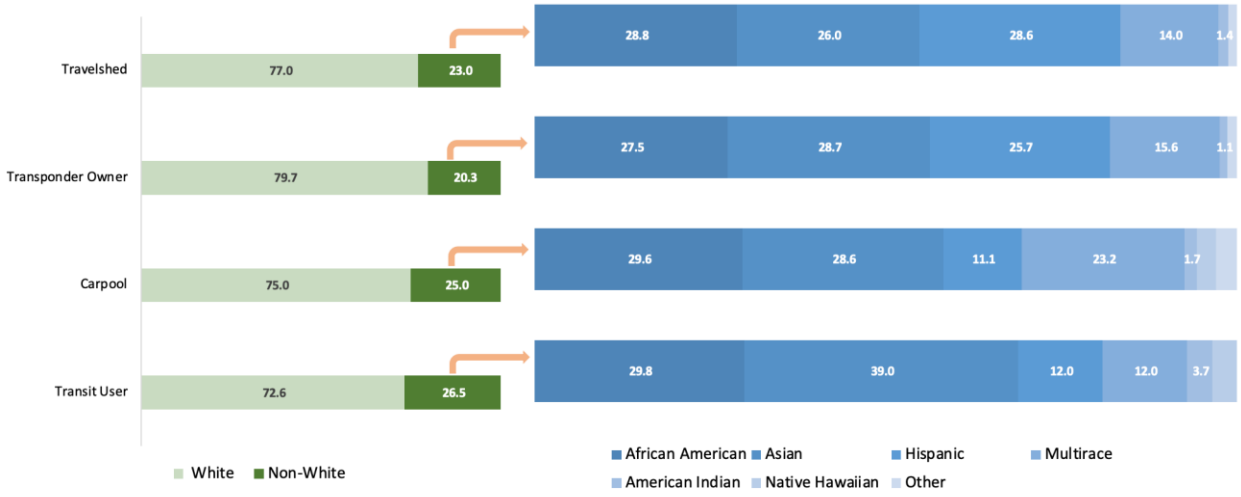
Panel B: Income distribution transit users

Source: *U.S. Census Bureau* (2019)*; Metropolitan Council* (2019)*; Metropolitan Council* (2016).

Figure 4-3 Income distribution of users of the I-35W (South Metro) corridor

The percentage of people identified as white is relatively lower among carpoolers and users of transit services along the I-35W (South Metro) corridor than among the travelshed population and the transponder owners. About 10 percent of users of transit services along the corridor identified as Asian, which is less than double compared to those identified as Asian among the travelshed population and transponder owners. Conversely, about 3 percent of users of transit services along the corridor identified as Hispanic, almost half than those who identify themselves as Hispanic among the travelshed

population and transponder owners. Figure 4-4 presents the race distribution for the travelshed population, transponder owners, carpoolers, and transit users along the I-35W (South Metro) corridor.



Source: *U.S. Census Bureau* (2019)*; Metropolitan Council* (2019)*; Metropolitan Council* (2016)*.*

Figure 4-4 Race of users of the I-35W (South Metro) corridor

4.3.3 I-35E Corridor

The population in the I-35E corridor has the lowest average median household income among the four travelsheds. In addition, the percentage of the population identified as white is the lowest compared to other travelsheds. About 10 percent of the travelshed population identified as Asian (the highest among the four travelsheds). When accounting for transponder ownership, the average median household income increases as well as the percentage of the population identified as white. Contrarily, the percentage of households headed by single parents slightly decreases as well as the percentage of people with a disability. Carpoolers' income is more comparable to the travelshed population and transponder owners, while the income of transit users is relatively lower. Lastly, the percentage of female carpoolers and transit users is higher than the percentage of females in travelshed. Table 4-5 presents the demographic characteristics of users of the I-35E corridor.

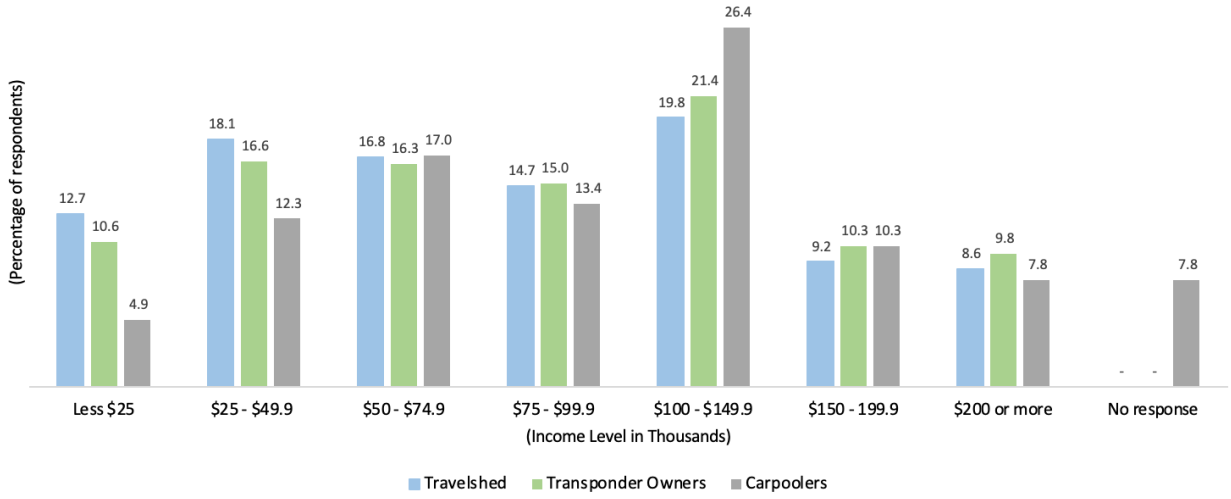
Table 4-5 Demographics of the I-35E corridor

Demographic Variable	I-35E Travelshed	E-ZPass Managed Lane Users		
		Transponder Owners (1)	Carpoolers (2)	Transit Users (3)
Median Household Income	$82,823.9	$88,698	55.5% with HH income below $100K	77.04% with HH income below $100K
Pop. living below the poverty threshold	6.9%	4.87%	N.A.	N.A.
People identified as person of color	24.4%	17.40%	25.01%	10.5%
Female	51.26%	51.28%	56.90%	57.78%
People with disability	11.0%	10.31%	4.33%	1.01%
Adult people (with ages between 18-64)	61.0%	60.94%	92.34% (4)	97.98% (5)
Adults with bachelor's degree or higher	40.3%	41.46%	57.48%	N.A.
HH headed by single parents	8.8%	7.80%	8.87%	N.A.
Pop. (5 and older) who speak English at home	85.25%	89.60%	N.A.	97.98%
Pop. born outside the U.S.	10.00%	7.39%	N.A.	N.A.
Employed population carpooling	8.9%	7.83%	-	-
Employed population working from home	5.2%	5.38%	-	-
HH with zero vehicles	6.18%	4.82%	0.89%	-

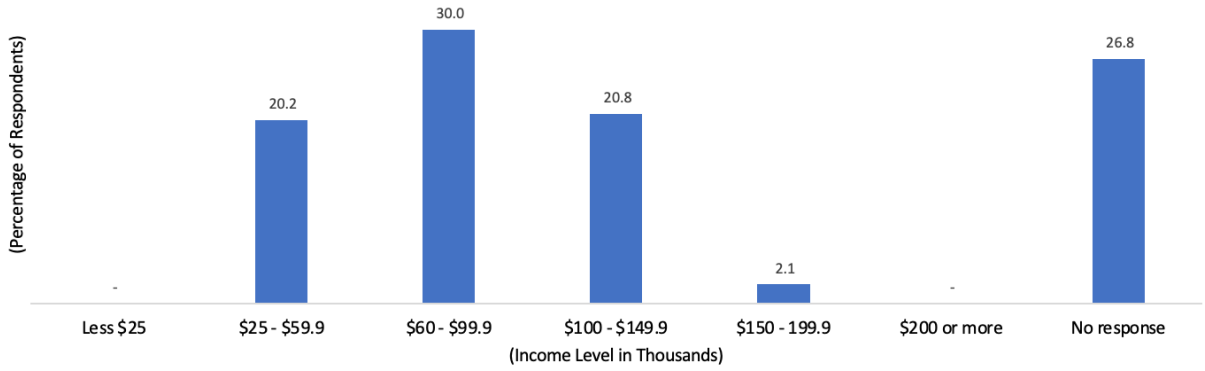
Notes: *(1) Using weighted average. (2) Information for carpoolers in the greater Twin Cities region. (3) Information for users of transit services along the corridor. (4) As a percentage of workers. (5) As a percentage of transit users.*

About 30 percent of the travelshed population, transponder owners, and those carpooling have income levels between $50,000 and $99,999. Similarly, 30 percent of those using transit services along the corridor have incomes between $60,000 and $99,999. Less than 20 percent of the travelshed population, transponder owners, and those carpooling have incomes of $150,000 or above. Figure 4-5

presents the income distribution for the travelshed population, transponder owners, carpoolers (panel A), and transit users (panel B) of the I-35E corridor.



Panel A: Income distribution for the travelshed, transponder owners, and carpoolers

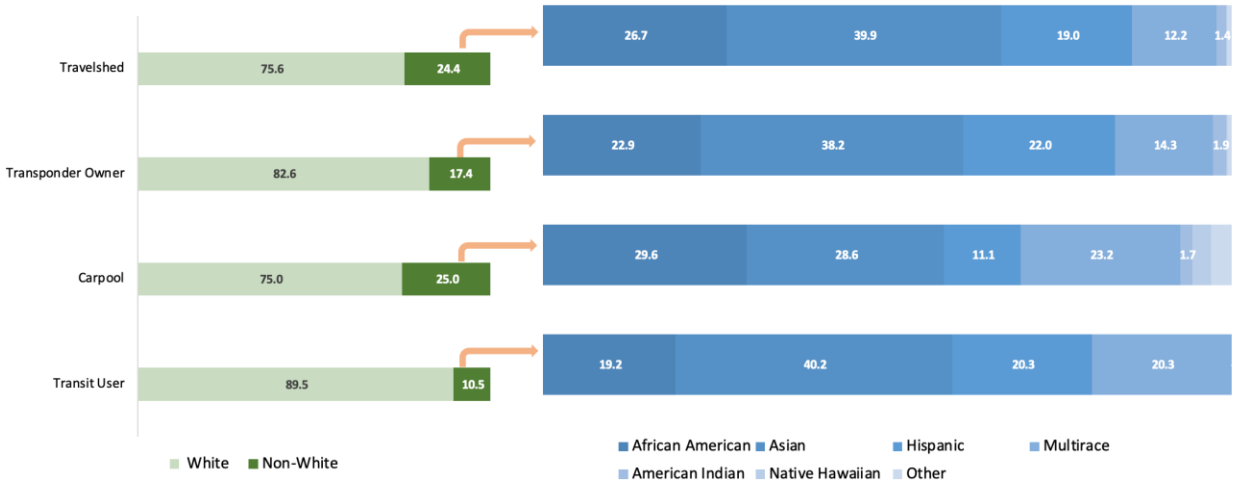


Panel B: Income distribution transit users

Source: *U.S. Census Bureau* (2019)*; Metropolitan Council* (2019)*; Metropolitan Council* (2016).

Figure 4-5 Income distribution of users of the I-35E corridor

The percentage of people identified as white is higher among users of transit services along the I-35E corridor than among the travelshed population, transponder owners, and carpoolers. Figure 4-6 presents the race distribution for the travelshed population, transponder owners, carpoolers, and transit users along the I-35E corridor.



Source: *U.S. Census Bureau* (2019)*; Metropolitan Council* (2019)*; Metropolitan Council* (2016).

Figure 4-6 Race of users of the I-35E corridor

4.3.4 I-35W (North Metro) Corridor

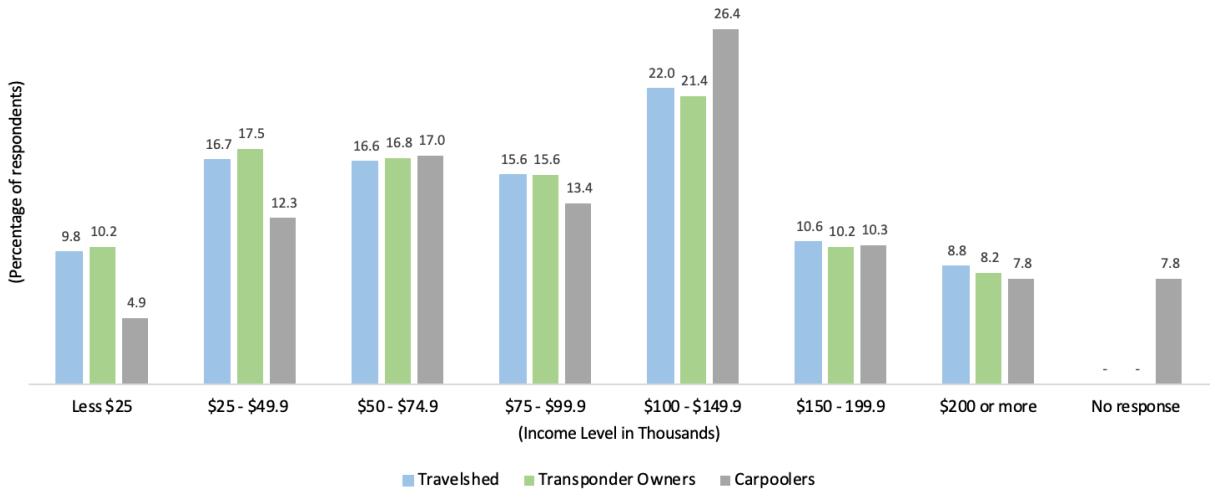
The population in the I-35W North Metro corridor has a slightly higher average median household income than the I-35E corridor. About 80 percent of the travelshed population identified as white. Transponder owners have higher median household incomes and are whiter than the travelshed population at large. The percentage of carpooling adults with a bachelor's degree or higher is notably higher than the travelshed population at large. Carpoolers' income is more comparable to the travelshed population and transponder owners, while the income of transit users is relatively low. Additionally, the percentage of female carpoolers and transit users is higher than the percentage of females in the travelshed. Table 4-6 presents the demographic characteristics of users of the I-35W (North Metro) corridor.

Table 4-6 Demographics of the I-35W (North Metro) corridor users

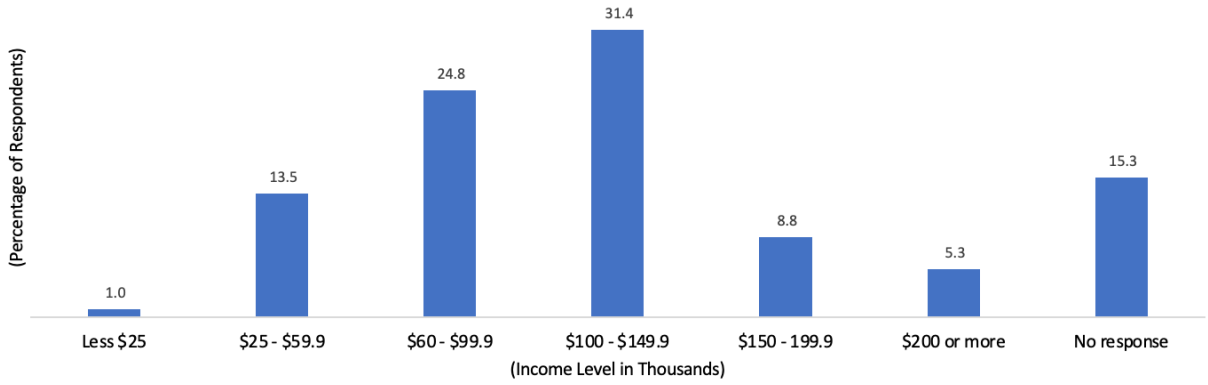
		Transponder Owners (1)	Carpoolers (2)	Transit Users (3)
Median Household Income	$86,524.5	$89,756	55.5% with HH income below $100K	59.85% with HH income below $100K
Pop. living below the poverty threshold	5.9%	5.40%	N.A.	N.A.
People identified as person of color	19.8%	17.94%	25.01%	13.22%
Female	50.56%	50.55%	56.90%	61.21%
People with disability	9.51%	9.40%	4.33%	2.68%
Adult people (with ages between 18-64)	61.4%	61.63%	92.34% (4)	97.74% (5)
Adults with bachelor's degree or higher	38.4%	39.96%	57.48%	N.A.
HH headed by single parents	9.2%	8.70%	8.87%	N.A.
Pop. (5 and older) who speak English at home	87.18%	88.30%	N.A.	92.68%
Pop. born outside the U.S.	9.23%	8.30%	N.A.	N.A.
Employed population carpooling	7.9%	7.55%	-	-
Employed population working from home	6.1%	6.38%	-	-
HH with zero vehicles	4.13%	3.97%	0.89%	2.78%

Notes: *(1) Using weighted average. (2) Information for carpoolers in the greater Twin Cities region. (3) Information for users of transit services along the corridor. (4) As a percentage of workers. (5) As a percentage of transit users.*

About 30 percent of those using transit services along the I-35W (North Metro) corridor have incomes between $100,000 and $149,999, compared to around 23 percent of the travelshed population, transponder owners, and those carpooling. Figure 4-7 presents the income distribution for the travelshed population, transponder owners, carpoolers (panel A), and transit users (panel B) of the I-35W (North Metro) corridor.



Panel A: Income distribution for the travelshed, transponder owners, and carpoolers

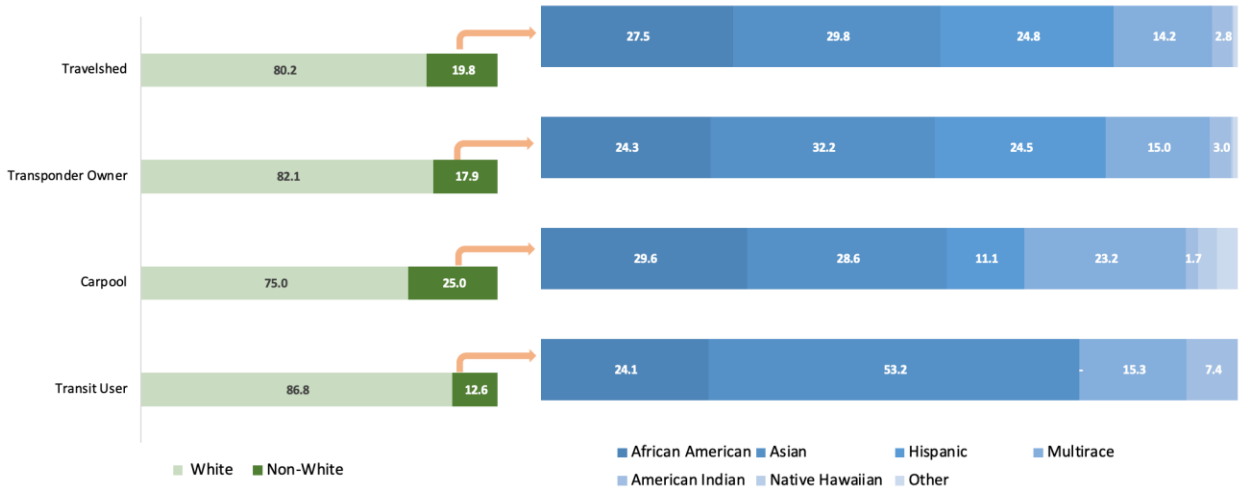


Panel B: Income distribution transit users

Source: *U.S. Census Bureau* (2019)*; Metropolitan Council* (2019)*; Metropolitan Council* (2016).

Figure 4-7 Income distribution of users of the I-35W (North Metro) corridor

The percentage of people identified as white is higher among users of transit services along the I-35W (North Metro) corridor than among the travelshed population, transponder owners, and carpoolers. Figure 4-8 presents the race distribution for the travelshed population, transponder owners, carpoolers, and transit users along the I-35W (North Metro) corridor.



Source: *U.S. Census Bureau* (2019)*; Metropolitan Council* (2019)*; Metropolitan Council* (2016)*.*

Figure 4-8 Race of users of the I-35W (North Metro) corridor

4.4 CHANGES IN THE DEMAND OF MANAGED LANES DUE TO COVID-19

The COVID-19 pandemic continues encouraging workers to work from home or remotely. Using data from loop detectors and radar sensors from the Minnesota Department of Transportation, the research team found that traffic has bounced back to pre-pandemic levels in some areas but continued to decrease in other areas. Researchers also found differences between travel rates across the days of the week.

We analyzed traffic volumes in October of 2019, 2020, and 2021 on three corridors that have E-ZPass lanes. We looked at the volumes on 35W at 98th street, 35E at County Road H2, and I-394 at Penn Avenue (with High Occupancy Reversible lanes). Figure 4-9 presents the travel demand during the day in the I-35W corridor and the 98th St (Northbound). Morning volumes are mostly commuter trips while evening volumes also have discretionary trips. The figure shows reduced congestion during morning peak hours, a gradual travel increases throughout the day, and a slight increase during afternoon peak hours.

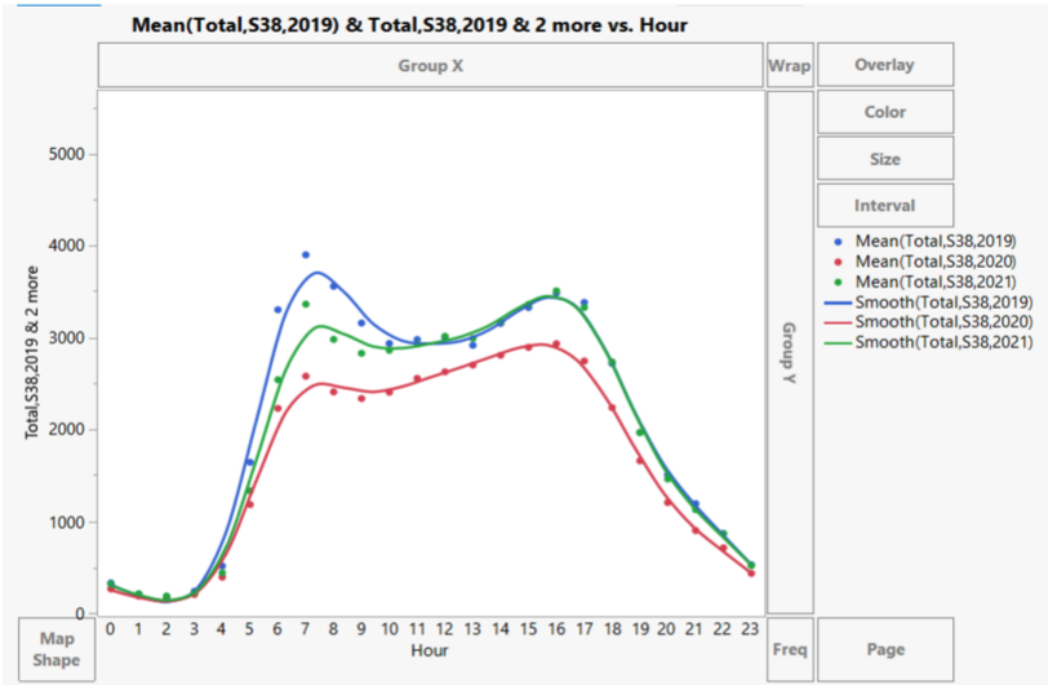


Figure 4-9 Travel demand during the day in the I-35W & 98th St (Northbound)

Figure 4-10 shows the data for southbound traffic of I-35E & County Road H2 which is mostly commuter in the morning. This area serves commuters from northern suburbs to employment centers of St. Paul and traffic is significantly directional. As seen in the figure, traffic dropped in 2020 but the morning traffic has recovered but not to 2019 volumes. Contrarily, the afternoon traffic recovered and surpassed the 2019 volumes.

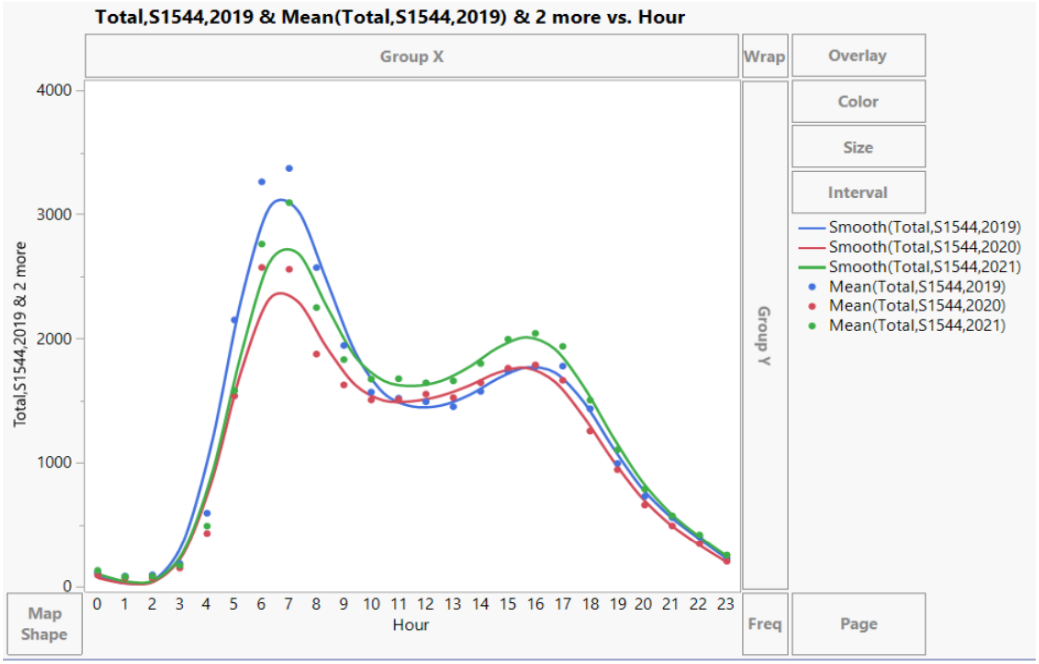
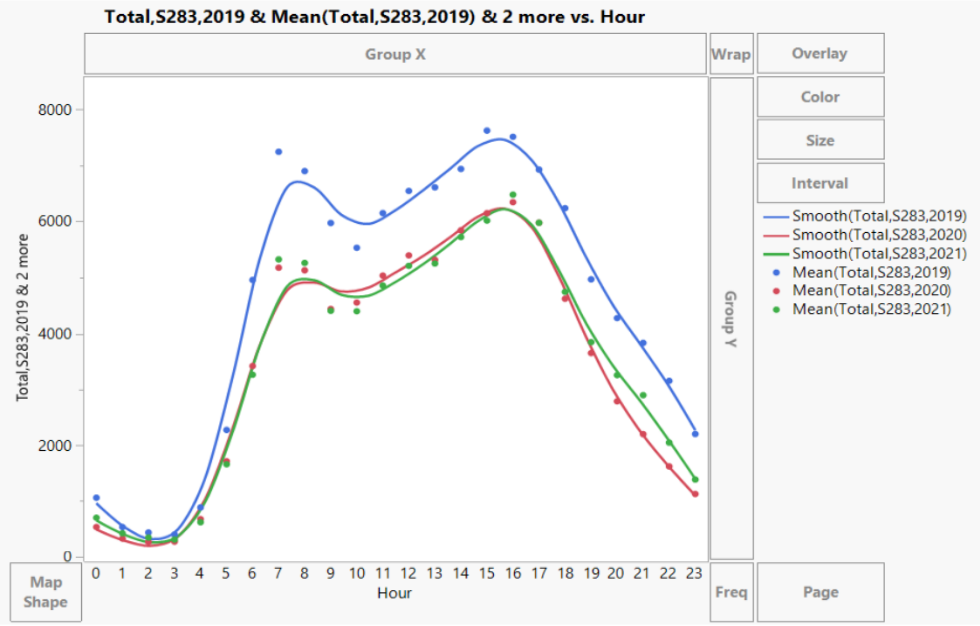
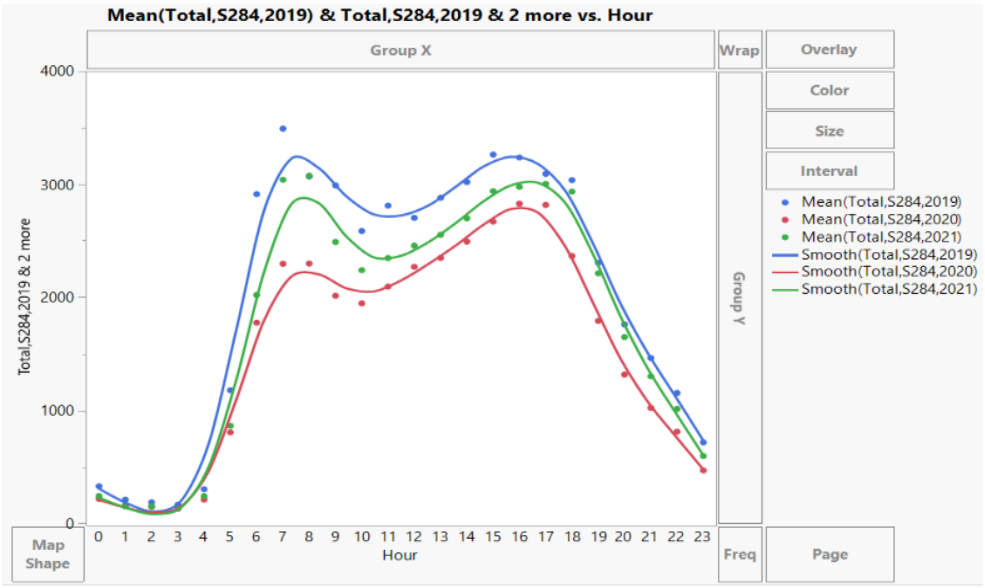


Figure 4-10 Travel demand during the day in the I-35E & County Road H2 (Southbound)

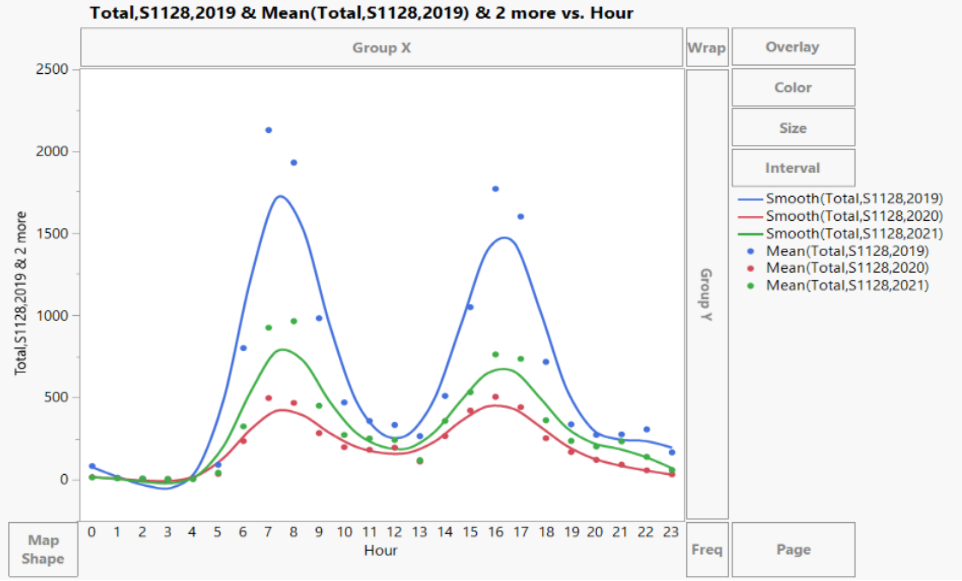
Figure 4-11 shows the traffic for westbound, eastbound, and reversible lanes in I-394 & Penn Avenue. Panel A and Panel B show that traffic volumes in 2021 are below 2019 volumes. Overall, we observe an afternoon peak that is wider, it starts earlier and ends later. Panel C shows a significant drop in the traffic of the reversible lane in 2020 and is still significantly lower than the other detector stations in 2021. It is possible that the low traffic and the resulting reduction in congestion in general lanes results in fewer people using the high occupancy lanes.



Panel A: Westbound lanes



Panel B: Eastbound lanes



Panel C: Reversible lanes

Figure 4-11 Travel demand during the day in the I-394 & Penn Avenue

The COVID-19 pandemic is changing commuting patterns. As more and more organizations start to call back their employees to the office, it is evident that it will not be 5 days a week for most of the organizations. Most organizations are adopting a hybrid work model that provides employees the flexibility to work from home a few days a week. This flexibility could change the daily traffic patterns. We have analyzed traffic volumes during different days of the week to see whether any pattern is being developed. It seems volume reduction on Wednesday and Thursday between 2021 and 2019 is a bit higher than other days of the week. It is worthwhile to monitor traffic in these areas as it may impact how we provide services.

Such increased telecommuting has equity implications. In Minnesota, approximately 43.5 percent of households had at least one person telecommuting in 2021 (Bureau of Transportation Statistics). Overall, a higher percentage of those who identify themselves as white (29.9%) are able to telecommute compared to those who identify themselves as African Americans (19.7%) and Hispanics (16.2%) (U.S. Census Bureau, 2021).

CHAPTER 5: POLICY REVIEW FOR ALTERNATIVES ANALYSIS

The impacts on the different demographic subgroups discussed in earlier tasks must be accounted for in planning for implementation of managed lanes. This task discusses how these impacts might be measured and compared through the Alternatives Analysis process that is included in the preparation of Environmental Assessments (EA) and/or Environmental Impact Statements (EIS), required for most managed lane projects.

5.1 NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)

Title 40, Chapter V, Subchapter A, Part 1500, Section 1500.1 of the U.S. Code states that, "The National Environmental Policy Act (NEPA) is a procedural statute intended to ensure federal agencies consider the environmental impacts of their actions in the decision-making process. Section 101 of NEPA establishes the national environmental policy of the federal government to use all practicable means and measures to foster and promote the general welfare, create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans. Section 102(2) of NEPA establishes the procedural requirements to carry out the policy stated in section 101 of NEPA. In particular, it requires federal agencies to provide a detailed statement on proposals for major federal actions significantly affecting the quality of the human environment" (Code of Federal Regulations, 2022). Major Federal actions in this context are defined as 'an activity or decision subject to federal control and responsibility, [which] may include new and continuing activities, including projects and programs entirely or partly financed, assisted, conducted, regulated, or approved by Federal agencies; new or revised agency rules, regulations, plans, policies, or procedures; and legislative proposals.'

NEPA Process: Under NEPA regulations, all federal agencies are required to prepare detailed statements assessing the environmental impact of and alternatives to major federal actions significantly affecting the environment. These statements are commonly referred to as Environmental Assessments (EA) and Environmental Impact Statements (EIS). EAs determine if a proposed federal action has the potential to cause significant environmental effects. If the action has the potential to significantly impact the human environment, an EIS is required.

5.1.1 Environmental Impact Statements (EIS)

According to Title 40, Chapter V, Subchapter A, Part 1502, Section 1502.1, the purpose of an environmental impact statement "is to ensure agencies consider the environmental impacts of their actions in decision making. The EIS shall provide a full and fair discussion of significant environmental impacts and shall inform decision-makers and the public of reasonable alternatives that would avoid or minimize adverse impacts or enhance the quality of the human environment. Agencies shall focus on significant environmental issues and alternatives and shall reduce paperwork and the accumulation of extraneous background data. Statements shall be concise, clear, and to the point, and shall be

supported by evidence that the agency has made the necessary environmental analyses" (Code of Federal Regulations, 2022a).

EIS Process - The following is a summary of the EIS process, as stated by the Environmental Protection Agency:

1. An agency publishes a Notice of Intent in the Federal Register. The Notice of Intent informs the public of the upcoming environmental analysis and describes how the public can become involved in the EIS preparation. This Notice of Intent starts the scoping process, which is the period in which the federal agency and the public collaborate to define the range of issues and potential alternatives to be addressed in the EIS.
2. A draft EIS is published for public review and comment for a minimum of 45 days. Upon close of the comment period, agencies consider all substantive comments and, if necessary, conduct further analyses.
3. A final EIS is then published, which provides responses to substantive comments. Publication of the final EIS begins the minimum 30-day "wait period," in which agencies are generally required to wait 30 days before making a final decision on a proposed action. EPA publishes a Notice of Availability in the Federal Register, announcing the availability of both draft and final EISs to the public.
4. The EIS process ends with the issuance of the Record of Decision (ROD). The ROD explains the agency's decision, describes the alternatives the agency considered, and discusses the agency's plans for mitigation and monitoring, if necessary (U.S. EPA, 2021).

5.1.2 Alternatives Analysis (AA)

An alternatives analysis is a required portion of an EIS. The analysis compares the potential environmental impacts of the proposed action and alternatives based on the information presented in the EIS.

AA Process - The components of alternatives analysis, as listed in the Code of Federal Regulations, are as follows. Section headers are italicized, followed by the researchers' explanation. Some of the headers appeared to be self-explanatory, and therefore do not have additional discussion:

Evaluation of reasonable alternatives to the proposed action, and a brief discussion of eliminated alternatives. NEPA calls for federal agencies to "utilize a systematic, interdisciplinary approach which will

insure the integrated use of the natural and social sciences and the environmental design arts in planning and in decision making which may have an impact on man's environment", and to "identify and develop methods and procedures, in consultation with the Council on Environmental Quality established by title II of this Act, which will insure that presently unquantified environmental amenities and values may be given appropriate consideration in decision making along with economic and technical considerations" (U.S. Congress, 1970). The process for determining alternatives is vague. The NEPA statute states that the responsible federal agency shall, "study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources" (U.S. Congress, 1970).

A detailed discussion of each alternative, including the proposed action, so that reviewers may evaluate their comparative merits. Section 1502.14 states that, "The alternatives section should present the environmental impacts of the proposed action and the alternatives in comparative form based on the information and analysis presented in the sections on the affected environment and the environmental consequences" (Code of Federal Regulations, 2022a).

Inclusion of the no-action/no-build alternative. In essence, what are the consequences of doing nothing?

Identification of the agency's preferred alternative (or alternatives, if multiple) in the draft statement and identification of that alternative in the final statement unless another law prohibits the expression of such a preference. Section 1502.15 references the affected environment, and states that "the environmental impact statement shall succinctly describe the environment of the area(s) to be affected or created by the alternatives under consideration, including the reasonably foreseeable environmental trends and planned actions in the area(s)" (Code of Federal Regulations, 2022a). Additionally, section 1502.16 discusses the environmental consequences of the alternatives, and forms the scientific and analytic comparisons of the alternatives analysis. The discussion in section 16 calls for agencies to consider the following criteria:

- The environmental impacts of the proposed action and reasonable alternatives to the proposed action and the significance of those impacts. The comparison of the proposed action and reasonable alternatives shall be based on this discussion of the impacts.
- Any adverse environmental effects that cannot be avoided should the proposal be implemented.
- The relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity.
- Any irreversible or irretrievable commitments of resources that would be involved in the proposal, should it be implemented.

- Possible conflicts between the proposed action and the objectives of Federal, regional, State, Tribal, and local land use plans, policies and controls for the area concerned.
- Energy requirements and conservation potential of various alternatives and mitigation measures.
- Natural or depletable resource requirements and conservation potential of various alternatives and mitigation measures.
- Urban quality, historic and cultural resources, and the design of the built environment, including the reuse and conservation potential of various alternatives and mitigation measures.
- Means to mitigate adverse environmental impacts.
- Where applicable, economic and technical considerations, including the economic benefits of the proposed action (Code of Federal Regulations, 2022a).

Inclusion of any additional mitigation measures deemed appropriate that are not already included in the proposed action or alternatives.

Limitation of considered alternatives to a reasonable number.

5.1.3 Analysis of the EIS and AA Processes

The current EIS process focuses on impacts to the 'human environment', which is defined as "the natural and physical environment and the relationship of present and future generations of Americans with that environment" (Code of Federal Regulations, 2022b). However, NEPA creates a framework upon which individual laws and agency policies can further influence the environmental review process. As such, while an equity analysis is not currently required, policy changes currently underway may result in equity consideration becoming part of the federal environmental review process.

As it stands, public agencies do not have adequate guidance on how to incorporate equity considerations into their alternatives analysis process. The prospect of a federal legislative solution to this problem is grim, given the endemic political gridlock present at the moment. Similarly, while the prospect of a state-level legislative solution is potentially more promising, it remains unlikely. Given the lack of a statutory requirement, it is the responsibility of the individual agencies working through the NEPA process to incorporate equity considerations into their proposals. Depending on the political, historical, or socioeconomic contexts surrounding the primary agency, disparities in the development and implementation of alternatives can arise. MnDOT (or any public agency responsible for oversight of transportation projects) can address this problem by developing an equity framework that analyzes the

potential impacts of a project on the social environment, in the same way that the current statute calls for the examination of impacts to "the natural and physical environment" (Code of Federal Regulations, 2022b).

Several criteria mentioned in section 5.1.2 could potentially form the basis for equity criteria or be interpreted through an equity lens. Specifically:

- Commitments of resources could be defined as allocation according to various equity criteria (e.g., race, income, etc.), as proposed in the developing Justice 40 guidance (The White House, 2023).
- Conflicts between the proposed action and the objectives of Federal, regional, State, Tribal, and local land use plans, policies and controls for the area concerned, especially as local land use plans may impact other disadvantaged groups, in addition to tribes.
- Urban quality, historic, and cultural resources, as these resources can be linked to sites with significant cultural heritage and/or racial history.
- Economic benefits of proposed action, as these articulate the benefits to marginalized communities.

5.2 EQUITY ANALYSIS CASE STUDY

To assess racial equity programs implemented by other public agencies, we examined the Racial Equity Toolkit (RET) developed by the City of Seattle and Sound Transit, the primary provider of public transportation in the Puget Sound region. The purpose of the RET is to enhance and guide the City of Seattle's commitment to achieve racial equity in the community, end institutional and structural racism in city government, promote inclusion and full participation of all residents, and partner with the community to achieve racial equity across the City of Seattle (SoundTransit and City of Seattle, 2019). In this instance, it was applied to the West Seattle-Ballard Link Light Rail Extension (WSBLE), an expansion of the current light rail system in Seattle.

The involved agencies utilized the RET to inform the technical evaluation of the project, as well as the focus and level of community engagement. The RET specifically elevates project issues that impact low-income communities and communities of color (SoundTransit and City of Seattle, 2019). Specific aspects of the alternatives Development process that were conducted using the RET included:

- Targeted outreach, including first language workshops and interviews by service providers in the corridor
- Community workshops in affected neighborhoods to collect additional feedback, explicitly including the Pioneer Square neighborhood in these efforts.

- Strategic partnerships with community liaisons and organizations to expand engagement

As part of the development process, the agencies concerned created the Racial Equity Toolkit Collaborative (RET Collaborative), an interagency comprised of staff from Sound Transit's West Seattle and Ballard Link Extensions project and supported by city staff from the Office of Planning and Community Development, Seattle Department of Transportation, Seattle Department of Neighborhoods, and the Seattle Office for Civil Rights (SoundTransit and City of Seattle, 2019). The RET Collaborative team identified four desired racial equity outcomes for low-income community members and communities of color:

- Enhancement of access and mobility
- Creation of equitable development opportunities
- Avoidance of disproportionate impact on historically marginalized communities
- Meaningful involvement of low-income community members and communities of color in project development

Early efforts by the cooperating agencies focused on compiling and analyzing racial data within the project corridor. Using five-year American Community Survey data (2011-2016), the agencies examined demographic data within a half-mile catchment area along the proposed alignment. External engagement work involved the development of a targeted community engagement strategy to best understand the 'priorities, desires, and concerns' of communities of color along the project corridor, and to incorporate community feedback into project planning and evaluation measures (SoundTransit and City of Seattle, 2019).

The Racial Equity Toolkit Report developed by Sound Transit and the City of Seattle was released in April 2019. Just one year earlier, in March 2018, HNTB Corporation prepared an alternatives evaluation framework and methodology technical memorandum for the project. The alternatives evaluation framework for the WSBLE project created a series of sequential evaluation levels, in which increasingly detailed and comprehensive evaluation measures were applied to a decreasing number of alternatives at each level. The process was designed to identify the alternatives that best achieve the Purpose and Need for the WSBLE Project. At each sequential evaluation level, the process became increasingly rigorous, either by adding new measures, progressively refined definitions of the same measures, or removing measures no longer useful in differentiating performance to assess each remaining alternative more comprehensively than at the previous level. The goal was to develop a wide range of alternatives as early as possible in the review process, in order to systematically identify the most promising alternatives (Parsons & Ives, 2018).

Interestingly, at no point does this memorandum mention equity of any kind. Given the lack of any mention of equity in the NEPA statute, it would stand to reason that HNTB did not feel obligated to include that in their evaluation framework. As mentioned previously, the lack of an explicit requirement to address equity concerns in EIS and AA materials leaves that up to the discretion of the conducting

agencies. The release of the RET a year after the alternatives evaluation framework could be interpreted as a reaction to that flaw in the EIS process.

The draft EIS released by Sound Transit and the Federal Transit Administration for WSBLE mentions equity in the environmental justice section of the report, noting that the RET process is a method for the City of Seattle to fulfill its commitment to its Race and Social Justice Initiative, consistent with federal Executive Order 12898, which is the basis for this environmental justice evaluation (SoundTransit, 2022).

5.3 EQUITY ANALYSIS

5.3.1 Potential Sources of Equity Criteria

A number of existing sources may be able to provide equity criteria to public agencies in lieu of statutory guidance.

In 1994, President Clinton issued **Executive Order 12898**, a set of federal actions designed to address environmental justice in minority and low-income populations (U.S. EPA, 2021). The order directs federal agencies to explicitly "focus federal attention on the environmental and human health effects of federal actions on minority and low-income populations to achieve environmental protection for all communities" (U.S. EPA, 2021).

E.O. 12898 states that, "To the greatest extent practicable and permitted by law, and consistent with the principles outlined in the report on the National Performance Review, each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States" (Code of Federal Regulations, 1994).

President Biden pushed this direction further with Executive Order 13985 (The White House, 2021), "Advancing Racial Equity and Support for Underserved Communities Through the Federal Government," which directs federal agencies to evaluate whether their policies produce racially inequitable results when implemented, and to make the necessary changes to ensure underserved communities are properly supported (Office of Civil Rights, 2023). A subsequent Executive Order (The White House, 2023), released on February 16, 2023, then calls for implementation of an Agency Equity Team within the Department of Transportation (as well as other federal agencies) "to coordinate the implementation of equity initiatives and ensure that their respective agencies are delivering equitable outcomes for the American people."

Legislatively, the **Reconnecting Communities Act**, introduced by Representative Anthony G. Brown (D-MD) in the 117th Congress, also has the potential to create statutory equity guidelines for policymakers. The bill would "establish a program to improve community connectivity by identifying and removing or

mitigating infrastructural barriers that create obstacles to mobility or economic development or expose the community to pollution and other health and safety risks" (U.S Congress, 2021).

The bill would establish a program in which communities would have the means to "identify infrastructural barriers within the community that create obstacles to mobility or economic development; or expose the community to high levels of particulate matter, noise pollution, and other public health and safety risks" and "study the feasibility of improving, and develop plans to improve, community connectivity, including through removal or retrofit of an infrastructural barrier; or construction of facilities to mitigate the obstacle created by the infrastructural barrier by enhancing connectivity across the infrastructural barrier" (U.S Congress, 2021).

Grants to accomplish these tasks would be distributed in the form of community engagement, education, and capacity-building grants; planning and feasibility study grants; and capital construction grants. Notably, to be selected for a grant, the bill requires that "a project shall provide the majority of project benefits to 1 or more communities of color or low-income communities" (U.S Congress, 2021). Finally, $3 billion is appropriated annually from the Highway Trust Fund for fiscal years 2022 through 2026 to fund the efforts laid out in the bill. Ultimately, the bill was folded into the Infrastructure Investment and Jobs Act, which became law in November 2021. $500 million was appropriated for a Reconnecting Communities Pilot Program, distributed between planning grants and capital construction grants (U.S. Congress, 2021).

5.3.2 Equity Inclusive Alternatives Analysis

Any alternatives analysis process that explicitly includes equity criteria should start with a recognition of any historical inequities in the planning and execution of the project in question. The level at which communities have been marginalized and discriminated against depends on the type of project that is under assessment. For our purposes, the history is clear that highway construction was detrimental to low-income communities and communities of color, both in Minnesota and across the country. This historical reality in some ways makes it easier to incorporate equity criteria into the AA process, since the actions that led to inequitable outcomes are quite clear. Through proper planning, extensive community outreach, and a commitment to social and environmental justice, public agencies can create improved AA processes that center equity.

The Federal Highway Administration (FHWA) notes in its **Road Pricing Equity Guidebook** that it is imperative that public agencies address equity issues at the earliest practical phase in project development because those who perceive inequity are likely to object to the project's implementation (Madi, Wiegmann, Parkany, Swisher, & Symoun, 2013). They make this assessment specifically as it relates to congestion pricing schemes, but it would appear to apply to any type of project. The FHWA has created equity evaluation guidelines that agencies can use to guide them through the AA process. The guidelines are shown below, taken directly from the guidebook (Madi, Wiegmann, Parkany, Swisher, & Symoun, 2013):

1. *Consider equity impacts early and throughout the project planning process*: Agencies will benefit from identifying and measuring

potential equity impacts early and throughout the process, which should lead to greater awareness and public acceptance and ultimately success of the road pricing project.

2. *Determine users potentially impacted by the proposed project as well as regional equity priorities:* Various categories of users may become impacted by a particular road pricing project. How the impacts are measured may vary with whether the proposed road pricing project impacts low-income travelers, particular ethnic groups, particular residents, and/or travelers with less access to alternative travel modes. A socio-economic analysis of an agency's and a project's regional boundaries can help identify the various demographic, socioeconomic, industry, and other system user groups potentially affected by the proposed road pricing initiative. The magnitude of road pricing equity impacts will likely influence the choice of an appropriate remediation method.
3. *Evaluate equity impacts of the base case or "no-build" alternative as well as the impact of the road pricing project*: A roadway may have a negative impact on low-income travelers or particular residents with less access to alternative modes whether or not the roadway is priced. A limited access roadway (such as a highway) may limit local connectivity and access to shopping and services. There may be externalities [such as] noise and air pollution. Part of the baseline evaluation is that, at a minimum, an agency should "do no additional harm" with a road pricing project.
4. *Consider a variety of perspectives and impacts*: Projects will likely have groups of people that benefit from the project and may have other groups that are negatively affected. Project evaluation should consider impacts on all impacted groups, not just those on lower-income people or the residents of one particular neighborhood. It is better to consider multiple origins and destinations and multiple types of potential users.
5. *Measure effects*: Utilize one of several qualitative and quantitative methodologies for measuring equity impacts. Until impacts are quantified and compared against the base, no-build case, it is difficult to fully understand how the project affects different groups.

FHWA lays out a procedure for evaluating equity at the project level, both at the beginning of a project and throughout the evaluation process. The following action items are taken directly from the FHWA guidebook (Madi, Wiegmann, Parkany, Swisher, & Symoun, 2013):

- Determine the stakeholder groups that could potentially be affected by a given project. Catalog the known concerns of the major

stakeholder groups that will be affected and make best guesses as to which kinds of equity will matter to them. Choose only the top few kinds for each stakeholder group.

- Internally, use modeling to determine impacts on the types of equity chosen for analysis. Modeling techniques may include the following: Transportation modeling, financial modeling, and environmental modeling.

- Design mitigation strategies to mitigate significant equity impacts. Hold stakeholder outreach meetings to explain the project. Explain how the project creates a net social benefit and explain the mitigation strategies to those who would perceive harm. After the stakeholders understand the system, ask for their remaining concerns about the project. Stakeholders should be engaged early in the process, but not before the first efforts at alleviating equity concerns are incorporated into the project design.

- Based on stakeholder concerns from the meeting, consider whether further mitigation strategies are warranted. Continue to work with stakeholder groups throughout project implementation to ensure that no new equity concerns arise.

There are numerous policies that agencies have implemented to mitigate negative equity effects and enhance accessibility to wider sections of the population. Some of the following policies have already been implemented by MnDOT. The following policies are taken directly from the guidebook (Madi, Wiegmann, Parkany, Swisher, & Symoun, 2013):

> **Use of revenues**: judicious use of revenues generated by a pricing project is the single most important way of mitigating equity effects. The European Union's Coordination of Urban Road User Charging Organizational Issues (CURACAO's) road pricing fact sheet reads: "Evidence suggests that the judicious use of hypothecated revenues is likely to achieve a greater improvement in equity than simply reducing the overall charge level." In order to ensure such judicious use, the agency should, foremost, hypothecate or ring-fence revenues from the project for use on transportation. Such uses may include public transportation, but also highway operations and improvements.
>
> **Vary pricing by time of day, type and location of road, vehicle type, etc.**: use of pricing that varies by location, road type, time of day, vehicle type, and other characteristics may mitigate some equity impacts of pricing projects.

Discounts/Exemptions: discounts and exemptions—in essence, varying pricing by person type—are a way of mitigating some demographic equity effects. However, such discounts and exemptions often lead to a greater need for enforcement and high administrative costs, and so should be avoided unless no other means of equity mitigation exists.

Provide payment means for the unbanked: in order to avoid creating a system where the unbanked are unable to easily participate in a pricing project, the agency should provide a means for them to pay by cash, such as top up terminals in gas stations or grocery stores.

Through the steps laid out by NEPA, the federal government has an established process for assessing the environmental impacts of proposed projects. The same cannot be said for impacts on the social environment and impacts on equity in particular.[11] In the absence of statutory or policy-based guidance for equity criteria, agencies must utilize their own resources to incorporate equity considerations into their projects. Currently, any consideration of equity impacts is at the discretion of the primary agency. MnDOT can be a leader in the equity analysis space by developing an equity framework that accounts for the social impacts of proposed projects in the same way that the EIS and AA process accounts for environmental impacts. The Racial Equity Toolkit and the FHWA Road Pricing Equity Guidebook provide examples that MnDOT can use to formulate its own equity criteria.

[11] While not law or formal policy, FHWA's *Community Impacts Assessment: A Quick Reference for Transportation* was written as a primer for transportation professionals and analysts who assess the impacts of proposed transportation projects on communities. It outlines the community impact assessment process, highlights critical areas that must be examined, and identifies the basic tools and information sources in parallel with the FHWA NEPA project development process (Grant, Morris, Strum-Gilliam, & Brown, 2018).

CHAPTER 6: DEMONSTRATION OF ALTERNATIVES ANALYSIS

This chapter draws on earlier work to inventory, screen, and recommend a series of evaluation metrics that can feasibly and effectively capture a variety of equity considerations in project evaluation. Recommended measures are subsequently demonstrated in an equity evaluation of an E-ZPass alternatives analysis that is representative of projects currently in development. The demonstration uses readily available data, analysis, and modeling to highlight opportunities to apply equity evaluation criteria in the alternatives analysis process and evaluate the equity implications of constructing an E-ZPass lane on a major corridor in the Twin Cities Metropolitan Area.

In addition to improved evaluation methods, this report also explores the role of mitigation measures that may be implemented as part of project investment for communities impacted by the project. A variety of mitigation types – several examples of which are already standard practice for MnDOT projects – may provide some effectiveness in remediating current and past harms associated with highway projects. Limitations on potential mitigation approaches resulting from existing statute or policy is also discussed.

The goal of this work is to provide modified approaches that can be implemented immediately, or through policy or legislative changes, to improve the evaluation and outcomes of E-ZPass projects in understanding and addressing disparities among people living in EJ and non-EJ communities.

About Managed Lanes

Managed lanes describe any lane or feature of a highway that uses active management to limit the eligibility to use the facility. In some cases, this management may be static, as in the case of a dedicated transit lane. More frequently, managed lanes employ dynamic management techniques, through methods like time-of-day restrictions for HOV-only eligibility, performance triggers for a dynamic shoulder, or congestion-sensitive toll rates.

In Minnesota, the most prevalent deployment of managed lanes is the E-ZPass system in the Twin Cities metropolitan area. E-ZPass lanes fall in the category of high-occupancy/toll (HOT) lanes and were formerly named MnPASS lanes. During peak periods, E-ZPass lanes are free for carpools, motorcycles, and transit vehicles, and single-occupant vehicle (SOV) drivers can use them if they have an E-ZPass account and transponder and pay a congestion-sensitive toll. E-ZPass lanes are open to all traffic during non-peak times of day.

In the past Minnesota had high-occupancy vehicle (HOV) lanes in Interstates 394 and 35W. Between 2004 and 2010 these HOV lanes were converted to HOT lanes and branded as MnPASS. Since that time the managed lane system has grown and now includes I-35E and another segment of I-35W, and has been renamed to E-ZPass. I-494 is programmed to for a project that will include the addition of E-ZPass lanes, and additional planning efforts are currently underway that include consideration of managed lanes on other highway corridors.

The demonstration evaluation references analysis completed for the I-35W North Environmental Assessment (EA) which included a MnPASS alternative. Since MnPASS was the formal name of this alternative in the EA and related project documentation, this description is used throughout the demonstration analysis described in Section 6.3

In the future, other forms of managed lanes may emerge such as transit only, electric vehicle (EV) only, truck only, or perhaps a return to HOV. The intent of the research presented in this report is that the methods can be applied to these other potential types of managed lanes in order to provide improved information about the equity implications of transportation investment decisions among potential project alternatives.

6.1 EQUITY EVALUATION METRICS

This section describes the process used to develop and select evaluation criteria and metrics for use in equity evaluations of managed lane project alternatives. These criteria and metrics are applied to an example managed lane project in in Section 6.3

6.1.1 Metric Suitability for E-ZPass Alternatives Analysis

Equity metrics for managed lanes were proposed and assessed for suitability in alternatives analysis through a four-step process:

- Identify criteria used to evaluate project alternatives in alternatives analysis.
- Propose metrics to measure the distribution of project alternative benefits and burdens.
- Assess the suitability of proposed metrics for use alternatives analysis.
- Develop and apply equity metric screening scenarios.

6.1.1.1 Identify criteria used to evaluate project alternatives in alternative analysis

The first step in the development of equity evaluation criteria was to identify criteria used in traditional alternatives analyses. This step was completed through a survey of alternatives analysis completed as part of environmental reviews of three recently completed or ongoing highway projects in the Twin Cities Metropolitan Area. These projects are:

- I-35W North Gateway
- I-494 – Airport to Highway 169
- Highway 252 and I-94 Environmental Review

The survey of alternatives analysis evaluation criteria identified 19 types of criteria in 7 broad categories. These results are presented in Table 6-1.

Table 6-1 Survey of evaluation criteria used in alternative analysis

Categories	Evaluation Criteria
Corridor throughput	Multimodal person throughput
Safety	Crashes
Mobility	Travel volume, travel time, travel time reliability, system operations
Freight movement	Freight volume, freight travel time
Transit	Transit advantages, transit ridership, transit performance, access to transit, operations & maintenance costs
Walking and biking	Traffic exposure, ped/bike infrastructure accessibility, ped/bike network connectivity
Additional considerations	Strategic alignment, impact to local roadways, financial considerations
Social, environmental, and economic (SEE) impacts	Social & economic impacts, neighborhood impacts, environmental impacts

6.1.1.2 Identify criteria used to evaluate project alternatives in alternative analysis

The second step in the development of equity evaluation criteria was to propose new and/or refined metrics to measure the distribution of project alternative benefits and burdens. Twenty-seven new of refined equity metrics were proposed under the evaluation criteria introduced in Table 1. Each metric was supported with a methodology describing how to apply the metric in the surveyed alternatives analyses.

Of the equity metrics proposed, four metrics measure the distribution of project benefits to system users. These metrics assume a user profile that assigns E-ZPass, general purpose (GP), and transit trips through the project area to TAZs based on trip origin and documented assumptions about mode choice among TAZ residents. This methodology is necessary to distinguish project users living in EJ and non-EJ communities.[12] This method represents a new analysis procedure that has not traditionally been undertaken in project evaluations and would require analytical processes to be developed and performed beyond what is included in most existing project scopes. It does, however, offer the potential to better understand the population characteristics of anticipated project users and the ability to distribute project benefits among demographic groups.

6.1.1.3 Assess the suitability of proposed metrics for use in alternative analysis

The third step in the development of equity evaluation criteria was to assess the suitability of using proposed equity metrics in an alternatives analysis. The suitability of proposed equity metrics was

[12] For the demonstration of equity evaluation methods presented in Chapter 6, the Minnesota Pollution Control Agency definition of Environmental Justice community is used as the method to identify disadvantaged communities and is described in more detail in Section 6.3.2.2. Other methods to identify disadvantaged communities may be appropriate in other project applications.

assessed in terms of feasibility, sensitivity, risk, and value. Table 6-2 explains these terms and describes how they were applied.

Table 6-2 Criteria used to assess the suitability of equity metrics in alternative analysis

Suitability criteria	Explanation	Scale
Feasibility	Assesses the feasibility of applying the metric with available data and tools	5-point scale, with Good representing a metric that can be calculated with confidence and reasonable level of effort
Sensitivity	Assesses the sensitivity of the metric to differences in project alternatives	5-point scale, with Good representing a metric that is highly sensitive to differences in project alternatives
Risk	Assesses the likelihood that stakeholders will buy into and find meaning in metric results	5-point scale, with High representing a metric that is likely to produce results that rely on uncertain or unproven methods
Value	Assesses the value of applying the metric (i.e., is the metric result likely to be actionable/relevant to decision-makers)	5-point scale, with High representing a metric that is highly likely to influence the alternatives analysis process

6.1.1.4 Deploy and apply equity metric screening scenarios

The fourth step in the development of equity evaluation criteria was to develop equity metric screening scenarios. These scenarios screen equity metrics using the suitability criteria introduced in Step 3. The following screening scenarios were used to identify metrics meeting suitability thresholds (bold text indicates adjustments in the screening thresholds relative to scenario #1):

Feasibility ≥ Good-Fair; Sensitivity = Good; Risk ≤ Med; Value = High
Feasibility ≥ Good-Fair; Sensitivity = Good; **Risk ≤ High-Med**; Value = High
Feasibility ≥ Good-Fair; **Sensitivity ≥ Fair-Poor**; Risk ≤ Med; Value = High

Equity metric screening scenario #1 applied the most rigorous screen. It identified equity metrics that scored at least “Good-Fair” on feasibility; “Good” on sensitivity; had a low, low-medium, or medium risk of stakeholder rejection; and high value. Equity metric screening scenarios #2 and #3 relax one threshold to identify additional metrics on the screening bubble. Table 6-3 identifies the equity metrics passing through each screen.

Table 6-3 Equity evaluation measures screening results

Equity Metrics	Screen #1	Screen #2	Screen #3
Number of people in EJ communities receiving transit advantages as a share of all people receiving transit advantages	●	●	●
New transit trips originating in EJ communities as a share of all new transit trips	●	●	●
Travel time savings for transit trips originating in EJ communities as a share of travel time savings for all transit trips	●	●	●
Description of how each project alternative incorporates input/involvement from EJ populations	●	●	●
Net project benefit to EJ communities compared to net project benefit to non-EJ communities	●	●	●
EZPass trips originating in EJ communities as a share of all EZPass trips*	X	●	X
Travel time savings for auto trips originating in EJ communities as a share of travel time savings for all auto trips*	X	●	X
Average travel time savings for trips originating in EJ communities compared to average travel time savings for trips originating in non-EJ communities*	X	●	X
EJ population as a share of total population living within 300 meters of roadways with changes in air and noise pollution	X	X	●
Number of parcels acquired in EJ communities compared to the total number of parcels acquired in the project area	X	X	●
Construction impacts in EJ communities compared to construction impacts in non-EJ communities	X	X	●

Notes: ** Assumes a user profile. User profiles require additional analysis to determine the demographic characteristics of corridor users and distribute project benefits to demographic groups.*

As illustrated above, five equity metrics were found suitable for use in alternatives analysis in screening scenario #1. An additional six metrics were found suitable for use in alternatives analysis under relaxed screening scenarios. Having identified a universe of suitable equity metrics, the next step in the process was to organize the metrics under equity evaluation criteria recommendations.

6.1.2 Equity Evaluation Criteria and Metric Selection

Equity evaluation criteria selections were developed by relating equity metrics to broader equity goals. The following equity goals in Table 6-4 were identified for this exercise based on stakeholder input and experience in recent projects. Each equity goals is paired with one or more metrics from the inventory that addresses the project impacts described by the goal. These measures are then related to their rankings in the screening procedure described in Subsection 6.1.1. For those that did not pass the screening procedure, they are not necessarily inappropriate for use in a project evaluation, however analysts should be cognizant of additional risk and qualify analysis results accordingly.

Table 6-4 Equity goals and associated evaluation metrics

Equity Goals	Evaluation Metric	Screening Result / Application Concerns
Improve the accessibility of EJ populations to jobs, goods, and services	Additional jobs accessible to EJ communities as a share of additional jobs accessible to all communities (auto only).	Did not pass screen (Value = High-Med) Metric does not measure access to jobs for households without motor vehicles.
Improve the safety of trips taken by EJ populations on local roadways and freeways	Severe highway crashes avoided for trips originating in EJ communities as a share of the total severe highway crashes avoided.	Did not pass screen **High risk** due to limited data on safety performance for E-ZPass compared to other alternatives
	Severe intersection crashes avoided in EJ communities as a share of all severe intersection crashes avoided.	Did not pass screen Ability to differentiate between alternatives considered **Fair** as there are often minimal differences among local road forecasts
Improve air quality and noise in EJ communities	EJ population as a share of total population living within 300 meters of roadways with changes in air and noise pollution.	Passed 1 screen No major concerns
Expand the availability of convenient, reliable, and affordable transportation options in EJ communities	Number of people in EJ communities receiving transit advantages as a share of all people receiving transit advantages.	Passed all screens
	New transit trips originating in EJ communities as a share of all new transit trips.	Passed all screens
	Travel time savings for transit trips originating in EJ communities as a share of travel time savings for all transit trips.	Passed all screens
	Ratio of average frequency of on-time performance for transit routes serving TAZs with majority EJ populations to average frequency of on-time performance for all transit routes serving the EZ Pass travelshed.	Did not pass screen **High-Med risk** reflecting additional analysis complexity associated with transit reliability estimation which is not frequently evaluated for E-ZPass projects
	Number of people in EJ communities living within 1/2 mile of high frequency transit.	Did not pass screen Ability to differentiate between alternatives considered **Fair** as there are typically not differences in transit routes or service among alternatives

As shown in Table 6-4, evaluation metrics have been identified that can address the equity goals. For each equity goal, at least one metric is available that either pass the screen or does not pose any major concerns for implementation. In sum, the high-performing measures that address equity goals in Table

6-4, along with measures passing the screens in Table 6-3, provide a valuable contingent for use in project alternatives evaluation. The set of metrics best representing these characteristics include the following.

- Number of people in EJ communities receiving transit advantages as a share of all people receiving transit advantages.
- New transit trips originating in EJ communities as a share of all new transit trips.
- Travel time savings for transit trips originating in EJ communities as a share of travel time savings for all transit trips.
- EJ population as a share of total population living within 300 meters of roadways with changes in air and noise pollution.
- Additional jobs accessible to EJ communities as a share of additional jobs accessible to all communities (auto only).
- Severe intersection crashes avoided in EJ communities as a share of all severe intersection crashes avoided.
- Person throughput generated from trips originating from EJ communities as a share of total person throughput (peak hour and direction).
- Net project benefit to EJ communities compared to net project benefit to non-EJ communities
- Description of how each project alternative incorporates input/involvement from residents of EJ communities.

In addition to the measures listed above, it may also be beneficial to utilize one or more measures that utilize the corridor user profile. This method involves estimating the project users among EJ and non-EJ populations to understand the distribution of user benefits. Measures that utilize the project user profile include:

- Severe highway crashes avoided for trips originating in EJ and non-EJ communities.
- Managed lane trips originating in EJ communities as a share of all managed lane trips.
- Travel time savings for auto trips originating in EJ communities as a share of travel time savings for all auto trips.
- Average travel time savings for trips originating in EJ communities compared to average travel time savings for trips originating in non-EJ communities.

As noted previously in this section, use of the user profile introduces additional analysis effort as well as methodological risk due to a lack of data about the individual characteristics of actual users. However, since the most significant differences between E-ZPass and likely alternatives are operational and primarily experienced by corridor users, these measures may provide more meaningful comparison of alternatives.

6.2 MITIGATION OF SOCIAL, ECONOMIC, AND ENVIRONMENTAL IMPACTS

6.2.1 Mitigation Introduction

This chapter explores the concept of mitigating the social, economic, and environmental impacts of transportation project to improve project equity. Mitigation, in this context, describes the practice of including enhancements in a project investment to benefit adjacent communities to provide additional benefits since those that live along a highway may be less likely to benefit directly from the primary function of the project. Mitigations can serve as a way of acknowledging and redressing past harms and ongoing externalities associated with the presence of a major highway facility in the community.

6.2.2 Application

Recent projects suggest that it has become MnDOT practice to include local enhancements as part of project design. Common features include pedestrian bridges, local ADA improvements, improved transit stops, and other types of infrastructure that support walking, bicycling, transit use, and multimodal accessibility. Furthermore, this practice is not limited to E-ZPass deployments but is seen on a range of highway projects. As a result, equity driven mitigations are unlikely to differentiate alternatives (a Section 6.1 rating criteria). Nonetheless, there is value in acknowledging that adjacent communities often receive benefits from project elements that complement the primary function of the project.

In the context of transportation equity, a natural and appropriate evolution of this practice would be to place more emphasis on prioritizing these types of enhancements in majority-EJ communities. Based on the result in the Section 6.1 screening showing that the metric "Description of how each project alternative incorporates input/involvement from EJ populations" was highly rated, designing potential mitigation in direct response to input from neighboring EJ communities is seen as the best path to improving equitable outcomes.

6.2.3 Future Considerations

A potential opportunity that is unique for managed lanes is the use of E-ZPass toll revenues as a funding mechanism for mitigation of project and/or transportation system impacts. Indeed, the availability of an ongoing funding sources presents opportunities to consider mitigations that extend beyond capital infrastructure to recurring investments in the community.

This approach was explored by UCLA researchers and presented in the paper *The political calculus of congestion pricing* (King, Manville, & Shoup, 2007). In this work, the authors posit that the cities through which highways pass are the strongest claimants to toll revenue generated by the highway. The rationale for this is that the expected revenue generation may make the highway more palatable to the city. Additionally, revenues may then be distributed by the cities receiving them, which can be done to achieve progressive results, particularly for those negatively impacted by the presence of the highway.

A spectrum of mitigation programs funded on an ongoing basis might include:

- Only MnDOT "products", specifically subsidized E-ZPass transponders and account stipends
- Other transportation benefits such as subsidized transit passes and shared mobility vouchers
- Non-transportation benefits such education scholarships, healthy nutrition options, job training or ESL programs, and childcare subsidies

In addition, managed lane toll revenue could be used to fund capital improvements that provide benefits for neighboring communities. Examples include:

- Enhanced transit service
- Bike lanes on adjacent facilities
- EV charging stations
- Sound walls

Current statute imposes very narrow restrictions on the use of toll revenues to repay the capital investment of E-ZPass facilities and secondarily to support operations costs. As a result, legislative changes would be required to enable these types of mitigations to be funded with toll revenues. Thus, such statutory changes may be needed to provide additional tools that can improve equitable outcomes of E-ZPass projects. In the absence of statutory changes, consideration of other funding mechanisms to provide innovative mitigations may merit further consideration.

Revenue from HOT lanes is currently dedicated to paying for operations and maintenance expenses of the facilities themselves. Any excess may then be used for any Federal Title 23 or 49 eligible expense. This permits its use it for most kinds of transportation related projects. However, non-transportation projects like housing, parks, and small business would be difficult outside of some specific relationship to transportation.

Future research should explore whether any congestion pricing or other toll project has implemented a system that distributes toll revenues to the cities highway pass through. If any are identified, the economic and political impacts should be explored to gauge whether such a system be implemented in Minnesota. Ultimately, legal, political, and institutional issues would need to be addressed. A potential starting point for this would be to survey the current receptivity of this approach among city, regional, and state decisionmakers in Minnesota.

6.3 EQUITY DEMONSTRATION EVALUATION OF I-35W NORTH

6.3.1 Project Description

The I-35W North MnPASS project was conducted by MnDOT to explore improvements along a 12-mile stretch of the interstate between Roseville and Lino Lakes, Minnesota. The goals of the project included reducing congestion, increasing highway safety, and providing long-term, sustainable travel options for motorists and transit. As part of the Environmental Assessment (EA) prepared for this project, an extensive alternatives analysis (AA) was conducted. The build alternatives that were analyzed included

the addition of one general purpose lane, one MnPASS lane, or one HOV lane in each direction in the project area. The analysis incorporated numerous transportation performance measures to compare the outcomes of each alternative against the project goals, including traffic operations, travel time reliability, corridor person throughput, transit ridership, and benefit-cost analysis. The alternatives analysis concluded with the selection of MnPASS as the preferred alternative, which was ultimately carried forward in the EA and constructed in 2019 through 2021. Figure 6-1 illustrates the project extents, project area communities, and intersecting roadways. Additional information can be found on MnDOT's project website: https://www.dot.state.mn.us/metro/projects/35wnorthmnpass/

Figure 6-1 Map of I-35W North project area

The previous design of I-35W in the project area was primarily a six-lane freeway (three lanes in each direction) with a wide ditch median. All of the build alternatives considered in the alternatives analysis would expand I-35W by one lane in each direction by constructing new lanes in the median space as illustrated in Figure 6-2. The three build alternatives included the same increase in lane-miles and new pavement area.

The difference between the build alternatives is how the newly constructed lanes would be operated. Under the General Purpose alternative, the new lanes would be open to all traffic at all times of day and would have no restrictions relative to the existing lanes. The MnPASS alternative would operate the new lanes a high occupancy/toll (HOT) lanes during the peak periods in the peak direction, which is southbound from 6 to 9 am and northbound from 3 to 6 pm. The HOT lanes would be accessible for free to carpools and transit vehicles, and single-occupant vehicle (SOV) drivers would be eligible if they own a transponder and are willing to pay a congestion-sensitive toll. The HOV alternative is largely similar to the MnPASS alternative but allows only HOV and transit vehicles to use the lanes and does not include the SOV toll option. The existing six lanes of I-35W in the project area would remain general purpose lanes open to all traffic under the MnPASS and HOV alternatives.

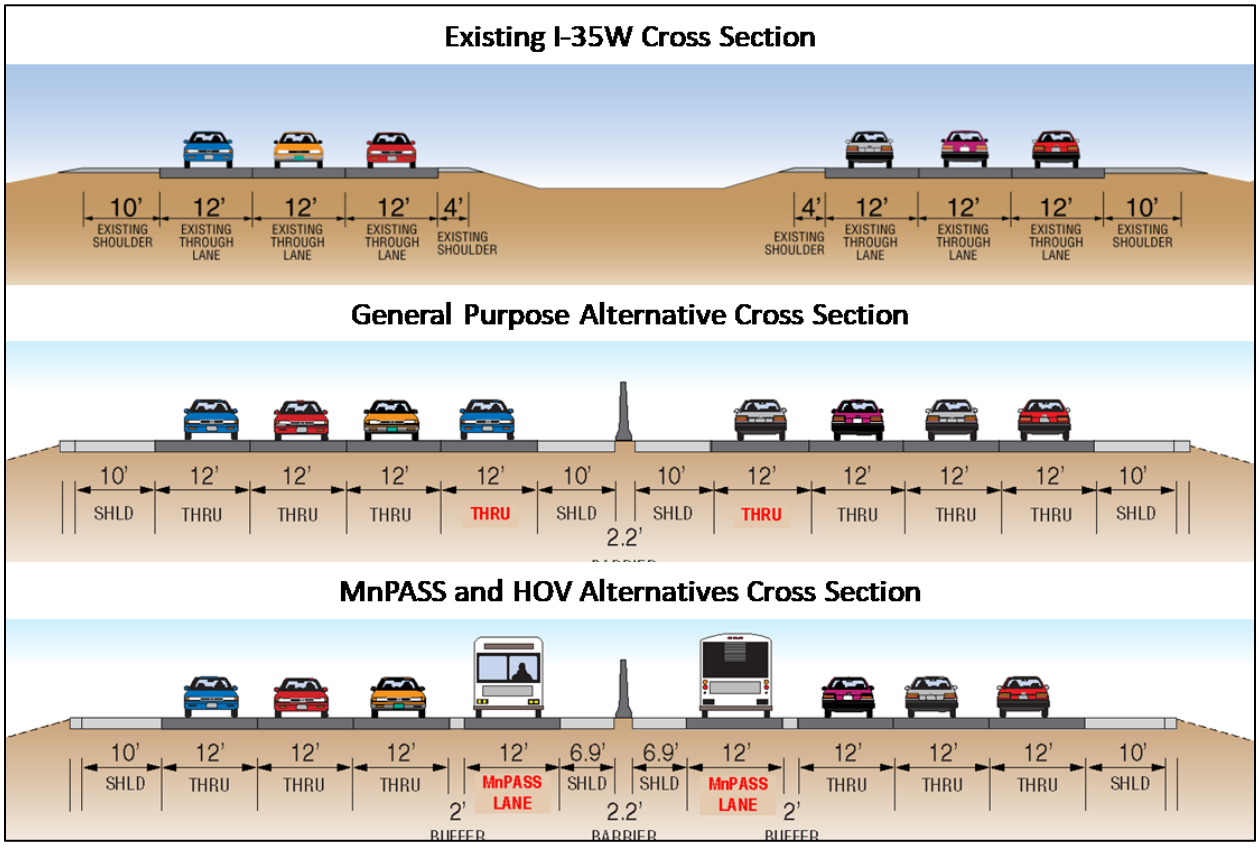


Figure 6-2 Cross section of I-35W North MnPASS alternatives

The project alternatives referenced in this demonstration evaluation are those that add one General Purpose lane or one MnPASS lane in each direction. They are referred to as the General Purpose and MnPASS alternatives, respectively, through the remainder of this report.

6.3.2 Equity Evaluation Methods

All quantitative results reflect year 2040 conditions and were estimated using the Metropolitan Council's four-step regional travel demand model as prepared for the I-35W North MnPASS Environmental Assessment in 2015. It should be noted that this model is no longer in use, as the Metropolitan Council has replaced it with its Activity-Based Model (ABM). However, all of the methods described in section are understood to be equally feasible in the current ABM as is demonstrated using the older, four-step model.

In addition, some of the measures here also referenced transportation performance measures generated from other models and tools utilized in the I-35W North project. These include CORSIM freeway microsimulation models and a predictive travel time reliability analysis tool. Many current corridor projects considering MnPASS alternatives include these types of analysis tools alongside forecasts generated using the travel demand model. Analysts intending to implement the methods described below will benefit from considering the data and formats needed for each measure and ensure that the transportation models and tools used in a project are employed to produce the necessary results.

6.3.2.1 Data Sources

Census Data – population information from US Census Bureau was incorporated into the analysis at the block group level.

Regional Travel Demand Model – the Metropolitan Council utilized its four-step model in use at the time of the I-35W North project development. Important components of this model referenced in the demonstration evaluation included:

- **2040 highway and transit networks** – representations of the roadway system and transit service that reflect anticipated year 2040 conditions
- **Zonal employment and population data** – the seven-county metropolitan area is segmented into 1,201 transportation analysis zones (TAZ). Each zone contains the portion of the region's population, households, and jobs projected to be located within its boundaries in year 2040.
- **Year 2040 model run results developed for the I-35W North Project in June 2015** – model runs performed as part of the original alternatives analysis provide forecasts of highway and transit travel under each of the project alternatives.
    - **Output: Origin-Destination (OD) tables** – travel demand model data is frequently expressed in OD tables, which are large matrices with origin zones represented by each row and destination zones represented by each column. These tables can be used to store information about transportation characteristic between each individual OD zone pair, such as number of trips, travel time, travel distance, etc.

- **Output: Traffic volumes** – the model run process also produces highway networks with the forecast traffic flows assigned to each link of the highway system. These provide estimates of year 2040 traffic volumes and can be disaggregated at the hourly, peak period, or daily levels.

6.3.2.2 Socio-Economic Analysis

Census block group data was used to identify block groups for EJ and non-EJ communities. The definition of environmental justice community was referenced from the Minnesota Pollution Control Agency (MPCA) website https://www.pca.state.mn.us/about-mpca/mpca-and-environmental-justice.

> *The agency considers a census tract to be an area of concern for environmental justice if it meets one or both of these demographic criteria:*
>
> - *The number of people of color is greater than 50%; or*
> - *More than 40% of the households have a household income of less than 185% of the federal poverty level*
>
> *Additionally, the MPCA considers communities within Tribal boundaries as areas of concern. This is an initial first step to identify areas where additional consideration or effort is needed to evaluate the potential for disproportionate adverse impacts, to consider ways to reduce those impacts, and to ensure meaningful community engagement as described in MPCA's environmental justice framework.*

Next, the census block groups were spatially related to TAZ that provided the closest representation of its location and coverage. This was completed using GIS to identify the best match. In some instances subjective judgments were necessary to distribute census block groups to the TAZ(s) that most closely reflect the block group's access to the transportation network.

It is noteworthy that the spatial characteristics of many TAZs and census block groups are not well aligned, resulting in some areas with partial coverage or multiple block groups associated with a single TAZ. Future evaluations using these methods may wish to utilize a TAZ system more closely aligned with census block groups to capture the transportation characteristics of EJ and non-EJ communities more accurately.

6.3.2.3 Transportation Analysis

This section describes several distinct technical steps that must be performed to produce the data inputs needed to produce the various equity metrics. These are described in the following paragraphs.

Highway Assignment: Calculate the shortest vehicle travel time between each OD pair and multiply by the number of trips to compute VHT. VMT is done similarly using OD trips multiplied by the route

distance. Summarize VMT and VHT for the presumed "home zone" by aggregating for origin zones in the morning and destination zones in the afternoon/evening.

Transit Assignment: Run the highway assignment module of the travel demand model for the General Purpose and MnPASS alternatives. Compare the number of transit trips originating in each TAZ under General Purpose and MnPASS alternatives. Calculate total person transit travel time between each OD pair and multiply by the number of transit trips to estimate passenger hours traveled (PHT). Summarize PHT for the presumed "home zone" by aggregating to production zones.

Identify Roads with +/-5% Volume Change: Compare loaded highway networks for General Purpose and MnPASS alternatives to compute the difference in daily volume. Filter the result to create a network that contains only links with an absolute daily volume change greater than 5%. Prepare a shapefile with roadway links with daily delta of ≥5% between alternatives.

Identify I-35W Trips: Perform a select link analysis along entire I-35W project to produce a trip table of corridor trips. Identify the number of non-toll SOV, non-toll HOV, toll SOV, and toll HOV trips originating in each TAZ using I-35W in the AM peak. Identify the number of non-toll SOV, non-toll HOV, toll SOV, and toll HOV trips destined for each TAZ using I-35W in the PM peak.

Accessibility Within 30 Minutes by Auto: Identify shortest vehicle travel time between each OD pair and remove the OD pairs with a travel time greater than 30 minutes. Calculate the total number of jobs available in the destination zones accessible within 30 minutes from each TAZ.

Benefits Analysis: Complete benefit analysis using MnDOT's benefit-cost analysis (BCA) method for EJ and non-EJ population using TAZ-level VMT and VHT summaries from the ***Highway Assignment*** step.

Corridor Throughput: Summarize change in person throughput by trips from EJ vs. non-EJ communities from the ***Identify I-35W Trips*** step.

These analysis steps become inputs to one or more of the equity metrics. Table 6-5 shows this relationship, both in terms of the inputs required for each metric and inputs utilized among multiple equity metrics.

Table 6-5 Transportation analysis steps and equity metrics

Analysis Step	Equity Metric							
	Transit Advantage	New Transit Trips	Transit Travel Time Savings	Changes in Air and Noise Impacts	Job Accessibility	Local Road Safety	Corridor Person Throughput	Project Benefits
Highway Assignment					X			X
Transit Assignment	X	X	X					
Identify Roads with +/-5% Volume Change				X		X		
Identify I-35W Trips							X	
Accessibility					X			
Benefits Analysis						X		X
Corridor Throughput							X	

6.3.3 Analysis Results

The results of the demonstration evaluation are presented for each equity metric in the sections that follow. For each measure evaluated in the demonstration, the following items are summarized:

- Definition
- More detailed description of what is used to produce the measure and how it should be interpreted
- Evaluation Measure Results
- Assessment of Demonstration Findings including the feasibility, sensitivity, risk, and value
- Results discussion

6.3.3.1 Transit Advantage

Definition: Number of people in EJ communities receiving transit advantages as a share of all people receiving transit advantages.

Transit advantage is a somewhat qualitative measure in the sense that a project alternative either provides an advantage or it does not. This is determined by observing whether the transit travel time(s) from a home TAZ either went up, went down, or did not change between alternatives. The goal is to identify those that changed between alternatives, and then assess the share of the positive/negative changes among EJ and non-EJ communities. Figure 6-3 shows the change in transit advantages between the General Purpose and MnPASS alternatives among EJ and non-EJ block groups.

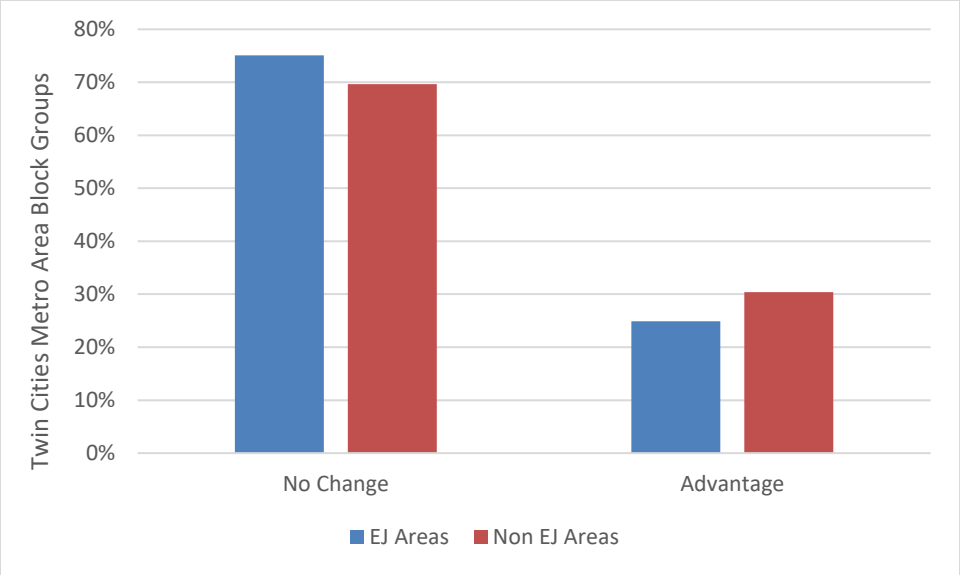


Figure 6-3 Distribution of transit advantages between the general purpose and the MnPASS alternatives

Findings

- **Feasibility** – High, the demonstration shows that existing travel demand models have the capability of producing this measure.
- **Sensitivity** – Medium, this measure is only as good as the data that was input into the travel demand model or other forecasting tool (e.g. STOPS model). The ABM does not intrinsically adjust transit route run times based on highway congestion, so this is a manual user input. Additional effort is required to identify transit routes with run times impacted by the alternative, estimate the run time changes, and modify transit input data accordingly. The role of the model is to determine the origin zones that utilize affected transit routes and their contribution to transit travel times for each zone. In sum, the sensitivity is dictated by the user transit run time inputs. Additionally, for communities served by many transit routes, the impact of a transit advantages on routes using a single corridor may get washed out.
- **Risk** – Medium-Low, this is a measure of the transit advantages available to given communities but is not dependent on estimates of the extent that it is used. On the one hand, this is low risk because the transit advantages associated with an alternative design are typically well understood and this measure avoids the uncertainty associated with transit ridership forecasting.
- **Value** – Medium, measure provides an indication of the spatial distribution of transit travel time improvements. It is limited, however, because it does not quantify the magnitude of the savings or how many riders are affected. Depending on the context of the project being evaluated, the importance of changes amongst alternatives may get washed out in communities with more substantial transit service.

Results discussion – this measure offers a meaningful and reliable indication of the distribution of transit advantages among EJ and non-EJ communities. This can provide important value to an alternatives analysis to gauge whether designs are equitable in this regard. However, some stakeholders may find this measure insufficient since it does not capture the extent to which those transit advantages are ultimately utilized

6.3.3.2 New Transit Trips

Definition: New transit trips originating in EJ communities as a share of all new transit trips.

New transit trips is a quantitative measure of forecast transit ridership growth that reflects impacts of project alternatives at the mode choice level. Increases in transit ridership may result from improvements in transit travel times and/or increases in travel times of other modes. For the I-35W project, transit travel times improve under the MnPASS alternative due to the free flow transit service provided by the MnPASS lanes on I-35W. The resulting increase in ridership was distributed among EJ and non-EJ communities. Figure 6-4 shows the change in transit trips between the General Purpose and MnPASS alternatives among EJ and non-EJ block groups.

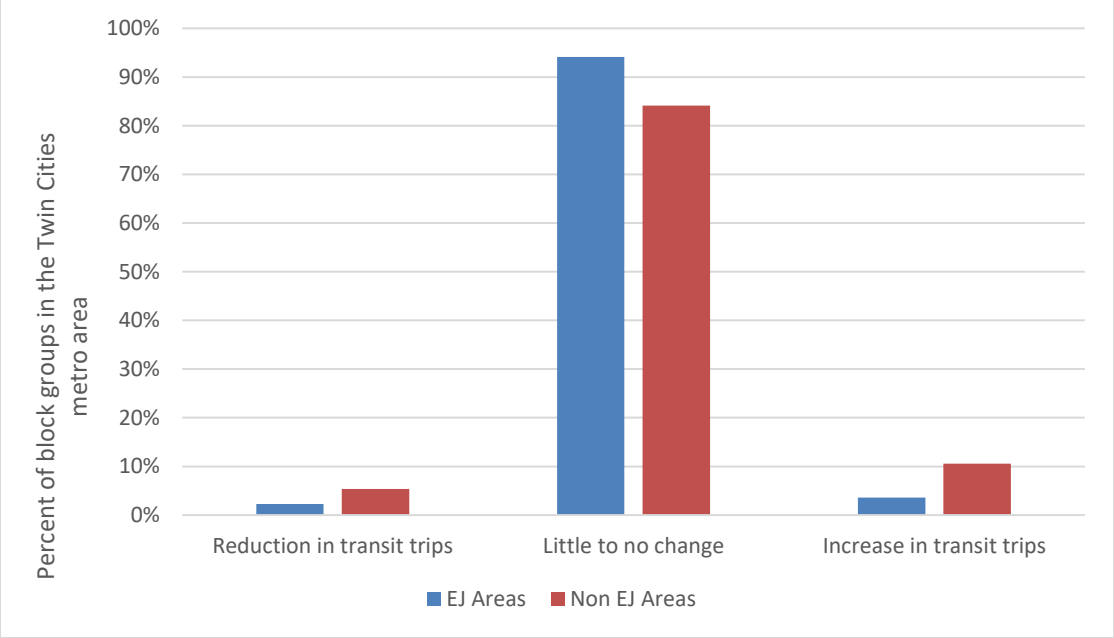


Figure 6-4 Distribution of new transit trips between general purpose and MnPASS alternatives

There is an overall increase in transit trips between the General Purpose and MnPASS alternatives. Table 6-6 summarized the total number of transit trips originating from EJ and non-EJ communities for each alternative as well as the change in new transit trips.

Table 6-6 Results – Transit ridership changes

	Transit Trips under GP Alternative	Transit Trips under MnPASS Alternative	New Transit Trips
EJ communities	17,909 18.23%	17,930 18.17%	21 4.7%
Non-EJ communities	80,330 81.77%	80,759 81.83%	429 95.3%
Total	98,239	98,689	450

Findings

- **Feasibility** – High, the demonstration evaluation shows that new transit trips can be associated with specific communities and summarized by trips originating in EJ and non-EJ communities.
- **Sensitivity** – Medium, the overall magnitude of new transit trips is relatively small in the context of overall travel on the transportation network. In addition, the small number of trips is spread over a large number of TAZs, resulting very small numbers of trips associated with any given TAZ. This has the effect of diluting the impact to any individual community.
- **Risk** – Medium-High, owing to the sparse distribution of new transit trips among individual TAZs, any forecast involving small numbers is subject to high levels of uncertainty. Basing important transportation investment decisions on small numbers with this level of uncertainty introduces substantial risk.
- **Value** – Medium-High, understanding the users of a transportation project and the characteristics of their communities can be tremendously beneficial to project decision making.

Results discussion – quantifying new transit riders and summarizing by characteristics of the communities where they live offers an important input to transportation decision making. The demonstration suggests there is strong value in this measure and high feasibility. Analysts implementing this measure, however, should be cognizant that this metric possesses some liabilities in the form of modest sensitivity to changes and risk of uncertainties from small numbers.

6.3.3.3 Transit Travel Time Savings

Definition: Travel time savings for transit trips originating in EJ communities as a share of travel time savings for all transit trips.

Transit travel time savings is a quantitative measure of the magnitude of transit travel time savings experienced by travelers from EJ and non-EJ communities. This measure is a reflection of two factors: 1) the magnitude of transit travel time reductions, and 2) the number of transit riders. The metric is computed by multiplying the ridership in each census block group by the travel time savings to get PHT savings, then aggregating the block groups by EJ and non-EJ communities. Figure 6-5 shows the change in transit travel times between the General Purpose and MnPASS alternatives among EJ and non-EJ block groups.

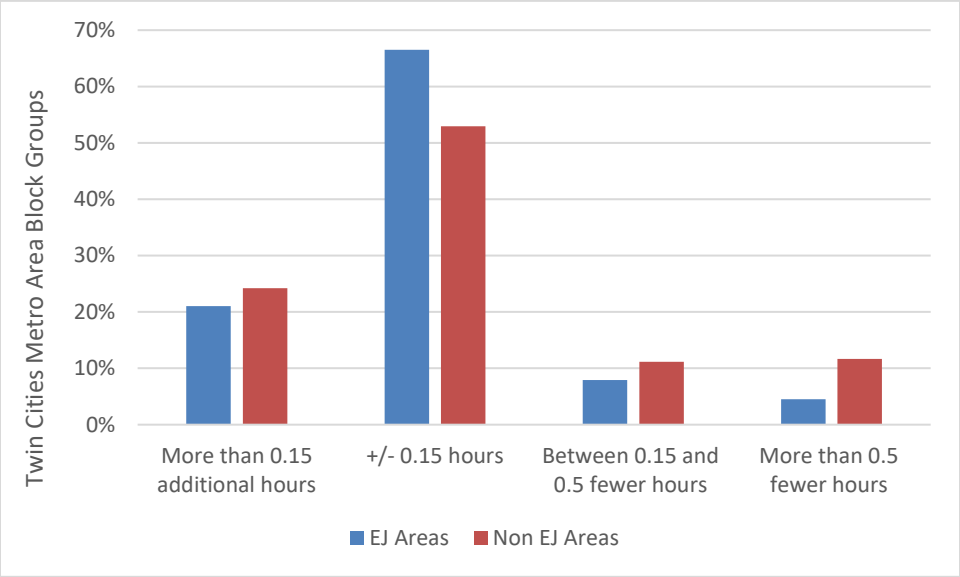


Figure 6-5 Change in transit PHT between general purpose and MnPASS alternatives

There is an overall decrease in transit time between the General Purpose and MnPASS alternatives. Table 6-7 summarized the total transit time for trips originating from EJ and non-EJ communities for each alternative as well as the change in total transit travel time.

Table 6-7 Results – Change in transit person-hours traveled (PHT)

	Transit PHT under GP Alternative	Transit PHT under MnPASS Alternative	Change in Transit PHT
EJ communities	103,132 30.1%	103,130 30.1%	-2 3.1%
Non-EJ communities	239,042 69.9%	238,988 69.9%	-54 96.9%
Total	342,174	342,118	-56

Findings

- **Feasibility** – High, the demonstration evaluation shows that new transit trips can be associated with specific communities and summarized by trips originating in EJ and non-EJ communities.
- **Sensitivity** – Medium, the magnitude of transit travel time savings from a managed lane project may be small relative to overall transit trip times. As a result, the difference between alternatives can be easily diluted, producing changes that appear small relative to more direct project impacts.
- **Risk** – Medium, owing to the potential for small changes in transit travel times, this metric poses some risk of uncertainty in results. However, since the changes driving this measure are more

weighted towards transit travel times rather than distribution of ridership, the risk is lower than the new transit trips metric.

- **Value** – Medium-High, transit travel time savings is a direct and quantifiable project impact, and as such offers good value to the decision-making process. For example, results can be combined with other user benefits as part of a benefit-cost analysis.

Results discussion – transit travel time savings is a valuable equity metric for transportation investment decision making. It has high feasibility and the ability to monetize this metric adds to its favorability. Use of this measure should be tempered by potential moderate sensitivity to managed lane alternatives and the presence of risk from uncertainty associated with very small changes in the travel demand model.

6.3.3.4 Changes in Air and Noise Impacts

Definition: EJ population as a share of total population living within 300 meters of roadways with changes in air and noise pollution.

This metric captures all roadway segments with a change in daily volume of more than +/- 5 percent between alternatives. A 300-meter buffer was applied and then the buffer areas were intersected with census block groups. In this way, a roadway segment may map to more than one census block group if it crosses the border or is located within 300 meters of a border. Similarly, a single census block group may contain roadways with both volume increases and decreases for a specific alternative. The goal of this measure is to look at the overall distribution of roadways with a change in daily volume to see if those with increases or decreases are disproportionately distributed among EJ and non-EJ communities as an indicator of air emissions impacts. Figure 6-6 shows the distribution of volume changes between the General Purpose and MnPASS alternatives on roadway segments in EJ and non-EJ communities.

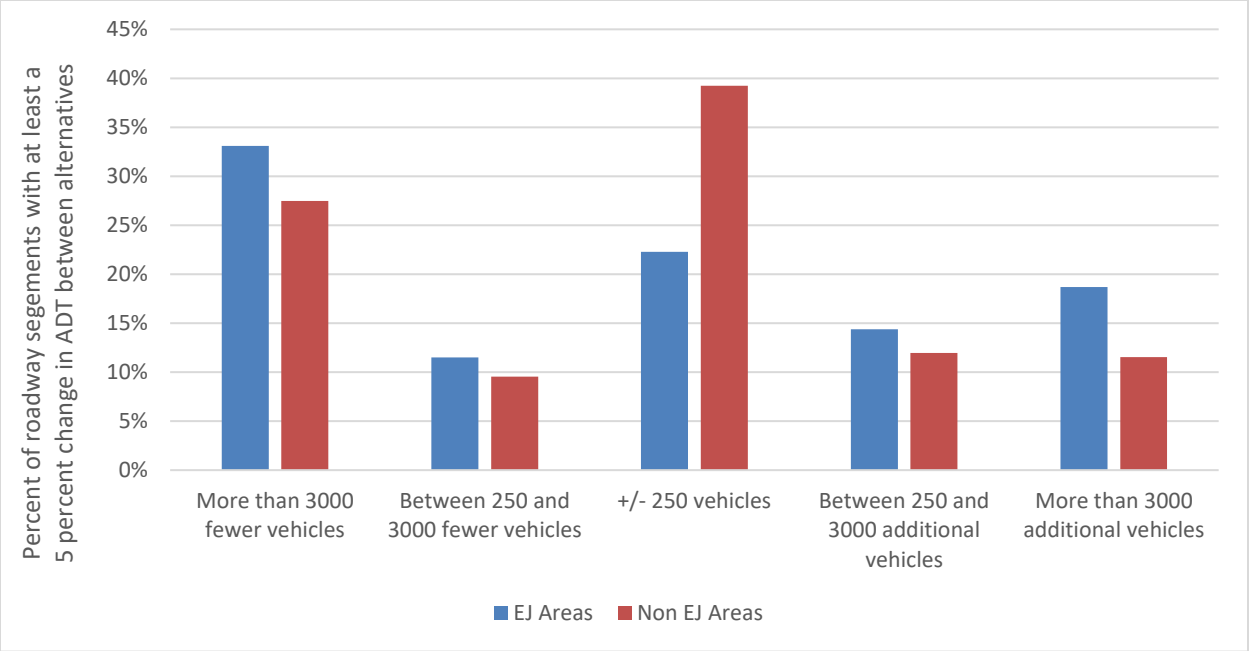


Figure 6-6 Distribution of traffic volume changes between general purpose and MnPASS alternatives

There were found to be 100 block groups that had an absolute change in volume of five percent or greater between General Purpose and MnPASS alternatives. Table 6-8 summarizes the total number of residents living in these block groups that have been defined as EJ and non-EJ communities.

Table 6-8 Results – Communities populations by changes in daily traffic

	Number of block groups containing segments with a +/- 5% change in ADT	People living in block groups with a net DESCREASE in traffic volume	People living in block groups with a net INCREASE in traffic volume
EJ communities	15	8,706 20%	10,209 18%
Non-EJ communities	85	34,442 80%	47,805 82%
Total	100	43,148	58,014

Findings

- **Feasibility** – High-Medium, the demonstration evaluation was successful in producing this metric. There is some uncertainty whether the +/-5 percent threshold is appropriate for this application, and whether the travel demand model provides the precision at this threshold.

- **Sensitivity** – High-Medium, the metric demonstrated good aptitude for capturing traffic volume changes on several types of roads with a variety of traffic volumes.
- **Risk** – Medium-Low, forecasting of daily traffic volumes is a primary function of the ABM, and is generally reliable on higher-volume roadways. Forecasts on lower-volume roadways may be more volatile, however these facilities do not contribute as significant of externalities in regards to air and noise pollution.
- **Value** – High, impacts from air quality in particular has been an intense focus for environmental justice communities impacted by highway projects. This measures offers significant value to better quantify and compare those impacts among EJ and non-EJ communities.

Results discussion – this equity metric offers high value, has better-than-average feasibility and sensitivity, and relatively little downside risk. It can be confidently implemented in future project applications, provided the analyst confirms that minor changes on lower-volume roadways does not unduly influence results.

6.3.3.5 Job Accessibility by Auto

Definition: Additional jobs accessible to EJ communities as a share of additional jobs accessible to all communities (auto only).

Job accessibility has become a popular measure for measuring the ability of the transportation system to allow travelers to reach desired destinations within a fixed amount of time, in this case the number of jobs within 30 minutes. Additional types of accessibility analysis have been proposed to consider other destinations – such as education, fresh food, and healthcare – and using other modes, like transit, walking, and biking. The method shown here could be broadened in the future to capture these outcomes as well.

It is important to distinguish accessibility as it has been defined here from other uses of the term accessibility in transportation. This definition of accessibility describes the quantity of destinations a traveler can access using the transportation system. This differs from accessibility when used in the context of the Americans with Disabilities Act (ADA) which establishes design standards for transportation facilities to ensure they can be used by people with disabilities. While this is a very important aspect of equity in transportation, it is separate from the type of accessibility evaluated in this demonstration.

Figure 6-7 shows the distribution of changes in job accessibility between the General Purpose and MnPASS alternatives on roadway segments among EJ and non-EJ communities.

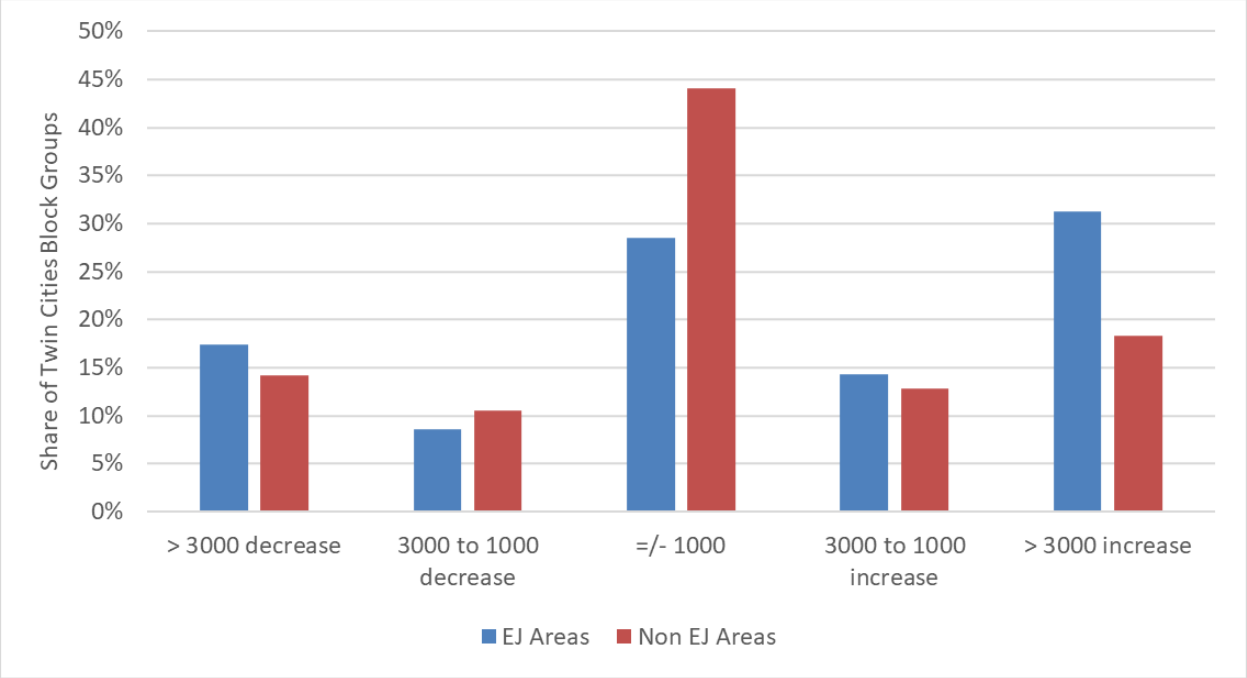


Figure 6-7 Distribution of changes in job accessibility between general purpose and MnPASS alternatives

Block groups defined as EJ and non-EJ communities were found to have both increases and decreases job accessibility between the General Purpose and MnPASS alternatives. Table 6-9 summarizes the number of block groups by change in job accessibility. It also provides the percentage of the change in block groups at each level of change in job accessibility.

Table 6-9 Results – Change in job accessibility between general purpose and MnPASS alternatives

	Number of Block Groups by Change in Job Accessibility					
	>3000 Decrease	**3000 to 1000 Decrease**	**<1000 Change**	**1000 to 3000 Increase**	**>3000 Increase**	**Total**
EJ Communities	77	38	126	63	138	442
Non-EJ Communities	233	173	724	211	300	1641
Total	310	211	850	274	438	2083
EJ Communities Percent of Total	25%	18%	15%	23%	32%	21%

Findings

- **Feasibility** – High, the analysis demonstrates it is feasible to estimate job accessibility for project alternatives using the travel demand model.

- **Sensitivity** – High, the demonstration analysis shows good sensitivity to changes in job accessibility resulting from the project alternatives.
- **Risk** – Medium-High, accessibility is a measure that captures the ability of the transportation system to provide a trip to desired destinations within a specific time threshold. However, it is not a reflection of how the system is actually used and the extent to which travelers take advantage of it for the specific purpose (i.e., travel to work). Therefore, this measure poses some risk that an analysis may show strong accessibility benefits to EJ communities, but is no guarantee that those benefits will be realized by members of disadvantaged communities.
- **Value** – Medium-High, accessibility offers a valuable lens on how improved travel opportunities of a transportation investment are distributed among geographic areas. It is an objective measure in the sense that it can be well-validated with real-world data and is less prone to accumulation of errors based on unrealistic assumptions.

Results discussion – accessibility is gaining favor in the transportation profession as there is an increasing appreciation for what a transportation system *accomplishes*, not just how it *operates*. Accessibility captures the ability of travelers' ability to reach desired destination, thereby offering access to opportunity. As such it is important to understand how changes in accessibility are distributed among EJ and non-EJ communities.

6.3.3.6 Local Road Safety

Definition: Severe intersection crashes avoided in EJ communities as a share of all severe intersection crashes avoided.

Local (non-freeway) roadways with a change in daily volume of more than +/- 5 percent between alternatives. Roadway segments meeting this volume change threshold were intersected with census block groups. A roadway segment may map to more than one census block group if it crosses the border. Similarly, a single census block group may contain roadways with both volume increases and decreases for a specific alternative. The change in volume is then used to estimate annual crashes based on statewide averages for crashes based on traffic exposure. The goal of this measure is to look at the overall distribution of increases or decreases in expected crashes on local roadways based on change in daily volume to see if they are disproportionately distributed among EJ and non-EJ communities as an indicator of local traffic safety. Table 6-10 shows the distribution of monetized crash cost savings between the General Purpose and MnPASS alternatives on local roads located in EJ and non-EJ communities.

Table 6-10 Results – Local road crash cost savings (dollars per day)

Community Characteristics	General Purpose Alternative	MnPASS Alternative	Difference
EJ Communities	$223,138	$219,318	-$3,820
Non-EJ Communities	$2,018,896	$1,987,681	-$31,215
Total	$2,242,034	$2,206,999	-$35,035
Percent of Total Crash Costs in EJ Communities	9.9%	9.9%	10.9%

Findings

- **Feasibility** – Medium-High, this measure was successfully demonstrated using highway assignment outputs from the regional travel demand model.
- **Sensitivity** – Medium-High, this method is a continuous variable that easily aggregates to the community level, allowing for objective comparison at various geographic levels. It can also account for relatively small changes in local road traffic volumes between alternatives, provided model outputs are considered stable and reliable.
- **Risk** – Medium, there are some risks associated with this method. First, the approach of using statewide average crash rates to estimate changes in crashes may not capture unique characteristics of specific roadways in the project influence area that may have higher or lower crash histories. Second, driver behavior on trips using local roadways as a diversion route off of larger, regional facilities is often associated with higher speeds and more aggressive driving. This is not captured in the average crash rate method and may underestimate crash risks associated with alternatives that have higher levels of diversion off the project facility.
- **Value** – High, there is increased emphasis on local road safety, and this is particularly true in disadvantaged communities where there may be higher rates of walking and biking.

Results discussion – this measure shows how changes in local road safety are distributed among EJ and non-EJ communities. This is an area of particular concern among communities impacted by major road construction projects. This measure provides and objective method to compare expected local road safety outcomes between EJ and non-EJ communities to ensure project alternatives are not placing a disproportionate burden in disadvantaged communities.

6.3.3.7 Corridor Person Throughput

Definition: Person throughput generated from trips originating from EJ communities as a share of total person throughput (peak hour and direction).

Corridor person throughput captures the number of individuals actually traveling on the project facility. In this case, it is limited to the peak period and peak direction, as this is the constrained condition during which the operational characteristics of the alternatives make the most significant difference to person

throughput. It is one method of capturing the transportation improvements provided by project alternatives as they are experienced by users. Table 6-11 summarizes the corridor person throughput on I-35W by different modes between the General Purpose and MnPASS alternatives for trips originating in EJ and non-EJ communities.

Table 6-11 Results – Corridor person throughput for general purpose and MnPASS alternatives

	General Purpose Alternative Person Throughput	**MnPASS Alternative** Person Throughput	**Difference GP vs. MnPASS**	
			Person Throughput	Percent Change
EJ SOV	4,837	5,078	241	5.0%
Non-EJ SOV	23,159	24,292	1,133	4.9%
EJ HOV	1,357	1,655	298	22.0%
Non-EJ HOV	5,246	7,379	2,133	40.7%
Total EJ	6,194	6,733	539	8.7%
Total Non-EJ	28,405	31,671	3,266	11.5%
Corridor Total	34,599	38,404	3,805	11.0%
Percent of increased person throughput from EJ communities			14.2%	

Findings

- **Feasibility** – High-Medium, method was successfully demonstrated using the travel demand model and estimated person throughput using survey-based vehicle occupancies.
- **Sensitivity** – Medium, the travel demand model is capable of capturing changes in travel patterns and traffic volumes in response to fairly small changes on the highway network. The disadvantage to this is that travel changes quickly become diluted as they are distributed over a large geographic area, resulting in very small changes by absolute magnitude at the TAZ or census block group level.
- **Risk** – Medium-High, this method is built on many layers of assumptions, including traveler elasticity to managed lanes, vehicle access and flexibility to carpool, language barriers to understanding managed lane eligibility, and relativity of travel choices among residents in EJ and non-EJ communities. While the model accounts for factors such as vehicle ownership and median income, these do not play a large role in travel behavior estimates. As a result, the specific travel behavior choices of residents in EJ and non-EJ communities may differ dramatically from the estimates produced by the model.
- **Value** – High-Medium, it is critical to have an understanding of where the users and beneficiaries of a transportation investment live. In an equity context, it is important to understand the extent to which a project alternative serves EJ and non-EJ communities at different rates, particularly in situations where disbenefits or externalities are disproportionately borne by disadvantaged communities.

Results discussion – corridor person throughput is a valuable measure as it presents a snapshot of the communities project users are understood to come from. At a technical level, it is demonstrated to be highly feasible and demonstrates good sensitivity to projects that include a managed lane alternative. It does involve some risks, however, owing to the model's limited functionality around travel options among disadvantaged and more affluent communities.

6.3.3.8 Project Benefits

Definition: Net project benefit to EJ communities compared to net project benefit to non-EJ communities

This measure uses MnDOT's traditional benefit-cost analysis methodology but attempts to distribute benefits to travelers based on their home location. There are three categories of user costs in MnDOT's benefit-cost procedure: travel time costs, crash costs, and vehicle operating costs. The demonstration analysis involved preparing estimates of regional VMT and VHT at the individual TAZ level. TAZ-level data was then referenced to census block groups in order to distinguish vehicle-miles and vehicle-hours traveled by residents from EJ and non-EJ communities. After aggregating results among EJ and non-EJ communities, the benefits calculations were completed for each community characteristic. This provides two results that sum to the original total, but allows for comparison among EJ and non-EJ communities.

An important step in this process is converting VHT to PHT, or person-hours traveled. This is particularly crucial for alternatives with managed lanes that incentivize higher occupancies. Occupancy data from the I-35W North EA allows for conversion of general purpose and managed lane VHT to PHT. The table below summarizes PHT for the two alternatives. Table 6-12 provides the total PHT for the General Purpose and MnPASS alternatives – and the difference between them – for trips originating in EJ and non-EJ communities.

Table 6-12 Person- hours traveled (PHT) for general purpose and MnPass alternatives

	General Purpose Alternative	MnPASS Alternative	Difference
PHT from EJ Communities	1,065,510	982,418	-83,092
PHT from Non-EJ Communities	7,029,725	6,495,362	-534,363
Total PHT	8,095,235	7,477,780	-617,455

The PHT was then used to calculate travel time costs among travelers from EJ and non-EJ communities. Similarly, VMT was used to calculate crash costs and vehicle operating costs. The sums of these three user cost categories are presented in the following table, along with the overall difference between alternatives and the proportion of user costs and benefits experienced by travelers from EJ communities. Table 6-13 enumerates the estimated user cost savings for the General Purpose and

MnPASS alternatives. The difference between them represents the savings users receive under the MnPASS alternative compared to the General Purpose alternative. The percent of total user costs and savings among EJ communities is also provided.

Table 6-13 Results – User cost and savings for auto trips (dollars per year)

	General Purpose Alternative	MnPASS Alternative	Difference
User Costs for EJ Communities	$24,565,340	$22,649,651	-$1,915,689
User Costs for Non-EJ Communities	$162,070,303	$149,750,567	-$12,319,736
Total user Costs	$186,635,643	$172,400,218	-$14,235,425
EJ Percent of Total Costs	13.2%	13.1%	13.5%

Findings

- **Feasibility** – High-Medium, this demonstration showed that this measure is feasible to produce with existing tools. It does require more sophisticated methods to generate VMT and VHT data from the travel demand model compared to what is used for traditional benefit-cost analysis that aggregates VMT and VHT to the regional level.
- **Sensitivity** – High-Medium, this measure is ultimately a breakdown of the same benefits calculated in a traditional benefit-cost analysis, so regionally it will result in the same outcomes. The spatial distribution of user benefits is already inherent in the travel demand model and sensitive to project-level improvements, so this method simply preserves that detail further into the calculation process.
- **Risk** – Medium, on one hand this measure is low risk because it is simply a somewhat disaggregated version of a measure already produced for project alternatives analysis. Where risk is introduced is whether model results are an accurate reflection of travel behaviors and choices of residents in EJ communities. In addition, there is some uncertainty about the true home location of trips captured in the VMT and VHT results since these are assigned at the trip table level and not the production-attraction level.
- **Value** – High, project benefits are one of the most objective ways to capture the differences in performance between project alternatives. They are scaled and monetized to be able to aggregate across travelers impacted (positively or negatively) by a project and be able to make meaningful comparisons. The ability to distinguish the share of benefits accruing to residents in EJ and non-EJ communities offers crucial insight to the characteristics of communities benefitting from a particular investment.

Results discussion – summarizing project benefits among EJ and non-EJ communities demonstrated strong feasibility and sensitivity to project alternatives. While there are some risks associated with this method, these same risks are present in most other quantitative measures, and actually viewed as less

concerning in this measure. In light of the very high value this measure offers, it should be strongly considered for use in future project applications.

6.3.3.9 Input and Involvement from Residents f EJ Communities

Definition: Description of how each project alternative incorporates input and involvement from residents of EJ communities.

An important, and sometimes overlooked, aspect of improving equity in transportation is ensuring underrepresented communities are meaningfully involved in project decision-making. This goes beyond one-direction information flow regarding project development to actively engaging members of disadvantaged communities and affording them decision-making power to shape project outcomes.

For this demonstration, community outreach and engagement activities conducted as part of the I-35W North EA were reviewed to assess the extent to which input and involvement from members of disadvantaged communities influenced project alternatives.

I-35W North EA – Targeted Engagement. During the fall of 2015, MnDOT hosted a round of public engagement activities intended to involve historically underrepresented populations in the project area. Activities were held at various apartment complexes and manufactured home communities throughout the corridor to make it easier for people to participate. Ten outreach events were held to:

- Provide information on the purpose, content, and schedule of the proposed project
- Provide information about the MnPASS Lane System
- Obtain input from corridor users about current travel patterns and choices; and
- Engage underrepresented communities less inclined to attend a public meeting

Approximately 1,900 households were contacted and at least 225 adults participated directly in the engagement activities. An equal number of youths also participated and were engaged in the community socials.

I-35W North EA – Resident Survey. A survey was provided at all engagement activities to solicit feedback about travel patterns and choices of people who live along the I-35 North corridor. The surveys were available electronically through Survey Monkey and on paper, in English, Spanish, and Hmong. Six questions were asked about current travel behavior and opinions related to MnPASS lanes and transit. Respondents were given the option of providing information about race/ethnicity, gender, age, and income.

A key finding of the resident survey was that low-income respondents reported longer commute times on I-35W but less willingness to pay for or travel time savings compared to all respondents. Among respondents with household incomes under $20,000, about 20% were willing to pay between $1-$2 to save 10-15 minutes of travel on I-35W and 0% were willing to spend more than $2. Non-white respondents were more willing to pay for reliability and travel time savings, with nearly half indicating they would pay between $1-$2 and 1 in 4 reporting they would pay $2-$5.

Another key finding of the resident survey was that different bus stop locations was a key factor in whether low-income and non-white respondents would use transit more often. Bus stop location was the most cited factor for low-income respondents. For non-white respondents, the most cited factor was transit travel savings, followed closely by bus stop locations and reliability.

I-35W North EA – How Input from EJ Communities was Used. MnDOT did not receive opposition to a I-35W MnPASS lane from EJ communities through the targeted engagement activities and survey described above. As such, input from the EA's environmental justice finding focused on technical evaluations of project alternative impacts and benefits to determine whether a MnPASS lane on I-35W would result in disproportionately high and adverse human health or environmental effects on non-white and low-income populations. This evaluation determined the proposed project would not result in such effects. Information about the environmental justice evaluation of the I-35W MnPASS proposal is available in Section 6.3 of the I-35W North Corridor Preliminary Design Project Environmental Assessment.

Input provided by EJ communities on the I-35W MnPASS proposal reinforces observations made in Chapter 3 about the limitation of traditional alternative analysis and the potential opportunity to address transportation equity through project mitigations and local community enhancements made as part of freeway projects. In the case of the I-35W EA, the finding that low-income communities have the highest commute times but lack the ability to pay E-ZPASS fees highlights the need for subsidized access to E-ZPASS facilities. Similarly, the finding that bus stop locations is the primary driver of transit use for low-income households along the I-35W corridor suggests an opportunity to coordinate E-ZPASS expansion with improvements in transit service on local roadways.

Findings

- **Feasibility** – High-Medium, the demonstration evaluation shows that engagement with members of EJ communities is feasible as part of the project development process. Space for improvement remains, however, to offer a more meaningful "seat at the table" for representatives from EJ communities to help shape project outcomes.
- **Sensitivity** – Medium, this particular evaluation showed that the ultimate project outcomes were not significantly influenced by input from EJ communities.
- **Risk** – Medium-Low, in general there is low risk from involving more voices from diverse communities in the transportation decision making process. Indeed, a widely cited view is that incorporating more diverse perspectives improves outcomes and produces more inclusive results. A potential source of risk is whether a lower familiarity with transportation project and processes introduces additional steps in the process and extends project schedules.
- **Value** – High, increased involvement and decision making agency from residents of EJ communities is essential to improving equity of managed lane projects.

Results discussion – incorporating input and involvement from EJ communities offers the highest value to improve equity of managed lane projects. Extending existing engagement efforts to ensure

meaningful participation and influence over project outcomes is highly feasible and has minimal downside risk.

6.4 CONCLUSIONS AND RECOMMENDATIONS

6.4.1 Equity Metric Suitability - Revisited

The evaluation of performance measures considered in the demonstration were evaluated against the same four criteria used in the initial assessment of equity metrics (Section 6.1 These include feasibility, sensitivity, risk, and value. Using a similar five-point scale, results for each criterion have been updated for the measures with the insights gained through the hands-on experience of the demonstration evaluation. The updates for each measure were discussed as part of the demonstration results in Section 6.3 These updates are summarized in Table 6-14.

Table 6-14 Equity metric screening criteria updates based on demonstration evaluation

Equity Metric	Feasibility	Sensitivity	Risk	Value	Score
Transit Advantage	High	Medium	Medium-Low	Medium	15
New Transit Trips	High	Medium	Medium-High	Medium-High	14
Transit Travel Time Savings	High	Medium	Medium	Medium-High	15
Change in Air and Noise Impacts	High-Medium	High-Medium	Medium-Low	High	15
Job Accessibility by Auto	High	High	Medium-High	Medium-High	16
Local Road Safety	Medium-High	Medium-High	Medium	High	16
Corridor Person Throughput	High-Medium	Medium	Medium-High	High-Medium	14
Project Benefits	High-Medium	High-Medium	Medium	High	16
Input and Involvement from Residents of EJ Communities	High	Medium	Medium-Low	High	15

The summary of results shows that all of the equity metrics considered in the evaluation score well across the four criteria. Cumulatively, none of the measures are separated by more than two points. Those scoring highest with 16 points are Job Accessibility by Auto, Local Road Safety, and Project Benefits. The next tier of metrics includes Transit Advantage, Transit Travel Time Savings, and Change in Air and Noise Impacts, and Input and Involvement from Residents of EJ Communities. Metrics scoring 14 points include new Transit Trips, and Corridor Person Throughput. While these scored slightly lower than the others, the marginal differences in scores are so small that none of the metrics are recommended for exclusion from application to future managed lane project evaluations.

CHAPTER 7: CONCLUSIONS AND RECOMMENDATIONS

As the Minnesota Department of Transportation analyzes the expansion of E-ZPass corridors, it is imperative that it evaluates project alternatives from an equity perspective. This research project produced information to develop a better understanding of potential equity concerns associated with project alternatives, identified the actions needed to address the needs of all populations that have been historically underrepresented in planning efforts, and developed better and more consistent methods for improving equity and environmental justice analysis during planning and environmental studies.

The research team proposes the following recommendations based on the research findings:

1. **Consider collecting more demographic data from transponder owners**

MnDOT should consider collecting more demographic data from E-ZPass lane users. For instance, MnDOT could include demographic questions with the purchase of the E-ZPass transponder or through regular surveys. MnDOT may assess the instrument to capture such information to avoid survey fatigue. Variables to be collected could include race, income level (provide brackets), gender, disability status, and common usage of the E-ZPass lane (as a solo driver or carpooler). Use related questions from the questionnaire conducted by the U.S. Census Bureau to make the information compatible with other sources.[13] MnDOT should communicate its intended use of the data that is being collected and potential reporting methods to disclose the collected information. The following is some language that MnDOT could include in the questionnaire to capture demographic information: *"The following demographic questions will be used to assess equity in E-ZPass managed lanes. You do not need to respond to questions unless you choose to. The information you provide will support the Minnesota Department of Transportation's decision-making on potential changes to the E-ZPass program and distribute benefits to disadvantaged populations."* Collecting information from actual E-ZPass transponder users will better inform equity assessments of managed lanes.

2. **Continue redistribution of toll revenues to support transit services in E-ZPass lane corridors**

Current law requires E-ZPass revenue to be shared with Metro Transit for transit improvements in E-ZPass corridors. Use of this funding allows for the redistribution of transportation benefits to a wider section of the population in the corridors where managed lanes are located. Supporting transit services enhances equity in managed lanes as transit users are generally more racially diverse and have lower incomes than the overall travelshed population.

[13] The questionnaire from the U.S. Census Bureau is available at https://www2.census.gov/programs-surveys/decennial/2020/technical-documentation/questionnaires-and-instructions/questionnaires/2020-informational-questionnaire-english_DI-Q1.pdf

3. Continue to explore strategies to reduce entry barriers to managed lanes

MnDOT should consider strategies to ease access to E-ZPass lanes for certain populations. For instance, MnDOT could explore a cash option to allow unbanked and underbanked people to access managed lanes. Unbanked and underbanked rates are higher among low-income households, African American and Hispanic households, households with disabilities, and single-mother households (FDIC, 2021). In Minnesota, the unbanked rate has been increasing from 1.5 in 2017 to 2.4 in 2021, and the underbanked rate was 7.7 in 2021 (FDIC, 2021a).

MnDOT could also explore an *Equity Allowance Credit* for low-income populations and people with disabilities. The eligibility could be tied to existing programs such as the Supplementary Security Income (SSI), Earned Income Credit (EITC), and General Assistance program. The credit could be applied to the prepaid toll deposit or to the transponder deposit. MnDOT could also collaborate with other local transportation agencies that provide services to people with disabilities to better serve these populations.

4. Include equity measures on ongoing and upcoming projects that involve managed lane alternatives

MnDOT should encourage the use of some or all of the demonstrated quantitative measures on ongoing and upcoming projects that involve managed lane alternatives. These measures are specifically intended to capture transportation outcomes of project alternatives among environmental justice communities and compare them to non-environmental justice communities. The measures recommended for comparison among environmental justice communities and non-environmental justice communities include transit advantage, new transit trips, transit travel time savings, changes in air and noise impacts, job accessibility by auto, local road safety, corridor person throughput, and project benefits.

MnDOT should also include stakeholder feedback in the alternatives analysis to improve the equity of project outcomes. Feedback to be incorporated includes ways in which individual alternatives serve communities differently or how they could be modified to enhance outcomes, particularly for underserved and overburdened areas. MnDOT and its partners have made important strides toward intentional and meaningful engagement with targeted communities in the project development process. This recommendation is to take that one step further by explicitly including feedback received through that engagement in the alternatives analysis process.

5. **Consider project enhancement opportunities to improve transportation and non-transportation outcomes in disadvantaged communities**

MnDOT should consider project enhancement opportunities to mitigate the social, environmental, and economic impacts associated with a project. This could be accomplished through specific pieces of infrastructure constructed as part of a project, such as improved non-motorized trails and highway crossings, new or enhanced transit stations, or local roadway modernization. This already occurs in many projects; however, the process could be further enhanced by providing opportunities for increased leadership and decision-making among disadvantaged communities to shape these outcomes.

As a longer-term consideration, communities impacted by nearby managed lane highway corridors could receive further mitigation on an ongoing basis through distribution of any surplus toll revenue. Current law allows toll revenue to be used on transportation improvements, albeit only once capital and operating costs have been repaid. If this were to occur, additional transportation enhancements could be provided, such as multimodal infrastructure or services. This would more equitably distribute the benefits of E-ZPass.

Two potential opportunities for community enhancements could be considered if changes to statute were enacted. The first would be to loosen requirements that toll revenues pay back capital costs first, allowing revenue to be passed on sooner in the project life cycle. The second is to broaden the allowed uses of these revenues, permitting them to be applied to other locally driven purposes such as education scholarships, healthy nutrition options, job training or ESL programs, and childcare subsidies.

6. **Elevate underrepresented voices**

As noted in recommendation 4, MnDOT has made important strides toward meaningful project engagement with historically underserved and overburdened communities. This engagement has helped keep a broader cross-section of the population informed about project planning and development and to gather input from more diverse groups. The path to achieving truly equitable project outcomes is to share decision-making power with representatives of the communities where a proposed project is located.

There are a number of recent examples of projects that have moved in this direction. For example, some bus rapid transit (BRT) planning efforts have established community design, or co-design, committees that provide direct input to help shape project features and characteristics. Similarly, the Highway 252/I-94 Environmental Review convened a group of equity and health heighborhood advisors (EHNA) composed of individuals representing project-area communities who review project materials through an equity and health lens. Nonetheless, these efforts are undertaken on a largely *ad hoc* basis, and true decision-making power remains undefined.

MnDOT can seek additional approaches to share decision-making power at the project level by codifying processes and guidelines for establishing community-led groups and their roles in the project

development process. This would involve establishing thresholds for project size or impacts triggering establishment of a group. It would also lay out their privileges in terms of being informed of project progress and define key decision points where they would have an opportunity to debate and influence project outcomes. This would provide consistency among projects and a clear understanding of how communities can use their voices to shape project outcomes.

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APPENDIX A: DEMOGRAPHICS FROM THE MNPASS CUSTOMER SURVEY

Table A-1 presents demographic information collected through the MnPASS Customer Survey conducted in Feb/March 2017. The table only presents information for all corridors except for the I-35W (North metro) corridor as it was opened in 2021 (after the survey was distributed).

Table A-1 Demographics from the 2017 MnPASS Customer Survey

Demographics	I-394	I-35W South Metro	I-35E
Income	71.64% with an income of $100K or more	66.67% with an income of $100K or more	63.4% with an income of $100K or more
Percentage of people identified as white alone	92.59%	91.9%	92.69%
Percentage of adult people (with ages between 18-64)	85.38%	89.32%	92.18%

APPENDIX B: TRANSIT SERVICES INCLUDED IN THE ANALYSIS

Table B-1 presents the transit services that travel along a managed lane corridor. The demographic profile of those using transit services along Minnesota's managed lanes is based on users of these routes. It is worth noting that the information comes from a 2016 survey, therefore several transit services that currently provide services along the corridors with managed lanes are not included. These include the 472 Eagan-Minneapolis route from MVTA, the METRO Orange Line Burnsville-Bloomington-Richfield-MPLS from Metro Transit, and the 600 Chaska-Eden Prairie-Minneapolis from Southwest.

Table B-1 Transit Services selected for the Analysis by Provider

Managed Lane Corridor	Provider	Route
I-394	Plymouth	747 Plymouth - Express - Station 73 - Mpls 774 Plymouth - Express - Station 73 776 Plymouth - Express - Southwest Plymouth 777 Plymouth - Express - NW Plymouth - Station 73 790 Plymouth - Express - Cub Foods - Four Seasons 795 Plymouth - Express - Midday - Northeast Plymouth
	Southwest	690 SW Transit - Express - Eden Prairie - Mpls 698 SW Transit - Express - Chaska - Chanhassen - Mpls 699 SW Transit - Express - Chaska - Mpls
	Metro Transit	667 Express - Minnetonka - St Louis Park - Mpls 673 Express - Co Rd 73 P&R - Mpls 764 Express - Winnetka Av - 42nd Av - Mpls
I-35W (South Metro)	MVTA	460 Burnsville-Minneapolis 465 Burnsville-Minneapolis-U of M 470 Eagan-Minneapolis 475 Apple Valley-Cedar Grove-Mpls/U of M 476 Palomino Hills-Minneapolis 477 Lakeville/Apple Valley-Mpls 478 Rosemount-Minneapolis 490 Prior Lake-Shakopee-Minneapolis 493 Shakopee-Minneapolis
	Metro Transit	578 Express - Edina - Southdale - Mpls
	Southwest	695 SW Transit - Express - Chaska - Chanhassen - Mpls
I-35E	Metro Transit	275 Express - Forest Lake-Running Aces - St Paul
I-35W (North Metro)	Metro Transit	250 Express - St Joseph's P&R - 95Av P&R - Mpls 252 95AV P&R- U of M