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Evaluating Transportation Equity

Guidance for Incorporating Distributional Impacts in Transport Planning

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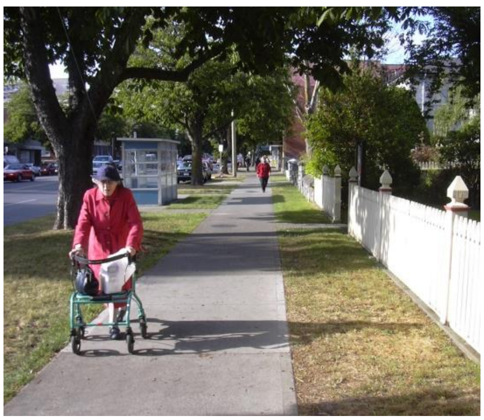


Abstract

Equity refers to the fairness with which impacts (benefits and costs) are distributed. Transportation planning decisions can have large and diverse equity impacts. Evaluating these can be challenging because there are several types of equity and impacts to consider, and various ways to measure them. Horizontal equity assumes that people with similar needs and abilities should be treated equally; vertical equity assumes that disadvantaged groups should receive a greater share of resources. Social justice addresses structural inequities such as racism and sexism. This report provides guidance for transportation equity analysis. It describes various perspectives and impacts, and practical ways to incorporate transportation equity goals into policy and planning analysis.

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Executive Summary

Social *equity* (also called *fairness* and *justice*) refers to the distribution of impacts (benefits and costs) and whether that is considered appropriate. Transportation policy and planning decisions have many equity impacts: they affect the allocation of public resources, people's quality of life and economic opportunities, and external costs that travellers impose on others. People care about these impacts – they want planning decisions to reflect equity goals. As a result, practitioners have a responsibility to evaluate equity impacts in transportation planning analysis.

This is a timely issue. Previously transportation equity analysis mainly considered public spending fairness, such as whether jurisdictions and user groups bear appropriate costs and receive appropriate benefits from public investents. There was little analysis of impacts on disadvantaged groups such as whether automobile-oriented planning harmed non-drivers, the unfairness of parking mandates that force non-drivers to pay for costly parking facilities they don't need, or the harms that urban highway projects imposed on neighborhoods.

These examples illustrate the need for more comprehensive transport planning equity analysis. However, such analysis can be challenging. How equity is defined and measured, which impacts are considered, and how people are categorized affects analysis results. A decision may seem equitable if evaluated one way but not another. There is no single correct way to evaluate transportation equity; it is usually best to consider various perspectives, methods and impacts, and to ensure that affected groups are adequately involved in structuring equity analysis.

This report provides an overview of key transportation equity concepts and describes practical ways to incorporate equity goals into policy and planning analysis. It should be of interest to policy makers, practitioners, advocates and anybody who cares about social equity.

Consumer demands Versus Access Needs
Consumer demands refers to the type and amount of goods that people would purchase at a given price. *Consumer sovereignty* means that public policies respond to these demands. For example, if most travellers in an area prefer driving over other modes, consumer sovereignty considers it is efficient and fair to build roadways to serve those demands.

However, equity analysis recognizes the importance of serving *basic accessibility needs*, which means that travellers can reach services and activities that society considers essential, such as healthcare, food, education and jobs. This justifies planning decisions that favor inclusive and affordable modes such as walking, bicycling and public transit, and land use development policies that locate essential services in accessible, multimodal areas.

This is an example of trade-offs between *horizontal equity* (everybody receives a fair share) and *vertical equity* (policies favor disadvantaged groups). A planning process should explicitly recognize these trade-offs. There is no single way to determine the right balance between these goals; planning decistions should reflect community values.

Types and Impacts

There are various types of equity. *Horizontal equity* assumes that people with similar needs and abilities should be treated similarly. *Vertical equity* assumes that disadvantaged people should receive favorable treatment. This report considers the five types listed below.

Table ES-1 **Types of Transportation Equity**

Horizontal	1. *Fair resource allocation*. This reflects whether individuals or groups receive a fair share of public resources such as funding, road space or planning priority. It implies that people should generally "get what they pay for and pay for what they get" unless subsidies are specifically justified.
	2. *External costs.* Costs that travel activities impose on other people, such as the delay, risk and pollution, are unfair. Fairness requires minimizing or compensating for such impacts.
Vertical	3. *Inclusivity - vertical equity with regard to need and ability*. This considers how transport systems serve people with impairments and other special needs. It justifies universal design and multimodal planning.
	4. *Affordability - vertical equity with regard to income*. This considers how decisions affect income classes. Policies that favor lower-income people are called *progressive* and those favoring wealthier people are called *regressive*. It supports affordable mode improvements and low-income traveller subsidies.
	5. *Social justice*. This considers how transportation systems serve disadvantaged and underserved groups, and address structural injustices such as racism and sexism.

There are several types of equity to consider in transportation planning.

The table below lists possible types, impacts, metrics and groups to consider in equity analysis.

Table ES-2 **Transportation Equity Evaluation Factors**

Types of Equity	Impacts	Metrics	Groups
A fair share of resources. "Get what you pay for and pay for what you get." **External costs** Minimize costs imposed on other people. **Inclusivity** Ensure that transport systems serve everybody. Multimodal planning and Universal design. **Affordability** Ensure that everybody can afford basic mobility. Quality of low-price modes. Targeted subsidies. **Social Justice** Minority status Other injustices	**Facilities and Services** Funding and subsidies. Planning and design. Involvement in planning. **User benefits and costs** Costs and affordability. Service quality (convenience, comfort, speed, safety). Fares, fees and taxes. **External Impacts** Congestion delays. Crash risk. Noise and air pollution. **Economic Impacts** Economic opportunities. Job and business impacts. **Legal Process** Regulations and enforcement.	**Level of Impacts** *Inputs* (funding, road space, etc.). *Outputs* (amount of mobility and accessibility). *Outcomes* (destinations accessed, cost burdens, crash casualties, etc.). **Units of People** Per person, household, commuter, or peak-period travel. **Units of travel** Per vehicle-mile/km. Per passenger-mile/km. Per trip (by type). **Financial** Per dollar. Subsidies. Cost recovery.	**Demographics** Age and household type. Physical and cognitive ability. Income and poverty. Race and ethnicity. **Location** Jurisdiction and neighborhood. Urban/suburban/rural. **Mode** Active (walking & bicycling). Vehicle ownership & licensure. Transit user/dependent. **Industries** Equipment/service providers. Shippers and Employees. **Trip type** Commutes and errands. Commercial/freight. Recreational/tourist.

Equity analysis can consider various types, impacts, metrics and groups.

This section describes ways to evaluate the various types of equity.

A Fair Share of Resources

Horizontal equity assumes that people with similar needs and abilities should receive similar shares of public resources and bear similar costs, and should "get what they pay for and pay for what they get" unless subsidies are specifically justified. This is the basis of most traditional transportation equity debates, such as how road user taxes should be collected and allocated, and the degree that different vehicles pay their share of roadway costs.

More recent debates concern allocation between modes. In a typical community, 20-40% of travellers cannot, should not, or prefer not to drive for most trips, as indicated in ES-2. To be fair transportation planning should invest a similar portion of infrastructure resources (money, road space and parking facilities) to serve those users. Many communities invest far less, creating automobile-oriented communities where it is difficult to get around without a car. This is unfair to non-drivers, who lack independent travel options, and increases chauffeuring burdens and traffic problems.

Table ES-2 **Non-Auto Travel Demands**

Type	Prevalence	Consequences
Seniors who do not or should not drive.	10-20% of residents.	Lack independent mobility, require chauffeuring (special vehicle travel to transport a non-driver) or expensive taxi travel, or move to another community with better transport options.
People with disabilities.	3-5% of residents	
Adolescents (12-20 years)	10-20% of residents	
Drivers who share vehicles.	Varies	
Drivers who temporarily lack a vehicle.	Varies	
Low-income households who spend more than affordable for vehicles.	20-40% of households	Lack mobility or are burdened by transport costs.
Tourists and visitors	Varies	Lack mobility or visit other areas.
People impaired or distracted by alcohol, drugs or devices.	Varies.	Drive impaired or distracted, risking citations and crashes.
People who want to walk and bike for health and enjoyment	40-60% of residents, plus pets on leashes.	Have insufficient exercise or must spend time and money exercising at a gym.
Motorists who want better travel options for other travellers.	Most motorists.	Motorists bear more chauffeuring burdens, congestion and cash risk.

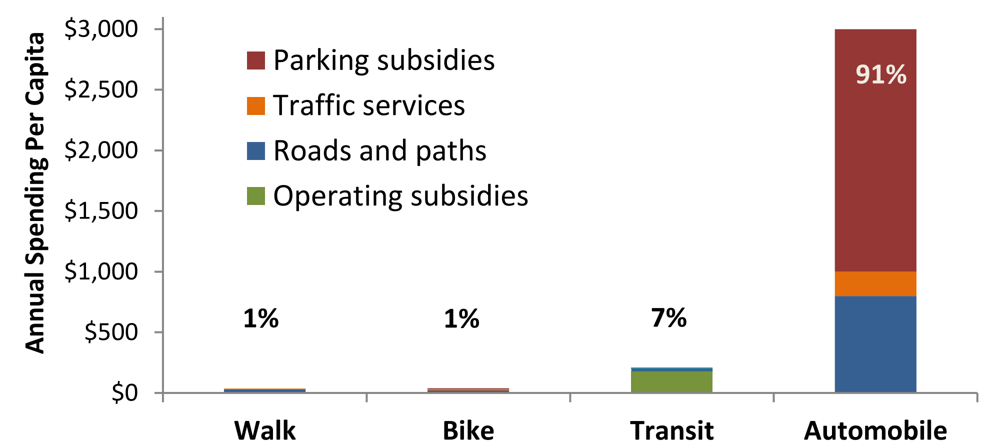
In a typical community, 20-40% of travellers cannot, should not, or prefer not to drive. Most people benefit from the availability of non-auto modes in their community.

How impacts are measured affects equity analysis. For example, in the U.S., user fees finance less than half of what governments spend on roads and a smaller portion of what businesses spend on government-mandated parking facilities. Walking, bicycling and public transit services receive small portions of total transportation spending. Public transit travel is highly subsidized, but since users travel relatively few annual miles so their annual subsidy is smaller than for motorists. You could argue:

- It is unfair to "divert" road user fees to other modes (motorists should "get what they pay for"), or conversely it is unfair that motorists only pay a small portion of total road and parking costs (motorists should "pay for what they get").
- Motorists pay a *greater share* of government expenditures, but a *smaller share* of total expenditures (considering parking as well as roadway costs) than transit users.
- Motorists receive smaller subsidies per vehicle-mile but greater subsidies per capita than travellers who rely on walking, bicycling or public transit.

Since equity is concerned with *people*, equity impacts should generally be measured *per capita*, rather than distance-based metrics, such as cost per mile or kilometer travelled, which would assume that people who travel more should receive a larger share of resources. Public spending on a travel option should generally reflect its share of demand: if 10% of travellers would use a mode it should receive 10% of investments. Figure ES-1 compares spending by mode. Automobiles receive the most.

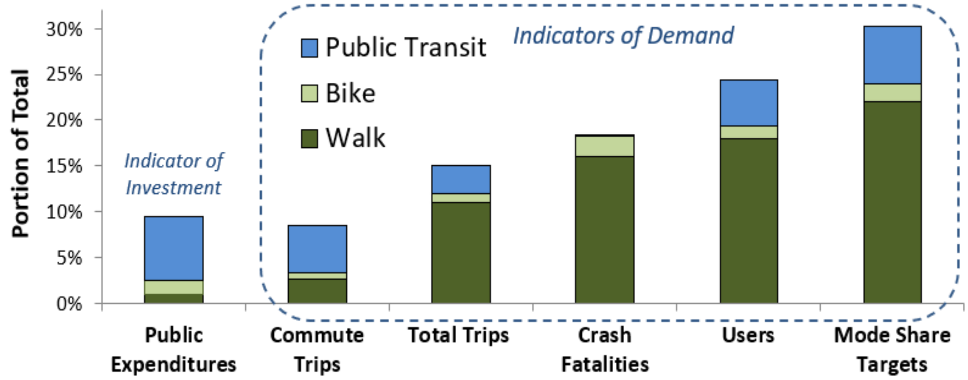
Figure ES-1 **Infrastructure Spending** (APTA 2020; FHWA 2018; LAB 2018; Litman 2020)



This graph compares infrastructure investments for various modes. Automobiles currently receive far more investments than other modes.

Figure *ES*-2 compares the portion of transportation infrastructure spending on non-auto modes with indicators of their demand (their shares of trips, fatalities, and targets). By this metric, non-auto modes should receive 10% to 30% of infrastructure investments. This suggests that non-drivers receive less than their fair share of spending.

Figure ES-2 **Demand Indicators and Public Spending** (APTA 2017; LAB 2018)

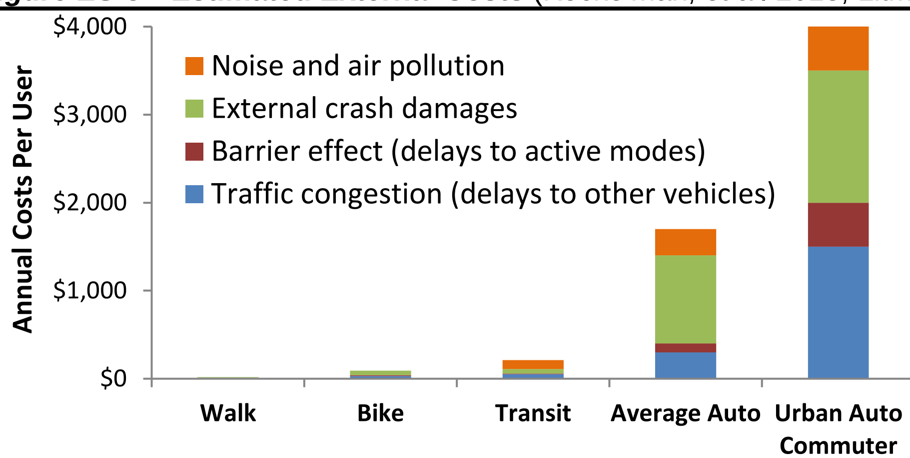


This figure compares public expenditures on walking, bicycling and public transit with indicators of their demand. This suggests that non-auto modes receive less than their fair share of investments.

External Costs

Horizontal equity analysis can also be applied to external costs such as congestion, crash risk and pollution that vehicle traffic imposes on other people. Horizontal equity requires minimizing and compensating for these costs, so one group does not impose excessive burdens on others. Because they are larger, faster and more energy intensive, automobiles impose larger external costs than other modes, as illustrated below.

Figure ES-3 **Estimated External Costs** (Kockelman, et al. 2013; Litman 2020)



Travel activity imposes various external costs on other people. ("Barrier effect" refers to the delay and risk that motor vehicle traffic imposes on walking and bicycling.) Automobile travel imposes larger external costs than other modes, particularly under urban-peak travel conditions.

External costs are unfair; they benefit some people at others expense. For example:

- It is unfair that travellers using space-efficient modes buses bear congestion delays caused by space-intensive modes such as low-occupant automobiles. Fairness justifies bus-lanes and decongestion tolls to internalize these costs.
- It is unfair that pedestrians and bicyclists bear excessive barrier effects (delays and crash risk) imposed by motor vehicle traffic. Fairness justifies roadway designs that minimize these risks, financed with road user fees to internalize these costs.
- It is unfair that communities bear noise and pollution caused by non-resident motorists. Fairness justifies pollution reduction policies and emission fees to internalize these costs.

Inclusivity: Serving Disadvantaged Travellers

Inclusivity requires that transportation systems serve disadvantaged groups. This can be evaluated based on basic or sufficient accessibility, referring to people's ability to access services and activities that society considers important such as healthcare, education, employment and basic shopping (Rode 2022; Martens, Singer and Cohen-Zada 2022).

The table below indicates the modes used by various disadvantaged groups. Many disadvantaged travellers rely on non-auto modes, or would do so if they were convenient and affordable. To serve these needs, transportation systems must be diverse, with particular attention to non-auto mode quality and integration. This requires *multimodal planning*, to serve diverse demands, and *universal design*, to ensure that facilities and services accommodate all types of travellers including people with impairments, pregnant, carrying luggage, accompanying children, etc.

Table ES-3 **Disadvantaged Groups' Travel Demands**

Users (portion of population)	Universal Design	Walk	Bicycle	Transit	Auto	Taxi/ Ridehailing
People with mobility impairments (5-10%).	✓	✓	✓	✓	✓	✓
Youths (15-20%).		✓	✓	✓		
Low-income households (20-40%).		✓	✓	✓	✓	
Zero-vehicle households (5-15%)	✓	✓	✓	✓		✓
Adults who lack a driver's license (10-20%).	✓	✓	✓	✓		✓
People impaired by alcohol or drugs (?).		✓		✓		✓

Disadvantaged groups have diverse travel needs. (Uni. Des. = Universal Design; RH = Ride Hailing)

Vertical equity justifies giving priority to higher value travel (called *basic* or *essential*), disadvantaged users, and the modes they use. The table below shows typical priorities.

Table ES-4 **Prioritizing Travel**

Social Value	Type of Trip	Type of Traveller	Modes
Higher	• Urgent errands	• People with disabilities	• Walking
	• Healthcare access	• Seniors	• Bicycling
	• Basic shopping	• Children and families	• Public transit
	• Commuting to jobs or school	• Public service providers	• Freight and service vehicles
	• Non-essential shopping	• Low-income motorist	• Taxi/Ridehail
Lower	• Entertainment and recreation	• Higher-income motorist	• Private automobile

Vertical equity justifies planning that favors higher value trips, more vulnerable travellers and their modes.

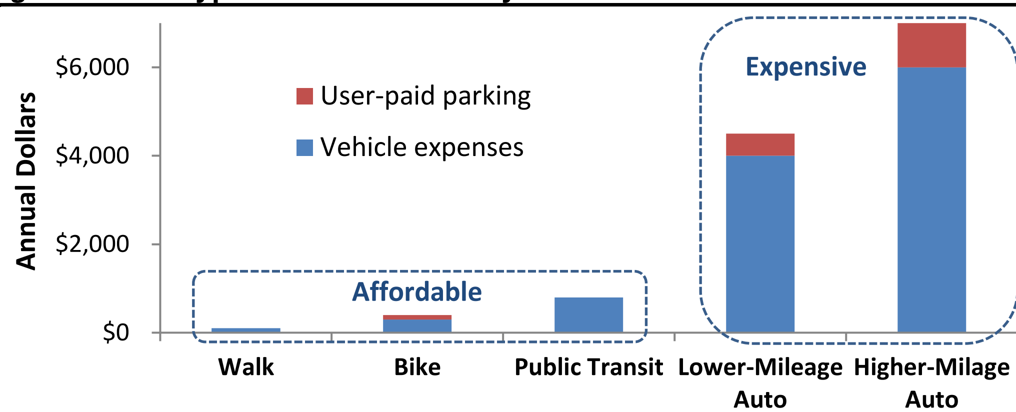
Inclusivity can be evaluated by establishing standards or targets for the sufficient quality of transportation for disadvantaged travellers (Singer, Cohen-Zada and Martens 2022). It can also be evaluated by comparing disparities in mobility and accessibility between advantaged and disadvantaged groups, such as the number of services and jobs that can be reached within a given time by physical ability, income, age, and gender.

Affordability: Serving Travellers with Low Incomes

Another type of vertical equity is *affordability*, which refers to costs relative to incomes, and therefore people's ability to purchase basic goods within their limited budgets. Experts define affordability as households spending less than 45% of their budgets on transportation and housing combined, so a typical household that spends 30% of its budget on housing has 15% to spend on transportation; more if their housing costs are low and less if housing costs are more than 30% of income.

Figure ES-4 compares various modes' user costs. Although lower-income motorists use various strategies to minimize their vehicle expenses, by purchasing older vehicles and minimum insurance, and performing their own maintenance, it is difficult to legally operate a vehicle for less than $4,000 annually, or $6,000 if it is driven high annual miles. Automobile travel sometimes imposes large unexpected costs due to mechanical failures, crashes or traffic violations which can cause household financial stress. Equity requires improving and favoring affordable mobility and accessibility options.

Figure ES-4 **Typical Annual Costs by Mode**



Walking, bicycling and public transit are the most affordable modes. Automobiles are more expensive and sometimes impose large, unpredictable costs that cause financial stress.

Conventional planning seldom considers transportation affordability, or evaluates it based on individual costs such as fuel prices, road tolls or transit fares rather than total transportation cost. To increase affordability communities can improve lower-cost modes and increase affordable housing in accessible, multimodal neighborhoods. Tools such as the *Location Affordability Index* and the *Housing and Transportation Affordability Index*, calculate total housing and transportation costs, and therefore the savings provided by more affordable modes and more accessible locations.

Social Justice

Social justice considers structural inequities (also called *discrimination)* such as racism, sexism, and classism. It can be addressed by defining basic rights for disadvantaged groups, such as pedestrians and people with disabilities, and by establishing affirmative action policies, programs and targets.

Social justice can be evaluated by comparing disparities in various inputs and outcomes between advantaged and disadvantaged groups (racial and sexual minorities, women, immigrants, lower-income groups, etc.), including the allocation of public resources (money and road space), access to basic services and activities (education, jobs, healthcare, shops, parks, etc.), travel comfort and safety, exposure to noise and pollution, employment opportunities, and involvement in a planning process. It can also consider historical inequities, such as damages that urban highways imposed on minority communities.

Equity Objectives

Transportation equity evaluation is challenging because there are many possible perspectives and impacts to consider. Because of this complexity, the best way to incorporate equity into planning is usually to define a set of measurable objectives, such as those in Table ES-5. A planning process can evaluate specific policies and planning decisions based on whether they support or contradict them.

Table ES-5 **Typical Transportation Equity Objectives**

Horizontal Equity		Vertical Equity		
Fair Share	*External Costs*	*Inclusivity*	*Affordability*	*Social Justice*
• Everybody contributes to and receives comparable shares of public resources. • Planning serves non-drivers as well as drivers. • Affected people are involved in planning.	• Minimize external costs. • Favor resource-efficient modes that impose less congestion, risk and pollution on other people. • Compensate for external costs.	• Accommodate people with disabilities and other special needs. • *Basic access* (ensure that everybody can reach essential services and activities).	• Favor affordable modes. • Provide discounts and exemptions for lower-income users. • Provide affordable housing in high-accessibility neighborhoods.	• Protect and support disadvantaged groups (women, youths, minorities, low-income, etc.). • Affirmative action policies and programs. • Correct for past injustices.

This table identifies typical measurable equity objectives. A planning process can evaluate specific policies and decisions based on whether they support or contradict these objectives. (WRT = With Respect To)

Programatic versus Structural Strategies

There are two general types of equity strategies. *Programmatic* (or *categorical*) strategies provide special benefits to designated groups. These include, for example, universal design standards and special mobility services for people with disabilities, transit fare discounts for seniors and people with disabilities, and affirmative action programs. *Structural* (or *functional*) strategies reform planning practices to create more inclusive, affordable and resource-efficient transportation systems. These include multimodal planning, pricing reforms to internalize external costs, and development policy changes to increase affordable housing options in multimodal neighborhoods.

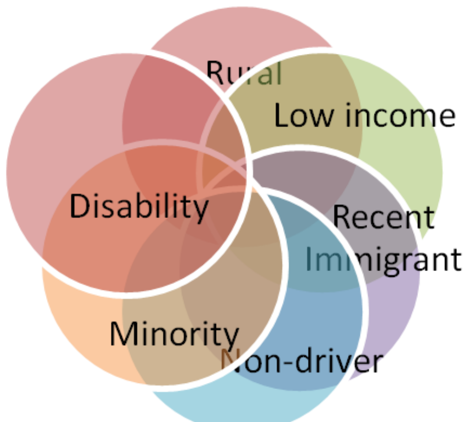
Programatic strategies often seem most effective because they provide measurable benefits to a clearly defined group but are not necessarily the most effective overall. For example, universal design standards and public transit fare discounts provide little benefit in automobile-dependent sprawled areas that lack sidewalks and transit services, and seniors and students have lower poverty rates than families with children. Table ES-6 indicates the equity objectives achieved by various strategies. Programatic strategies tend to achieve fewer objectives and have more negative impacts than structural reforms that improve affordable and efficient transportation options, which tend to achieve multiple equity objectives and provide co-benefits such as reducing traffic congestion and pollution emissions. To maximize equity, communities should generally implement a combination of programatic and structural strategies.

Table ES-6 **Transportation Equity Strategies**

Equity Strategy	Fair Share	External Costs	Inclusivity	Affordability	Social Justice
Comprehensive data and analysis	✓	✓	✓	✓	✓
Accessibility-based analysis	✓	✓	✓	✓	✓
Multimodal planning	✓	✓	✓	✓	✓
Smart Growth policies		✓	✓	✓	✓
Subsidize public transportation		✓	✓	✓	✓
Complete streets policies	✓	✓	✓	✓	
Universal design	✓		✓	✓	✓
Prioritize affordable-efficient modes	✓	✓	✓	✓	✓
Vehicle travel reduction targets		✓	✓	✓	✓
Commute trip reduction programs	✓	✓	✓	✓	
Efficient road & parking pricing	✓	✓	✓	×	
Parking cash out and unbundling	✓	✓	✓	✓	
Subsidize electric car	×	✓			
Subsidize cars for low-income motorists	×	×	✓	✓	
Improve public engagement	✓		✓		✓
Affirmative action programs	×		✓		✓
Compensate for past harms	✓				✓

This matrix indicates whether strategies support (✓) or contradict (×) various equity goals.

Many inequities overlap, which justifies cross-cutting solutions. People with disabilities, frail seniors, young families, racial minorities, recent immigrants, and older rural residents tend to have low driver's licensure rates, are vulnerable to traffic external costs, and have high poverty rates. For example, people with disabilities benefit little from universal design standards if there are few sidewalks and crosswalks, minimal public transit services, and sprawled development patterns. Disadvantaged people tend to benefit most from structural reforms that create a more diverse, affordable and efficient transportation system.



Conclusions and Recommendations

Transportation planning decisions often have significant equity impacts, so it is important to incorporate comprehensive equity analysis into transportation planning. This is challenging because it must consider several equity types, impacts, metrics, and groups of people. Planning decisions should reflect a community's concerns and priorities, so public involvement is important.

How impacts are measured can significantly affect analysis results. For example, public transit has relatively high subsidies per passenger-mile but most users travel relatively few miles per year so their annual subsidy is relatively small. Automobile infrastructure subsidies are smaller per vehicle-mile, but motorists travel more annual miles and impose significant congestion, risk and pollution costs, so they generally impose greater total external costs per year than travellers who rely on other modes. Because equity is concerned with *people* it should generally be evaluated per capita; measuring impacts per mile underestimates total costs imposed by higher-mileage users.

Many common planning practices contradict equity objectives. For example, prioritizing speed over other goals favors faster but expensive and resource-intensive modes, such as automobile and air travel, over affordable and efficient modes such as walking, bicycling and transit. Parking mandates force non-drivers to subsidize motorists.

The table below summarizes analysis and optimization strategies for the five equity types. New tools can help with equity evaluations. They require detailed data on travel demands, the quality of various modes, user and external costs, public spending, equity programs and planning engagement by various groups.

Table ES-7 **Transportation Equity Analysis Summary**

Type	Description	Metrics	Optimization Strategies
Horizontal – Fair Share	Each person receives a comparable share of public resources	Per capita share of public resources (money, road space, etc.).	Multimodal transport planning. Comprehensive impact analysis. Least-cost funding.
Horizontal – External costs	Travellers minimize and compensate for external costs.	Infrastructure costs, congestion, crash risk and pollution that travellers impose on other people.	Minimize and compensate for external costs. Favor resource-efficient modes.
Vertical – Inclusivity	Transportation systems provide basic mobility to disadvantaged groups.	Quality of travel for people with disabilities and other special needs. Disparities between groups.	Favor inclusive modes and accessible community development.
Vertical – Affordability	Lower-income households can afford basic mobility.	Transportation costs relative to incomes. Quality of affordable modes.	Favor affordable modes and housing in high-access areas.
Social Justice	Policies address structural inequities.	Whether organizations address biases such as racism and classism.	Identify and correct structural inequities. Affirmative action.

This table summarizes transportation equity types, ways to measure them, and optimization strategies.

END OF EXECUTIVE SUMMARY

Introduction

Equity (also called *justice* and *fairness*) refers to the distribution of impacts (benefits and costs) and whether that distribution is considered fair and appropriate. Transportation planning decisions have large and diverse equity impacts. For example:

- Transport expenditures are a major share of household, business and government spending.
- The quality of transportation options available affects people's quality of life, and economic and social opportunities.
- Transport facilities and activities impose various external costs including infrastructure subsidies, congestion delay, crash risk and pollution damages imposed on other people.
- Transport planning decisions can affect development location and type, and therefore accessibility, land values and local economic activity.

Equity analysis is important and unavoidable. Equity concerns often influence transportation policy and planning decisions, and most decision-makers sincerely want to address these concerns. However, there is currently limited guidance for comprehensive transport equity analysis. Conventional planning often considers a narrow set of perspectives and impacts. It is often ad hoc, based on the concerns and values of the people involved, which can result in important impacts being overlooked.

Many common transportation planning practices lead to inequitable outcomes. For example, conventional planning evaluates transportation system performance based primarily on vehicle traffic speeds and delay, which favors faster modes, such as automobile travel, over slower but more inclusive and affordable modes with lower external costs, such as walking, bicycling and public transit. This favors motorists over non-drivers, and since vehicle travel tends to increase with ability and income, is unfair to disadvantaged groups.

Transportation equity analysis is challenging because there are several types of equity to consider, numerous impacts and ways of measuring those impacts, and various ways that people and travel can be grouped for equity analysis. A particular decision may seem equitable when evaluated one way but inequitable when evaluated another.

This report provides an overview of transport equity issues, defines various types of transportation equity, discusses methods of evaluating equity impacts, and describes ways to incorporate equity analysis into transportation decision-making.

Equity Analysis Concepts

This section discusses key transportation equity concepts. Also see Di Ciommo and Shiftan (2017); Haque 2024; Lewis, MacKenzie and Kaminsky 2021; Pereira and Karner (2021); Romero-Lankao and Nobler (2021); van Burgsteden, Grigolon and Geurs 2024; and Verlinghieri and Schwanen (2020).

Types of Transportation Equity

There are two main types of equity. *Horizontal equity* (also called *fairness* and *equality*) is concerned with the distribution of impacts between people with similar needs and abilities. *Vertical equity* is concerned with the distribution of impacts between people who differ in needs and abilities. There are five main categories of transportation equity:

1. A Fair Share of Resources

Horizontal equity requires that people with similar needs and abilities receive similar shares of resources and bear similar shares of costs. It implies that consumers should "get what they pay for and pay for what they get" unless subsidies are specifically justified.

2. External Costs

External costs, such as infrastructure subsidies, congestion delays, crash risk and pollution that one person imposes on others are horizontally inequitable. Fairness requires minimizing or compensating for these costs.

3. Inclusivity – Vertical Equity With Regard to Mobility Need and Ability

Vertical equity requires that transportation systems serve travelers with mobility impairments. This supports multimodal planning, to accommodate people who cannot or should not drive, plus *universal design* (also called *accessible* and *inclusive* design), which ensures that transportation facilities and services accommodate all users, including those with disabilities and other special needs.

4. Affordability – Vertical Equity With Regard to Income

Vertical equity assumes that public policies should favor economically disadvantaged groups, and ensure that lower-income people can afford basic mobility. Policies are called *progressive* if they favor disadvantaged groups and *regressive* if they harm such groups. This definition supports affordable mode improvements, affordable housing in multimodal neighborhoods, plus special transportation services and discounts for lower income groups.

5. Social Justice

Social justice (also called *environmental justice*[1] and *social inclusion*[2]) objectives address structural social inequities such as racism, sexism, and unfair disparities. It is usually addressed by establishing affirmative action programs and targets, employee training, and procedural justice (the decision-making process is transparent and fair).

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[1] *Environmental justice* is defined as the "equitable distribution of both negative and positive impacts across racial, ethnic, and income groups, with the environment defined to incorporate ecological, economic, and social effects" (Alsnih and Stopher 2003).

[2] *Social inclusion* means everybody can participate adequately in important activities and opportunities, including access to services, education, employment, and decision-making (Litman 2003b; Lucas 2004).

Impact Categories

Transport equity can involve various impacts (costs and benefits), such as those listed below. Which are considered and how they are measured, affects planning analysis results.

Public Facilities and Services

- Amount and distribution of public resources (money and land) for facilities and services.
- Government subsidies and tax exemptions for transportation activities and industries.
- Parking requirements imposed on developers, businesses and residents.
- Transportation facility planning and design.
- Degree of procedural justice and public involvement in a planning process.

User Costs and Benefits

- Vehicle ownership and operating expenses.
- Vehicle fees, road tolls, parking fees and fuel taxes.
- Public transportation fares.
- Cost recovery and subsidies (portion of costs borne by a particular activity or group).

Service Quality

- Mobility and accessibility (amount that people travel and their accessibility).
- Number of travel modes available in an area (walking, cycling, private automobile, vehicle rentals, public transportation, taxi, rail, air travel, delivery services, etc.).
- Roadway quality (traffic speeds, delay, safety, physical condition, etc.).
- Parking facility supply, location, regulation, price and design.
- Public transportation service quality (frequency, speed, reliability, safety, comfort, etc.).
- Land use accessibility (density, mix, connectivity, location of activities, etc.).
- Universal design (accommodation of people with disabilities and other special needs).

External Impacts

- Traffic congestion and crash risk an individual or group imposes on other road users.
- Air, noise and water pollution emissions.
- Barrier effect (delay that roads and railroads cause to nonmotorized travel).
- Transport of hazardous material and disposal of hazardous waste.
- Aesthetic and amenity impacts of transportation facilities and traffic activity.
- Impacts on public health, livability and community cohesion.

Economic Impacts

- Access to education and employment, and therefore economic opportunities.
- Impacts on business activity, property values, and economic development in an area.
- Distribution of expenditures and employment (who gets contracts and jobs).

Regulation and Enforcement

- Regulation of transport industries (public transportation, trucking, taxis, etc.)
- Traffic and parking regulation and enforcement.
- Regulation of special risks (railroad crossings, airport security, hazardous material, etc.).

Measurement Issues

Transportation impacts can be measured in various ways that affect equity analysis (Suel, et al. 2024).

Mobility- Versus Accessibility-Based Planning

Transportation planning is undergoing a paradigm shift that changes the way problems are defined and potential solutions are evaluated. This involves a change from *mobility-based* to *accessibility-based* analysis. Mobility-based analysis evaluates transportation system performance based on vehicle travel speeds, using indicators such as roadway level of service (LOS) and hours of congestion delay. The new paradigm recognizes that the ultimate goal of most travel activity is access to services and activities, and that many factors affect accessibility including vehicle travel, the quality of non-auto modes, transport system connectivity, development density, and affordability (SSTI 2021).

This has important implications for equity analysis. Mobility-based planning tends to favor faster modes and longer trips over slower modes and shorter trips, and therefore favors motorists over non-drivers. For example, conventional planning recognizes congestion costs to motorists, which justifies roadway expansions, but ignores the costs that wider roads and higher traffic speeds impose on walking and bicycling trips (called the *barrier effect*), and since most public transit trips include walking links, this reduces transit access. Accessibility-based evaluation considers such tradeoffs.

Table 1 **Transportation Evaluation Perspectives** (Litman 2003)

	Mobility	Accessibility
Definition of *Transportation*	Vehicle travel	Ability to obtain desired services and activities
Measurement units	Vehicle-miles/kms	Trips, generalized costs
Modes considered	Automobile, truck and transit	Active transport (walking and cycling), motorized, mobility substitutes
Common indicators	Vehicle traffic speeds, roadway Level of Service, costs per vehicle-mile	Quality of available transport options, average trip distances, costs per trip
Favored transportation improvement strategies	Roadway and parking facility expansion	Improvements to various modes, transport demand management, Smart Growth development policies

This table compares mobility- and accessibility-based transport planning.

Accessibility-based analysis recognizes the importance of slower modes and shorter trips, and the effects that land use factors such as density and mix have on access. This allows more comprehensive equity analysis. For example, mobility-based planning justifies highway projects that destroy high-accessibility urban neighborhoods because it recognizes the benefits that faster vehicle travel provides to suburban commuters but ignores the loss of access to urban residents (Brown, Morris and Taylor 2009).

Basic Mobility and Accessibility

Basic (also called *essential*, *sufficient*, or *lifeline*) mobility and *accessibility* refers to people's ability to reach activities that society considers essential, such as those listed below. Basic mobility can be considered a *merit good* or a right (Caywood and Roy 2018). This is why, for example, emergency, service and high occupant vehicles often receive priority in traffic, why public transit services are often subsidized, and why transport systems are required to accommodate people with disabilities. Equity can justify prioritizing transportation activities and services to favor basic access (Pereira, Schwanen and Banister 2016; van Burgsteden, Grigolon and Geurs 2024).

<u>Basic Goods, Services and Activities</u>

- Emergency services (police, fire, ambulances, etc.).
- Public services and utilities (garbage collection, utility maintenance, etc.).
- Health care (medical clinics, pharmacies, etc.).
- Basic food and clothing.
- Education and employment (commuting).
- Some social and recreational activities.
- Freight delivery.

Measurement Units

Transportation impacts can be measured in various ways that can affect analysis results (Suel, et al. 2024). For example, infrastructure costs can consider expenditures by a particular government agency, a level of government, all governments, or governments and businesses that are required by law to provide off-street parking.

Impacts are compared using various *reference units*, such as per-capita, per-trip, per-passenger-mile, or per-dollar. These reflect various assumptions and perspectives. For example, *per capita* analysis assumes that every person should receive an equal share of resources. *Per-mile* or *per-trip* analysis assumes that people who travel more should receive more public resources. *Cost recovery* analysis assumes that people should receive public resources in proportion to how much they pay in fees and taxes.

Consider how different measurement units can affect equity analysis:

- User fees finance about half of roadway costs, about a quarter of public transit costs, and about 5% of non-residential parking facility costs. Motorists therefore pay a larger *portion* of their costs than transit users, considering just roadway costs, but a smaller portion considering road and parking costs, and since motorists travel about five times more annual miles, they receive larger total annual subsidies than transit users.
- Public transit services experience economies of density and scale, so cities tend to have higher service quality and ridership, and lower subsidies per trip than in suburban and rural areas. In addition, suburban and rural areas have higher roadway subsidies per capita than in cities. As a result, if equity is evaluated based on transit service quality or transit subsidies per capita, suburban and rural residents seem to receive less than their fair share. However, If measured based on transit subsidies per trip, or total road and transit subsidies per capita, urban residents seem to receive less than their fair share.

- Because cities have high land prices and design requirements, they have high unit costs, per lane-mile or parking space, but because those facilities are used intensely, their costs per user are often lower than in rural areas. Because expanding these facilities is costly, urban-peak motorists tend to be subsidized by off-peak motorists.

For example, in the U.S. governments spend about $800 annually on roadways, about $400 of which is funded by user fees, and businesses spend more than $2,000 per vehicle-year subsidizing government-mandated parking facilities (FHWA 2018, Table HM-72; Litman 2020; Scharnhorst 2018). Walking, bicycling and public transit receive less than 20% of government transportation spending and less than 10% of total (including parking subsidy) transportation infrastructure spending. You could argue:

- It is unfair to "divert" road user fees to other modes (motorists should "get what they pay for"), or conversely it is unfair that motorists only pay a small portion of total road and parking facility costs (motorists should "pay for what they get").
- Motorists pay a greater share of government expenditures but a smaller share of total expenditures (including parking subsidies) than transit users.
- Motorists receive smaller subsidies per vehicle-mile but greater subsidies per capita than travellers who rely on walking, bicycling or public transit.

The table below summarizes the equity implications of various transport reference units. It is important that people who analyze equity understand these factors.

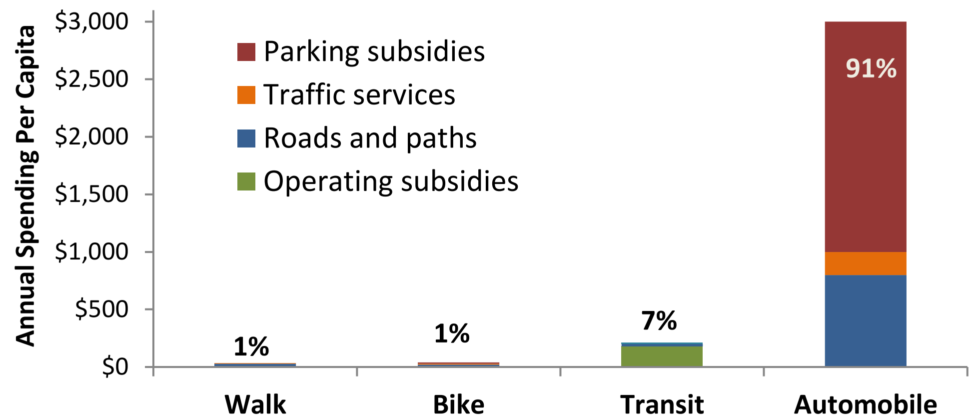
Table 2 **Equity Implications of Different Measurement Units**

Unit	Description	Equity Implications
Congestion impacts	Transportation funds are allocated based on their expected congestion reductions.	Favors people who frequently drive on congested roads.
Vehicle Miles Traveled (VMT)	Transportation funds are allocated based on vehicle-miles driven in an area.	Favors people who drive their automobile more mileage than average.
Passenger Miles Traveled (PMT)	Transportation funds are allocated based on passenger-miles travelled in an area.	Favors people who travel by any mode, with more funding for longer trips.
Passenger Trips	Transport investments are evaluated according to where trips occur.	Provides more support for shorter trips, including active modes and local travel.
Access	Transport investments can support many types of transport improvements.	Can benefit the largest range of users, particularly non-drivers.
Mobility Need	Transport investments maximize benefits to people with mobility impairments.	Favors people with disabilities and other special needs.
Affordability	Transport user fees are evaluated with respect to users' ability to pay.	Favors more affordable modes and lower-income people.
Cost Recovery	Transport expenditures are evaluated according to whether users pay their costs.	Favors wealthier travelers because they tend to spend the most.

How travel is measured can have equity impacts. Some units favor people who drive more than average.

Because equity is concerned with *people*, impacts should generally be measured *per capita*. For example, although public transit travel receives larger subsidies than automobile travel measured per passenger-mile, because motorists typically travel about five times as many annual miles as public transit users, motorists receive more total annual infrastructure subsidies, as illustrated in Figure 1.

Figure 1 **Infrastructure Spending** (APTA 2020; FHWA 2018; LAB 2018; Litman 2020)

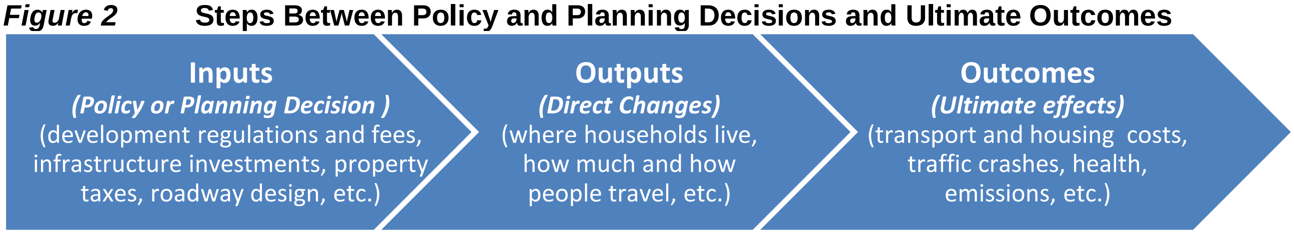


This graph compares infrastructure investments for various modes. Automobiles currently receive far more investments than other modes.

Level of Analysis

Planning decisions can be evaluated at various levels, as illustrated below. For example, transportation safety can be evaluated based on the amount of money governments spend on safety programs (an input), whether crashes decline (an output), or whether per capita crash causalities decline (the ultimate desired outcome).

Figure 2 **Steps Between Policy and Planning Decisions and Ultimate Outcomes**



There are often several steps between a policy or planning decision and ultimate economic, social and environmental outcomes. It is necessary to model these relationships for evaluation.

There is ongoing debate about how to measure equity. There is general agreement that everybody deserves *equity of opportunity*, meaning that disadvantaged people can access basic services and opportunities. There is less agreement concerning *equity of outcome*, meaning that disadvantaged people achieve improved health, education and employment goals. Opportunity can be considered a useful but incomplete metric since commonly used indicators of opportunity, such as whether disadvantaged people have public transit services, may overlook critical factors such as whether those services are sufficiently accessible, reliable and affordable. At a minimum, opportunity indicators should reflect the total door-to-door travel conditions as experienced by users. Newer equity indicators tend to measure outputs and outcomes, such as whether workers actually use transportation services, whether they obtain and retain jobs, and their net increases in incomes. This requires more integrated planning that identifies and corrects obstacles, and more multifaceted analysis which measures progress toward goals.

Categorizing People

Equity evaluation often categorizes people into groups according to their needs, abilities, demographics and geography (Jiao and Dillivan 2013; Pereira, Schwanen and Banister 2016). For example, planning analysis often divides people into walkers, bicyclists, transit users and motorists to determine who benefits from a project. Such categories can be overly simplistic since most people use multiple modes, and even people who don't currently use a mode may benefit from improvements; for example, non-auto improvements reduce motorists' chauffeuring burdens and may be useful to them in the future. Similarly, many rural residents work in or visit cities and so benefit from urban transportation improvements.

Vertical equity considers ways that people can be physically, economically or socially disadvantaged. Table 3 indicates various mobility disadvantaged groups and the travel modes they typically demand (they use it, or would use it if available).

Table 3 **Disadvantaged Groups' Travel Demands**

Users (portion of population)	Uni. Des.	Walking	Bicycling	Transit	Auto	Taxi/RH
People with mobility impairments (5-10%).	✓	✓	✓	✓	✓	✓
Youths (15-20%).		✓	✓	✓		
Low-income households (20-40%).		✓	✓	✓	✓	
Zero-vehicle households (5-15%).	✓	✓	✓	✓		✓
Adults who lack a driver's license (5-15%).	✓	✓	✓	✓		✓
People impaired by alcohol or drugs (?).		✓		✓		✓

Disadvantaged groups have diverse travel needs. (Uni. Des. = Universal Design; RH = Ride Hailing)

Disadvantaged status is multi-dimensional so its evaluation should take into account the degree and number of disadvantaged factors: the greater their degree and the more factors that apply, the more disadvantaged an individual or group can be considered. For example, a person who has a low income but is physically able, has no caregiving responsibilities, and lives in an accessible community is not significantly transportation disadvantaged, but if that person develops a disability, must care for a young child, or moves to an automobile-dependent location, their degree of disadvantage increases. Since these factors can be difficult to measure, planning often uses surrogates. For example, being over 65 years of age is often used as an indicator of physical disability.

Equity Evaluation Summary

How equity is defined and measured can affect planning results. The table below summarizes key variables affecting transportation equity analysis.

Table 4 **Equity Evaluation Variables**

Types of Equity	Impacts	Metrics	Groups
A fair share of resources. "Get what you pay for and pay for what you get." **External costs** Minimize costs imposed on other people. **Inclusivity** Ensure that transport systems serve everybody. Multimodal planning and Universal design. **Affordability** Ensure that everybody can afford basic mobility. Quality of low-price modes. Targeted subsidies. **Social Justice** Considers structural injustices	**Facilities and Services** Funding and subsidies. Planning and design. Involvement in planning. **User benefits and costs** Costs and affordability. Service quality (convenience, comfort, speed, safety). Fares, fees and taxes. **External Impacts** Congestion delays. Crash risk. Pollution. **Economic Impacts** Economic opportunities. Job and business impacts. **Regulation and Enforcement** Regulations and enforcement.	**Level of Impacts** *Inputs* (funding, road space, etc.). *Outputs* (amount of mobility and accessibility). *Outcomes* (destinations accessed, cost burdens, crash casualties, etc.). **Units of People** Per person, household, commuter, or peak-period travel. **Units of travel** Per vehicle-mile/km. Per passenger-mile/km. Per trip (by type). **Financial** Per dollar. Subsidies. Cost recovery.	**Demographics** Age and household type. Physical ability. Income and poverty. Race and ethnicity. **Location** Jurisdiction and neighborhood. Urban/suburban/rural. **Mode** Active (walking & bicycling). Vehicle ownership & licensure. Transit user/dependent. **Industries** Equipment/service providers. Shippers. Employees. **Trip type** Commutes and errands. Commercial/freight. Recreational/tourist.

There are various types, impacts, metrics and groups to consider in equity analysis.

The table below lists various transportation equity analysis questions.

Table 5 **Transportation Equity Analysis Questions**

Horizontal Equity		Vertical Equity		
Fair Share	*External Costs*	*Inclusivity*	*Affordability*	*Social Justice*
• What demand exists for various modes and accessibility options? • What are the costs of serving those options? • How much do users pay toward their transport facilities and services. What subsidies do they receive? Are those subsidies justified?	• What external costs do various travellers impose and bear? • What are the net external costs imposed or borne by various groups? • How can external transport costs be mitigated?	• How well does planning respond to non-auto travel demands? • What is the mobility disparity between motorists and non-motorists? • What is needed to better serve mobility impaired travellers?	• What are the user costs of various accessibility options? • To what degree does planning respond to demands for more affordable modes and more accessible locations? • How can transport become more affordable?	• What structural inequities exist in transportation planning? • What is their legacy of inequity? • What policies and programs can reduce current and correct for the legacy of past injustices?

This table summarizes research questions for transportation equity analysis.

There is no single way to evaluate transportation equity; it is generally best to consider various perspectives and impacts. The most practical approach is to identify a set of measurable equity objectives, such as those in the table below. Specific policies and decisions can be evaluated based on whether they support or contradict them.

Table 6 **Typical Transportation Equity Objectives**

Horizontal Equity		Vertical Equity		
Fair Share	*External Costs*	*Inclusivity*	*Affordability*	*Social Justice*
• Everybody contributes to and receives comparable shares of public resources. • Serve non-drivers as well as drivers. • Affected people are involved in planning.	• Minimize external costs. • Favor resource-efficient modes that cause less congestion, risk and pollution. • Compensate for external costs.	• Accommodate people with disabilities and other special needs. • *Basic access* (ensure that everybody can reach essential services and activities).	• Favor affordable modes. • Provide discounts for lower-income users. • Provide affordable housing in high-accessibility neighborhoods.	• Protect and support disadvantaged groups (women, youths, minorities, low-income, etc.). • Affirmative action programs. • Correct for past injustices.

This table identifies typical measurable equity objectives. A planning process can evaluate specific policies and decisions based on whether they support or contradict these objectives. (WRT = With Respect To)

Many current planning practices contradict these objectives. For example, planning that prioritizes speed over other goals favors faster but more exclusive and expensive modes with greater external costs, such as automobile and air travel, over more inclusive, affordable and low external cost modes such as walking, bicycling, and public transit. Similarly, parking minimums and limits on development density create automobile-dependent, sprawled communities where it is difficult to get around without a car. The results are unfair to people who need or prefer non-auto transportation.

There are sometimes conflicts between equity objectives. For example, horizontal equity requires roadway user fees but vertical equity may justify underpricing and subsidies for lower income travellers. Comprehensive analysis recognizes and addresses such conflicts, such as efficient pricing with targeted discounts. Equity mitigation strategies should reflect community needs and values, so affected stakeholders, particularly disadvantaged groups, should be involved in planning. The worksheet below can help stakeholders identify equity conditions, objectives and mitigation strategies.

Table 7 **Multifaceted Equity Analysis Worksheet**

	Fair Share of Resources	External Costs	Inclusivity	Affordability	Social Justice
Current conditions					
Objectives					
Mitigation strategies					

This worksheet can help identify current equity conditions, objectives and mitigation strategies.

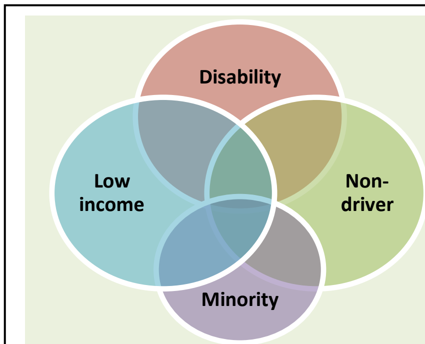
There are two general types of equity mitigation strategies. *Programmatic* (or *categorical*) solutions are special policies or programs that target designated groups. These include universal design standards to accommodate people with disabilities, senior and student fare discounts, special mobility services, and affirmative action programs. *Structural* (or *functional*) solutions reform planning practices to create more diverse, affordable and efficient transport systems. These include multimodal planning, efficient pricing reforms, and Smart Growth development policies that increase affordable housing options in accessible neighborhoods. The table below compares these approaches.

Table 8 **Structural versus Programatic Solutions** (Litman and Brenman 2012)

	Programatic (Categorical)	Structural (Functional)
Description	Programs provide targetted benefits to designated groups with special needs.	Reforms that correct unfair planning practices.
Examples	Special facilities for people with disabilities, targetted discounts and subsidies, special mobility services, and affirmative action programs.	Multimodal planning that favors affordable and resource-efficient modes, least-cost funding, pricing reforms, Smart Growth development policies.
Additional impacts	Often increases total vehicle travel which increases external impacts.	More affordable and resource-efficient accessibility options, which reduces traffic problems and provides many co-benefits.
Scope	Provides large, measurable benefits to a relatively small group.	Provides diverse but sometimes difficult to measure benefits to many groups.

This table compares different types of solutions.

Equity programs sometimes identify a list of disadvantaged groups (people with disabilities, low-income families, visible minorities, recent immigrants, unhoused people, etc.) and provide special services or subsidies for each. However, this often overlooks disadvantaged people who do not fit into a designated group, and crosscutting solutions. For example, travellers pushing a stroller or handcart may benefit from universal design but are not considered disabled; wealthy and physically abled pedestrians and bicyclists benefit from reduced vehicle traffic risk, noise and pollution; and many non-poor families need affordable transportation. Structural reforms that create more diverse, efficient and affordable transportation systems helps achieve crosscutting equity goals.

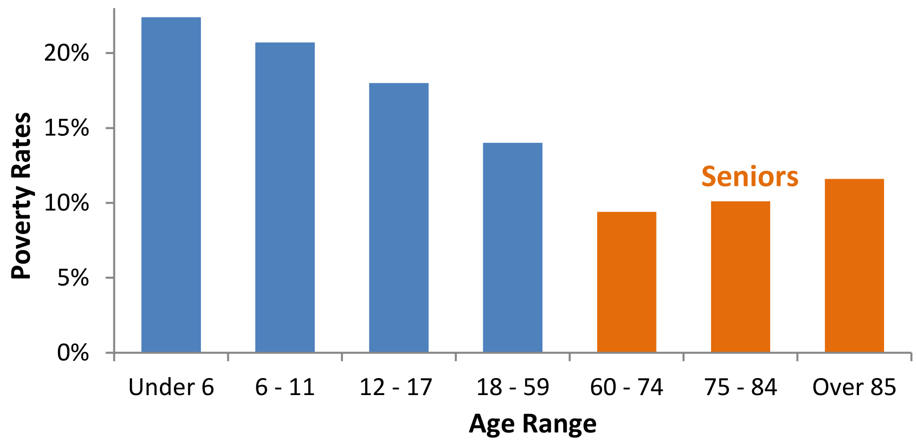


Equity analysis should consider various overlapping factors that can contribute to transport disadvantage.

Programatic solutions often seem most cost effective because they provide clearly-defined benefits to a specific group of people, but their total benefits are often limited, and they may seem unfair to people who don't quality. For example, universal design provides little benefit in areas with few sidewalks, transit fare discounts are of little value in communities with minimal transit services, and special mobility services are inconvenient and inefficient in sprawled areas.

The rules that determine who qualifies for special benefits are sometimes based on administrative convenience rather than maximizing equity objectives. For example, many public transportation agencies offer senior fare discounts for equity sake. However, poverty rates are lower for seniors than younger households, particularly families with young children, as illustrated in Figure 3. Programs that offer special benefits to categories of people based on attributes such as minority status may alienate other disadvantaged groups, such as minorities that are not included and low-income whites.

Figure 3 **Poverty Rates by Age** (www.welfareinfo.org/poverty-rate)



One of the most common and expensive transportation equity strategies are senior fare discounts, although seniors have lower average poverty rates and more discretionary spending than younger households, particularly families with young children.

Programs to help people with disabilities often focus on universal design, but overlook their high rates of poverty and therefore the importance of affordable modes and accessible locations. People with disabilities have more than three times the average poverty rate and a third lower driver's licensure rates as non-disabled people (Brumbaugh 2018). As a result, people with disabilities need frequent and affordable public transit service, and homes in urban villages where commonly-used services and activities are easy to reach by wheelchair.

More structural solutions are justified by the concept of *intersectionality*, which recognizes that inequities often overlap. For example, people with disabilities tend to have significantly lower incomes and driver's licensure rates than their non-disabled peers. Similarly, minority groups (Black, Indigenous, gay, etc.) and females also tend to have high rates of poverty and unemployment, are more likely to live in zero vehicle households, rely on non-auto modes, and live in neighborhoods that have high traffic and pollution exposure, and have more caregiving responsibilities for young children and family members with disabilities than white males. Seniors also tend to have high rates of disability and communications constraints. The following table shows the overlaps between various inequities.

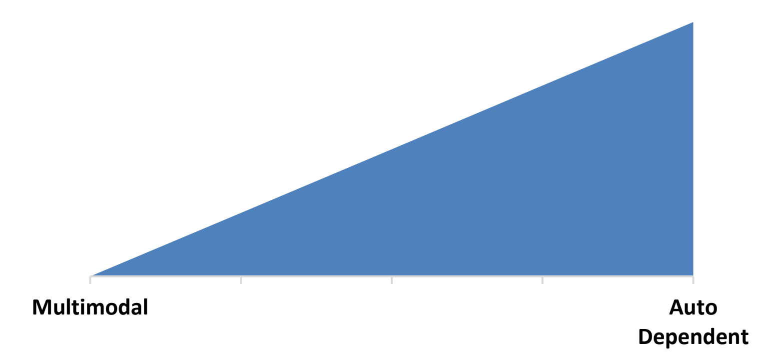
Table 9 **Overlapping Inequities** (Brumbaugh 2018; ITE 2022)

		Categorical				
		Disability	**Low Income**	**Minority**	**Female**	**Senior**
Functional	Mobility impairment	X	X	X	X	X
	Poverty and unemployment	X	X	X	X	
	Low license and vehicle ownership rates	X	X	X	X	X
	Central city residents		X	X		
	High noise and pollution exposure		X	X		
	Families responsibilities		X	X	X	
	Communication constraints	X		X		X

There are significant overlaps between physical, social and economic inequities. Virtually all disadvantage groups benefit from a more diverse, affordable and efficient transportation system.

Several recent studies highlight the inequities that result from automobile-oriented planning which favors motorists over non-drivers (Archer 2020; ITF 2021; Krapp 2021; Shill 2020). Automobile dependency increases disparities in accessibility between drivers and non-drivers, plus the delay, risk, noise and air pollution that motorists impose on other people, as illustrated below.

Figure 4 **Drivers Versus Non-Driver Disparities**



As a transportation system becomes more automobile dependent, disparities between drives and non-drivers increase, including differences in accessibility, plus external costs that travellers bear. Multimodal transport planning minimzies these inequities.

No single program – universal design, affirmative action or targetted fare discounts – can address these disparities, correcting them requires more multimodal transportation systems and reduced external transportation costs. These structural reforms tend to be more challenging to implement, but by creating more accessible, multimodal communities addresses functional disadvantages such as disability, poverty and non-driver status, and provide many benefits in addition to equity. Programatic strategies are important to address specific inequities but should generally be implemented as part of a multifaceted equity plan that helps achieve various equity objectives and applies both categorical and structural solutions.

Analysis Methods

This chapter describes techniques for incorporating equity analysis into transport planning. Also see Shah and Wong (2020); Fan, et al. (2019); and Toole, Butler and Chrzan (2020).

A Fair Share of Public Resources

Many long-running transportation equity debates reflect the assumption that motorists should "get what they pay for a pay for what they get." For example:

- Officials often complain if their jurisdiction receives less highway funding than residents pay in fuel taxes (CRS 2011). However, most experts recommend that public funds be allocated based on cost efficiency or user needs; allocation based on tax payments can result in inefficient and regressive funding allocation.

- Highway advocates complain when fuel taxes are *diverted to* non-highway projects (Feigenbaum and Hillman 2020). However, these critics ignore the fact that those taxes only fund about half of roadway costs; their argument that motorists should "get what they pay for" ignores the corollary that motorists should also "pay for what they get."

- Highway cost allocation studies examined whether various vehicle types pay their share of roadway costs through user fees (Balducci and Stowers 2008). However, the U.S. government has not commissioned such a study since 1997 because their conclusions, that fairness requires higher taxes on heavy vehicles, faces political opposition.

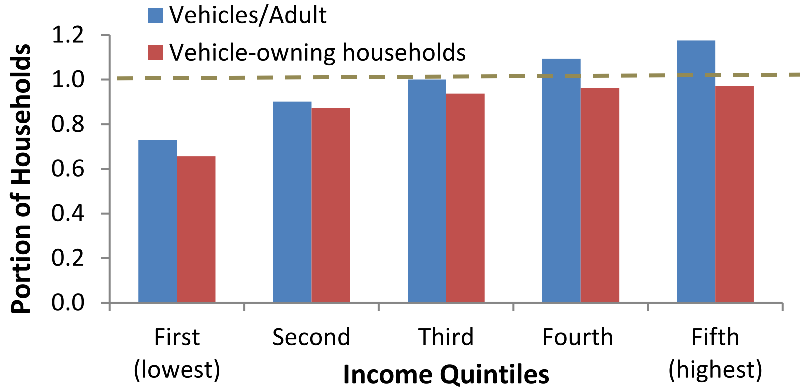
Comprehensive equity analysis considers the distribution of resources between different groups, including motorists and non-motorists. In a typical community, 20-40% of travellers cannot, should not, or prefer not to drive for most trips, as indicated below.

Table 10 **Non-Auto Travel Demands** (Buehler & Hamre 2015; Litman 2016; ITE 2022)

Type	Prevalence	Consequences
Seniors who do not or should not drive.	5-15% of residents.	Lack independent mobility, require chauffeuring (special vehicle travel to transport a non-driver) or expensive taxi travel, or move to another community with better transport options.
People with disabilities.	5-10% of residents	
Adolescents (12-20 years)	10-20% of residents	
Drivers who share vehicles.	10-20% of motorists	
Drivers who temporarily lack a vehicle.	Varies	
Low-income households who spend more than affordable for vehicles.	20-40% of households	Lack mobility or are burdened by transport costs.
Tourists and visitors	Varies	Lack mobility or visit other areas.
People impaired or distracted by alcohol, drugs or devices.	Varies.	Drive impaired or distracted, risking citations and crashes.
People who want to walk and bike for health and enjoyment	40-60% of residents, plus pets on leashes.	Have insufficient exercise or must spend time and money exercising at a gym.
Motorists who want better travel options for other travellers.	Most motorists.	Motorists bear more chauffeuring burdens, congestion and cash risk.

In a typical community, 20-40% of travellers cannot, should not, or prefer not to drive.

Figure 5 **Vehicle Ownership Rates by Income Class** ([BLS 2011-2020](#))



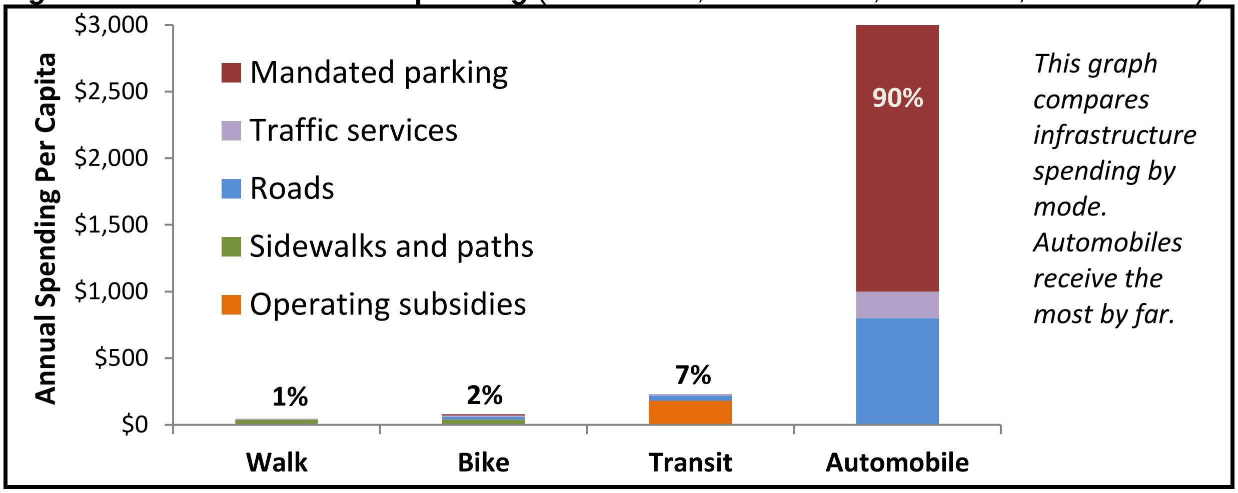
Although about 90% of total U.S. households own at least one vehicle and there are about as many vehicles as adults, these rates are much lower in lower-income households. Among the lowest income quintile, a third of households are car-free and most vehicles are shared.

Motorists may prefer that their transportation funding be spent primarily on roads and parking subsidies, but people who rely on other modes prefer more investments in walking, bicycling and public transit, as illustrated below.

Figure 6 **A Fair Share of Public Investments**

Currently, only about 3% of total transportation dollars are spent on sidewalks and paths, and about 7% on public transit; the majority of transportation resources are devoted to automobile travel, including roads, traffic services and government-mandated parking facilities. The figure below compares infrastructure spending by mode.

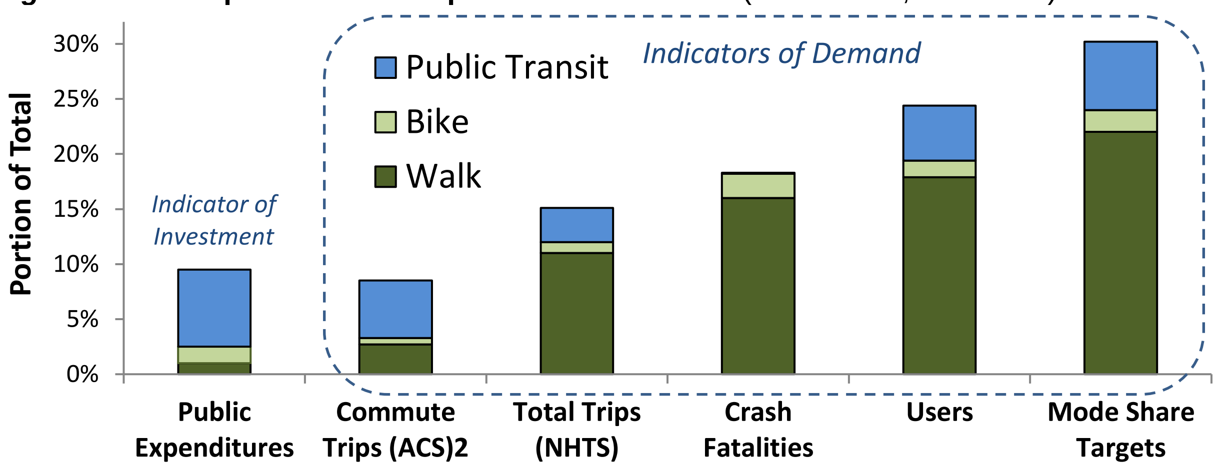
Figure 7 **Infrastructure Spending** (APTA 2020; FHWA 2018; LAB 2018; Litman 2020)



A minority of transportation infrastructure costs are funded by user fees. For example, in 2018 fuel taxes, vehicle registration fees and road tolls paid less than half of the $800 governments in the U.S. spend on roads per vehicle (FHWA 2018, Table HM-72), and less than 10% of the estimated $2,000 in government-mandated off-street parking facility costs (Litman 2020). As a result, households that drive less than average receive a smaller portion of public resources than households that drive more than average.

The figure below compares non-auto mode spending with indictors of their demand. In a typical community, non-auto modes represent 10-20% of trips, 20-30% of traffic deaths, 20-40% of travellers, 30-60% of future target mode shares (DfT 2020), but less than 10% of infrastructure investments (Litman 2016). This indicates that people who cannot, should not or prefer not to drive receive less than their fair share of funding.

Figure 8 **Expenditures Compared with Demands** (APTA 2017; LAB 2018)



This figure compares spending on walking, bicycling and public transit with indicators of their demands. This indicates that people who rely on non-auto modes receive less than their fair share of public investments. (ACS = American Community Survey. NHTS = National Household Travel Survey)

Studies by Creutzig, et al. (2020), Gössling, et al. (2016) and Levinson (2023) analyzed the allocation of urban road space and planning priority between various modes. This indicates that motorists tend to receive more and pedestrians and bicyclists receive less than their fair and efficient share of road space.

Common Planning Biases that Underinvest in Non-Auto Modes (Litman 2023; Shill 2020)

- Undercounting of non-auto travel in travel surveys. For example, commonly-used commute mode share data undercounts walking and bicycling mode shares.
- Underestimating non-auto travel demands such as travel by adolescents and low-income households, and growing demands for walking and bicycling (including e-bikes).
- Ignoring external traffic costs. For example, quantifying and monetizing congestion delay to vehicles, but not the delay that vehicle travel imposes on pedestrians and bicylists (called the *barrier effect*)
- Mobility-based transportation performance indicators, such as roadway level-of-service and congetion delay, which undervalue slower modes and shorter trips.
- Minimum parking requirements in zoning codes that subsidize automobile ownership and use, and cause sprawled development patters.
- Dedicated funding for roads and parking facilities that cannot be spent on other modes even such investments are most cost effective and beneficial overall.
- Ignoring induced vehicle travel, and its additional external costs, which exaggerates highway expansion benefits and undervalues improvements to other modes.
- Limits on urban development density and mix, which increases sprawl and automobile dependency.

Some highway advocates argue that motorists receive *less* than their fair share of spending (O'Toole 2019; Winters 2019), but their analysis only considers a small portion of total public investments. For example, they consider spending on state highways, which are mostly funded by user fees, but ignore spending on local roads that are mainly funded by general taxes. They ignore the costs of government-mandated parking facilities. They compare costs per passenger-mile, which ignores the larger infrastructure costs of people who drive high annual miles. Since horizontal equity is concerned with fairness between people, analysis should be comprehensive and measure impacts per capita rather than per unit of travel.

Transportation models can be used to evaluate the distribution of benefits from transportation improvements in specific situations (Bills and Walker 2017). This can determine whether various groups, including non-drivers, receive a share of benefits proportional to their share of residents or travellers.

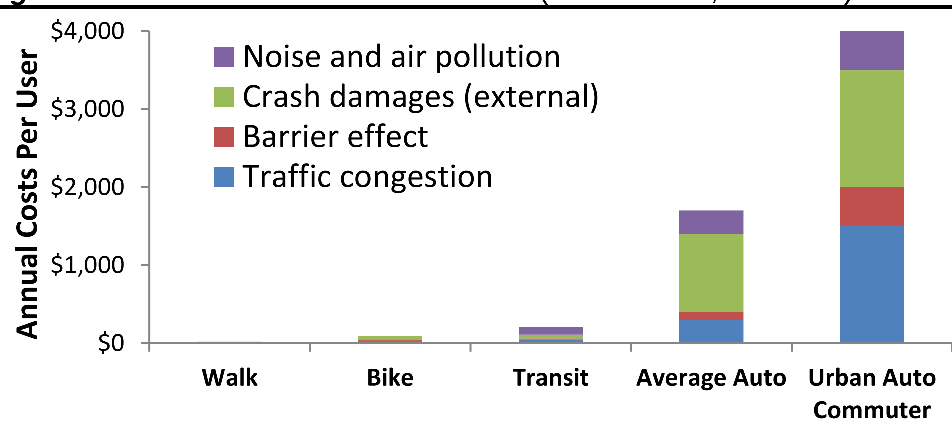
External Costs

External costs, such as the congestion, risk and pollution damages that travellers impose on other people are unfair. They violate the horizontal equity requirement that people should "get what they pay for and pay for what they get," so one person does not impose excessive costs on others. For example:

- It is unfair that travellers using space-efficient modes, such as carpools and buses, bear traffic congestion caused by space-intensive modes such as automobiles. Fairness justifies HOV and bus-lanes, and congestion tolls to internalize this cost.
- It is unfair that walkers and bicyclists bear barrier effects (delays and crash risk) imposed by automobile traffic. Fairness justifies that motorists pay for protected sidewalks and paths, traffic calming and traffic speed reductions to reduce and internalize these costs.
- It is unfair that communities bear traffic noise and air pollution. Fairness justifies pollution reduction policies, such as electric vehicle mandates, fossil-fuel traffic restrictions and speed reductions, plus emission fees to internalize these costs.

Various studies quantify and monetize (measured in monetary units) these costs (DfT 2021; Litman 2020; Ricardo-AEA 2014; TTI 2019). The figure below illustrates estimates of these costs. Because they are large, fast and resource-intensive, automobiles tend to impose larger external costs than most other modes, particularly under urban-peak conditions. As a result, people who drive more than average impose net external costs on people who drive less than average, and since vehicle travel tends to increase with income these external costs tend to be regressive (McNeil and Roll 2021).

Figure 9 **Estimated External Costs** (Litman 2020; TTI 2019)



Transportation imposes various external costs on other people. ("Barrier effect" refers to the delay and risk that wide roads and vehicle traffic impose on walking and bicycling.)

Critics sometimes argue that, since most people travel by automobile we all impose and bear similar external costs, but this is untrue due to large variations in their magnitude. For example, central neighborhood residents tend to emit less but are exposed to more pollution than average, while fringe neighborhood residents impose more but less pollution exposure (Boeing, et al. 2023). People who drive more than average tend to impose net infrastructure, congestion costs on people who drive less than average.

Inclusivity: Accommodating Diverse Mobility Needs

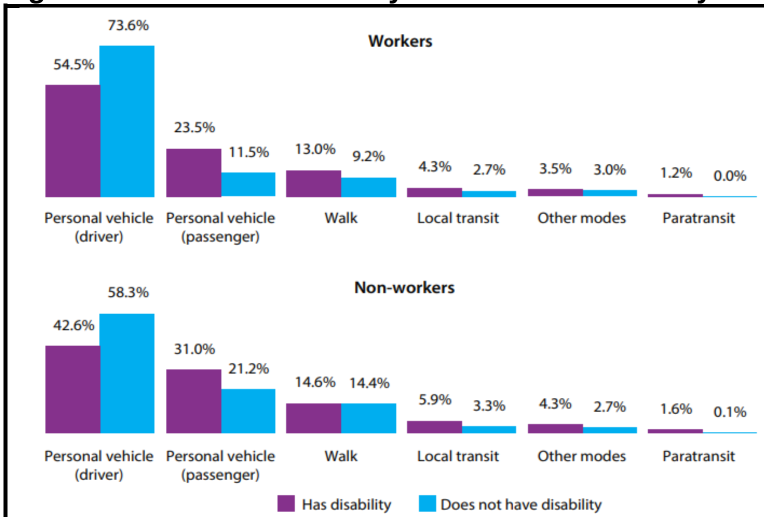
To be equitable, a transportation system must serve diverse users including people with disabilities and other special needs, such as those listed to the right. These groups rely more than average on non-auto modes (Wang and Renne 2023). Accommodating their needs requires *multimodal planning* to provide diverse travel options, plus *universal design* to accommodate travellers with disabilities and other special needs, and priority parking. Some can benefit from suitable housing options located in high accessibility areas where most common services are available within a short walk.

Diverse Mobility Needs

- People with mobility impairments (disability, pregnancy, etc.).
- Families with young children.
- Youths and families with children.
- Visitors and immigrants.
- People carrying baggage or pets.
- Car-free and car-deficit households.
- Motorists who temporarily lack an operating vehicle or driver's license.

About 8% of the U.S. population has travel-limiting disabilities (Brumbaugh 2018). People with disabilities tend to make fewer trips, travel less by automobile and more by other modes, and have lower employment rates and lower incomes than comparable non-disabled people, as illustrated below. As a result, people with mobility impairments tend to benefit from pedestrian and public transit improvements.

Figure 10 **Mode Share by Worker and Disability Status** (Brumbaugh 2018)



People with disabilities tend to drive less and rely more on walking, taxis, public transit and other modes than people without mobility impairments.

Accommodating these needs often benefits other travellers. For example, curb-cuts benefit pedestrians with wheeled luggage, prams and handcarts, in addition to wheelchair users, and public transit improvements benefit low-income commuters.

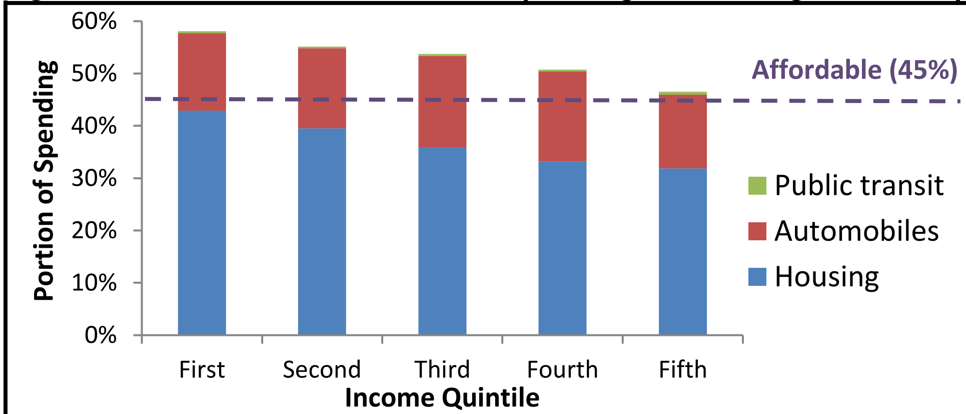
Inclusivity can be evaluated by defining universal design standards and targets. For example, targets could include accessible sidewalks on all streets, all transit vehicles accommodate wheelchairs, and that 90% of households can access basic services within 15 minutes without a car. It can also be evaluated by comparing accessibility disparities between people with and without impairments, and between drivers and non-drivers (Martens, Golub and Robinson 2012). These factors can be analyzed using universal design standards (Saha, et al. 2019), multimodal level-of-service ratings (Dowling, et al. 2008), and comprehensive accessibility models that measure travellers' ability to access services and activities by various modes (Levinson and King 2020; SSTI 2021).

Affordability: Serving Travellers with Low Incomes

Affordability refers to costs relative to incomes, and therefore people's ability to pay for basic goods within their limited budget. Surveys indicate that many travellers want more affordable mobility options (Mattson 2012), but conventional planning gives little consideration to this goal. If considered at all it is evaluated based on individual costs such as fuel prices, tolls and transit fares rather than total transportation expenses.

Affordability is defined as households spending no more than 45% of their budgets on transportation and housing combined (CNT 2018), so a typical household that spends 30% of its budget on housing should spend no more than 15% on transportation (Litman 2024). Most households spend more on them than is considered affordable, as illustrated below. When households are unable to purchase healthy food, healthcare or education, the root reason is often excessive housing and transportation expenses which leave insufficient money for these other essential goods.

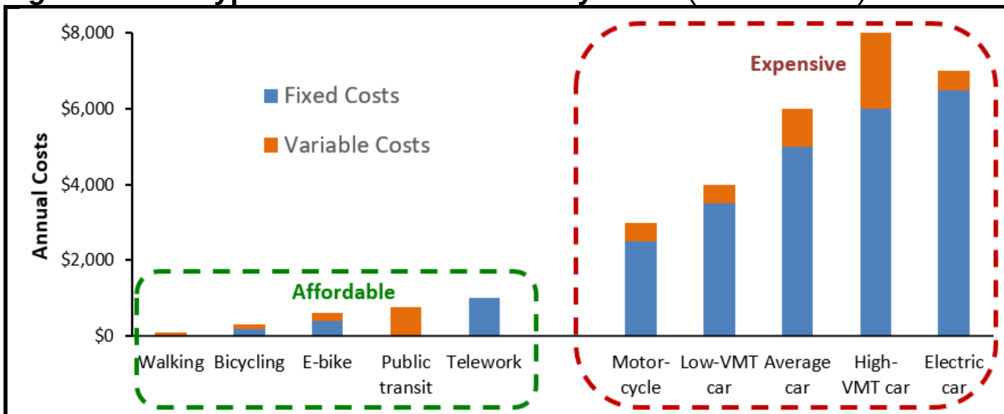
Figure 11 **Portion of Household Spending on Housing and Transport** (BLS 2020)



Most households, particularly those with lower incomes, spend a larger share of their budgets on housing and transportation (45% maximum) than is considered affordable.

The figure below compares typical costs of various modes. Active modes are cheapest, public transit costs are moderate, and automobiles are most expensive. Equity requires policies that favor affordable mobility and accessibility options.

Figure 12 **Typical Direct User Costs by Mode** (Litman 2020)

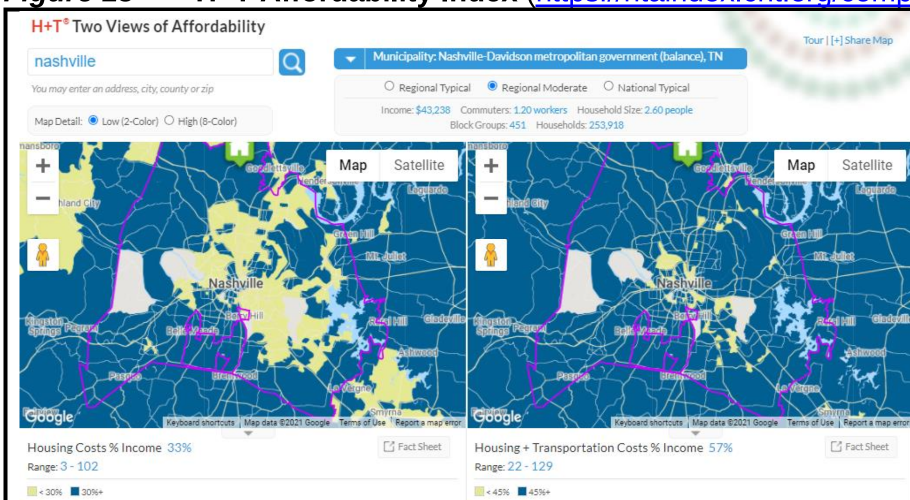


Walking, bicycling and public transit are affordable. Automobiles are expensive and sometimes impose large, unpredictable costs. Equity requires favoring affordable mobility and accessibility options.

Although lower-income motorists often try to minimize their vehicle expenses by purchasing older cars and minimal insurance, and performing their own maintenance, it is difficult to spend less than $4,000 annually, or $6,000 if driven high annual miles, including sometimes large, unexpected costs due to mechanical failures, crashes or traffic violations that can cause financial stress (Agrawal, et al. 2011). This indicates that automobile ownership is unaffordable (it requires more than 15% of their budget) for many low-income households, and multiple-car ownership is unaffordable to many low- and moderate-income households.

Transportation planning decisions can be evaluated based on their impacts on the availability, quality and price of affordable modes. New tools can evaluate these impacts (Lavery 2019). Since households often make trade-offs between housing and transport costs, for example, between a cheaper but isolated house with more expensive transportation or a higher cost house in an accessible location with cheaper transport, it is important to evaluate these costs together. The *Location Affordability Index* (HUD 2019) and the *Housing and Transportation Affordability Index* (CNT 2008), calculate the total housing and transportation costs for various neighborhoods, and therefore the savings provided by more affordable modes and more accessible, multimodal locations.

Figure 13 **H+T Affordability Index** (https://htaindex.cnt.org/compare-affordability)



These two maps compare two views of affordability for Nashville, Tennessee. The left indicates in yellow areas where housing is affordable (less than 30% of moderate-income household budgets). The right map shows in yellow the much smaller areas where housing and transportation together total less than 45% of budgets.

Transportation investments can also be evaluated based on their impacts on lower-income communities. For example, highways tend to improve access for more affluent suburban motorists but displace and degrade lower-income urban neighborhoods (Brinkman and Lin 2019; Fretz, Parchet and Robert-Nicoud 2021; Mahajan 2023). The *Gini index*, the *Theil Coefficient* and the *Coefficient of Variation* can be used to measure wealth inequity (Lucas, van Wee and Maat 2016). For example, the Gini index ranges from 0 (everybody has equal wealth) to 1.0 (perfect inequality, one person has all income or wealth).

Social Justice

Social justice considers structural inequities such as racism, sexism, and classism (America Walks; Martens 2016; Romero-Lankao and Nobler 2021). It can be evaluated by measuring disparities in public investments, transportation service quality, quality of mobility and accessibility, costs and risks, decision-making participation, and employment between advantaged and disadvantaged groups such as between minority and non-minority communities, able and impaired travellers, lower- and higher-income households, and non-drivers and drivers (ICLEI 2022). It is often addressed by establishing affirmative action policies, programs and targets (Raleigh 2021).

Transportation equity analysis requires comprehensive information on the impacts that planning decisions would have on disadvantaged groups. Analysis can compare the quality of mobility and accessibility options, and user satisfaction experienced by different groups. This can include transportation-related questions in surveys concerning other issues (Schmocker, et al. 2005); for example, social service client surveys can include questions concerning their mobility costs and obstacles.

Health Equity and Social Justice

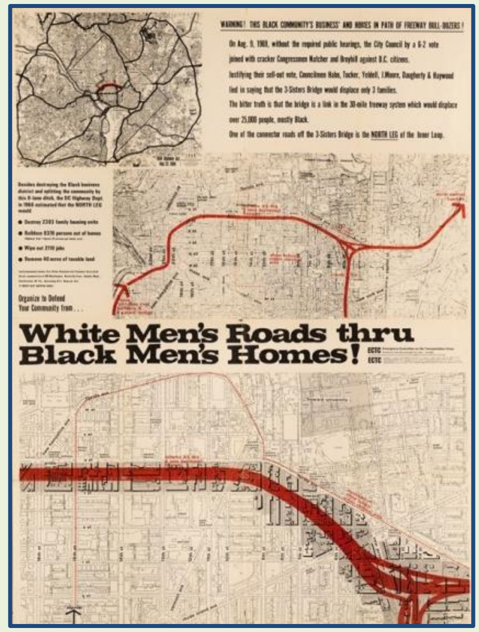
Equity can be evaluated based on health as well as economic impacts. Planning decisions affect disadvantaged people's health in many ways. Transportation quality and affordability affect their ability to access healthcare, healthy food and exercise. Vehicle traffic imposes barriers, risk and pollution on communities. Travel comfort and convenience affect daily stress and mental health.

Various studies (Ewing and Hamidi 2014; Lachapelle, et al. 2011; Mindell 2018; Rachele, et al. 2018) indicate that people, particularly disadvantaged groups, tend to be healthier when living in multimodal neighborhoods and travelling by active and public transport modes. Publications such as the *Toolkit to Integrate Health and Equity Into Comprehensive Plans (*Shah and Wong 2020) and *Investing in Health* (Jones 2021) provide guidance for incorporating health into transport planning.

Social justice analysis should also examine structural biases in planning and funding practices that favor advantaged over disadvantaged groups, and procedural justice reforms to correct them.

A century of automobile-oriented planning left a substantial legacy of injustice in many areas, including destroyed and degraded communities, and reduced economic opportunities for physically, economically and socially disadvantaged residents. At a minimum, this justifies reforms to ensure that future planning supports and protects disadvantaged communities. It could also justify mitigation and compensation, for example, urban highway removals and targeted programs to improve livability and economic opportunity in areas harmed by previous transportation planning decisions.

Equity Analysis: Lessons from Urban Highways



During the Twentieth Century highways displaced many low-income, largely minority urban neighborhoods. The article, *Interstate Injustice: Plowing Highways Through Minority Neighborhoods* (Problogic 2018) identifies more than fifty. This shows how incomplete and biased planning can lead to unfair and harmful outcomes (Bullard and Johnson 1997).

Those highways harmed communities and reduced accessibility, as described in a Federal Reserve Bank study, *Freeway Revolts!* (Brinkman and Lin 2019). High-speed highways are not really necessary in urban areas: many cities function well with moderate-speed surface streets and high quality public transit, and the displaced neighborhoods generally had much better access than the suburbs those highways were built to serve. Some cities are now replacing highways with surface roads and improvements to other modes (CNU 2019).

The planning process that created these highways was classist and racist as described in *White Men's Roads Through Black Men's Homes (*Archer 2020) and *Justice and the Interstates* (Reft, du Lucas and Retzlaff 2023). Urban planners described low-income and minority communities as *blight* to be displaced when possible. For example, a Transportation Research Board report, *Beneficial Effects Associated with Freeway Construction* (Gamble and Davinroy 1978) stated that *"Old housing of low quality occupied by poor people often serves as a reason for the destruction of that housing for freeway rights of way."* It claimed that freeways improve safety, environmental quality, economic productivity and aesthetics:

> "Blighted or substandard housing, junkyards, dumps, and other sources of ugliness may be eliminated through condemnation, eminent domain, out-right purchase, and other procedures. The effect is a reduction in visual discontinuity to the highway viewer and a possible improvement in the entire visual quality of the affected area and the community."

The *motivation* may have been classism and racism, but the *mechanism* through which transportation agencies displaced urban neighborhoods was a planning process which valued mobility over accessibility, and therefore prioritized vehicle traffic over slower travel modes. This process placed a high value on vehicle travel time and cost savings, and ignored the reduction in access and other costs to urban residents. In addition, minority neighborhoods had lower land values, making highway displacement cheaper there than in more affluent, white neighborhoods. If considered at all, harms to urban communities were described as *intangibles*, with the implication that they are difficult to quantify and unimportant. Federal and state governments offered large and generous grants for urban highways, but little support for affordable and resource-efficient urban modes.

The article, "Paved with Good Intentions: Fiscal Politics, Freeways, and the 20th Century American City" (Brown, Morris and Taylor 2009) concluded that these highways were not cost effective. Consider an example. A six-lane (three lanes each direction) city-to-suburb freeway typically serves 5,000 to 10,000 automobile commuters, assuming 2,000 vehicles per lane-hour during one to three peak hours, a third of which are local trips. The freeway corridor is five-miles long and 600 feet wide, with 30 average residents per acre, it displaced about 10,000 residents. By reducing affordable homes in high-accessibility neighborhoods the project forced many households to shift from multimodal to automobile-dependent communities. In addition, urban freeways create barriers to local travel, particularly for non-drivers, making trips that could previously be made by a short and pleasant walk, bike ride or transit trip longer and less pleasant, and imposing noise and air pollution on urban neighborhoods.

By measuring the mobility benefits of faster traffic but ignoring the accessibility value of compact, multimodal neighborhoods this planning process favored motorists over non-drivers, wealthy over lower-income residents, and suburban over urban communities. To be more equitable, planning must correct these structural biases.

Evaluation Examples

Incorporating Equity Goals into Transportation Planning

These examples describe how transportation agencies and practitioners can address equity goals.

Transportation Equity Theories

The following table summarizes various transportation equity analysis theories or principles.

Table 11 **Equity Theories** (Bills and Walker 2017; Creutzig, et al. 2020; Levinson 2010; Lewis, MacKenzie and Kaminsky 2021; Martens 2016; Pereira, Schwanen and Banister 2016)

Equity Theory	Description	Resource Allocation
Egalitarianism/ Equality	Each person receives an equal share of resources regardless of differences in need.	Per capita.
Proportionality	Each group receives a share of resources proportional to its share of the population.	Allocated to each mode based on the portion of users in that community.
Payment-Based	"You get what you pay for." Resources are allocated in proportion to user payments.	Based on the amount that each group pays.
Utilitarianism/ Pareto Optimal	Resources are distributed to maximize benefits for the most people.	Based on a comprehensive benefit-maximizing formula.
Basic Needs	Basic mobility or accessibility needs are satisfied.	Ensure everybody can achieve basic access.
Social Equity/ Rawls	Resources are allocated to provide the greatest benefits to the most disadvantaged groups.	Based on indicators of special mobility needs, such as disability and poverty rates.
Mini-Max	Average benefits are maximized while keeping disparities within an acceptable range.	Allocated to maximize benefits and correct disparities to disadvantaged groups.
Capability/Equal Opportunity	Resources are allocated to allow people achieve equality of opportunity.	To improve economic opportunities for disadvantaged groups.
Restorative Justice	Distribute benefits to equalize differences between groups and remediate disparities.	Allocated to correct disparities facing disadvantaged groups.
Libertarianism	Free markets provide the most just allocation of resources through consumer choice.	Considers taxes, so minimizes public subsidies and relies on private transport services.

This table summarizes various equity theories that can be applied to transportation planning.

As an example, consider how different theories would affect public transit funding. *Egalitarianism* would allocate funds equally per capita. *Proportionality* allocates based on transit demand. *Payment-based* allocates according to an area's tax revenues. *Utilitarianism* funds transit that provides the highest economic returns. *Basic needs* funds basic services for disadvantaged groups. *Social equity*, *Mini-max* and *Capability* provides more funding in disadvantaged area. *Restorative justice* gives more to areas that suffered past discrimination. *Libertarianism* minimizes public subsidies. Because transit service efficiency (more passenger-trips per dollar) increases with density, input-based theories such as *egalitarianism*, *proportionality* and *utilitarianism* direct more funds to urban areas, while output-based indicators such as *basic needs* and *capability* direct more resurces to suburban and rural areas, giving them more money per user.

Palmateer and Levinson (2018) evaluate transit job access based on four equity metrics: *Absolute Need* (basic access), *Equality of Opportunity* (equal access between groups), *Maxi-Min* (better access for disadvantaged groups), and *Relative Need* (access differences between drivers and non-drivers). They conclude that *Absolute Need* is suitable for measuring basic access; *Equality of Opportunity* is suitable for comparing access between areas; *Maxi-Min* works well for comparing regions but not groups; and *Relative Need* compares groups within and between modes or regions. Rode (2022) concludes that equitable transportation planning should balance minimum access for disadvantaged groups against resource allocation and pollution exposure by all groups. Lucas, van Wee and Maat (2016) develop the *socially relevant accessibility impact* (SRAI) indicator that combines various ethics principles including *egalitarianism* and *sufficientarianism* with accessibility-based analysis, the Lorenz curve and Gini index.

Guidelines & Roadmap for Equity Planning (www.teacost.eu)
The European Union funded COST project, *Transport Equity Analysis* (Di Ciommo 2018a) provides practical guidance for assessing transportation planning equity impacts. The *Guidelines & Roadmap for EU Equity Planning* describe methods and tools for analyzing the distribution of impacts suitable for urban mobility planning.

Streetlight Equity Impact Mapping Tools (https://tinyurl.com/yn6b7h7z)
The *Transportation-Social Equity Toolkit* (Streetlight 2025) uses various data sets for transportation equity impact analysis and mapping. An example compares the incomes and demographics of travelles on particular roadways to evaluate who is affected by potential design changes.

Illustrated Equity and Mobility Article (https://issuu.com/cite7/docs/tt40.2-summer2018/24)
Transportation engineer Ryan Martinson's "Equity and Mobility," 2018 *Transportation Talk* article provides an overview of equity concepts including *equality* (being equal) and *equity* (being fair, considering differing needs and abilities), and how they are reflected in common planning decisions such as funding allocation and roadway design. It also discusses ways to include diverse perspectives in transportation planning.

Balancing Horizontal and Vertical Equity in Planning (Shafiq, Amorim and Couto 2025)
The study, "Assessment of Integrated Rail and Bus Transport Network Design: Equity and Efficiency Perspectives" uses *adjusted demand* analysis to optimize transit network planning that balances efficiency and vertical equity goals (serving all travellers' demands) and vertical equity goals (serving the mobility needs of disadvantaged groups). The methodology is applied in a case study in Porto, Portugal, offering insights into the equity implications for infrastructure planning and decision-making. It provided a robust process for generating multiple bus and rail transit network solutions that balance efficient and equitable goals, based on each areas' travel demand and needs. This analysis emphasizes the importance of integrating various economic efficiency and equity perspectives to ensure fair access for diverse populations.

Transportation Community Explorer (USDOT 2024)

The *Transportation Community (TC) Explorer* helps evaluate how transportation planning decisions affect disadvantage communities. It consists of four tools:

1. **TC Explorer — National Results**, an interactive dashboard to help users understand how a project area experiences disadvantage compared to other census tracts.
2. **TC Explorer — State Results**, a dashboard that provides data on how a project area is experiencing transportation disadvantage compared to all other state census tracts.
3. **Transportation Insecurity Analysis Tool (TIAT)**, analyzes local transportation cost burdens to evaluate affordability impacts of programs, policies, and investments.
4. **Data and Methodology Download** contains TC Explorer and TIAT methodology documentation and raw data for technical users.

Equity Evaluation Indicators

*Understanding Transport-Related Social Exclusion (*TRSE) (Yigitcanlar et al. 2018) developed a framework for evaluating the *Transport-Related Social Exclusion* that individuals face, using 15 key indicators and 47 sub-indicators reflecting physical, economic, temporal, spatial, psychological, and information factors. Creger, Espino and Sanchez (2018) propose a framework for evaluating mobility equity and addressing inequities. They identify the twelve equity indicators summarized below.

Table 12 **Transportation Equity Indicators** (Creger, Espino and Sanchez 2018)

Increase Access to Mobility	Reduce Air Pollution	Enhance Economic Opportunity
1. Affordability 2. Accessibility 3. Efficiency 4. Reliability 5. Safety	6. Air quality and health impacts 7. Greenhouse gas emissions 8. Total vehicle travel (less is better)	9. Connectivity to employment, education, services and recreation 10. Fair labor practices 11. Transport-related employment opportunities 12. Inclusive local business & economic activity

Several indicators should be used when evaluating transportation equity.

Ciommo (2018b) developed an *inaccessibility index* which indicates the number of desirable activities (jobs, healthcare, shopping, etc.) that a group cannot reach. This provides a practical way to evaluate the equity of planning decisions in Barcelona, Spain, such as vehicle restrictions, parking policy changes, and transit service improvements. Adli and Donovan (2018) developed a "justice test" for transportation planning decisions which measures how changes in accessibility affect different socioeconomic groups. Golub and Martens (2014) define an *access ratio*, as the ratio of automobile and public transit employment access, and define the *access poverty line* as a ratio of 0.33, which implies that transit users can access one third as many jobs as by car. This is used to evaluate the equity of San Francisco's regional transportation plan scenarios. They investigate and map how access and access poverty rates vary by demographic groups.

Guidance for Transportation Agencies (https://bit.ly/3DMXoMJ)

The *Transportation Equity Toolkit* (Williams, et al. 2021) provides a framework for equity needs and project prioritization analysis. It describes the *Transportation Equity Audit Tool* and *Transportation Equity Scorecard* to help planning agencies prioritizing equity projects. The report, *Advancing Transportation Equity: Research and Practice* (Fan, et al. 2019) describes ways to define transportation equity and incorporate equity into policy and planning. It concludes that equity requires affordable, sustainable, reliable, efficient, safe and convenient transport with inclusive public engagement. *From State of the Practice to State of the Art: Improving Equity Analysis in Regional Transportation Plans* (Cabello, Hyland and Marantz 2023) critically evaluates equity analysis in current regional planning and provides practical steps for improving equity analyses. The National Association of Science report, *Assessment of Data, Tools, and Metrics for Equity in Decisions About Surface Transportation Investments* (NAS (2025) describes how U.S. transportation agencies can improve equity analysis. Najaf, et al. (2017) describe ways to incorporate equity goals into traffic safety planning.

Critical Evaluation of Transportation Equity Analysis

Manaugh, Badami and El-Geneidy (2015) evaluate how social equity is conceptualized, operationalized, and prioritized in 18 North American regional transportation plans. It identifies good examples of social equity objectives but finds that they are seldom translated into specified objectives and targets. *Transportation Equity Project Prioritization Criteria* (Krapp 2021), and *Transportation-Related Equity Indicators to Improve Mobility and Transportation System Access for Low-Income and Disadvantaged Communities* (DRISI 2021) examine how transportation agencies incorporate equity goals in their prioritization and planning. They identify two major shortcomings: analyses seldom consider all the relevant equity factors and equity is seldom given enough weight to significantly influence decisions. To correct this they recommend giving equity more priority to correct disparities and past discrimination, and better opportunities to disadvantaged communities to participate in planning.

Martens (2006) argues that current transportation evaluation methods that overvalue auto-oriented improvements and undervalue non-auto modes are unfair and regressive. He concludes that “Both transport modeling and cost-benefit analysis are driven by distributive principles that serve the highly mobile groups, most notably car users, at the expense of the weaker groups in society.” To maximize consumer welfare, economic efficiency and social justice objectives he recommends accessibility-based planning, and valuing accessibility gains and travel time savings inversely to people’s current accessibility levels so gains to mobility-poor travelles are valued more than gains to mobility-rich. The study, *The Impact of Transit Monetary Costs on Transport Equity Analyses* (Herszenhut, et al. 2021) shows how evaluating accessibility based on travel time, ignoring monetary costs, exaggerate economic opportunity for lower-income travellers who must work more hours to pay travel expenses.

Public Transit Equity Analysis

There are several ways to evaluate public transit equity. For example, horizontal equity implies that transit funding should be allocated so each person receives comparable shares, but vertical equity implies that disadvantaged groups should receive more per capita. Since transit efficiency (passengers per vehicle-mile) increases with density, *input-based* indicators such as per capita funding justify more service in denser areas, but *output-based* indicators such as service quality or accessibility justify more funding per capita in less dense areas, particularly if residents are relatively disadvantaged.

The Federal Transit Administration report *Practical Measures for Advancing Public Transit Equity and Access* (FTA 2023) describes methods currently used by U.S. transit agencies to evaluate the equity in their planning and budgeting. The report, *Defining and Measuring Equity in Public Transportation* (Ferrell, et al. 2023) argues that because inequity is multifaceted, transportion agencies should expand equity indicators. The Transit Center's *Transit Equity Dashboard* (https://dashboard.transitcenter.org) measures how well transit networks connect disadvantaged populations (racial minorities, people with low incomes, single mothers, etc.) to jobs, services, and amenities. Farber and Allen (2019) find better public transport accessibility in Toronto's central areas, reflecting the greater efficiency of transit services in compact neighborhoods, but because many carless households live in outer areas, additional transit services may be justified there on vertical equity grounds.

Tools for Measuring Multimodal Accessibility

New tools use various approaches to measure multimodal accessibility, taking into account the time and money required to reach basic services and activities (Levinson and King 2020; SSTI 2021). They support equity analysis by measuring the quality of access available to people with various abilities and needs (mobility impaired, non-drivers and low-incomes). These include:

Access Across America (http://ao.umn.edu/research/america) and the **Accessibility Observatory** (http://ao.umn.edu) measure accessibility to jobs via various modes.

Opportunity Score (www.redfin.com/news/introducing-opportunity-score) maps the number of jobs that can be accessed within a 30-minute walk or transit ride in U.S. cities.

Smart Location Mapping (www.epa.gov/smartgrowth/smart-location-mapping) by the US EPA provides interactive maps and data for measuring access to jobs by public transit.

Transport Access Manual: A Guide for Measuring Connection between People and Places, (https://hdl.handle.net/2123/23733) provides guidance for accessibility evaluation.

Walkscore (www.walkscore.com) measure the services reachable by non-auto modes.

Vehicle Travel Reduction Strategy Equity (Lindsey, Tikoudis and Hassett 2023)
The OECD report, *Distributional Effects of Urban Transport Policies to Discourage Car Use*, investigates the distributional effects of vehicle travel reduction policies such as cordon tolls, distance-based charges, fuel taxes, parking measures and public transport subsidies. It evaluates their potential distributional and discusses ways to design such policies to support more equitable outcomes.

Land Use Development Policies
Because land use factors such as density and mix affect accessibility, particularly for non-drivers, they have significant equity impacts: disadvantaged people tend to have much better access in compact, multimodal areas. As a result, development policies that create automobile-dependent sprawl tend to be inequitable (Beard, Mahendra, Westphal 2016), and Smart Growth policies that increase affordable housing options in walkable urban neighborhoods tend to support transportation equity goals (Ewing and Hamidi 2014; Semuels 2017). Guthrie, et al. (2019) used sophisticated surveys to assess transportation needs and abilities in Areas of Concentrated Poverty (ACPs) that have majority minority populations. They found that pedestrian environments around transit stops significantly affect public transit travel experience, leading to the conclusion that transit- and pedestrian-oriented community design can help achieve equity goals.

Mode Shift Social Impact Assessment (Curl, et al. 2020)
The report, *Social Impact Assessment of Mode Shift* examines the social equity impacts of automobile-dependency, and ways to make vehicle travel reduction policies consistent with social equity goals. It includes statistics on the vehicle travel by various groups (by income, age, gender, geography, etc.), and how vehicle travel reduction strategies would affect these groups. It recommends land use policies to increase non-auto accessibility and reduce the need to travel such as more affordable housing in multimodal neighborhoods; infrastructure investment that focus in areas with poorer accessibility and higher needs; plus policies to reduce unnecessary vehicle travel.

Transportation Equity in Developing Countries
The report, *From Mobility to Access for All: Expanding Urban Transportation Choices in the Global South* (Venter, Mahendra and Hidalgo 2019) evaluates the quality of lower-income residents' access in developing countries. They find that up to half of urbanites experience limited access leading to excessive cost burdens or limited opportunities, and many cities have declining accessibility due to motorization. It recommends more multimodal planning and TDM policies that favor space-efficient modes over private car use. The study, *Urban Access Across the Globe: An International Comparison of Different Transport Modes* (Wu, et al. 2021) evaluated 30-minute access to jobs by four modes in 117 global cities. Chinese and European cities tend to have the best overall accessibility due to their combination of compact development and multimodal transport networks. Australian, Canadian and European cities have better transit access than in the United States. They quantified the disparities in access provided by different modes.

Fair Share Resource Allocation

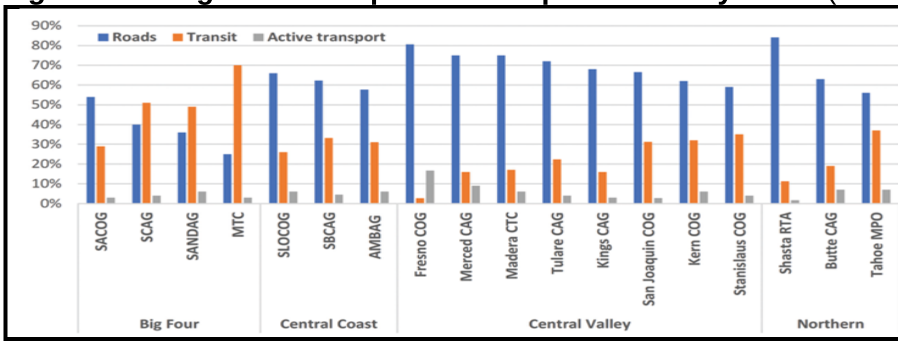
These studies evaluate whether transportation resources are equitably distributed.

Evaluating Non-Drivers' Share of Infrastructure Investments

It is generally fair to allocate transportation resources (funding, road space and traffic safet) based on a mode or group's share of demands: if a mode serves 10% of trips or travellers it should receive approximately 10% of public resources unless there are good reasons to do otherwise. This should reflect *potential* use after improvements are completed. For example, if bicycling currently has 5% mode share but this would increase 10% after improvements, a 10% resource allocation is justified. Since fairness is concerned with *people*, resources should be allocated to ensure that each traveller receives a comparable share; if allocated based on travel distance (such as cost per mile or kilometer) people who travel farther would receive more resources.

About 15% of U.S. trips are made by walking, bicycling and public transit but the potential is often higher (FHWA 2014). The study, *The Multimodal Majority?* (Buehler and Hamre 2015) found that during a typical week about 7% of Americans rely entirely on non-auto modes, 65% use a car plus another mode one to five times, and 25% use a car and another mode seven or more times. Less than 2% of federal and state transport funding and less than 10% of local funds are spent on active modes (ABW 2018; Jones 2021), and less than 14% are spent on public transit (Davis 2021). The majority of regional transportation funding is spent on roads even in highly urbanized regions. This suggests that non-auto mode investments are significantly smaller than their demands.

Figure 14 **Regional Transportation Expenditures by Mode** (Deakin, et al. 2021)



This study found that even very urban regions spend the majority of their transport funds on roads, and little on active modes. This is unfair to people who rely on non-auto modes.

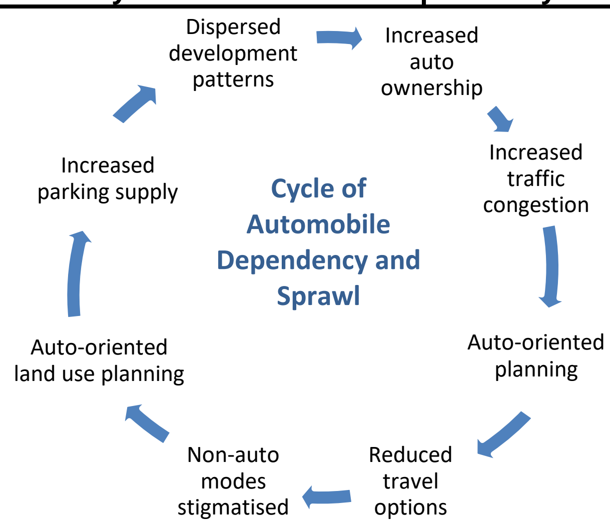
Special consideration is needed to determine optimal public transit investments (McGraw, et al. 2021; Mallett 2025). Transit supports both efficiency and equity by providing basic mobility for non-drivers, efficient travel on busy corridors, and a catalyst for compact development (Litman 2017). It bears special costs to provide basic mobility, such as wheelchair lifts and service in lower-density areas, but is generally cheaper than alternatives such as taxies or chauffeuring by motorists (Litman 2015). Automobile travel requires smaller subsidies per mile but imposes larger external costs. Transit users tend to travel fewer annual miles than motorists and so receive smaller subsidies per capita. All these factors should be considered when evaluating transit funding fairness.

From Auto-Oriented to Multimodal Planning

Many common planning practices favor automobile travel over other modes, and sprawl over compact development. The articles, "Should Law Subsidize Driving?" (Shill 2020), and, "The Political Economy of Car Dependence" (Mattioli, et al. 2020) identify various policies and planning practices that contribute to automobile dependency and sprawl. Professor Don Shoup's book, *The High Cost of Free Parking*, (2005) argues that common parking policies subsidize automobile travel. A Federal Reserve Bank study, *Freeway Revolts!* (Brinkman and Lin 2019), concluded that urban freeways built to benefit affluent suburban automobile commuters degraded the quality of life and economic opportunities for low-income, largely minority urban communities.

These automobile-oriented planning practices contribute to a self-reinforcing cycle of automobile-dependency and sprawl, as illustrated below. Automobile-dependent communities have low Walk and Bike Scores (typically below 70), poor public transit service (less than 8 buses per peak-hour), and large disparities (typically four times or higher) between the number of jobs accessible by automobile and by all other modes.

Figure 15 **Cycle of Automobile Dependency and Sprawl**



This figure illustrates how current planning practices contribute to a self-reinforcing cycle of automobile dependency and sprawl caused. This creates communities where it is easy to get around by automobile but difficult to use other modes.

The results tend to be inequitable. Non-drivers receive less than their fair share of public resources and lack basic access. It reduces affordability and increases external costs imposed on other people. It often harms disadvantaged groups such as low-income and minority communities.

These practices are unfair in several ways. Non-drivers receive less than their fair share of investments and lack access to basic services and activities, reducing their economic opportunities. Because automobiles require more space and use more energy than other modes, they impose greater external costs including infrastructure subsidies, congestion, crash risk and pollution. Automobiles are affordable to many households. Automobile infrastructure, such as highways and parking facilities, and the traffic they generate, often displace and harm low-income and minority communities.

The table below identifies common automobile-oriented planning practices and reforms that can create more equitable transportation systems. These can be called multimodal transportation planning or Smart Growth development policies.

Table 13 **Planning Reforms for Equity** (Holian and McLaughlin 2016)

Biased Planning Practices	Equitable Planning Reforms
Uses mobility-based analysis that favors faster modes and higher roadway design speeds, over slower but more affordable and resource-efficient modes.	Use accessibility-based planning. Consider all factors that affect accessibility including multiple modes, network connectivity, land use factors such as density and mix, and user costs. (Levinson and King 2021; SSTI 2021).
Ignores generated and induced travel caused by roadway expansions and sprawled development.	Account for induced vehicle travel and the increased external costs that result. (CalSTA 2021)
Evacuates transportation system performance based primarily on vehicle travel conditions, using indicators such as average traffic speeds, congestion delay and roadway level-of-service. Overlooks and undervalues non-auto modes.	Comprehensive and multimodal planning. Consider all significant community goals including cost-efficiency, affordability, public health and safety, equity, economic opportunity, community livability and environmental protection. Recognize the unique and important roles that non-auto modes play in an efficient and equitable transportation system. Use multimodal performance indicators.
Overvalues congestion costs and motorists travel time values.	Accurately evaluate congestion costs, and use travel time values that reflect motorists' willingness to pay.
Overlooks or undervalues equity impacts.	Apply comprehensive equity analysis that considers various equity perspectives and impacts.
Dedicated road and parking funds that cannot be used for other modes or TDM programs, even if they are most cost effective.	Apply least-cost planning so infrastructure funds can be invested in the most cost-effective and beneficial programs, including demand management.
Impose parking minimums which force property owners to subsidize parking facilities, and provide unpriced or underpriced public parking.	Eliminate parking minimums so developers can decide how many parking spaces to provide based on user demands. *Unbundle parking* (rent parking spaces separately from building space) so car-free households are not forced to pay for costly parking facilities they don't need. *Cash-out* free parking, so non-drivers receive the cash equivalent of parking subsidies provided to motorists.
Restricts development density and mix result in automobile-dependent sprawl.	Upzone to allow more affordable infill development, so every household that wants can find suitable homes in a compact, mixed, multimodal neighborhood.
Collects data on vehicle travel activity and conditions, and motorists' costs and benefits.	Collect comprehensive data on non-auto travel activity and conditions, costs and benefits to users of these modes.

Many current planning practices favor automobile travel over more inclusive, affordable and resource-efficient modes, and sprawl over more compact, multimodal development. This is unfair.

Active Travel Equity (http://dx.doi.org/10.1080/01441647.2016.1239660)
The report, *Understanding the Role of Equity in Active Transportation Planning in The United States* (Lee, Sener and Jones 2016) identifies ways to reduce transportation inequities in underserved communities. An equity audit of Bloomington, Indiana's sidewalks investments found that the current politically-biased process resulted in skewing sidewalk projects towards neighborhoods that were wealthier, less dense and had lower pedestrian demand. (Mark Stosberg 2020). *Signalling Inequity – How Traffic Signals Distribute Time to Favour the Car and Delay the Pedestrian* (Levinson 2018) argues that standard traffic signal control practices favor automobile traffic over pedestrian travel, and recommends various reforms to increase equity.

Creitzig, et al. (2020), De Gruyter, Zahraee and Young 2022 and Gössling, et al. (2016), evaluated the fairness of road space allocation in several cities using various equity metrics. They found that most road space is devoted to private automobile travel in the form of higher-speed traffic lanes and parking lanes, while walking, bicycling and public transit receive less than their fair share. They conclude that current roadway planning practices that favor motorized modes and ignore motor vehicle traffic external costs are unfair. Similarly, the Transportation Alternatives campaign, *NYC 25x25: A Challenge to New York City's Next Leaders* (TA 2020) argues that motor vehicles receive an excessive portion of street space and more rational allocation can provide large economic, social and environmental benefits. The International Transport Forum report, *Streets that Fit: Re-Allocating Space for Better Cities* (ITF 2022) and the European Union's *Streetspace Allocation Option Generation Tool* (https://ifpedestrians.org/roadoptions/public) provide guidance for more efficient and equitable road space allocation.

The U.S. Federal Highway Administration report, *Pursuing Equity in Pedestrian and Bicycle Planning* (Sandt, Combs and Cohn 2016), identifies practical ways to evaluate the travel demands of traditionally underserved populations (low income, minority, older adults, limited English proficiency and people with disabilities), and to ensure that active transport planning decisions serve those unmet needs. The research finds:

- People with limited travel options (including nonmotorized modes) travel less overall, make fewer shopping and social trips, have more difficulty accessing education and employment, are less likely to access healthcare and healthy foods, and experience more social isolation.
- Many older adults, children and people with disabilities are unable to drive and would use nonmotorized modes more if they are convenient, comfortable and safe. Many women and minorities feel unsafe bicycling. Those who do bicycle are less likely to practice safe bicycling (riding with traffic, using lights, and wearing helmets), and must often ride on unsafe roads.
- Many people, particularly underserved populations, suffer from problems associated with physical inactivity that could be reduced with better walking and wheeling conditions.
- Many underserved population groups live in areas with limited public transit services.

External Costs

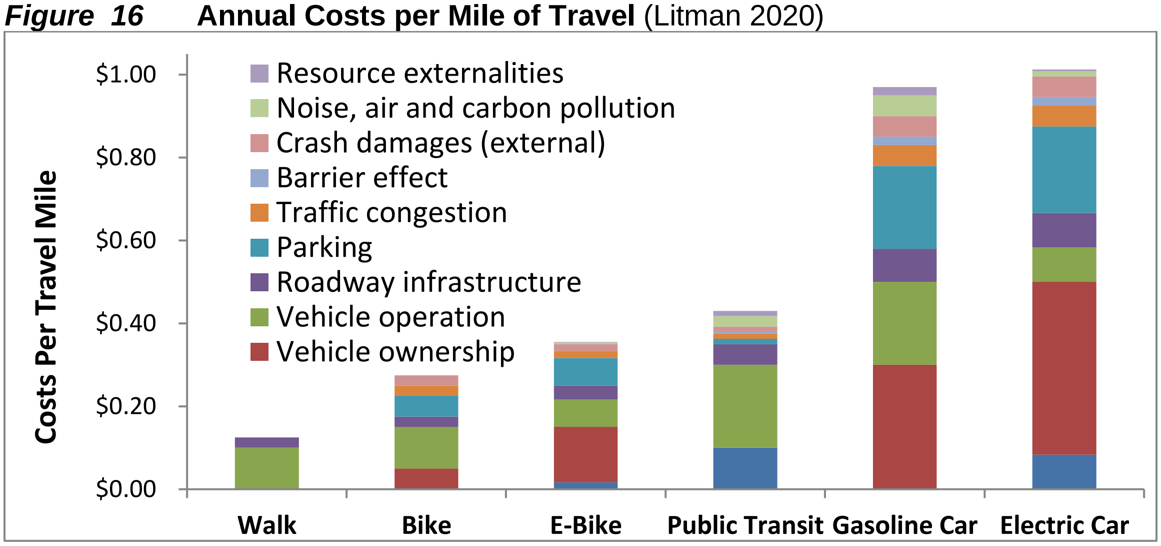
Various data sources and studies can help measure the external costs that transportation activities impose on other people.

External transportation costs include infrastructure subsidies, congestion delays, crash risk, noise and air pollution that vehicle travel imposes on other people. Although all travellers both impose and bear external costs, their magnitude varies significantly; automobile travel imposes far greater external costs than active and public transport modes, so people who drive more than average tend to impose net costs on people who drive less than average. External costs are horizontally inequitable to the degree that travellers impose net costs on others, and vertically inequitable to the degree that wealthier travellers impose net costs on those with lower incomes. For example, it is unfair that space-efficient bus passengers are delayed by congestion caused by motorists; it is unfair that motor vehicles impose risk on walkers and bicyclists; and it is unfair that out-of-town motorists impose pollution on urban residents (Gössling 2016).

Comprehensive Transportation Cost Studies (www.vtpi.org/tca)

Several studies provide comprehensive estimates of transportation costs. For example, Transport Canada's *Estimates of the Full Cost of Transportation in Canada* (TC 2008) summarized vehicle ownership and operations, infrastructure, congestion, accident and environmental costs. The European Commission's *Handbook on Estimation of External Cost in the Transport Sector* (CE Delft 2019) estimates traffic congestion, crash and pollution costs. *Transportation Cost and Benefit Analysis* (Litman 2020) provides estimates of twenty costs for eleven modes under three travel conditions (urban-peak, urban off-peak and rural). The figure below illustrates these costs per mile of travel.

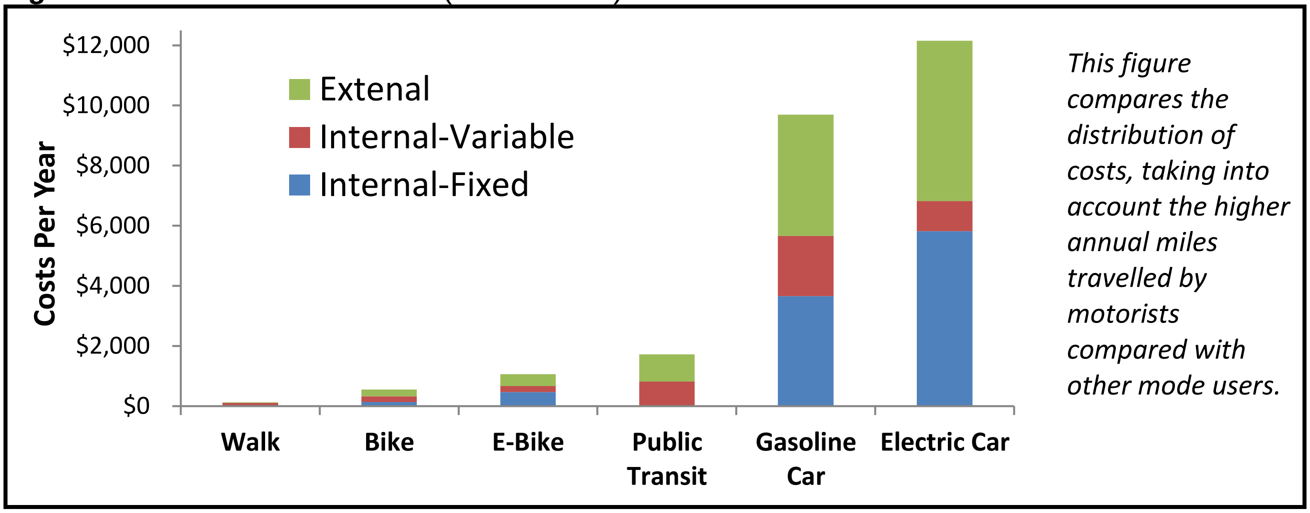
Figure 16 **Annual Costs per Mile of Travel** (Litman 2020)



This figure compares total costs of six travel modes, many of which are external. Automobile travel imposes larger external costs per mile, and since motorists tend to travel far more annual miles than non-drivers they impose much larger total annual external costs. (Walking operating costs include $100 annual costs for shoes).

The figure below illustrates the distribution of total annual costs for these modes, taking into account differences in annual miles travelled by motorists.

Figure 17 **Cost Distribution** (Litman 2020)



Comprehensive Economic Evaluation Guides

Some transportation agencies have developed comprehensive and regularly updated guides for evaluating transportation policies and projects. These include the *Australian Transport Assessment and Planning Guidelines* (ATAP 2017), the UK Department for Transport's *Transport Analysis Guidance*, (DfT 2021), the European Commission's *Guide to Cost-Benefit Analysis of Investment Projects: Economic Appraisal Tool for Cohesion Policy 2014-2020*, (EU 2014), and New Zealand's Waka Kotahi Transport Agency. *Monetized Benefits and Costs Manual*, (NZTA 2020).

Estimates of Individual Costs

Some studies estimate individual external costs. For example, the U.S. *Highway Statistics Reports*, Table 72, provides information on roadway user payments and expenditures. The report, *Quantified Parking: Comprehensive Parking Inventories for Five U.S. Cities* (Scharnhorst 2018) provides estimates of parking costs in typical U.S. urban regions. *The Economic and Societal Impact of Motor Vehicle Crashes* (Blincoe, et al. 2015) provides monetized estimates of traffic crash costs and discussion of the degree that they are external. Khayesi (2020) examines the risk that motorists impose on pedestrians and cyclists. These sources can be used to calculate the external costs that various modes impose and bear, how these vary by demographic and geographic factors, how policy and planning decisions affect these economic transfers, and in some cases, the appropriate prices to charge or compensation needed to internalize them.

Equitable Transportation Pricing
These studies examine the equity of transportation pricing.

User charges are economic transfers: costs to the people who pay and benefits to those who receive the revenue. As a result, equity analysis should account for both the prices that users pay, how revenues are used, and what would occur without the pricing.

As previously described, economic efficiency and horizontal equity require that consumers pay directly for the costs they impose unless subsidies are specifically justified. This should include variable road user fees that reflect marginal congestion and infrastructure costs, fuel tax that reflect pollution costs, and distance-based vehicle insurance fees that reflect crash costs (Butner and Noll 2020; Litman 2021). Although pricing debates are often framed as a choice between free or priced roads and parking facilities, these are never really free; the decision is really between paying directly through user fees, or indirectly through higher taxes, rents and higher prices for other goods. Paying directly can provide many benefits.

Efficient pricing gives travellers new opportunities to save money, increasing affordability. For example, if parking costs are incorporated into rents and retail prices (e.g., restaurant meals are more expensive to subsidize parking facilities), everybody pays regardless of how much they travel. If instead, users pay directly for parking, households can save money if they drive less or choose less costly parking facilities. For example, with current policies a typical apartment rents for $2,500 per month with one parking space; with efficient pricing the apartment rents for $2,250 per month plus $250 per month for each parking space used, giving car-free households a 10% savings on rents.

Efficient pricing allows higher-value trips to outbid lower-value trips for scarce road and parking space. For example, efficient road tolls allows urgent errands, freight vehicles and buses to travel unimpeded by congestion, and encourages travellers making less urgent trips to choose less congested times, modes and routes. Similarly, it ensures that motorists in a hurry can always find convenient parking spaces. Cost-recovery road and parking pricing (user fees pay for facilities) typically reduces affected vehicle travel by 10-30%, reducing external costs including congestion, crash risk and pollution emissions (CARB 2014). Efficient road pricing increases bus transit operating speeds and reliability, and increases demand for transit services, benefiting transit users (Cortright 2018).

Table 13 indicates efficient transportation pricing burdens and benefits. Pricing debates often focus on just one or two of these impacts, such as higher costs to lower-income motorists, while ignoring the large potential benefits from faster and more reliable bus service, and reduced taxes, rents and retail prices. Since lower-income households tend to own fewer vehicles, drive less and rely more on non-auto modes, they tend to benefit significantly. Their costs can be further reduced with targeted discounts. For example, the Los Angeles Metro Expresslane toll road offers discounted fees to low-income residents.

Table 14 **Transportation Pricing Impacts**

Burdened	Benefited
• Motorists who bear the inconvenience of paying tolls (which is minimized with new automated payment systems). • Lower-income motorists who pay the fee and bear major cost burdens. • Lower-income travellers priced off the road or parking facility to less desirable alternatives.	• Motorists who benefit from reduced congestion. • Public transit passengers who are no longer delayed by congestion and benefit from increased transit demand. • Residents who benefit from reduced traffic risk, noise, pollution and sprawl-related costs. • Consumers who pay lower taxes, rents and prices that would otherwise subsidize road and parking facilities.

Comprehensive analysis considers all ways that price changes affect people, including those who bear costs, and those who benefit from increased efficiency and reduced subsidy cost burdens. Because lower-income households tend to own fewer vehicles, drive less, rely more on walking, bicycling and public transit, and live in urban neighborhoods, they tend to benefit significantly.

Efficient pricing is often criticized as being regressive, since a particular fee represents a greater portion of income for wealthy than poorer households. Automobile advocates often argue that fuel tax increases, road tolls and parking fees harm low-income households, although higher-income motorists gain most of the savings. Overall equity impacts depend on who pays, price structures, the quality of alternatives, how revenues are used, and whether driving is considered essential or a luxury (Levinson 2010). User fees can be progressive if revenues reduce regressive revenue sources, are spend in ways that benefit lower-income households, or if lower-income motorists receive discounts.

Some transportation price reforms are particularly effective at achieving equity goals. For example, since vehicle ownership and use tend to increase with income, *parking cash out* (non-drivers receive the cash equivalent to parking subsidies provided to motorists), parking unbundling (parking spaces are rented separately from building space, so occupants are no longer required to pay for costly parking spaces they don’t need), and distance-based pricing (vehicle insurance and registration fees are prorated by mileage) tend to increase both horizontal and vertical equity.

Equitable Road Pricing

Various studies (see box on the following page) have investigated the equity impacts of road pricing systems, and ways to design them to support equity objectives. Most find that because (1) only a small portion of urban-peak road users are low-income; (2) tolls are less regressive than most other taxes; (3) urban-peak vehicle traffic imposes large external and often regressive costs; and (4) lower-income travellers can benefit from affordable mode improvements, road pricing tends to support equity goals if a portion of the revenues support affordable modes or disadvantaged travellers receive discounts.

Schweitzer and Taylor (2008) evaluated the cost distribution of various highway funding options. They found that sales taxes are more regressive than tolls. Low-income *drivers* pay more with tolls, but low-income residents as a group pay more with sales taxes.

Leung, et al. (2018) found that fuel taxes tend to be regressive but often less so than other transportation funding options, and their regressivity declines if lower-income travellers have better mobility options. Cortright (2017) found that peak-period automobile commuters have about twice the average incomes as commuters who use other modes. Manville (2017) finds that congestion pricing can benefit lower income commuters and non-drivers overall by improving transit and rideshare services. The article, *Low-Income Access to Employer-Based Transit Benefits*, evaluated how commute trip reduction programs affect lower-income workers, and how such programs can support equity goals (Hamre 2019).

Research on Road Pricing Social Equity Impacts

Serena E. Alexander, Mariela Alfonzo and Kevin Lee (2021), *Safeguarding Equity in Off-Site Vehicle Miles Traveled (VMT) Mitigation in California*, Mineta Institute (DOI: 10.31979/mti.2021.2027).

Stuart Cohen and Alan Hoffman (2019), *Pricing Roads, Advancing Equity*," TransForm.

Joe Cortright (2017), *Transportation Equity: Why Peak Period Road Pricing is Fair*, City Observatory.

Brianne Eby, Martha Roskowski and Robert Puentes (2020), *Congestion Pricing in the United States: Principles for Developing a Viable Program to Advance Sustainability and Equity Goals*, Eno Center.

EcoNorthwest (2019), *Fair and Efficient Congestion Pricing for Downtown Seattle*, Uber Technologies.

ITF (2018), *The Social Impacts of Road Pricing Summary and Conclusions*, International Transport Forum.

David Levinson (2010), "Equity Effects of Road Pricing: A Review," *Transport Reviews*, Vol. 30/1, pp. 33-57.

Robin Lindsey, Ioannis Tikoudis and Katherine Hassett (2023), *Distributional Effects of Urban Transport Policies to Discourage Car Use: A Literature Review*, OECD (doi.org/10.1787/8bf57103-en).

Michael Manville and Emily Goldman (2018), "Would Congestion Pricing Harm the Poor? Do Free Roads Help the Poor?" *Journal of Planning Education & Research*, Vo. 38/3, pp. 329-344. Also see, *Is Congestion Pricing Fair?*

Michael Manville, Gregory Pierce and Bryan Graveline (2022), *Guardrails on Priced Lanes: Protecting Equity While Promoting Efficiency*, UCAL Institute of Transport Studies.

Metro Vancouver (2018), *Metro Vancouver Mobility Pricing Study*, Translink.

PDOT (2020), *Pricing Options for Equitable Mobility (POEM)*, Portland Department of Transportation.

SCAG (2017), *Decongestion Fee System*, Southern California Association of Governments.

Bruce Schaller (2018), *Making Congestion Pricing Work*, Schaller Consulting (www.schallerconsult.com).

Susan Shaheen, Adam Stocker and Ruth Meza (2020), *Social Equity Impacts of Congestion Management Strategies*, Transportation Sustainability Research Center.

Lisa Schweitzer and Brian Taylor (2008), "Just Pricing: The Distributional Effects of Congestion Pricing and Sales Taxes," Transportation, Vo. 35, No. 6, pp. 797–812.

Sightline Institute's *Congestion Pricing* page.

SPUR (2020), *Value Driven: How Pricing Can Encourage Alternatives to Driving Alone and Limit the Costs that Driving Imposes on Others*, San Francisco Bay Area Planning and Urban Research Association.

Inclusivity (Serving Mobility-Disadvantaged Travellers)

These studies evaluate transportation inadequacies for disadvantaged groups.

Transportation Security Index (https://bit.ly/32Amx0n)

The *Transportation Security Index* (Murphy, Gould-Werth and Griffin 2021), is a 16-item measure that captures travellers' experience of transportation insecurity. It measures the degree that disadvantaged people are unable to access services and activities, or are delayed, inconvenienced, stressed or embarrassed due to inadequate transport options. This can be measured both absolutely and relative to other groups.

Social Exclusion Risk Factors

Using semi-structured interviews, Ward and Walsh (2023) found that transport disadvantaged residents in Chattanooga, Tennessee faced more obstacles and experienced less mobility than drivers, which reinforce their social exclusion and marginalization. Stanley, et al. (2011) identify five social exclusion risk factors including income, employment, political engagement, participation in activities, and social support. Applying this approach in Melbourne, Australia they find that trip rates decline as these risk factors increase: people with 2 or more factors take 2.8 or fewer daily trips, indicating a significant decline in community involvement. They estimate an additional trip is valued at approximately $20 at an average income, and more by mobility-constrained households, a much higher value than most evaluation models assume. The World Economic Forum's *Inclusivity Quotient* (WEF 2020) evaluates a mobility system based on five factors: availability, affordability, performance, security and legacy.

Accessibility Experienced by Disadvantaged Groups (https://bit.ly/31ZbNbq)

The report, *Measuring Accessibility as Experienced by Different Socially Disadvantaged Groups* (TSG 2005) evaluates local and regional accessibility for seven disadvantaged groups: young people (16-24), older people (60+), Black and Minority Ethnic (BME) people, people with disabilities, travelers with young children, unemployed people, and shift workers. It developed the *WALC* (Weighted Access for Local Catchments) to reflect perceived walk access. Allen, et al. (2021) found that immigrants experience more social exclusion in auto-dependent suburbs than in transit-oriented neighborhoods. Smeds, Robin and McArthur (2020) find that London transport planning underweights disadvantaged groups' nighttime travel demands.

Women's Transportation Security

The article "'Paying to Stay Safe': Why Women Don't Walk as Much as Men" (Shadwell 2017) describes how personal insecurity deters women from walking, reducing their independence, health and opportunities. This disparity diminishes with increased walkability scores, suggesting that more compact and walkable communities increase women's security. *Building Sustainable Mobility for Women* (FIA 2017), and *Planning and Designing Transport Systems to Ensure Safe Travel For Women* (Tiwari 2014) use special South Africa, Ecuador, Argentina, Chile and India travel survey to develop recommendations for improving safety and mobility through better planning.

Transprotation Adequacy Analysis (Ettema 2025)
The study *What is Transport Adequacy? Quantifying Experienced Transport Poverty* surveyed people to determine their satisfaction with transport services using an eight-item scale. It found that transport adequacy is lower for those with lower incomes, no car access, and using mobility aids. I concluded that the transport adequacy scale is a meaningful indicator of the extent to which travel needs are met and can be a useful tool to monitor autonomous developments and mobility interventions.

Child in the City (https://bit.ly/3yojMuL)
The report, *Child in the City: Planning Communities for Children & their Families* (Agnello 2020) asks, "If you could see the city from an elevation of 95 cm, what would you do differently?" It describes policies for creating more child-friendly communities. It emphasizes the value of mixed-use and mixed-income neighborhoods with diverse and affordable housing, safe walking and bicycling conditions, and convenient non-auto access to commonly-used services (stores, schools, parks, etc.). Also see the American Planning Association's *Family Friendly Communities* (www.planning.org/research/family).

Transport Deprivation
The study, "How Does Transport-Related Deprivation Reduce Hours of Work in Australia?" (Adabor 2024) finds that the additional time spent commuting by lower-income suburban residents reduces their work hours and incomes. Similarly, Pollack, et al. (2013) found that transportation increases time, budget and stress burdens of low-income Latino residents in Massachusetts.

Fairness in a Car Dependent Society (https://bit.ly/3z7WgBJ**)**
The U.K. Sustainable Development Commission's report, *Fairness in a Car Dependent Society*, analyzes the benefits and costs of automobile transportation and the distribution of these costs to various groups. Car dependency is particularly burdensome to physically, economically or socially disadvantaged people because they benefit least and face major costs from reduced accessibility, risks and pollution exposure.

Transit Service by Urban Location (https://doi.org/10.1016/j.jtrangeo.2021.103275)
The study, "Where are Equity and Service Effectiveness?" (Wang, Liu and Zhang 2022) analyzes and maps public transit demand, supply and service effectiveness in Shanghai, China. They find that central districts tend to be high-supply, while outer areas have low-supply, and some have high unmet demands by disadvantaged groups. This information can identify areas that require increased transit service for equity sake.

Access to Opportunities (https://escholarship.org/uc/item/98g9d5p4)
The Urban Institute's report, *Access to Opportunities Through Equitable Transportation* (Stacy, et al. 2020) evaluates transportation equity and inclusion, taking into account lower-wage workers' access to jobs, particularly by public transit, and overall transport affordability and safety. The *Access to Opportunities Primer* (Bhusal, Blumenberg and Brozen 2021) examines why and how to improve access to opportunity.

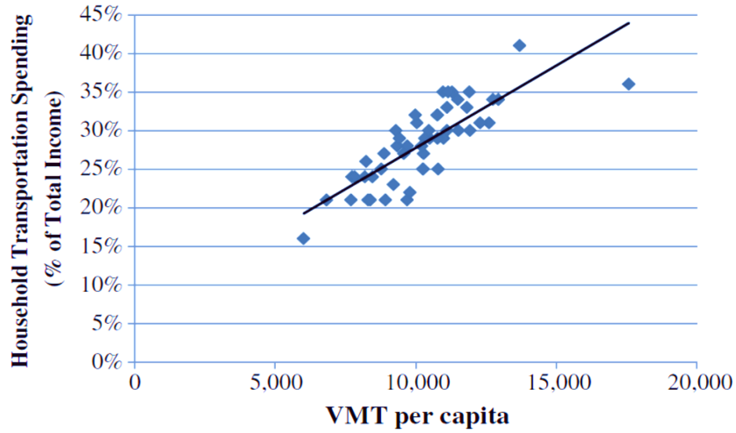
Affordability and Economic Opportunity

These studies examine ways to improve affordability (savings to lower-income households), economic opportunity (access to education, jobs and essential services), and economic mobility (the chance that children from low-income households become economically successful as adults).

Household Expenditure Surveys

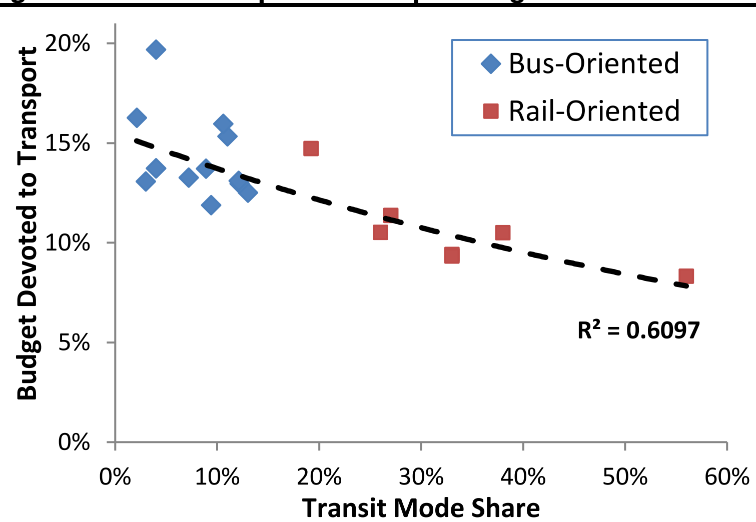
The U.S. Bureau of Labor Statistics produces *Consumer Expenditure Surveys* ([www.bls.gov/cex/home.htm)](www.bls.gov/cex/home.htm) that reports spending grouped in various ways. Similar surveys are available in other countries, or vehicle expenses can be estimated using vehicle ownership and vehicle-travel data. These surveys do not account for indirect costs, such as residential parking, so actual cost burdens are generally higher. These data indicate that transportation spending tends to increase with vehicle travel and decline with transit travel, as illustrated below. Guerra and Kirschen (2016), and Isalou, Litman and Shahmoradi (2014) find similar patterns in developing countries.

Figure 18 **Household Transport Expenditures Versus VMT** (Garceau, et al. 2013)



The portion of household income devoted to transportation increases with per capita vehicle miles traveled (VMT). Each dot represents a U.S. state.

Figure 19 **Transportation Spending Versus Transit Mode Share**



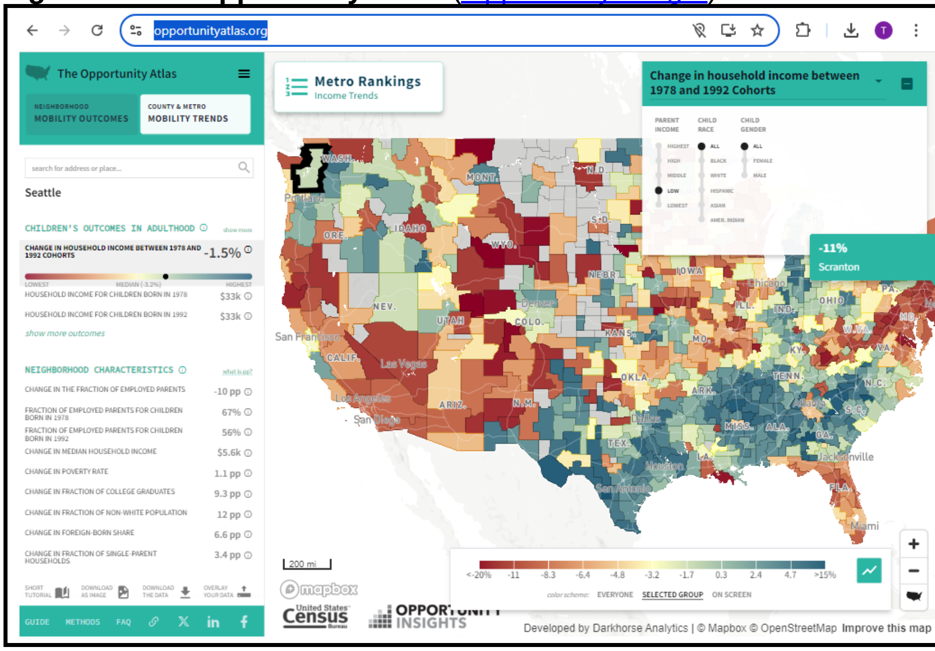
The portion of household budgets devoted to transportation (vehicles, fuel and transit fares) declines as transit mode share increases. Regions with urban rail systems tend to have the highest transit mode shares and the lowest transportation spending.

Based on BLS "Consumer Expenditure Survey" and the US Census "2012 American Community Survey" data.

Economic Opportunity and Mobility

Economic opportunity refers to people's ability to access education, employment and essential goods such as affordable healthy food. *Economic mobility* refers to whether children grow up to be more economically successful than their parents (Smith and Blizard 2021). New research is improving our understanding of these effects. Harvard University's Opportunity Insights program and the Urban Institute's Upward Mobility Initiative investigate factors that affect children's economic opportunity and mobility. The *Opportunity Atlas*, illustrated below, shows economic mobility rates for specific communities. The *Social Capital Atlas* shows rates of connectedness, cohesiveness and civil engagement in U.S. communities.

Figure 20 **Opportunity Atlas (Opportunity Insight)**



The Opportunity Atlas shows rates of economic mobility, the degree that children are more economically successful than their parents. This information can be used to identify where families can move to improve their children's opportunities, and what policies can improve opportunties in disadvangated areas.

This research identifies factors that affect economic opportunity and mobility. Ewing, et al. (2016) found that intergenerational economic mobility tends to increase with neighborhood density, mix and accessibility. Similarly, Wei, Xiong and Carlston (2023) found that economic mobility increases with Smart Growth conditions such as walkability, development mix and jobs-housing balance, and declines with sprawl, but these are offset if urban neighborhoods have concentrated poverty and racial segregation. Oishi, Koo and Buttrick (2018) found that walkable cities have smaller employment and income disparities between drivers and non-drivers. Talen and Koschinsky (2013) found that economic mobility increases with Walk Score, an indicator of density and mix. *National Household Travel Survey* data indicates that people of color, low-income households and rural residents have particularly high travel burdens including unmet mobility needs and excessive financial burdens (Espeland and Rowangould 2024).

Housing and Transportation Affordability Indices

The *Location Affordability Index* (https://bit.ly/3s1PeOo) and the *Housing and Transportation (H+T) Affordability Index* (https://htaindex.cnt.org) calculate total housing and transportation costs for various neighborhoods, and therefore the savings provided by more affordable modes and more accessible, multimodal locations. They present the analysis results in maps, charts and statistics for various locations and household types. This recognizes that a cheap house is not truly affordable if located in a less accessible area with high transportation costs, and households can rationally spend more for a home in a more accessible area where they can reduce their vehicle expenses, providing savings that can be invested in rents or mortgages.

Job Access by Income Class

Studies by Cui, et al. (2019), Rachele, et al. (2018), and Xia, et al. (2016), analyze how home locations, multimodal accessibility, transport-mode share, employment and income data affect economic outcomes. They find that improving public transit services for low income households, and increasing affordable housing and jobs in transit-oriented areas can significantly improve economic opportunity. Frederick and Gilderbloom (2018) found that increased commute mode diversity (lower automobile mode shares) tends to reduce income inequality. Turner (2019) concludes that bus service improvements and road pricing can do more to improve economic productivity and opportunity than expanding highways or subway systems. Researchers Manville, Monkkonen and Lens (2020) recommend allowing multifamily housing in economically successful neighborhoods in order to reduce income segregation and increase economic opportunity for disadvantaged groups. The Urban Opportunity Agenda identifies local policies for reducing poverty and increasing economic mobility by improving access to education, employment and basic services and improving housing affordability.

Low-Income Children's Economic Opportunity

More compact development and multimodal transportation increases disadvantaged people's economic opportunity and mobility (Bouchard 2015), particularly for workers who lack a driver's license or car (Kneebone and Holmes 2015). Ewing, et al. (2016) found that doubling their compactness index increases by 41% the probability that a child born in poverty will reach the top quintile by age 30. Using income and travel data for more than 3.66 million Americans, Oishi, Koo and Buttrick (2018) found significant positive relationships between walkability and economic mobility, particularly for workers who not drive. Talen and Koschinsky (2013) found strong correlations between neighborhood Walk Scores and economic mobility. Corak (2017) also found higher rates of economic mobility in compact Canadian communities. Lens and Monkkonen (2016) find that more compact development reduces economic segregation. Hsieh and Moretti (2015 and 2017) estimate that allowing affordable infill in economically productive U.S. cities could increase national economic output 13%, equivalent to several thousand dollars per worker, and improve disadvantaged workers' economic opportunity.

Spatial and Skills Mismatch of Unemployment and Job Vacancies

Fan, Guthrie and Vardhan Das (2016) evaluated disadvantaged residents' job access through metropolitan areas. They find that non-drivers' access to job vacancies varies widely. Targeted transit improvements can provide significant benefits by improving disadvantaged residents' access to "sweet spots," defined as in-demand occupations with low education requirements that are likely to pay a living wage. The report recommends job access metrics that consider every aspect of job availability including workers' skills, available training, in addition to home to worksite travel. The report also recommends identifying employers with labor supply problems, considering disadvantaged workers' complex schedules, and pursuing creative transportation solutions and transit-oriented development to improve low-income workers' job access.

Transportation Cost Impacts on Household Affordability (http://tinyurl.com/kdrbtmo)

Weinstein Agrawal, et al. (2011) investigated how financial stresses affect low-income families' travel and transportation expenditures, the costs and benefits of various travel modes, and users' opinions about these factors. They found that most low-income households are concerned about their transportation costs. Some low-income individuals willingly accept higher transport expenditures, such as automobile ownership, but many of these strategies have negative effects on their lifestyles.

Public Transit Economic Opportunity (Li and Wyczalkowski 2023)

The article, *How Buses Alleviate Unemployment and Poverty: Lessons from a Natural Experiment in Clayton County*, found that poverty and unemployment rates increased significantly when bus service ceased operation in a typical North American community.

Automobile versus Multimodal Solutions

Because automobile ownership tends to improve low-income people's economic opportunities, people sometimes propose providing disadvantaged people with automobile subsidies or underpricing to achieve social equity goals (Klein 2020). For example, Smart and Klein (2015) found that formerly carless households that obtain a car typically earn approximately $2,300 more per year, but they must spend more than $4,100 annually on their vehicles, and so are financially worse off overall. Vehicle failures, crashes and vehicle crimes often cause financial crises for lower-income motorists. This suggests that more flexible subsidies that can be used for any mode, or to top-up rents for more accessible homes, are probably better overall, so lower-income households can choose the mobility options that is best for them, and communities benefit from less congestion, crash risk and pollution.

Social Justice

Social justice considers how transportation systems serve disadvantaged and underserved groups, and address structural injustices such as racism and sexism.

Municipal Equity Action Plans

Raleigh, North Carolina's *Racial Equity Action Plan* and Richmond, Virginia's *Path to Equity: Policy Guide for Richmond Connects*, identify specific objectives, indicators, targets and actions to address structural inequities. These include employee training, surveys, an organizational assessment, and public engagement regarding racial equity, and various policy and planning reforms to support equity goals.

Human Rights Framework (https://bit.ly/2IDt10c)

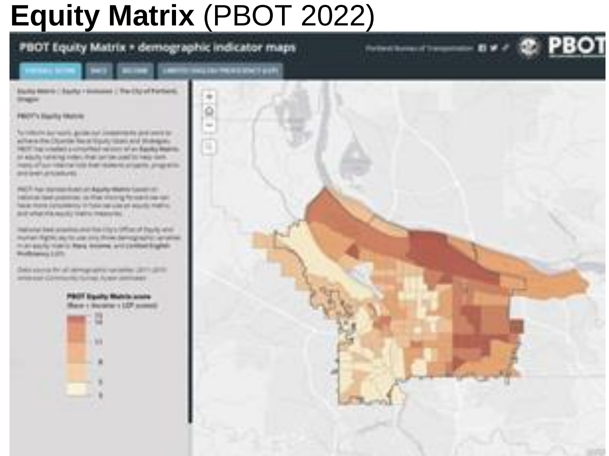
The article, "Civil Rights Guidance and Equity Analysis Methods for Regional Transportation Plans," (Karner and Niemeier 2013) evaluated the methods currently used to evaluate transportation impacts on minority populations. They conclude that prevailing equity analysis methods are inadequate. They recommend more integrated modeling and Geographic Information Systems analysis to provide better information on the ways that planning decisions affect disadvantaged groups' mobility and accessibility.

Appleyard and Riggs (2021), developed a framework for incorporating pedestrian rights into planning decisions. It assumes that "People have equal and comfortable access to opportunities to improve and/or maintain their desired quality of life," and that public policies "Prioritize the needs of the vulnerable and less powerful." Based on this framework they identified ways to apply pedestrian rights, safety and mobility.

Some groups advocate a *Transportation Bill of Rights* that defines the following basic levels of safety, mobility and accessibility (Wilson 2022):

1. No one dies or is seriously injured traveling on public roads, streets, and sidewalks.
2. Every household can access groceries within 20 minutes without a car.
3. No one is harmed by transportation noise or pollution.
4. Future generations are protected fro climate change.
5. All trips less than one mile are easily and enjoyably achieved by non-drivers and people with disabilities.
6. No household should spend more than 45% of its income on housing, transportation, and energy.
7. Every child who wants to can bike, walk, or roll safely to school.
8. Transit service is frequent and spans the day and night so people can get to work and come back.
9. The pursuit of happiness does not require a car.

Equity Matrix (PBOT 2022)



Portland, Oregon's Equity Matrix GIS mapping system identifies areas with higher than average racial minorities, lower incomes or limited English proficiency to help evaluate transportation planning equity impacts and guide investments to address equity objectives. (PBOT 2022)

Displacement and Gentrification
Transit-oriented development (TOD) provides many benefits, but by increasing housing prices can increase gentrification (more affluent residents) and displacement (lower-income and minority residents forced to leave), which erodes community cohesion (Chapple and Loukaitou-Sideris 2019; Howland 2020). These studies indicate the importance of including affordable housing in accessible, multimodal communities.

Planning Reforms
Planning reforms help evaluate equity impacts achieve equity objectives.

Comprehensive Evaluation
The article, “Looking Beyond the Mean for Equity Analysis: Examining Distributional Impacts of Transportation Improvements” (Bills and Walker 2017) recommends more disaggregated modelling to better understand planning decisions’ equity impacts. The *Equitable Transitions Guidebook* (ICLEI 2022) describes tools for cities to map the equity outcomes of local sustainability plans across three dimensions: access, participation and opportunity. It provides insights, recommendations, best practices, resources and tools, including the following:

- Framing social equity along the three dimensions of access, participation and opportunities;
- Mapping of social risks and opportunities associated with sustainability programs and initiatives at the local level;
- Learning about key equity aspects to consider when designing sustainability programs and applying concrete policy instruments to integrate social equity in such programs; and
- Identification of suitable indicators to monitor social impacts over time in a holistic manner.

Vehicle Travel Reduction Targets
Many jurisdictions have targets to reduce vehicle travel and increase active and public transport (Litman 2019). For example, California law requires reducing per capita vehicle travel 15% by 2050. Washington State requires 30% reductions by 2035 and 50% by 2050. British Columbia’s target is to reduce light-duty vehicle travel 25% by 2030, and approximately double active and public transport mode shares. The United Kingdom has a goal that by 2030, half of urban journeys will be by active modes. Although these targets are primarily justified to reduce congestion and pollution problems, they can also help achieve equity objectives by creating more diverse transportation systems and more accessible communities. California developed extensive guidelines and analysis tools to evaluate how transportation and land use development projects will affect vehicle travel and related costs, and their social equity impacts (CalSTA 2021).

Strategies for Achieving Transportation Equity Objectives

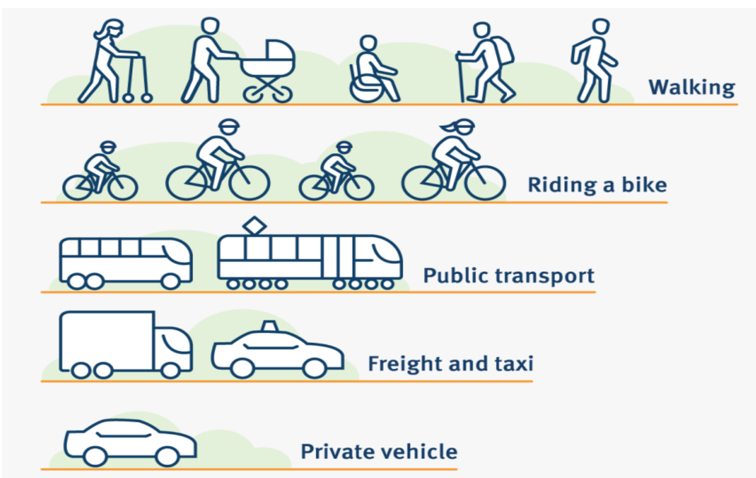
This section identifies ways to achieve transportation equity objectives.

Planning Reforms

Planning practices that create more diverse, affordable and efficient transportation systems, and more compact, multimodal communities, tend to support horizontal and vertical equity objectives (DFID 2013). Below are specific strategies.

- Develop planning practices, analysis tools and data to allow comprehensive equity analysis. Develop comprehensive information on disadvantaged groups' travel demands, including factors such as unmet demands for increased convenience and comfort by non-auto modes.
- Apply accessibility analysis, multimodal planning and least-cost funding so transportation funds are spent on the most cost effective investments, considering all impacts and equity goals. This tends to support walking, bicycling and public transit, plus TDM incentives that increase transportation system efficiency.
- Apply a sustainable transportation hierarchy, which prioritizes inclusive, affordable, resource-efficient modes in transportation funding, planning and design decisions.

Figure 21 **Sustainable Transportation Hierarchy** (Kindpng)



A sustainable transportation hierarchy prioritizes more affordable and efficient modes, such as walking, bicycling and public transit, and more important trips, such as freight and service vehicles, over expensive and resource-intensive modes, and lower value trips.

This increases economic efficiency and helps achieve social equity objectives.

- Establish vehicle travel reduction targets to coordinate planning decisions between various transportation agencies.
- Implement Smart Growth policies that create more affordable housing options in accessible areas, so any family that wants can find suitable homes in a neighborhood where it is easy to get around without a car.
- Apply efficient transportation pricing, including decongestion road tolls, variable parking fees, and distance-based vehicle insurance and fees.
- Ensure that traditionally underserved groups are effectively involved in transportation policy and planning decisions.
- Require or encourage employers to implement commute trip reduction programs.

Fair Share

Current transportation planning practices tend to favor automobile transportation over other modes. As a result, motorists tend to receive more public resources (money, road space and priority) per capita than people who rely on other modes. The following reforms can help ensure that all travellers receive a fair share:

- Collect comprehensive information on non-auto travel demands, activities and impacts, particularly by disadvantaged groups. Compare the allocation of public resources, including money and road space, between advantaged and disadvantaged groups.
- Develop accessibility-based evaluation tools that measure the time and money costs required to reach basic services and activities by various types of travellers under various conditions. Compare accessibility between advantaged and disadvantaged groups.
- Apply multimodal transportation planning, so non-auto facilities and programs are considered equally with those for automobile travel.
- Apply complete streets policies, streetscaping and traffic calming so that public roads safely accommodate all travellers, particularly walkers and bicyclists.
- Apply least-cost funding, so non-auto modes and demand management programs receive investments whenever they are cost effective, considering all impacts.

External Costs

Due to their size, speed and energy use, automobiles tend to impose more external costs than other modes, including facility subsidies, congestion and barrier effects, crash risk and pollution costs on other people. These tend to increase with travel speeds, and faster travel tends to induce more vehicle travel which also increases external costs. User fees only cover a small portion of road and parking facility costs. As a result, people who drive more than average tend to impose net internal costs on people who drive less than average. The following reforms can reduce and compensate for external costs:

- Collect information on transport external costs (traffic delay, risk, noise and air pollution).
- Increase user fees to recover costs and to encourage travellers to choose efficient options. Increase fuel taxes, and apply efficient road tolls and parking fees.
- Convert fixed vehicle insurance premiums, registration fees and sales taxes into distance-based charges to better reflect the facility, crash and pollution costs each vehicle imposes.
- Reduce total vehicle travel and traffic speeds, particularly in urban areas.
- Create HOV- or bus-lanes on busy urban roads so rideshare vehicles and buses are no longer delayed by congestion created by automobile traffic.
- Eliminate parking minimums and unbundle free parking (rent parking separately from building space) so non-drivers are no longer forced to pay for costly parking facilities they do not need. Cash out free parking so non-drivers receive benefits comparable to motorists.
- Establish and enforce vehicle design standards to reduce emissions and crash risks.
- Fund walking and bicycle improvements from road user fees as a mitigation for motor vehicle delay and crash risk.

Inclusivity

Inclusivity ensures that transportation systems serve people with disabilities and other special needs, particularly to access basic services and activities such as education, employment, healthcare, basic shopping, recreation, and civic activities.

- Collect information on non-auto travel demands and disadvantaged groups unmet transport needs. Use this information to target transportation improvements to address these needs.
- Prioritize transportation investments and management to favor people with mobility impairments, and to favor basic access over other travel activities.
- Apply universal design to transportation facilities and services. Perform audits and surveys that evaluate their performance from users' perspective.
- Favor inclusive modes (walking, bicycling, public transit, ridesharing, taxi/ridehailing and telework) over more exclusive modes such as private automobile travel.
- Ensure that any household that wants can find suitable housing in an accessible, multimodal neighborhood.

Affordability

Transportation, particularly private automobiles, impose excessive cost burdens on many low- and moderate-income households, including sometimes large, unexpected costs caused by vehicle failures, crashes or traffic citations which can impose severe financial shocks. Because households often make trade-offs between housing and transportation costs, true affordability reduces both housing and transportation costs.

- Favor affordable modes in planning, funding and facility design, including walking, bicycling, public transit services, taxi/ridehailing and carsharing, and high-speed internet services.
- Implement Smart Growth policies to create more affordable housing options in walkable and transit-oriented neighborhoods.
- Plan and regulate transport services to minimize public transit and taxi/ridehailing fares.
- Offer targeted discounts for road tolls, parking fees, carsharing and ridesharing to low-income travellers who require automobile travel to access essential services.

Social Justice

Social justice requires that transportation planning addresses structural injustices such as racism and sexism.

- Evaluate transportation impacts (benefits and costs) on disadvantaged groups, including negative impacts that increased vehicle traffic imposes on urban communities.
- Implement affirmative action policies and programs.
- Ensure that traditionally underserved groups are effectively involved in transportation policy and planning decisions.
- Correct for past injustices such as the damages that urban highways imposed on minority communities.

Summary of Equity Strategies

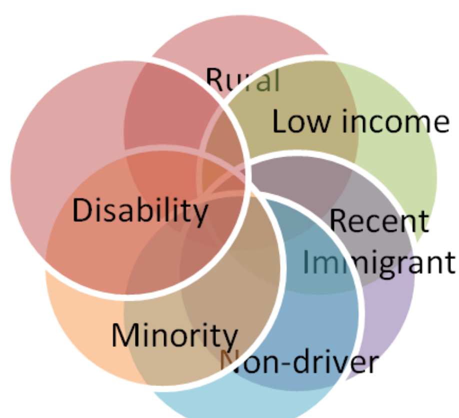
The table below evaluates whether various strategies support or contradict equity goals.

Table 15 **Transportation Equity Strategies**

Strategy	Fair Share	External Costs	Inclusivity	Affordability	Social Justice
More comprehensive analysis	✓	✓	✓	✓	✓
Accessibility-based planning	✓	✓	✓	✓	✓
Multimodal planning	✓	✓	✓	✓	✓
Smart Growth policies		✓	✓	✓	✓
Subsidize public transportation		✓	✓	✓	✓
Complete streets policies	✓	✓	✓	✓	
Universal design	✓		✓	✓	✓
Prioritize affordable-efficient modes	✓	✓	✓	✓	✓
Vehicle travel reduction targets		✓	✓	✓	✓
Commute trip reduction programs	✓	✓	✓	✓	
Efficient road & parking pricing	✓	✓	✓	×	
Parking cash out and unbundling	✓	✓	✓	✓	
Subsidize electric car	×	✓			
Subsidize cars for low-income motorists	×	×	✓	✓	
Improve public engagement	✓		✓		✓
Affirmative action programs	×		✓		✓
Compensate for past harms	✓				✓

This matrix indicates whether strategies support (✓) or contradict (×) various equity goals.

This indicates that some strategies help achieve multiple equity goals by making planning respond to unmet travel demands; favoring affordable and resource-efficient modes; and creating more compact and multimodal communities where it is easy to get around without a car. Targetted strategies tend to achieve fewer equity goals, and some can have negative equity impacts. For example, automobile subsidies are unfair to travellers who don't receive them, and by increasing total vehicle travel exacerbate traffic problems. Programatic strategies should be designed to minimize inequities. For example, electric vehicle subsidies can target public transit and taxi services, and subsidies for low-income motorists can be balanced with subsidies for other modes. A good example of multifaceted equity analysis is, *Changing Lanes: A Gender Equity Transportation Study* (LADOT 2021). It identifies various disparities between women's and men's travel opportunities, and ways to reduce them. It recommends both structural reforms to improve affordable mobility options, plus targetted programs to provide special services, including access to automobiles, to disadvantaged groups.



Equity Planning Audit

An equity planning audit examines whether a planning process has the resources needed analyze and achieve progress toward equity goals. The table below identifies data, analysis and targets for addressing five transportation equity types. This framework can be used to evaluate and guide an organization's transportation equity planning. It emphasizes the need for multifaceted equity planning. It is insufficient to address one type of equity but ignore others.

Table 16 **Equitable Planning Process Audit**

	Data	Analysis	Targets
Fair share planning	Collect information on demands and total expenditures and subsidies by and mode and user groups.	Examine the ratios between demands and investments. Identify planning biases that underinvest in non-auto modes.	Set targets for improving and encouraging each mode, and for more equitable investments.
External costs	Collect information on the external impacts (infrastructure subsidies, congestion, risk, pollution, etc.) by mode.	Examine the external costs that various modes and user groups impose on others.	Set targets for reducing or compensating excessive external costs.
Inclusivity	Collect information on travel demands and obstacles faced by disadvantaged groups.	Identify improvements needed to serve disadvantaged groups, such as universal design.	Set targets for improving travel conditions for disadvantaged users.
Affordability	Collect information on the user costs of various modes and investments in lower-cost modes.	Identify planning and funding biases that favor expensive over affordable modes.	Set targets for improving affordable travel options.
Social justice	Collect information on disadvantaged groups' travel and housing demands, service quality, and employment opportunities.	Identify disparities between advantaged and disadvantaged groups, and ways to correct them.	Set targets for improving disadvantaged groups' transportation, housing and employment options.

This matrix identifies data, analysis and targets for operationalizing transportation equity planning.

Transportation equity planning requires new types of data such as total expenditures and subsidies (including government-mandated parking subsidies) for each mode, user and external costs, plus current and latent travel demands by various groups, particularly disadvantaged groups. It also requires new types of analysis and targets.

Conclusions

Transportation planning decisions have significant equity impacts. Evaluating these can be challenging because there are multiple equity types, impacts, metrics, and groupings to consider. Planning decisions should reflect a community's equity needs and values, so it is important to incorporate effective public engagement that involves all stakeholders, particularly disadvantaged groups.

To be equitable, transport planning should strive to minimize disparities in *inputs* (funding, road space, and priority) and *outcomes* (convenience, comfort, safety and accessibility) between different groups, such as between drivers and non-drivers or between urban and rural travellers, with particular consideration to disparities borne by physically, economically and socially disadvantaged groups.

Transportation equity is not a single issue, it is an interrelated set of sometimes overlapping and sometimes conflicting concerns. Some reflect *horizontal equity*, which requires that people with comparable needs and abilities be treated equally. Others reflect *vertical equity*, which requires favoring disadvantaged people, and social justice which considers structural injustices such as racism and sexism.

Equity analysis generally involves the following steps:

1. Define the type of equity to be considered (horizontal, vertical, social justice)
2. Define the impacts to be considered (funding, facility supply, cost burdens, etc.)
3. Define what distribution of impacts is considered fair and appropriate.
4. Define the population groups considered (demographics, income, geography, mode users), and which are disadvantaged.
5. Evaluate the degree that the distribution of impacts is considered fair and appropriate.

How impacts are measured can significantly affect analysis results. A planning process should consider various types of equity (horizontal, vertical and social justice), various impacts (benefits and costs), and various groupings of people (by demographics, income, geography and ability). Analysis can measure *inputs* such as expenditures; *outputs* such as the amount of facilities or services provided; or *outcomes* such as the amount of travel people engage in, or the costs they bear. Comprehensive planning analysis generally considers various equity types and perspectives, impacts, and population groups that reflect the nature of the planning process. Because equity is concerned with *people*, impacts should generally be measured per person; measuring impacts per mile favors wealthier people who travel longer distances.

Automobile travel is exclusive (not everybody can drive), expensive and imposes large external costs. As a result, planning practices that favor driving over other modes tend to be inequitable: they favor motorists over non-drivers, reduce basic access for non-drivers, reduce affordability, and increases external costs imposed on communities. A sustainable transportation hierarchy, which favors resource-efficient over resource-intensive modes, tends to achieve both economic efficiency and social equity goals.

There are many possible ways achieve equity goals; some provide more total benefits than others. Programatic solutions deliver special benefits to designated groups. Structural solutions reform planning practices to create more inclusive, affordable and resource-efficient transportation systems. Although programmatic solutions may seem most effective specific equity goals, structural solutions tend to provide larger and more diverse benefits and so are generally most cost-effective and beneficial overall.

Many inequities overlap, which justifies integrated solutions. For example, racial minorities, new immigrants, people with disabilities, frail seniors, young families and adolescents all tend to have constraints on their ability to drive and high poverty rates, and are vulnerable to traffic external costs such as traffic risk and pollution exposure, and so tend to benefit from structural reforms that increase transportation system diversity, affordability and efficiency. Structural reforms tend to be more challenging to implement, but provide a wide range of benefits. As a result, equity programs should generally include both categorical and structural solutions, with emphasis on reforms that increase transportation diversity, affordability and efficiency.

A practical way to incorporate equity into planning is to define measurable equity objectives. Planning decisions can then be evaluated based on the degree that they support or contradict these. The table below identifies metrics suitable for evaluating various types of equity impacts, and strategies for achieving related objectives.

Table 17 **Transportation Equity Analysis Summary**

Type	Description	Metrics	Optimization Strategies
Horizontal – Fair Share	Each person receives a fair share of public resources.	Allocation of public resources (money, road space, parking facilities, etc.).	Multimodal planning. Least-cost funding. Efficient pricing.
Horizontal – External costs	Travellers minimize and compensate for external costs.	Infrastructure subsidies, congestion, crash risk and pollution that travellers impose on other people.	Minimize and compensate for external costs. Favor resource-efficient modes.
Vertical – Inclusivity	Transportation systems provide basic mobility to disadvantaged groups.	Quality of travel for people with disabilities and other special needs. Disparities between groups.	Favor inclusive modes and accessible community development.
Vertical – Affordability	Lower-income households can afford basic mobility.	Transport costs relative to incomes. Quality of affordable modes.	Favor affordable modes and housing in high-access areas.
Social Justice	Policies address structural inequities.	Whether organizations address inequities such as sexism and racism.	Identify and correct structural inequities. Affirmative action.

This table summarizes transportation equity types, ways to measure them, and optimization strategies.

Comprehensive equity analysis requires detailed data on travel demands, accessibility (the time and money required to reach services and activities), multimodal service quality, user and external costs, user satisfaction, and obstacles, disaggregated to measure disparities between advantaged and disadvantaged groups.

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