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Evaluating Transportation Equity: Guidance for Incorporating Distributional Impacts in Transport Planning

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Abstract

Equity refers to the distribution of benefits and costs between groups of people and whether that is considered fair and appropriate. Transportation planning decisions can have significant equity impacts; practitioners have a responsibility for evaluating these impacts in transportation planning. This can be challenging due to the variety of equity perspectives and impacts. This article provides practical guidance for transportation equity analysis. It defines various equity types, impacts, metrics and objectives to consider, and describes ways to incorporate equity evaluation into a transportation planning process.

Introduction

Social *equity* (also called *fairness* and *justice*) refers to the distribution of benefits and costs, and the degree that is considered appropriate. Transportation planning decisions can have significant equity impacts: they affect the allocation of public resources, and impact people's economic opportunities and quality of life. Most people care about these impacts – the want a fair and inclusive transportation system. As a result, practitioners have a responsibility to evaluate equity impacts in transportation planning.

This is a timely issue. In the past, transportation planning often gave little consideration to equity impacts (Litman 2020; Verlinghieri and Schwanen 2020). It evaluated transportation system performance based primarily on travel speeds, which favored faster but more costly modes, such as driving, over slower but more affordable modes with lower external costs, such as walking, bicycling and public transit. The results were often unfair.

For example, during the last century, highway projects displaced many high-access urban neighborhoods (Brown, Morris and Taylor 2009). The planning process recognized the benefits that those highways provided to motorists but gave little consideration to the reduced accessibility, economic opportunity and livability they imposed on urban residents. Those projects are now widely criticized and some are likely to be removed, but the damage they caused is irreversible (McCormick 2020).

Unfair practices persist. For example, many transportation agencies continue to allocate funds based primarily on roadway level of service and congestion delay, with little consideration to other goals such as affordability, mobility for non-drivers, or public health. This favors roadway expansions over other types of transportation improvements, and so favor motorists over people who rely on other modes.

Consider another example. Most jurisdictions have off-street parking minimums. This adds hundreds of dollars to annual housing costs and few dollars to a typical household's weekly grocery bills. This is unfair – it forces car-free households to subsidize the parking costs of their car-owning neighbors – but the equity impacts are usually overlooked; when evaluating parking minimums practitioners seldom analyze who ultimately bears the costs and how they affect housing and food affordability.

These examples illustrate the need more comprehensive equity analysis in transportation planning. However, equity analysis can be challenging. A decision may seem equitable when evaluated one way, but not if evaluated another. This article provides an overview of key transportation equity concepts and describes practical ways to incorporate equity analysis into planning.

Perspectives and Impacts

Transportation equity analysis is multifaceted. There are four main types to consider:

1. *Horizontal equity* (also called *fairness* or *equality)* requires that people with similar needs and abilities be treated similarly, for example, that they receive similar benefits and bear similar costs. It implies that people should generally "get what they pay for and pay for what they get," and external costs that person or group imposes on others should be minimized or compensated.
2. *Vertical equity with regard to need and ability* considers how transportation systems serve people with special mobility needs or impairments. This justifies multimodal planning and universal design practices to accommodate diverse users.
3. *Vertical equity with regard to income* considers how transportation systems affect lower-income people. Policies that favor lower-income people are called *progressive* and those that favor higher-income people are called *regressive*. This justifies policies that improve affordable modes, subsidies for low-income users, and more affordable housing in high-accessibility areas.
4. *Social justice* considers how transportation systems serve disadvantaged and underserved groups, and address structural injustices such as racism and sexism.

Table 1 lists various factors to consider in transportation equity analysis.

Table 1 **Transportation Evaluation Factors** (Litman 2021)

Types of Equity	Impacts	Metrics	Groups
Horizontal (Fairness) Equal treatment of equals. Equal benefits and costs. "Get what you pay for and pay for what you get." **Vertical with-respect-to need and ability** Multimodal planning Universal design. Special mobility services. **Vertical with-respect-to income and social class** Affordability. Quality of low-price modes. Targeted subsidies. Impacts on low-income communities. **Social Justice** Impacts on minority communities. Affirmative action.	**Facilities and Services** Facility planning and design. Funding and subsidies. Involvement in planning. **User benefits and costs** Service quality (convenience, comfort, speed, safety). User information. Fares, fees and taxes. **External Impacts** Congestion delays. Crash risk. Pollution and hazardous material exposure. **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* (trips made, cost burdens, crash injuries, etc.). **Units of People** Per adult. Per commuter or peak-period travel. Per household. **Units of travel** Per vehicle-mile or -km. Per passenger-mile or -km. Per trip (by type). **Financial** Per dollar. Subsidies. Cost recovery.	**Demographics** Age and household type. (Dis)ability. Income and poverty rates. Race and ethnicity. Driver's licensure. **Location** Jurisdiction and neighborhood. Urban/suburban/rural. **Mode** Active (walking & bicycling). Motor vehicles. Transit user/dependent. **Industries** Equipment/service providers. Shippers. Employees. **Trip type** Commutes and errands. Commercial/freight. Recreational/tourist.

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

It is generally infeasible to consider all of these factors in a planning process. A more practical approach is to define measurable equity objectives, such as those in Table 2. Planning decisions can be evaluated based on their effects on these objectives, and the planning process can identify policies to help achieve them.

Table 2 **Typical Transportation Equity Objectives** (Litman 2021)

Horizontal	WRT Ability and Need	WRT Income	Social Justice
• Each person receives a comparable share of public resources. • Planning serves non-drivers as well as drivers. • External costs are minimized and compensated. • All groups are involved in planning processes.	• *Inclusivity* (accommodate people with disabilities and other special needs). • *Basic accessibility* (ensure that everybody can access essential services and activities). • *Accessible development* (locate essential services and activities for easy access without a car).	• Favor affordable over expensive modes. • Price discounts and exemptions for lower-income users, particularly for essential travel. • Provide affordable housing in high-accessibility neighborhoods.	• Protect and support disadvantaged groups (women, youths, minorities, lower-income residents, etc.). • Implement affirmative action policies and programs.

This table reflects various transportation equity objectives. (WRT = With Respect To)

Analysis Methods

This section describes ways to evaluate various transportation equity impacts.

Horizontal Equity: A Fair Share of Public Resources

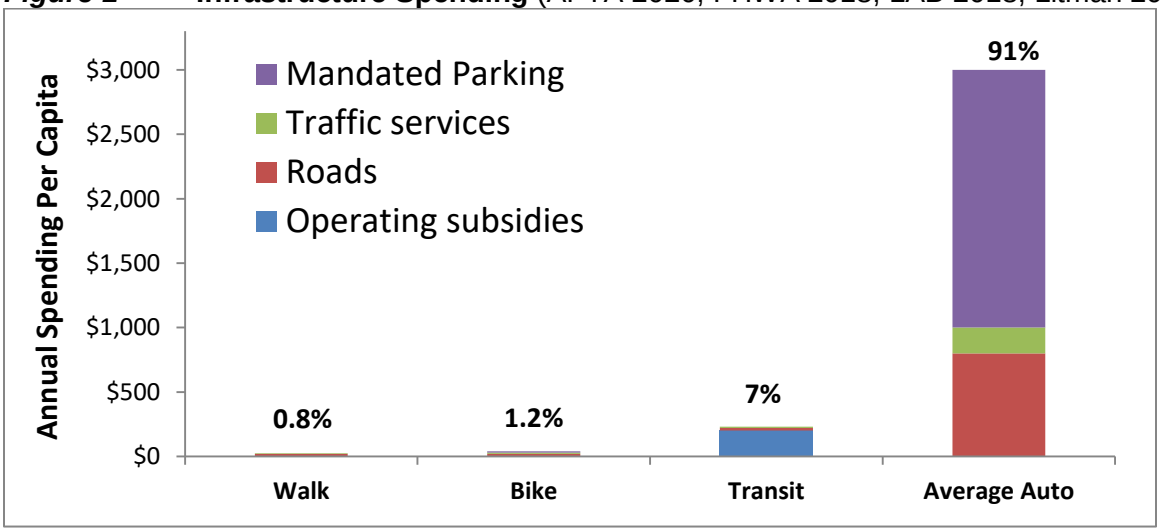
Some long-running transportation policy debates reflect horizontal equity, which assumes that people should generally receive equal shares of public resources, and users should "get what they pay for and pay for what they get." For example, state officials complain if they receive less federal highway funding than their motorists pay in fuel taxes (CRS 2011). Highway advocates complain when fuel taxes are "diverted" to non-highway projects (Winters 2019). Highway cost allocation studies examined whether various vehicle classes pay their share of roadway costs (Balducci and Stowers 2008). These examples illustrate how horizontal equity analysis can be structured to support particular conclusions, and may result in decisions that contradict other goals.

For example, most experts recommend that public investments maximize cost efficiency and respond to needs; allocating federal funds based on tax payments can result in inefficient and regressive planning decisions. Critics who complain about fuel tax "diversions" ignore the fact that those taxes only fund about half of total roadway costs; their argument that motorists should "get what they pay for" ignores the corollary that motorists should also "pay for what they get." The U.S. federal government has not commissioned a cost allocation study since 1997 because their conclusions – that fairness requires higher taxes on heavy vehicles plus new fees to reflect congestion, crash risk and pollution costs – faced political opposition.

There are other ways to evaluate horizontal equity that result in different conclusions concerning the fairness of transportation investments. For example, equity implies that the public resources spent on a mode or group should reflect its share of travel demands; if they generate 10% of trips it is fair that they receive 10% of investments or road space. Let's evaluate current infrastructure spending based on this principle.

North American communities typically spend about $25 annually per capita on walking facilities, $40 per capita on bicycling facilities, $200 per capita on public transit services, $1,000 per capita on roads and traffic services, plus more than $2,000 per capita on government-mandated off-street parking facilities, as illustrated in Figure 1. This indicates that currently walking receives about 0.8%, bicycling 1.2%, public transit 7%, and automobiles 91% of infrastructure investments.

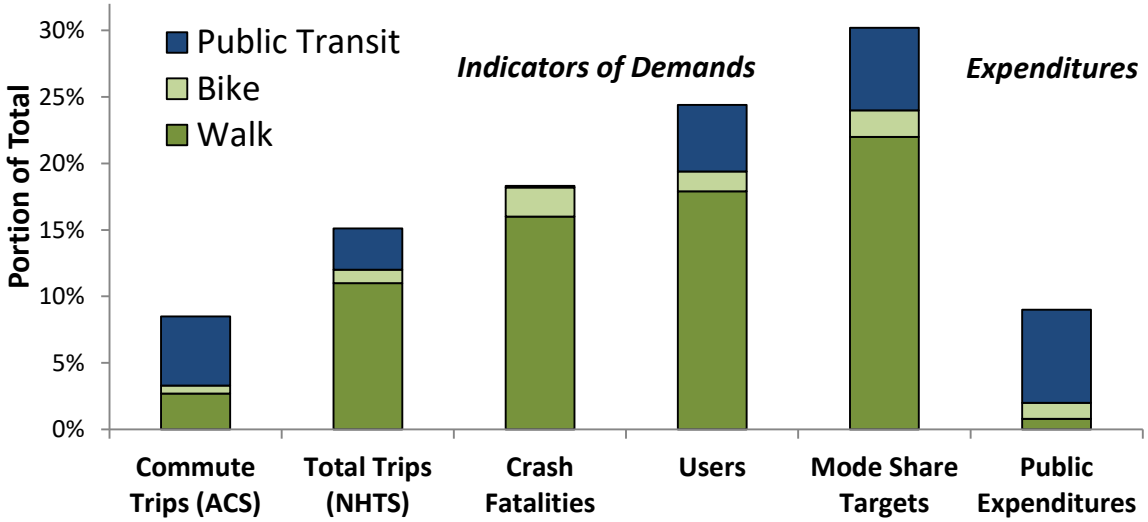
Figure 1 **Infrastructure Spending** (APTA 2020; FHWA 2018; LAB 2018; Litman 2019)



This graph compares infrastructure investments for various modes. Motorists receive far more investments than users of other modes.

Figure 2 compares indicators of walking, bicycling and public transit demands with their share of infrastructure expenditures. The first column shows commute mode shares. The second shows mode shares for all trips. The third shows their share of traffic fatalities, indicating that pedestrians and bicyclists bear excessive crash risks. The fourth shows the portion of travelers who use those modes at least occasionally. The fifth shows typical mode share targets intended to help achieve congestion reduction, public health and emission reduction goals. This suggests that horizontal equity justifies investing 10% to 30% of infrastructure spending on non-auto modes so their users receive a fair share of public resources. The last column shows the estimated portion of transportation infrastructure expenditures currently devoted to each mode. This indicates that people who rely on non-auto modes, or would like to, receive less than their share of investments.

Figure 2 **Non-Auto Demand and Expenditure Indicators** (APTA 2017; LAB 2018)



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

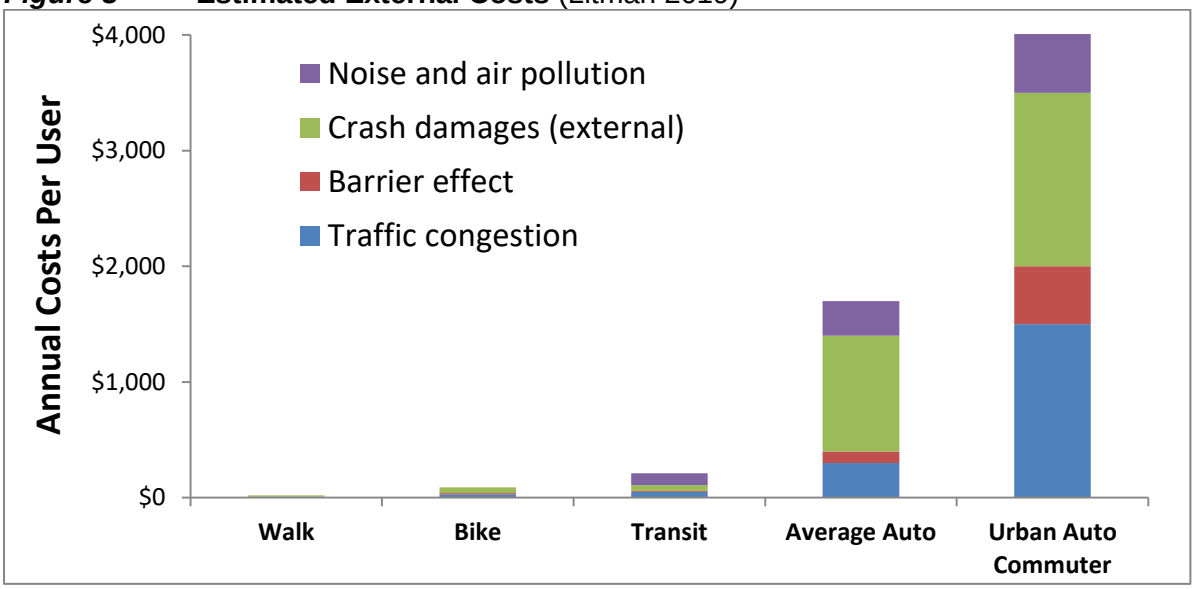
Of course, this analysis can be structured in other ways that provide different results (O'Toole 2019). Some evaluations only consider expenditures by a particular level of government, and ignore other costs such as government-mandated parking facilities. Some studies measure impacts per passenger-mile, which does not account for the greater annual travel-miles, and therefore greater infrastructure costs, by motorists compared with people who rely on non-auto modes. Since horizontal equity is concerned with fairness between people, analysis should be comprehensive and generally measure impacts per capita instead of distance-based units.

Horizontal Equity: External Costs

Horizontal equity can be applied to external costs, such as the congestion, risk and pollution damages that travellers impose on other people. Horizontal equity requires that those costs be minimized and compensated, so one mode or group is not imposing excessive costs on others.

Various studies have quantified and monetized (measured in monetary units) these costs (DfT 2020; Litman 2019; Ricardo-AEA 2014; TTI 2019). Figure 3 illustrates estimates. Automobiles impose far higher external costs than other modes: they require more space and therefore cause more traffic congestion and barrier effect, impose more risk on other road users, and generate more pollution than walking, bicycling and public transit. This is particularly true under urban-peak conditions.

Figure 3 **Estimated External Costs** (Litman 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.)

These external costs are inequitable:

- It is unfair that travellers using space-efficient modes, such as buses and rideshare vehicles, bear traffic congestion caused by space-intensive modes such as automobile. Fairness can justify bus and HOV lanes, and decongestion pricing to internalize this cost.
- It is unfair that pedestrians and bicyclists bear excessive delays and crash risk imposed by automobile traffic. Fairness can justify pedestrian and bicycle safety improvements, such as protected sidewalks, paths, bikeways and traffic calming, financed with road user fees to internalize these costs.
- It is unfair that communities bear traffic noise and air pollution. Fairness can justify pollution reduction policies, such as electric vehicle mandates, fossil-fuel traffic restrictions and speed reductions, plus emission fees to internalize these costs.

Because automobile travel imposes particularly large external costs, people who drive more than average impose significant net external costs on people who drive less than average.

Road user fees are sometimes criticized as unfair to lower-income motorists, but that generally reflects incomplete analysis. Lower income residents tend to own fewer vehicles, drive less, and rely more on non-auto modes than higher income residents (Schweitzer and Taylor 2008). As a result, disadvantaged groups tend to benefit overall if road user revenues are used to improve affordable modes (Manville 2017).

Inclusivity: Accommodating People with Disabilities and Other Special Needs

To be equitable, a transportation system must serve diverse users including travellers with impairments, young children, pets, baggage, and other special needs. Serving their demands requires *multimodal planning* to provide diverse travel options, plus *universal design* to accommodate travellers with disabilities and other special needs.

Inclusivity can be evaluated by defining service quality standards and targets. For example, a community could establish targets that all streets will have accessible sidewalks, all transit vehicles will accommodate people with disabilities, and 90% of households will be able to access basic services within 20 minutes without a car. Inclusivity can also be evaluated by comparing disparities between advantaged and disadvantaged groups, such as differences in the number of services and jobs that can be reached within 20 minutes between non-drivers and drivers. These factors can be analyzed using multimodal level-of-service ratings (Dowling, et al. 2008), universal design standards (Saha, et al. 2019), and comprehensive accessibility models that measure the services and activities that can be reached within a given time period by various modes (Levinson and King 2020).

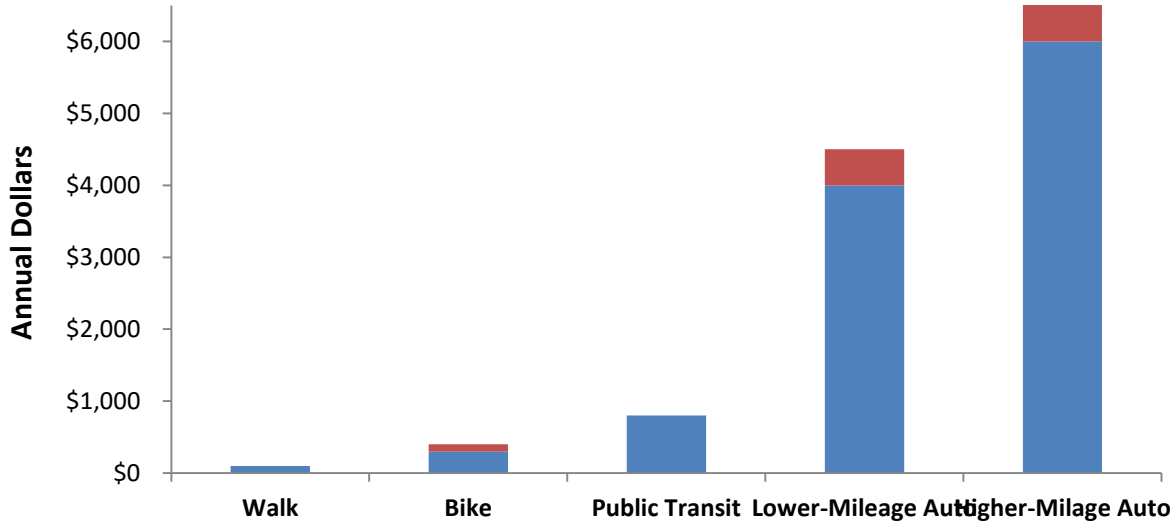
Affordability: Serving Travellers with Low Incomes

Affordability refers to costs relative to incomes, and therefore people's ability to purchase basic goods within their limited budget. Affordability is a *potential*: even car-owning households may benefit from having more affordable modes available if needed in the future. Experts define affordability as households spending less than 45% of their budgets on transportation and housing combined (CNT 2018), so a typical household that spends 30% of its budget on housing can spend up to 15% on transportation – more if their housing costs are lower than average and less if their housing costs are high. Most lower-income automobile-owning households spend more on transportation than is considered affordable (Litman 2020).

Conventional transportation planning gives little consideration to affordability goals. If considered at all, affordability is evaluated based on individual costs such as fuel prices, road tolls or public transit fares; total transportation costs are seldom considered.

Figure 4 compares typical user costs of various modes. Active modes have the lowest costs, public transit has moderate costs, and automobile travel is most expensive. Although lower-income motorists use various strategies to minimize their vehicle expenses, for example, by purchasing older vehicles and minimum insurance coverage, and sometimes performing their own repairs, it is difficult to legally operate a vehicle for less than $4,000 annually, or $6,000 if it is driven high annual miles. Because automobiles sometimes incur large unexpected costs due to mechanical failures, crashes or traffic violations, lower-income households can benefit from having affordable modes available, even if they own automobiles (Agrawal, et al. 2011).

Figure 4 **Typical Annual Costs by Mode** (Litman 2019)



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

To increase affordability communities can improve lower-cost travel modes and create more affordable housing in compact, multimodal neighborhoods where it is easy to get around without a car. New tools can evaluate affordability (Lavery 2019). The *Location Affordability Index* (HUD 2019) and the *Housing and Transportation Affordability Index* (CNT 2008), calculate total housing and transportation costs, and therefore the savings provided by more affordable modes and more accessible locations.

Social Justice

Social justice objectives address structural inequities such as racism, sexism, and classism (Martens 2016; Romero-Lankao and Nobler 2021). It is often addressed by establishing affirmative action policies, programs and targets, plus employee training and professional development.

Social justice can be evaluated by identifying structural inequities, such as inadequate participation by disadvantaged groups in a planning process, and disparities in outcomes between advantaged and disadvantaged groups, such as differences in job access between non-drivers and drivers, or between low- and higher-income residents.

Recommendations

Because transportation planning can have many equity impacts, its analysis should be multifaceted. A plan would not become equitable by addressing one inequity but ignoring others. Table 3 illustrates a multifaceted equity analysis framework. It describes current conditions, objectives and mitigation policies for various type of equity. Of course, this analysis must be tailored to each particular situation.

Table 3 **Multifaceted Equity Analysis Framework**

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

Transportation equity analysis should consider various impacts, objectives and mitigation policies.

Conclusions

Transportation equity evaluation is important but challenging due to the variety of impacts, metrics and groups that can be considered. Because of this complexity, the most practical way to incorporate equity into a planning process is to define measurable objectives that reflect various perspectives, such as horizontal equity, external costs, inclusivity, affordability and social justice, and identify policies to achieve them. These policies should usually include a combination of structural reforms to create a fairer and more inclusive transportation system, plus targeted programs to address specific injustices. Many of these reforms, such as more multimodal planning and more affordable and accessible development, provide additional benefits; they also reduce congestion, save money, improve public health and safety, and protect the environment.

New analysis tools can improve equity evaluation. They require more information on transportation costs and expenditures, multimodal levels of service, with particular attention to the travel demands and impacts on disadvantaged groups.

This is a timely issue. Most communities want to become more equitable and inclusive. Comprehensive equity analysis allows transportation practitioners to reflect these values.

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