URBAN TRANSPORT POLICIES

IN LATIN AMERICA AND THE CARIBBEAN

WHERE WE ARE
HOW WE GOT HERE
WHAT LIES AHEAD

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Urbanization poses a growing challenge to the cities of Latin America and the Caribbean (LAC) as they strive to meet residents' transport needs. The region's urban population has grown significantly in recent decades, from 41.3 percent of the total population in 1950 to almost 80 percent in 2015. By 2050, it is projected that 87.8 percent of the region's people will live in urban areas (United Nations 2018). But as the urban expanse has grown, the density of arterial roads has not kept pace, limiting the coverage of transport systems. As a result, the peripheries of metropolitan areas are poorly connected—and increasingly less walkable (Angel et al. 2012).

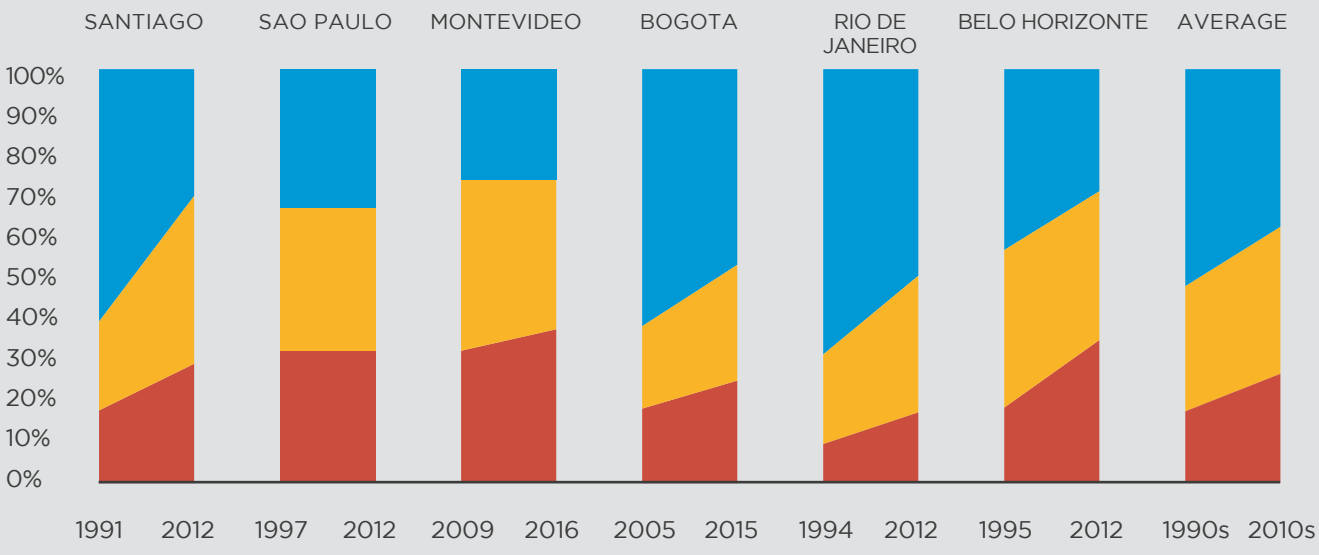
The past decade has seen a boom in private transport. For every child born in Latin America in 2010, 2.5 new motor vehicle registrations were recorded (Hidalgo and Huizenga 2013). The rate of motorization in the region—defined as the number of vehicles per thousand inhabitants—reached 201 in 2015, a product of an average annual growth rate of 4.7 percent (Rivas, Suárez-Alemán, and Serebrisky 2019). Similarly, the average annual growth rate of car ownership is much higher in Latin America than in most of the rest of the world (Masoumi and Roque 2015). The main results of such tremendous growth are clear: huge levels of congestion. Bogota, Mexico City, and Sao Paulo are among the top-five most congested cities in the world. In 2018, Bogota drivers lost 272 hours to congestion—more than in any other city in the world (INRIX 2019).

Congestion lengthens travel times and threatens environmental sustainability. Transport's contribution to overall CO2 emissions is large, and cars are the largest source in urban transport. Historically, LAC has been the region with the highest share of CO2 emissions per capita from transport (Rivas, Suárez-Alemán, and Serebrisky 2019). Transport's share of overall energy-related CO2 emissions in LAC was 37 percent in 2016, the highest of all world regions. In absolute terms, the region's transport emissions in 2016 were less than those of North America, Oceania, and Europe, but higher than those of Asia and Africa.

Motorization rates in the region are rising, but public transport accounts for a dwindling share. Contrary to the trend in Europe—where there has been a notable decrease in the use of private transport—the share of private transport is increasing in LAC. Major Western European cities have implemented policies to restrict car use, promote public transport, make walking and cycling more attractive, and apply land-use planning to solve transport-related problems (Buehler, Pucher, and Altshuler 2017). These policies are responsible for the significant growth of public transport, walking, and cycling in Europe in recent decades, and for the corresponding decrease in the use of private transport. Conversely, in LAC, public transport shares in some cities have been cut in half (Figure 1).

FIGURE 1

THE SHARE OF PUBLIC TRANSPORT IS DECREASING, AS PRIVATE TRANSPORT GAINS GROUND.



Source: Rivas, Suárez-Alemán, and Serebrisky (2019).
Note: Active transport includes cycling and walking.

Declining ridership affects the performance of public transport, which in turn encourages the use of private vehicles, setting in motion a vicious circle. Meanwhile, efforts to improve the quality, reach, and affordability of urban public transport are limited by the financial unsustainability of most systems in the region. Most service providers do not cover their own operating costs (Estupiñán et al. 2018), and the productivity of public transport has stagnated (or even decreased) over time (Gómez-Lobo and Barrientos 2019).

Public transport services are failing to improve the quality of life in the region's cities. People in LAC travel shorter distances than in developed countries, but their commuting time is longer. Surveys show that users in the region are dissatisfied with the quality of public transport, not only because of long commutes but also because of concerns about comfort, cleanliness, and fares (IDB 2014).[1]

1 Public transport services in LAC are of lower quality yet cost more than services outside the region. Low-income households are particularly affected by high prices. Transport service spending as a share of total consumption is 4.5 percent for the "lowest" segment of the population and 5.2 percent for the "low" segment (Estache, Bagnoli, and Bertomeu 2018).

FIGURE 2

PUBLIC TRANSPORT USERS IN THE REGION ARE CONCERNED ABOUT THE QUALITY AND FREQUENCY OF SERVICE, AS WELL AS OTHER FACTORS.

PERCENT OF USERS IN SELECTED CITIES CITING FACTOR AS A CONCERN.

CITY	OVERALL QUALITY	DAYTIME FREQUENCY	NIGHT TIME FREQUENCY	FARE LEVEL	COMFORT	CLEANLINESS
SAO PAULO	38%	35%	43%	57%	55%	28%
CAMPECHE	38%	13%	37%	69%	48%	41%
FLORIA-NOPOLIS	37%	35%	40%	53%	33%	20%
LIMA	36%	24%	37%	17%	45%	40%
PARANÁ	35%	45%	64%	48%	35%	29%
JOAO PESSOA	34%	32%	46%	38%	39%	29%
NASSAU	32%	24%	67%	7%	31%	18%
MAR DE PLATA	29%	21%	53%	54%	33%	47%
TAPACHULA	28%	13%	23%	9%	27%	19%
XALAPA	27%	18%	35%	67%	35%	33%
MEXICO CITY	27%	15%	33%	45%	35%	35%
BOGOTA	27%	16%	42%	23%	53%	58%
VITORIA	25%	19%	29%	34%	30%	16%
BUENOS AIRES	25%	28%	51%	19%	38%	34%
BRIDGE-TOWN	24%	18%	36%	3%	17%	16%

Source: Authors' elaboration based on IDB (2014).

Policy innovations are needed to break the vicious cycle. The ultimate objective should be reliable, efficient, high-quality, and sustainable urban transport. The following section describes urban transport policies implemented in the region, highlighting tangible impacts whenever possible. Section 3 then describes opportunities to improve urban transport policy. A two-pronged approach is suggested, based on:

- service-oriented policies in addition to the more common asset-oriented policies; and
- integrated policies that address public and private transport simultaneously, incorporating dimensions such as congestion pricing and land-use management.

2 HOW WE GOT HERE

URBAN TRANSPORT POLICIES IN LAC

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The challenges of congestion and poor connectivity in the region have motivated a search for new solutions, but to date those solutions have focused on promoting public transport assets rather than service. The region has pioneered some significant and successful policies and modes, including bus rapid transit (BRT), urban cable cars, and mass transit.[2] In addition, some countries in the region have implemented policies to promote active transport (walking and cycling) and to optimize public space through land-use strategies. Table 1 summarizes policies in a sample of LAC cities, dividing them into four categories:

- policies to restrict the use of cars;
- policies to promote public transport;
- policies to make walking and cycling more attractive; and
- land-use planning and policies to facilitate dense, mixed-use development.[3]

A quick look reveals that the region's cities have favored asset-oriented policies.

The following subsections employ the structure presented in Table 1 to describe policies in each category, together with their positive and negative features and tangible impacts (when possible).

2 See Suárez-Alemán and Serebrisky (2017) for a review of urban cable cars in LAC.

3 The table uses the policy categories set out by Buehler, Pucher, and Atshueler (2017), who identify the types of policy behind successful transport systems in Western European cities. The policies selected for analysis involve a significant amount of resources or have had significant impact. Therefore, the analysis is not exhaustive; some small local initiatives with successful results are not included in the analysis. On the other hand, in order to develop a sustainable transport system, cities must design integrated solutions by implementing coordinated and consistent instruments among the four group of policies and within each group.

TABLE 1

CITIES HAVE MADE PROGRESS IN ASSET-ORIENTED PUBLIC TRANSPORT POLICIES AND IN ACTIVE TRANSPORT POLICIES, BUT POLICIES RESTRICTING CAR USE, SERVICE-ORIENTED PUBLIC TRANSPORT POLICIES, AND LAND-USE PLANNING ARE LESS COMMON.

CITY	POLICIES THAT RESTRICT CAR USE	POLICIES THAT PROMOTE PUBLIC TRANSPORT		POLICIES THAT MAKE WALKING AND CYCLING MORE ATTRACTIVE	LAND-USE PLANNING AND POLICIES THAT FACILITATE DENSE, MIXED-USE DEVELOPMENT
		ACTIVE-ORIENTED	SERVICE-ORIENTED		
SANTIAGO DE CHILE	High fuel taxes Restrictions based on license plates Urban tolls	Metro	Integrated system	Downtown pedestrianization Improvement of bikeway network and bike services	Policies not significant
BOGOTA	High taxes on fuels Restrictions based o license plates	BRT	Integrated system Demand sub-sidies (low-in-come groups)	Recovery of public spaces Improvement of bikeway network and bike services	Requirement for comprehensive urban develop-ment plans in Colombian cities
MEXICO CITY	High fuel taxes	Metro BRT	Policies not significant	Policies not significant	Policies not significant
QUITO	Policies not significant	BRT Metro (opening 2019)	Policies not significant	Historic downtown pedestrianization	Policies not significant
BUENOS AIRES	Urban tolls	Metro BRT	Policies not significant	Downtown pedestrianization Improvement of bikeway network and bike services	Policies not significant
RIO DE JANEIRO	High fuel taxes	Metro Cable cars	Policies not significant	Rehabilitation of waterfront Improvement of bikeway network and bike services	Requirement for comprehensive urban develop-ment plans in Brazilian cities
CURITIBA	High fuel taxes Parking controls	BRT	Policies not significant	Pedestrianization Improvement of bikeway network and bike services	Integrated transport and land-use planning
LIMA	Urban tolls	Metro BRT	Policies not significant	Policies not significant	Policies not significant

IMPACT OF MEASURES: HIGH MEDIUM-HIGH MEDIUM-LOW LOW/NOT APPLICABLE

Source: Authors' elaboration based on Hidalgo and Huizenga (2013) and Buehler, Pucher, and Altshuler (2017).
Note: Policies shown in the table are not exhaustive either within the region or within cities. Most policies affecting car use, such as fuel taxes, are national policies.

2.1 POLICIES THAT RESTRICT CAR USE: CURBING PRIVATE TRANSPORT USING DEMAND MANAGEMENT

Transport policies in LAC have not been effective in reducing motorization. Over the past 10 years, the level of motorization has risen in most of the region, with an average annual growth rate of 4.7 percent. Today, the region's level of motorization exceeds 200 vehicles per 1,000 inhabitants (Rivas, Suárez-Alemán, and Serebrisky 2019).

To slow the rate of motorization, cities in the region have implemented a set of measures to manage travel demand. These measures can take several forms:

- physical changes, such as improving public transport or improving infrastructure for active transport;
- legal policies, such as restricting car use in city centers, controlling parking, or lowering speed limits;
- economic policies, such as taxing fuel and cars, introducing congestion pricing, and lowering fares for public transport; and
- information and education measures, such as public information campaigns (Gärling and Schuitema, 2007).

This section focuses on policies directly applied to the use of private cars in the region, chiefly restrictions tied to car registration, car-free days, and management of on- and off-street parking. An analysis of these measures in 12 cities in LAC reveals that these policies have not been effective or have had only a marginal effect (Ríos et al. 2013).

There is agreement about the economic efficiency of road pricing in general, and about congestion pricing in particular. In fact, the literature is in full accord concerning first-and second-best pricing solutions in the urban transport arena.[4] First-best pricing solutions use pricing signals to reflect the full social costs generated by each traveler. They are designed to influence drivers' behavior in a way that maximizes net social welfare (Bonsall et al. 2007). Congestion pricing has an advantage over other demand-management measures in that it encourages individuals and firms to adjust the full range of their behavior (De Palma and Lindsey 2011). However, political acceptability remains a challenge for implementation of such measures (Lindsey 2006); indeed, congestion pricing has failed to move beyond the proposal stage in the region (Ríos et al. 2013). Alternatives include fuel taxes and parking policies (Verhoef, Nijkamp and Reitveld 1995a), where parking fees represent the second-best pricing solution for reducing congestion (Verhoef, Nijkamp, and Reitveld 1995b).

2.1.1 RESTRICTIONS TIED TO LICENSE PLATE NUMBERS

Restrictions tied to license plate numbers have been implemented in several cities but have not had the expected results in reducing congestion. Examples include Santiago (1986); Mexico City (1989); Bogota (1998), Medellin (2005), and nine other cities in Colombia; Sao Paulo (1997); Quito (2010); and La Paz (2002) (Ríos et al. 2013). In Mexico City and Santiago de Chile, the motivation for implementing restrictions by license plate number was environmental, whereas in Bogota, Medellin, and Sao Paulo the main reason was to relieve congestion. Overall, this policy has not had the expected results in the region in terms of motorization and congestion (Table 2). However, Quito's *Pico y Placa* Program is a remarkable exception. The program, implemented in 2010, reduced carbon monoxide concentrations by 9–11 percent during peak hours (Carrillo, Malik, and Yoo 2016).

The main reason for the partial failure of these programs in the region is that many high-income households bought a second car to avoid the restriction. Usually, these second cars were more polluting. Car traffic increased on weekends and during unrestricted hours because of the increase in ownership of second cars.

4 For a more detailed analysis of first- and second-best practices in the urban transport sector, see Rothengatter (2003) and Tirachini and Hensher (2012).

TABLE 2

RESTRICTIONS BY LICENSE PLATE NUMBERS IN BOGOTA, MEXICO CITY, SANTIAGO DE CHILE, AND MEDELLIN HAVE NOT BEEN EFFECTIVE IN REDUCING MOTORIZATION OR EMISSIONS.

CITY	IMPACT ON USE OF PRIVATE CARS	IMPACT ON EMISSIONS
BOGOTA 1998: "Pico y Placa" Gradually the ban was increased to affect more cars and to cover a longer part of the day.	Trips made by car for work or education decreased significantly after implementation of the measure, but soon returned to their original levels (Cantillo and Ortúzar 2014).	After its implementation, there was a temporary decrease in PM10 pollutants but were ex-ceed in the medium and long-term. In 2002, 2005, and 2009 the schedule of restriction was increased, with a positive effect on PM10 levels (Cantillo and Ortúzar 2014).
MEXICO CITY 1989: "Hoy no circula"	Car restrictions turned Mexico City from a car exporter (average of 74,000 cars per year, 1983–89) to a car importer (84,000 cars per year, 1990–93) (Cantillo and Ortúzar 2014).	Short-run: CO reductions of 11 percent and 8 percent for peak and off-peak hours. Longer-run (a year from implementation): CO increases of 13 percent and 8 percent for peak and off-peak hours (Cantillo and Ortúzar 2014).
SANTIAGO DE CHILE 1986: Restrictions were placed on vehicles lacking catalytic converters. Later, restrictions were extended to vehicles with catalytic converters on emergency days. Originally the measure affected 20 percent of cars, but in 2008 coverage reached 40 percent.	The original measure (applying to vehicles without catalytic converters) had no effect on private car use, whereas the expanded application to vehicles with catalytic converters generated a decrease of 5.5 percent once the restriction affected 20 percent of cars (De Grange and Troncoso 2011).	Between 2000 and 2008, PM10 and PM2.5 were reduced by 5–7 percent during alerts and 12 percent during pre-emergencies; CO and NOx were reduced by 10 percent in alerts and 20 percent in pre-emergencies (Cantillo and Ortúzar 2014; Troncoso, De Grange, and Cifuentes 2012).
MEDELLIN 2005: "Pico y Placa" Gradually the ban was expanded to more cars. The measure affected 20 percent of cars during the first year, increasing to 40 percent in 2008.	There was a decrease in traffic flows at key intersections during the first year, but two years later flows were back to pre-measure levels. The rate of growth in the vehicle stock increased after implementation of the measure (Cantillo and Ortúzar 2014).	There was a decrease in airborne particulate matter and PM10 two years after implementation. But pre-implementation pollutant levels were ex-cee-ded in the medium and long-term (Cantillo and Ortúzar 2014).

Source: Authors' elaboration.

2.1.2 PARKING PRICES

Raising parking prices is a second-best solution to reduce congestion, but current prices are not high enough to discourage the use of private transport. This policy has the advantage of avoiding public opposition and the infrastructure costs of first-best pricing—namely road pricing—which makes it possible to charge users the marginal social cost of their automobile use. Table 3 summarizes experiences with parking solutions in several cities of the region. By comparing bus fares with the price of an hour of street parking, one can see that public transport costs more than parking in several LAC cities, the converse of the pattern in many European cities (Figure 3) and a disincentive for the use of public over private transport. In addition, it is common in the region to require a certain minimum amount of parking for given land uses, which is undesirable for reducing car use (Ríos et al. 2013). There is some evidence that this trend may be changing. For example, new building codes in Rio de Janeiro restrict off-street parking and remove minimum parking requirements, thus promoting nonmotorized transport (ITDP 2019).

TABLE 3

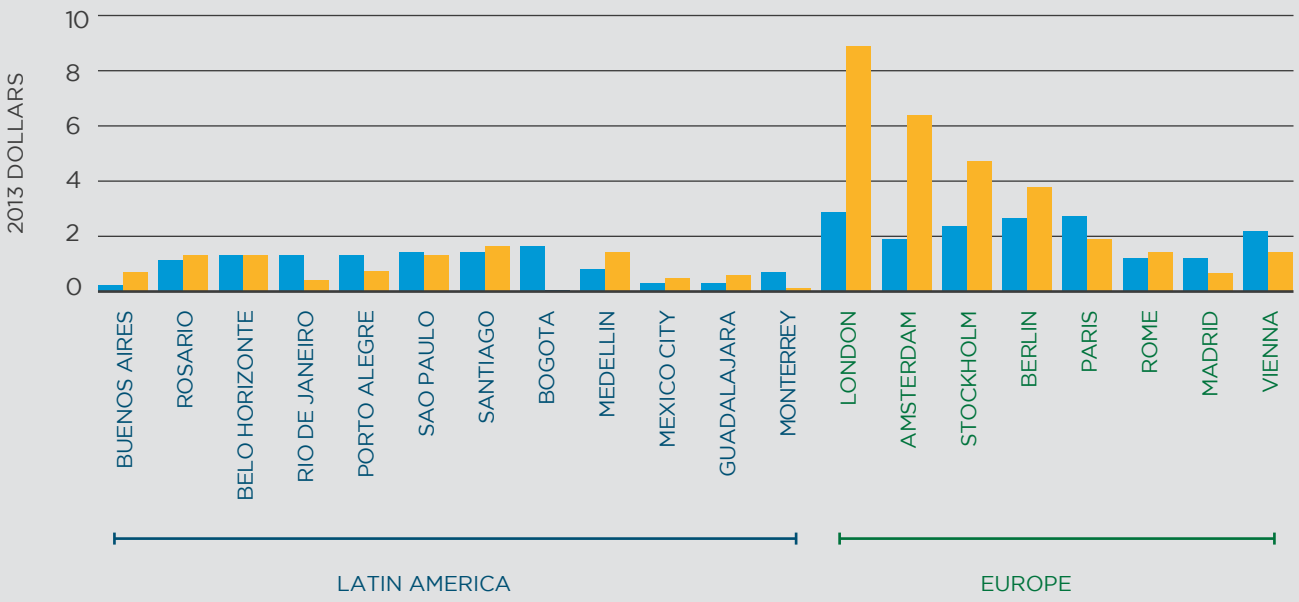
CITIES IN THE REGION HAVE IMPLEMENTED VARIOUS TYPES OF PARKING SOLUTIONS.

	ON-STREET PARKING			OFF-STREET PARKING	
CITY	METERED PARKING	WITH A TICKET	MANUAL / ROTARY PARKING (pay-by-phone/ credit card)	CONCESSIONS	PRIVATE REGULATED
MONTERREY	■			■	
GUADALAJARA	■		■	■	■
MEXICO CITY	■			■	
MEDELLIN			■		■
BOGOTA				■	■
BELO HORIZONTE			■	■	
SAO PAULO			■	■	
RIO DE JANEIRO			■	■	
PORTO ALEGRE	■		■		
SANTIAGO			■	■	
ROSARIO	■	■	■	■	
BUENOS AIRES		■		■	

Source: Authors' elaboration based on Ríos et al. (2013).

FIGURE 3

THERE ARE NO SIGNIFICANT DIFFERENCES IN THE REGION BETWEEN PARKING PRICES AND PUBLIC TRANSPORT FARES—IN MARKED CONTRAST TO SOME EUROPEAN CITIES.



Source: Authors' elaboration based on Ríos et al. (2013).

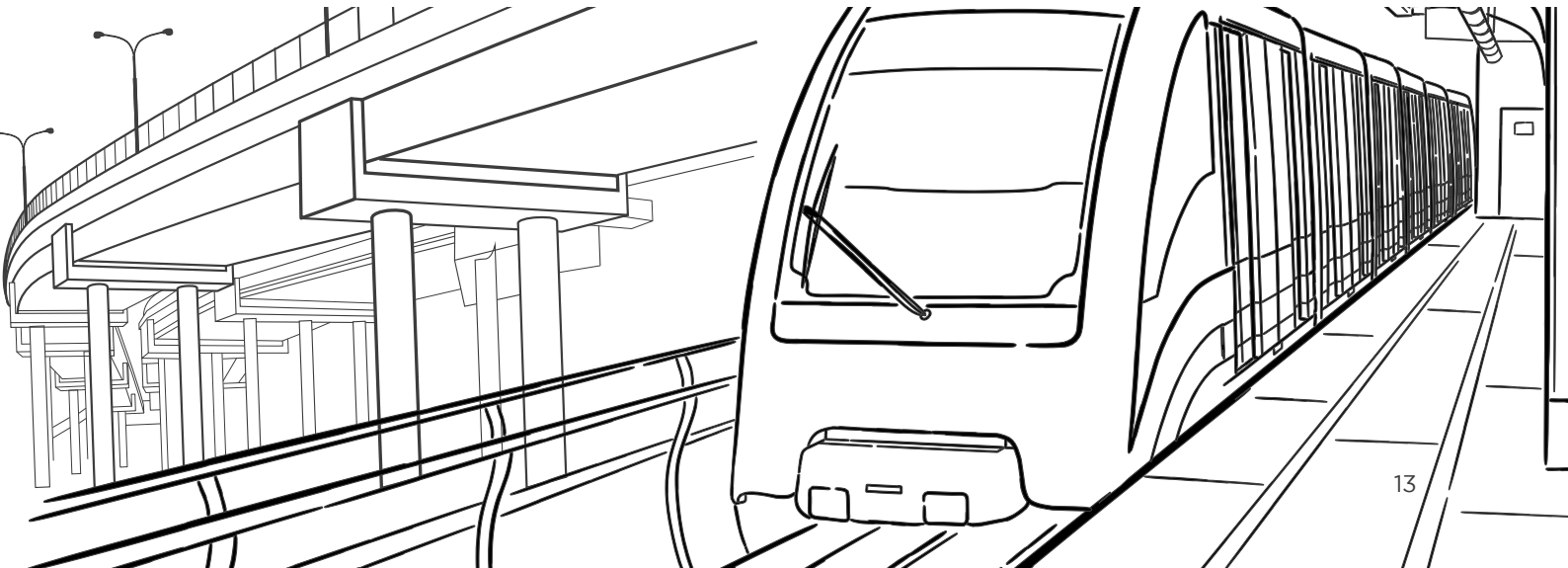
2.1.3 FUEL TAXES

Fuel taxes have not been effective in reducing traffic congestion. Fuel taxes represent a significant source of revenue in some countries in the region. In Colombia, for example, gasoline and diesel taxes represented 8.8 percent, on average, of current public revenue (Mendoza 2014). However, current fuel-tax schemes are not a significant disincentive for car use, as evidenced by the growth of private transport over the last years. Moreover, fuel taxes do not differentiate between urban and rural areas, or between times of day (Parry 2011).

2.2 POLICIES TO PROMOTE PUBLIC TRANSPORT

The cities of the region have adopted a diverse set of policies to improve public transport. The region was a pioneer, for example, in the implementation of BRT systems. Along with the maturation of BRT systems, 22 cities in 10 countries of the region have invested in metro systems or light rail (UITP 2016), and some have innovated with cable cars (Suárez-Alemán and Serebrisky 2017, Yañez-Pagans et al. 2018). BRT systems, metro lines, and metrobuses, together with subsidy schemes, have enhanced public transport in the region. But most of the region's mass transit policies have been asset-oriented rather than service-oriented, with a shortage of policies focused on the quality of the services provided.

Demand for transport is a derived demand: people move about to gain access to other goods, services, or activities (for example, work or study opportunities) at the lowest cost in terms of time, price, and discomfort or inconvenience. Key variables are physical (the transport network), financial (affordability), and quality-related (comfort and convenience). If, with Litman (2019a), one recognizes accessibility as the ultimate goal of transport activities, comprehensive and multi-modal evaluation becomes a necessity. With that in mind, this subsection analyzes transport policies in an integral way, highlighting their impact on affordability, accessibility, and quality. The analysis includes both asset-oriented and service-oriented policies.



2.2.1 ASSET-ORIENTED POLICIES: LAC AS A GLOBAL BRT PIONEER

In the region, 55 cities offer bus rapid transit (BRT) to 20 million of passengers per day, which represents 61.44 percent of all BRT passengers in the world (Global BRT Data 2019). BRT constitutes a "high-quality, efficient mass transport mode, providing capacity and speed comparable with urban rail" (Carrigan et al. 2013, p. 5). The first BRT was implemented in the region in the 1970s in Curitiba (Brazil). But it was the implementation of TransMilenio in Bogota in 2000 that revolutionized the industry, moving 45,000 passengers per hour per direction (Gómez-Lobo and Barrientos 2019). Yet there have been few studies of the impact of BRT systems on mobility and demand for public transport, and few studies of their benefits and costs.

The impact of BRT is positive overall, but significant shortcomings need to be addressed. An evaluation of Cali's and Lima's BRT systems shows that although both systems reported significant savings in travel time and substantial environmental benefits,[5] usage of the systems by poor groups living in the service area was lower than expected (Table 4) (Scholl et al. 2016). Gómez-Lobo and Barrientos (2019) hypothesize that trunk corridors impose a high generalized cost owing to waiting time and transfer times because of high occupancy rates, suppressing demand.

5 Users of Garzon BRT in Montevideo, inaugurated in December 2012, have not achieved mobility benefits (travel times have increased for some passengers), and no environmental benefits have been detected since its implementation (IDB 2015a). The corridor did not meet basic international standards for a BRT (IDB 2015b).

TABLE 4

BRT SYSTEMS IN CALI AND LIMA HAVE HAD POSITIVE EFFECTS ON ACCESSIBILITY, BUT HAVE NOT BEEN EFFECTIVE IN REACHING THE LOWEST-INCOME GROUP.

LIMA	CALI
COVERAGE AND ACCESSIBILITY FOR THE POOR	
■ Travel time decreases from 3–4 hours to 2 hours for some individuals. ■ BRT reaches middle- and low-incomes areas, but not extremely poor areas, partially for lack of access to the BRT corridor. Additionally, lack of income or jobs affects mobility.	■ Buses have trouble reaching poor neighborhoods on the western side of the city owing to difficult terrain, which is served by informal jeeps and motorcycle taxis. ■ 90 percent of people in the poorest-income group and nearly 80 percent from the next-poorest achieved time savings of at least 11 minutes. ■ The lowest and highest-income groups reaped the highest time savings—up to 35 minutes in some zones. High-income groups often settle in remote areas, reaping savings similar to those of the peri-urban poor. Middle-income groups (which already had lower travel times) saved up to 25 minutes.

LIMA	CALI
USAGE AND PERCEPTIONS OF THE BRT	
■ **USAGE:** The target of drawing 60 percent of customers from the bottom three socioeconomic strata was achieved. However, the share of trips taken by poor and very poor groups (43 percent) is lower than the share taken by middle-income groups (57 percent). Users attributed lower usage to the fact that the BRT system does not reach where they live or work.	■ **USAGE:** Initial usage by low-income groups was disappointing (a quarter of what was expected), but usage has increased over time. The system is the main mode of public transport for middle- and lower-income groups, but the middle stratum uses it more than the poorer strata. The share of trips taken by the extremely poor (29 percent) is lower than that of poor groups (39 percent).
■ **PERCEPTIONS:** 80 percent of users of BRT express services ranked the system as fast or very fast, as did 48 percent of users of the BRT trunk line service. This percentage falls to 21 percent for feeder services in poor neighborhoods. Low-income users have problems using feeder buses because of overcrowding, exposure, or distance from feeder lines.	■ **PERCEPTIONS:** More users from poor groups rated the system as very unreliable than did users among the very poor. The chief reasons cited by low-income users for not using the BRT were that: • other public transport modes were faster; • BRT buses were often delayed; and • lines at stations were too long.
AFFORDABILITY, FARE POLICIES, AND SUBSIDIES	
■ Discounts or free rides are offered to students, police, and the disabled, with 80 percent of users paying full price.	■ The Cali BRT is required to be financially self-sustaining—that is, to recover its operating and maintenance costs. The fare is COP 1,800, higher than that of traditional and informal services, which can be as low as COP 1,200. However, the spatial coverage and integrated fare is an advantage in terms of affordability.
■ BRT users in the three lowest income strata spend 22 percent of their income on BRT. This share rises to 35 percent when a fixed-basket affordability index is applied to include trips forgone because of budget constraints, using the trip rate of non-poor groups.	■ BRT users from poor and extreme poor groups spend 18 percent and 16 percent of their income, respectively, on BRT. These shares rise to 20 percent and 22 percent when a fixed-basket affordability index is used.

Source: Authors' elaboration based on Scholl et al. (2016).

Cost-benefit analyses for Bogota's TransMilenio and Mexico City's Metrobus show that both projects have positive net present benefits and make it possible to identify results by income strata (Carrigan et al. 2013).[6] However, the impact of BRT systems on total users,[7] property values,[8] land-use changes,[9] employment,[10] and the environment[11] in the region has been mixed. Limitations of the empirical strategies used in the studies may affect the results.

6 Cost-benefit analyses of TransMilenio's first two phases (1998–2017) revealed a cost-benefit ratio greater than one and a social internal rate of return greater than 12 percent. The largest benefits come in the form of travel time savings (47 percent) and savings on the costs of operating traditional buses (35 percent). Most riders are from middle- and lower-middle income groups, reflecting the demographic characteristics of the city and influencing how the benefits of the project are distributed among strata. In the case of Metrobus in Mexico City, the 2009–2028 cost-benefit ratio is also higher than one, and the social IRR in excess of than 12 percent. The largest benefit is in travel time savings (58 percent); the second largest from savings on the costs of operating traditional buses (15 percent). The second quintile receives the largest benefit, consistent with the share of users from this quintile (33 percent) and the location of the line, which passes through middle-class areas.

7 A study of the implementation of BRT systems in middle-size cities in Colombia based on an urban passenger transport survey shows a negative correlation between the introduction of BRT systems and total users of public transport (Gómez-Lobo and Barrientos 2019). Inte-

grated mass transit reforms were accompanied by a reduction in the bus fleet and in kilometers traveled, and by an increase in transfers, which no doubt increases users' wait times, increasing the generalized cost of travel and incentivizing the use of alternative transport modes, including informal modes such as moto-taxis. The authors offer several hypotheses to explain the observed reductions in Colombian cities; these are consistent with other BRT experiences in the region. First, the decrease in fleet and kilometers travelled could be explained by a lack of feedback between demand models and the impact of the operating plan on generalized cost of travel (which in turn will affect demand). Second, because no operating subsidies were considered, the increase in costs associated with improvements in the system was absorbed by adjustments in fleet size and service frequency. In addition, a financial restriction acts to prevent expanding the fleet to optimal levels. This is exacerbated by the fact that, in Colombian cities, fares finance costs other than operating costs (Hernández and Mehndiratta 2015), drawing investment away from operating improvements (Gómez-Lobo and Barrientos 2019).

8 Perdomo (2011), find positive impacts of Bogota's TransMilenio on property values in areas near the system. Rodriguez and Mojica (2009) analyze the impact of TransMilenio's extension on property values and find that although there was an appreciation in asking prices, the results were not conclusive because of fluctuations in the market associated with BRT investments in 2000. In the case of Lima's Metropolitano, a study finds evidence that residential rental prices increase along feeder lines connected to the BRT but not in the BRT corridor itself, suggesting that prices may absorb the accessibility gains of longer trips (Martinez et al. 2018 in Yañez-Pagans et al. 2018).

9 Regarding land-use changes, Bocarejo et al. (2015) finds that population growth is higher in areas served by Bogota's TransMilenio than in areas without access, but no significant changes in land use were found.

10 Regarding the employment effects of BRT systems, Scholl et al. (2018) finds that Lima's Metropolitano had large and significant impacts on employment, hours worked, and monthly labor income for individuals living close to BRT stations, but not for those living close to feeder lines. Despite the potential of BRT to connect poor populations, the evidence of positive labor-market effects is not significant for residents of lower-income areas; additional policies would probably be required to provide those benefits. For Bogota, Tsivanidis (2018) finds that even though TransMilenio generated increases in welfare and output larger than costs, the gains accrued to high-skilled workers. The results also show that welfare benefits would have been one-fourth larger if the government had implemented modifications in zoning policy, highlighting the benefits of adopting a unified transit and land-use policy.

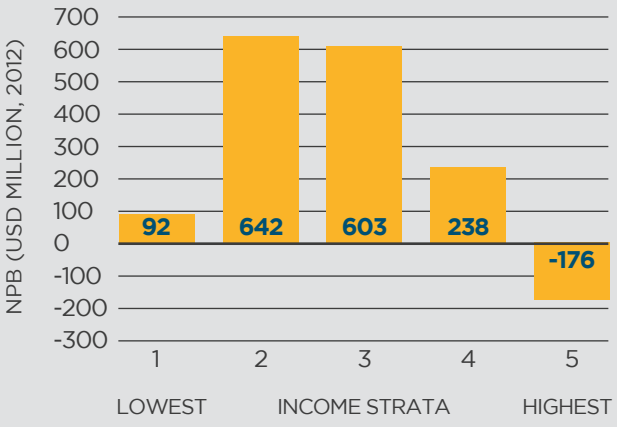
11 The impact of BRT systems on environmental pollution is highlighted in the literature (Cervero 2013a) but is not well documented in the LAC region. For Mexico City, Bel and Holst (2018) found significant reductions in air pollution (carbon monoxide, nitrogen oxides, and fines particles), showing that BRT represents an effective way to reduce emissions.

FIGURE 4

BOGOTA'S TRANSMILENIO AND MEXICO CITY'S METROBUS HAVE POSITIVE NET PRESENT BENEFITS, WITH THE SECOND QUINTILE RECEIVING THE GREATEST BENEFIT.

TRANSMILENIO | BOGOTA	
SCOPE OF CASE STUDY	**Phase 1–2**
TIME HORIZON	**1998–2017**
NET PRESENT BENEFIT (USD MILLIONS, 2012)	**1,400**
COST-BENEFIT RATIO	**1.6**
SOCIAL INTERNAL RATE OF RETURN (%)	**23**

METROBUS | MEXICO CITY	
SCOPE OF CASE STUDY	**Line 3**
TIME HORIZON	**2009–2028**
NET PRESENT BENEFIT (USD MILLIONS, 2012)	**36**
COST-BENEFIT RATIO	**1.2**
SOCIAL INTERNAL RATE OF RETURN (%)	**14**



Source: Authors' elaboration based on Carrigan et al. (2013)

BOX 1

CLOSED OR OPEN BRT?

Open BRT infrastructure can be used by buses operating beyond the limits of the BRT. In closed BRT, by contrast, buses may operate only within the limits of the infrastructure. The region's BRT systems were designed as closed systems. In recent years, however, the region has witnessed the emergence of several metrobus systems that provide a more flexible alternative.

Gómez-Lobo and Barrientos (2019) propose that open BRT should be favored in transport reforms because of its flexibility. Open BRTs do not increase transfers, are easy to implement, shorten riders' travel time, and reduce the operating costs of service providers (owing to higher speeds). The authors highlight that this alternative is especially important to consider in small cities, where the benefits of closed BRTs are not present.

Examples of open BRT in the region include Buenos Aires' system, known as Metrobus, and segregated-central-lane BRT and segregated corridors in Gran Concepcion (Chile), which were implemented without changing how buses operated before the BRT was built (Gómez-Lobo and Barrientos 2019). The Metrobus system in Argentina extends over 62.5 kilometers. Ninety-one bus lines operating in seven corridors carry a million riders each day (City Buenos Aires 2019). Although the La Matanza Metrobus is not connected with the city of Buenos Aires, it is considered part of the network because it is integrated within the smartcard system, RED SUBE. Metrobuses have achieved travel time reductions of 20–50 percent (Table 5).

TABLE 5

THE OPEN BRT SYSTEM IN BUENOS AIRES, KNOWN AS METROBUS, HAS ACHIEVED SIGNIFICANT REDUCTIONS IN TRAVEL TIME .

METROBUS	YEAR OF IMPLEMENTATION	LENGTH (KILOMETERS)	RIDERS	ESTIMATED TRAVEL TIME REDUCTIONS (%)
Juan B. Bustos	2011	12	150,000	40
9 de Julio	2013	3	255,000	Up to 50
Sur	2013	23	250,000	20
AU 25 de Mayo	2015	7.5	120,000	50
Norte	2015	5	> 200,000	32
Norte (Phase II)	2016	2.8	250,000	35
San Martin	2016	5.8	70,000	20
del Bajo	2017	2.9	300,000	45
La Matanza	2017	16	240,000	27

Source: Authors' elaboration based on City of Buenos Aires (2019) and Ministry of Transport (2017).

Metro transport networks have also had a substantial impact on the region. For the most part, however, these have been focused on cities large enough to justify the required investment. The first metro system in the region—and one of the first in the world—was launched in Buenos Aires more than a century ago. Since then, however, the growth of metro systems in the region has been meager. Until the 1970s, Buenos Aires and Mexico City hosted the region's only two systems. Today there are 19 such systems in Argentina, Brazil, Chile, the Dominican Republic, Mexico, Panama, and Venezuela (Metrobits 2019), but their combined 900 kilometers is less than the Shanghai metro's plan to reach 1,000 kilometers by 2030 (Yang, Goldman, and Lagercrantz 2018).

Some large cities in the region are currently considering the development of a metro system. However, demand requirements, investment needs, and geography may turn metros into a nonviable solution for most of the region. Sound cost-benefit analysis based on rigorous assessments of demand and technical feasibility will be essential.

BOX 2

CABLE CARS IN THE REGION: THE SUCCESSFUL CASE OF LA PAZ–EL ALTO, BOLIVIA.

To respond to growth challenges and mobility, urban specialists have begun to consider alternatives to traditional public transport modes. Among those alternatives are cable cars, traditionally associated with ski centers (Suárez-Alemán and Serebrisky 2017). The first cable car in the region opened in 2004 in Medellín, Colombia (Yañez-Pagans et al. 2018). Other examples include Cable Arvi in Medellin (Lines J, K, and L) and MIO Cable in Cali (Colombia); Metrocable in Caracas (Venezuela); Teleferico do Alemao in Rio de Janeiro (Brazil), currently closed; Mexicable in Mexico City (Mexico); and Mi Teleférico in La Paz (Bolivia).

Cable car systems are more limited in their capacity than other mass transport alternatives (Martinez, Sanchez and Yañez-Pagans 2018). However, they can be very effective in closing mobility gaps in hilly places with accessibility problems, such as the city of El Alto in Bolivia, which lies 420 meters above La Paz. The topography affects mobility both between the cities and within them (Suárez-Alemán and Serebrisky 2017).

Mi Teleférico began operating between La Paz and El Alto in 2014. It is the longest cable car line in the world, extending over 10 kilometers, with 11 stops. The single-trip fare of USD 0.44 (in 2017) is almost double the cost of the informal minibuses that remain the most common mode of transport (Suárez-Alemán and Serebrisky 2017).

Mi Teleférico has brought significant benefits to its users. Based on a 2015 survey, it was estimated that trips by cable car were 22 percent shorter than those made by other modes, regardless of the length of the trip (Suárez-Alemán and Serebrisky 2017). The time savings translated into a net benefit of USD 0.54 per trip. Another study, based on a 2016 survey that included cable car riders, found that those who switched from private transport to public alternatives experienced significant savings in travel time as well as an increase in self-employment and self-employment income. The cost-benefit analysis found that, in the most common scenarios, benefits outweighed costs by a ratio of 1.05 to 2.16 (Martinez, Sanchez and Yañez-Pagans 2018).

FIGURE 5

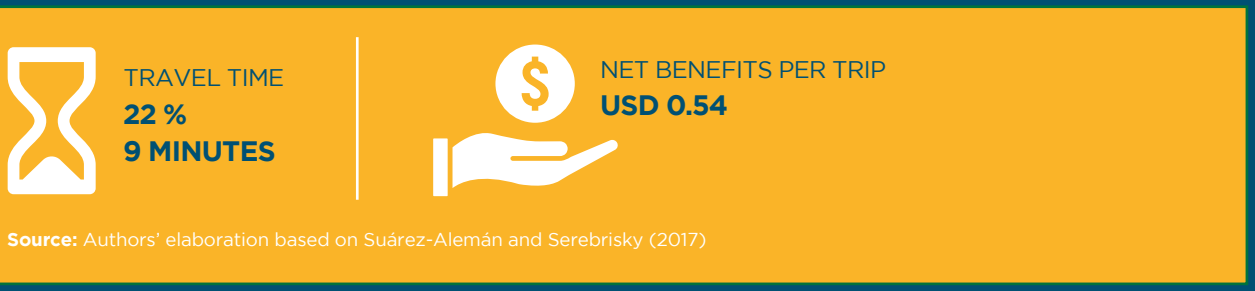
THE LA PAZ – EL ALTO CABLE CAR IS THE REGION'S LARGEST IN LENGTH AND NUMBER OF PASSENGERS.

	DAILY PASSENGERS	LENGH (KILOMETERS)
La Paz - El Alto (1st phase) (Bolivia)	80,000	10,0
Medellin Linea K (Colombia)	35,000	2,0
Medellin Linea J (Colombia)	15,000	2,6
Complexo do Alemao (Brazil)	13,000	3,5
Caracas (Venezuela)	5,000	1,8
Medellin Linea L (Colombia)	4,200	4,8

Source: Authors' elaboration based on Suárez-Alemán and Serebrisky (2017).

FIGURE 6

CABLE CAR USERS SAVE 22 PERCENT ON TRAVEL TIME, A NET BENEFIT OF USD 0.54 PER TRIP



Source: Authors' elaboration based on Suárez-Alemán and Serebrisky (2017)

The cable car in Medellin (Colombia) also appears to have led to a reduction in crime, in part by increasing the probability of apprehension and by reducing the travel costs and improving accessibility of low-income groups (Canavire-Bacarreza, Duque, and Urrego 2016).

2.2.2 SERVICE-ORIENTED POLICIES: SOME ATTEMPTS TO DEAL WITH AFFORDABILITY (DEMAND-SIDE SUBSIDIES), LITTLE ATTENTION TO QUALITY

Most attempts to improve public transport in the region have focused on infrastructure rather than service. The most significant service-oriented policy has been demand-side subsidies benefitting specific groups. Although policies related to service quality are not widespread in the region, and almost no policy assessments of such policies have been done, some attempts to improve service quality have been made. They include accessibility policies for the disabled (such as the implementation of bus platforms in Guayaquil[12]); road safety programs[13]; fare integration (such as SUBE in Buenos Aires[14]); and increased night service (such as Nochebús services in Mexico City[15]). The available information is anecdotical, however, and does not rebut the argument that too little attention has been placed on the quality of services.

DEMAND-SIDE SUBSIDIES

Demand-side subsidies, widespread in the region, have been proven to be more effective than supply-side subsidies, chiefly because they can target beneficiaries (Serebrisky et al. 2009). Yet the evidence of their effectiveness is mixed (Fay et al. 2017). The development of smart technologies has helped to improve operating efficiency, pricing flexibility, and targeting of subsidies (Gwilliam 2017). In 2014, a pro-poor public transport subsidy was implemented in Bogota through a national social policy targeting mechanism, SISBEN, which enables planners to classify beneficiaries and allocate subsidies. The system considers several socioeconomic characteristics of individuals and households to build a score, which is a proxy of poverty (Guzman and Oviedo 2018). The policy increased monthly trips by 56 percent among subsidy beneficiaries (Rodríguez Hernández and Peralta-Quiros 2016). Analysis of the current structure of the pro-poor subsidies, as well as alternative scenarios for increasing their coverage, show that both are progressive, with a positive impact on accessibility and equity for beneficiaries (Guzman and Oviedo 2018).

A range of subsidy programs is presented in Table 6.

12 Guayaquil has installed 30 electro-hydraulic platforms for the disabled in public buses; a second phase to install 150 new platforms has begun (ATM 2019).

13 Successful attempts to improve road safety in the region have focused on human factors, institutional factors, legal factors, and control factors (de la Peña et al. 2016).

14 In 2018, the Buenos Aires metropolitan area implemented the RED SUBE system, which integrates buses, metro buses, trains, and subways) providing discounts for the use of combinations of modes (Ministerio de Transporte 2019).

15 In 2013, Mexico City launched Nochebús, which provides night service from midnight to 5 a.m. (Crotte et al. 2018).

TABLE 6

THE REGION HAS IMPLEMENTED A WIDE RANGE OF DEMAND-SIDE TRANSPORT SUBSIDIES WITH VARIOUS SELECTION MECHANISMS AND IMPACTS.

TYPE OF PROGRAM AND SELECTION MECHANISM	DESCRIPTION AND EFFECTS
Vale Transporte Brazil ■ Employer-sponsored transport voucher introduced in 1985. ■ Mix of categorical and self-selected mechanism.	■ Benefits very poor people who are formally employed. ■ Does not benefit informal workers, who made up 37 percent of Brazil's workforce in 2013 (Cardoso 2016), or the unemployed. ■ Incentivizes employers not to employ people who live far away (Rebelo 2013). ■ Vulnerable to fraud when not electronic (Rebelo 2013). ■ Provides incentives for frequent fare increases (Rebelo 2013).
Cable cars, Rio de Janeiro ■ Implemented in 2011, suspended in 2016 ■ Geographic (operating in Complexo do Alemão)	■ Only 10 percent of the population of Complexo do Alemão was registered to travel free (Izaga and da Silva Pereira 2014). People continued using *kombis* (Volkswagen vans) and moto-taxis (Santos 2014). ■ Excludes low-income households living elsewhere in the city (Mehndiratta, Rodríguez, and Ochoa 2014).
Discounts for students, seniors, and people with disabilities ■ Several cities ■ Category-based subsidies	■ Vulnerable to errors of inclusion and exclusion (Mehndiratta, Rodríguez, and Ochoa 2014). ■ Subsidized fares for students in Chile funded by cross-subsidies before 2010 and by Fondos Espejo after 2010. In March 2010 the subsidy lowered Metro Valparaíso fares by 100 percent for primary students and by 66 percent for secondary and higher-education students (Metro Valparaíso 2010); fares for all other passengers fell 18 percent. Ridership increased 15 percent in 2011. The month of March of both years is excluded because of the distortion caused by the 2010 earthquake (Metro Valparaíso 2011). ■ A surcharge on the regular bus fare in Santiago, imposed to subsidize the student fares, has had a regressive impact (Gómez-Lobo 2009).
Bilhete unico (single ticket), São Paulo ■ Implemented in 2004 ■ Geographic (São Paulo)	■ Free transfers between buses and trains (World Bank 2017), subsidizing transfers for multimodal trips, with a positive impact on low-income users (Rodríguez Hernández and Peralta-Quiros 2016). ■ Share of low-income rail users increased from less than 5 percent to 35 percent after fare integration (World Bank 2017). ■ May contribute to sprawl (Rodríguez Hernández and Peralta-Quiros 2016).
Pro-poor subsidies, Bogota ■ Implemented in 2014 ■ Mix of means-tested and self-selection	■ Number of monthly trips increased in 56 percent of subsidy beneficiaries (Rodríguez Hernández and Peralta-Quiros 2016). ■ Job accessibility improved in the periphery and low-income areas (Guzman and Oviedo 2018). ■ Transport subsidies are most efficient and effective in low-income areas (Guzman and Oviedo 2018).

Source: Authors' elaboration based on Rivas, Serebrisky, and Suárez-Alemán (2018).
Note: The subsidies shown in the table are not exhaustive within the region or within countries.

2.3 POLICIES TO MAKE WALKING AND CYCLING MORE ATTRACTIVE

LAC has made progress in promoting active transport, notably cycling. Among the main policies that have helped boost walking and cycling as means of transport are the improvement of cycling infrastructure and the implementation of bike-sharing, pedestrianization, and ciclovías.[16] On the other hand, a recent study of a group of LAC cities[17] found no documented large-scale examples of dense development with an emphasis on walkability (Gomez et al. 2015), and only one program to support active transport to school.[18]

Despite policies promoting active transport, cycling still is not a common means of transport and cycling infrastructure remains underdeveloped. Modal shares for biking are still low in the region, with some exceptions such as Bogota (5 percent) and Rosario (5.3 percent).[19] There have been few studies of the impact of active transport programs in increasing the modal share of walking and cycling. The lack of impact assessment of these programs prevents governments from highlighting their benefits. Only 16 percent of 38 LAC cities sampled had impact indicators related to bicycle usage,[20] suggesting that the vast majority of the region's cities do not measure the impact of bicycles on citizens' quality of life (Ríos et al. 2015).

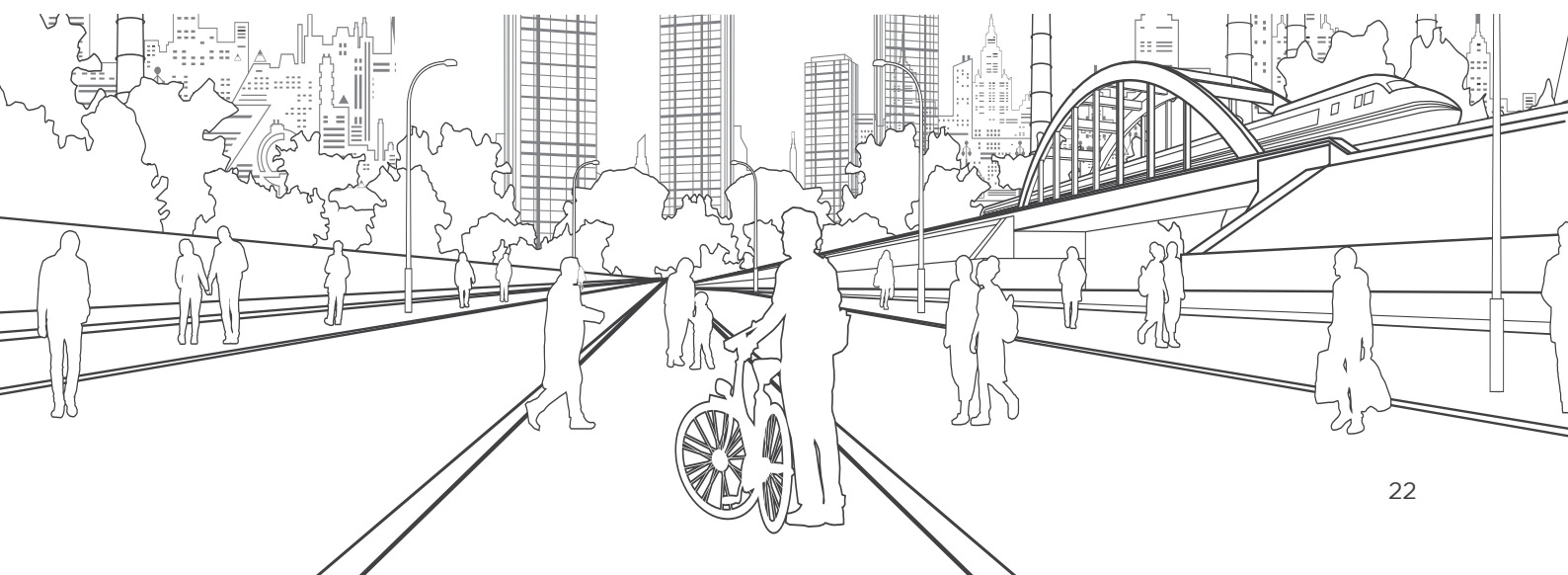
16 For more information on ciclovias, see Sarmiento et al. (2017).

17 Mexico City, São Paulo, Buenos Aires, Rio de Janeiro, Lima, Bogotá, Santiago de Chile, Belo Horizonte, Guadalajara, and Caracas (Gomez et al. 2015).

18 Bogota's "*Al colegio en bici*" program was implemented in 2014 to provide a sustainable way to travel to school (Alcaldía Mayor de Bogotá 2014). The program has 90 safety routes, where more than 5,000 students have biked since 2017, accompanied by 222 guides (Alcaldía Mayor de Bogotá 2018). To promote bike safety, the program has delivered 5,000 kits with helmets, safety vests, and a puncture repair kit; and it has installed more than 10,000 bicycle parking spaces in city schools.

19 In terms of cycling infrastructure, Bogota with 540 km (Alcaldía Mayor de Bogotá 2019), Sao Paulo with 503,6 km (CET 2019) and Rio de Janeiro with 450 km (SMAC 2016) have the largest infrastructures in the region.

20 Indicators include road safety, modal share, bicycle sales, share of trips made by women, stolen bicycles, emissions, among others.

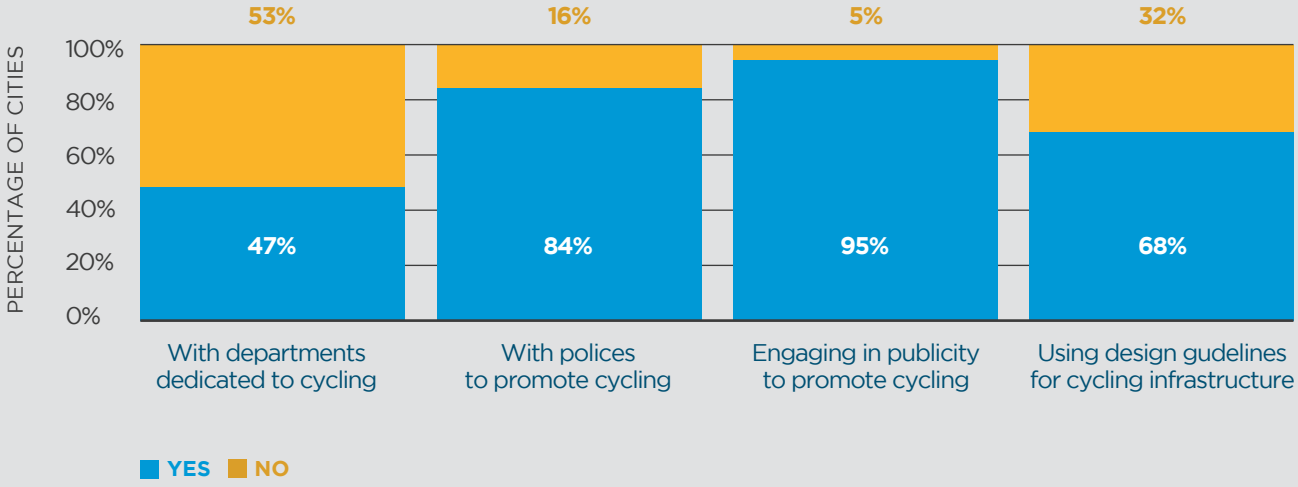


2.3.1 CYCLING-INCLUSIVE STRATEGIES

The region offers few examples of guidelines for cycling infrastructure. The most complete example is the *Manual de Ciclociudades* (Cyclocities Manual) in Mexico, which is used in several cities in the country. Several cities have also undertaken publicity to promote cycling, including bike-to-school and bike-to-work programs of Bogota and Buenos Aires, respectively. Regarding cycling-inclusive policies, Bogota has a mobility policy that explicitly prefers bicycles over other transport modes and employs dedicated staff in its offices of mobility, urban development, recreation, and education to coordinate activities and design projects (Ríos et al. 2015). Based on data from 38 cities in LAC, Ríos et al. (2015) catalogue cycling-inclusive strategies in the region, including departments dedicated to cycling, policies and publicity to promote bicycles, and design guidelines for cycling infrastructure (Figure 7).

FIGURE 7

POLICIES PROMOTING CYCLING ARE NOW COMMON IN THE REGION, BUT IMPACT ASSESSMENTS ARE RARE.



Source: Authors' elaboration based on Ríos et al. (2015).

2.3.2 BIKE-SHARING PROGRAMS

Several cities in the region have implemented bike-sharing programs. Development varies significantly by city in terms of the coverage and size of the system. Brazilian systems are the most developed. In some cities, experiences with bike-sharing may include more than one program, may feature cooperation with private systems or programs, or may offer different services, such as dockless systems or electric bikes. Sao Paulo currently has two dock-dependent systems (Bike Sampa and Ciclo Sampa) and one dockless system (Yellow).[21]

Despite the development of bike-sharing programs, little attention has been paid to their impact. In Buenos Aires, the percentage of daily trips taken using shared-bikes increased from 0.4 percent in 2009 to 3.5 percent in 2014 (City of Buenos Aires 2018). Although bicycle-sharing systems have positive environmental, social and transport-related impacts (Shaheen et al. 2013), benefits may not be equally distributed (Goodman and Cheshire 2014). In fact, an analysis of five bicycle-sharing systems in Brazil, shows that systems do not serve people equally: only a subset of the city's population (6.28–18.28 percent) and part of its area (7.9–24.7 percent) are served by the system (Duran et al. 2018). The areas served are wealthier neighborhoods. The mean income of areas with bike-sharing systems was twice the cities' mean income.

2.3.3 PEDESTRIANIZATION AND CICLOVÍAS

In recent years the region has witnessed substantial growth in pedestrianization and *ciclovías* programs, in which streets are closed periodically to motorized traffic. Several cities have pedestrianized their historic centers or certain avenues, as in Buenos Aires, Santiago, Bogota, and Quito (Hidalgo and Huizenga 2013). Some have started pilots to assess pedestrianization; Lima is one such (Municipalidad de Lima 2019). Pedestrianization has transport-related, social, environmental, economic, and health-related benefits (Soni and Soni 2016). Following the pedestrianization of Quito's historic center, the city saw reductions of 25 percent in fine particle emissions (PM2.5), 25 percent in carbon monoxide, and 30 percent in sulfur dioxide (Quito Alcaldía 2018).

The region has experienced a large-scale growth in ciclovías. Some 93 percent of *ciclovías* programs are in LAC countries, and 90 percent of these were instituted after 2000 (Sarmiento et al. 2017a). *Ciclovías* programs have had a positive impact on the promotion of walking and healthy habits among their participants in Bogota and Santiago de Chile (Sarmiento et al. 2017b; Mora, Greene, and Corado 2018).

21 Other micro-mobility options in Sao Paulo are the scooter-sharing systems, Scoo and Grin.

2.4 LAND-USE PLANNING AND POLICIES TO FACILITATE DENSE, MIXED-USE DEVELOPMENT: THE CASE OF CURITIBA (BRAZIL)

From a policy perspective, the equation between urban growth and transport is incomplete unless land use is taken into account. In fact, land use and transport are entwined, and transport planning models should be integrated with land-use models to capture the effects of their relationship (Waddell 2011). Land use and urban development also have a significant influence on travel behavior, mainly because they affect trip distance and determine whether walking, cycling, and public transport are feasible (Ewin and Cervero 2001, 2010 in Buehler et al. 2017).[22]

Integration of effective land-use planning with transport policies is not widespread in the region. LAC cities have developed various combinations of interventions linking land use with transport (Jirón 2013). Examples include the cities of Curitiba (see Box 3), Rosario (urban planning), other Brazilian and Colombian cities (where comprehensive plans are required by urban development laws) (Hidalgo and Huizenga 2013), Ecuadoran cities (urban planning), and Santiago de Chile (conditioned planning) (Jirón 2013). However, the region offers few examples of the effective integration of good land-use planning with transport policies.

22 For an intuitive insight into the problem, consider how unplanned urban growth characterized by low-density development affects the cost and quality of public transport: To provide decent service, the system must expand to keep pace with development, but low density and the limited ability to pay of outlying customers limit the revenue potential of expansion. Choosing not to expand, on the other hand, is tantamount to abandoning the mission of public transport, which is to serve the public.

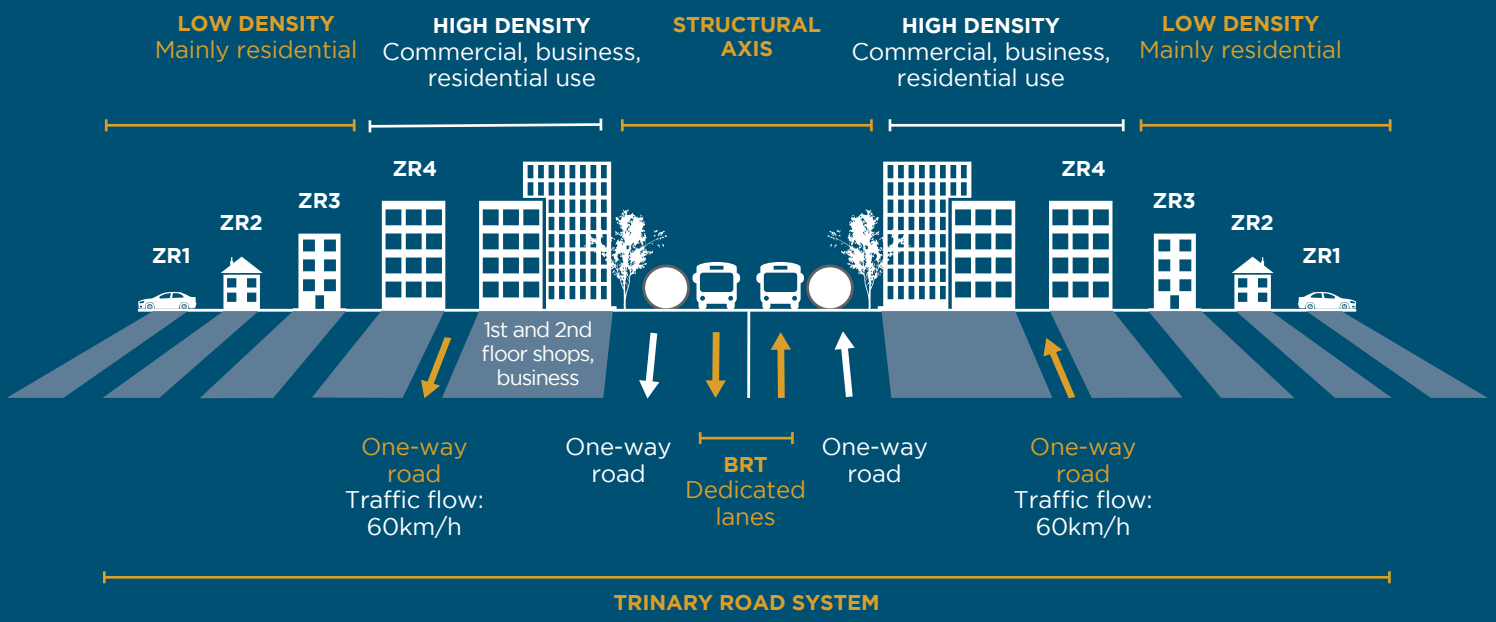
BOX 3

THE BRAZILIAN CITY OF CURITIBA INTEGRATED LAND-USE PLANNING WITH TRANSPORT POLICIES —BUT NEW CHALLENGES LOOM

In 1966 the city developed a master plan that integrated land use with transport. Bus rapid transit (BRT) was launched in 1974 under the plan. Following a cogent long-term vision of the city, the government decided that medium- and large-scale urban development should be concentrated along BRT corridors (Cervero 2013b). The city designed a trinary road system consisting of BRT-dedicated lanes, one-way roads along the BRT corridor, and one-way roads and compatible land uses that become less dense (and lower in height) with distance from the corridor (Cervero 2013b). Curitiba's success with sustainable development can be attributed to the Institute for Research and Urban Planning of Curitiba (IPPUC), an independent public authority that implemented and supervised a succession of urban plans and has provided continuity and consistency of policy under successive administrations (Suzuki et al. 2010).

FIGURE 8

CURITIBA HAS INTEGRATED LAND-USE PLANNING WITH TRANSPORT POLICIES IN ITS THREE-TIERED ROAD SYSTEM; IT NOW FACES NEW CHALLENGES TO ENHANCE SUSTAINABILITY AND BENEFIT LOW-INCOME GROUPS.



Source: Authors' elaboration based on Suzuki et al. (2010)

The well-designed bus system, integrated land-use regulations, and planned street networks have made it possible to reduce traffic congestion, improve air quality, increase green areas, enhance walkability and livability, and reduce crime (Suzuki et al. 2010). Curitiba has the highest rate of bus ridership in the region; 45 percent of trips are taken on buses (Suzuki et al. 2010). The city is also Brazil's cleanest city of more than 1 million inhabitants, despite the presence of a large industrial sector (Cervero 2013b). Green areas have grown from less than 1 square meter per capita in the 1970s (Suzuki et al. 2010) to 64.5 square meters per capita in 2010 (Scoz 2012 in Martínez et al. 2016).

Curitiba's urban transport system faces new challenges. Confronted with metropolitanization and growing demands from citizens to participate in decision making, it continues to practice the approach that has brought successful results in the past, but with some more interactive and participatory policy tools (Mercier et al. 2015). Facing problems of congestion, the city abandoned the prohibition of construction of new garages in 2004; today, more than half of the space in some blocks in the city center is taken up by garages (Nakamura, Makimura, and Toyama 2017). In addition, the city has fallen short in providing housing for low-income groups (Cervero 2013b). Most publicly funded housing for low-income groups was built far from the main transport corridors (Duarte and Ultramari 2012 in Cervero 2013b).

Curitiba's continuing reputation as a leading sustainable city no longer reflects material realities and blocks institutional transformation (Martínez et al. 2016). To make the institutional changes required to realign reality with reputation, the city's leaders and citizens alike will have to see past their past successes.

3 WHAT LIES AHEAD

THE SEARCH FOR A SUSTAINABLE EQUILIBRIUM

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Overall, the policies implemented in the region have proven ineffective in promoting efficient and sustainable transport systems. In some cases, it could even be said that policies have helped to worsen urban transport in LAC cities by increasing the use of private transport,[23] thus altering the relative prices between public and private modes (in favor of the latter), and so increasing congestion and pollution while decreasing the accessibility, affordability, and quality of public transport.

The results of the policies already implemented in the region suggest that transport policy should become:

- **more integrated and**
- **more service-oriented**

These categories are not mutually exclusive. In practice, transport policies should be implemented in an integral way—and with an eye to service quality.

23 For example, through lax regulations that promote the development of private parking in buildings, low prices for public parking in cities, or exogenous conditions such as the expansion of access to credit, which, while generally benefitting consumers, also increases demand for cars.

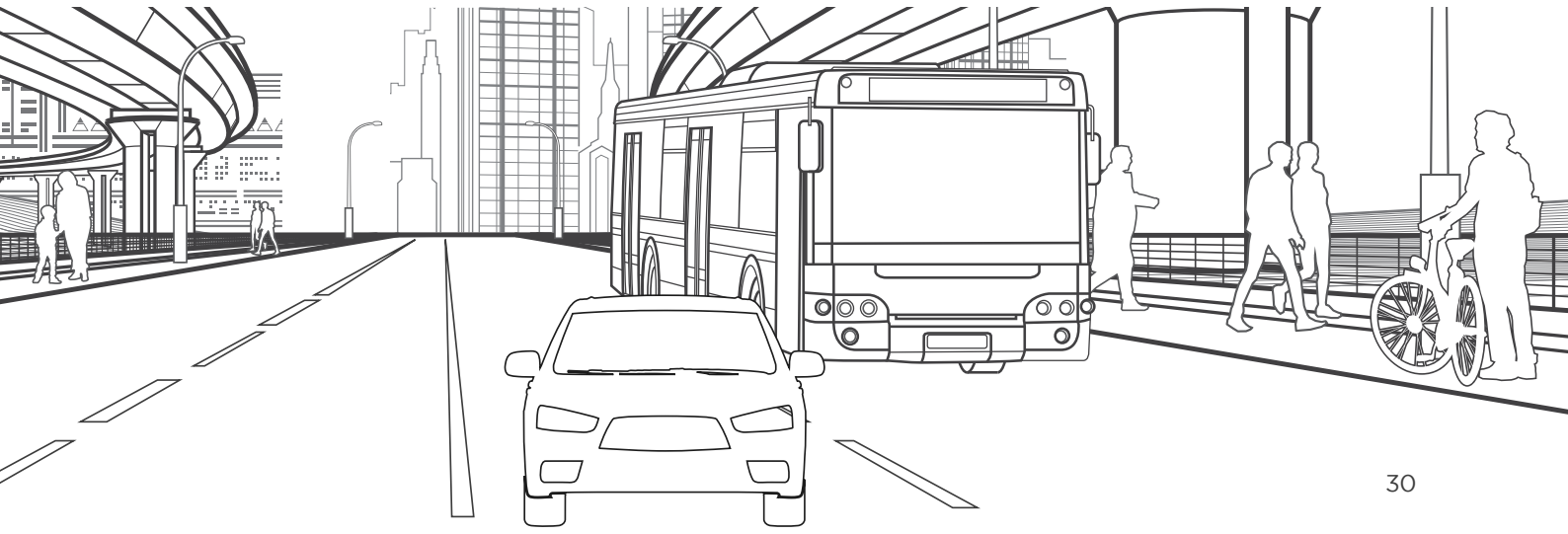
3.1 INTEGRATED TRANSPORT POLICIES: TYING PUBLIC AND PRIVATE TOGETHER.

Sustainable transport systems depend on coordinated and integrated transport policies. As noted previously, several Western European cities have made significant progress toward sustainable transport systems by restricting car use while simultaneously promoting public transport, making walking and cycling more attractive, and integrating land-use planning with transport planning (Buehler, Pucher, and Altshuler 2017). The links among these four categories of policies are very strong. For instance, land-use planning has effects on the use of private cars, public transport, and walkability. Therefore, policy aims and the design and implementation of transport policies should be conceived and presented in a thoroughly integrated way.

Overall, the region has not succeeded in implementing policies to improve urban transport. The effectiveness of certain policies has not been enough to counter the negative trends in the region. Among the four categories of policies analyzed, LAC cities have made progress in public transport and, to a lesser extent, in active transport policies. They have not been effective with policies that restrict automobile use or in integrating land-use planning with transport policies.

Based on this diagnosis, the top three opportunities for improvement would be:

- **to pursue policies that integrate all dimensions of transport;**
- **to link policies to restrict private transport with policies to improve public transport; and**
- **to coordinate transport policies with land-use planning (urban policies).**

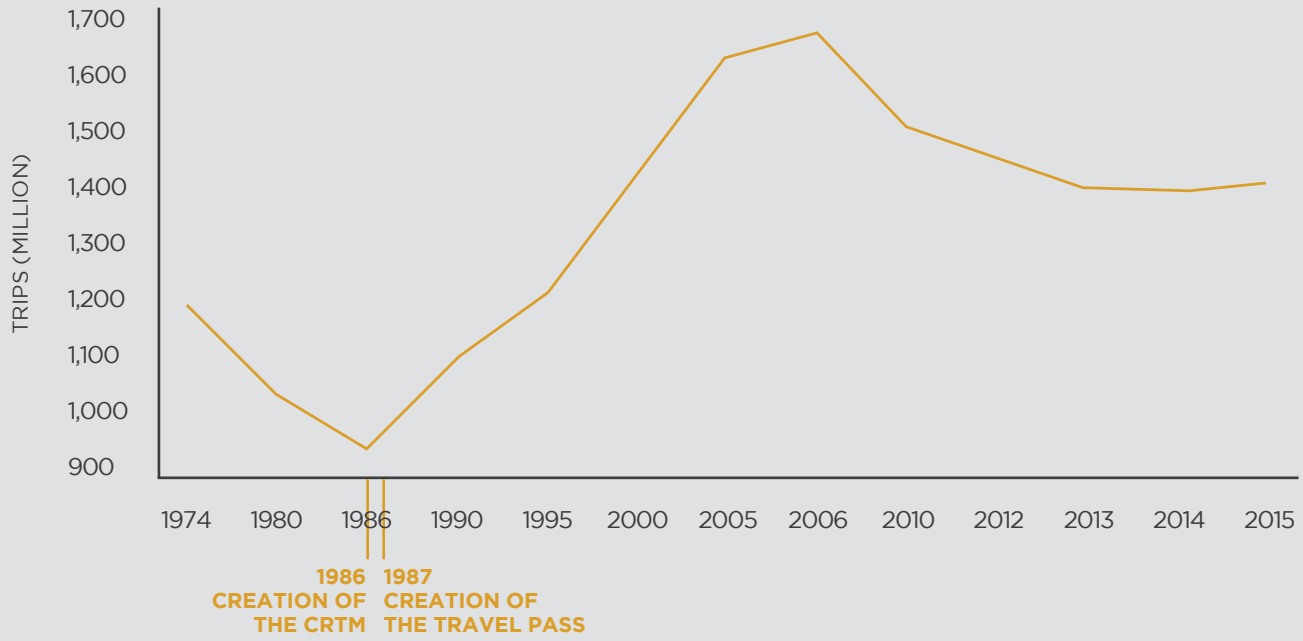


3.1.1 THE DIMENSIONS OF INTEGRATING POLICY

Integration has not been a common characteristic of transport policy in the region. The failure to integrate policies related to administration, fare-setting, and modes has translated into less efficient and effective public transport systems (Vassallo and Bueno 2019). By contrast, many cities around the world have achieved significant benefits from integration policies—among them increases in ridership, revenue, modal shares for public transport, and user satisfaction; reductions in fraud; and money savings for users (Vassallo and Bueno 2019). A study of the city of Haifa (Israel) found that fare integration increased passenger trips by 7.7 percent, and that fare reduction was a significant factor in attracting passengers (Sharaby and Shiftan 2012). Fare integration also shifted trips from cars and taxis to transit. In the LAC region, Bogota has made significant progress in integrating public transport policy, but it still needs to implement structural changes to exploit the benefits of integration (Vassallo and Bueno 2019). The bases for integrating public transport policies in three cities—London, Bogota, and Madrid—are depicted in Table 7. Figure 9 illustrates a remarkable example in Madrid.

FIGURE 9

IN MADRID, DEMAND FOR PUBLIC TRANSPORT GREW SIGNIFICANTLY AFTER THE INTRODUCTION OF THE MADRID REGIONAL TRANSPORT CONSORTIUM AND THE TRAVEL PASS.



Source: Authors' elaboration based on CRTM (2015), discussed in Vassallo and Bueno (2019)
Note: CRTM = Madrid Regional Transport Consortium.

TABLE 7

KEY FOUNDATIONS OF PUBLIC TRANSPORT INTEGRATION IN LONDON, MADRID, AND BOGOTA.

	LONDON	MADRID	BOGOTÁ
PHYSICAL AND NETWORK INTEGRATION	A number of multimodal facilities and physical adaptations are provided by the system. Transport networks (e.g., bus, rail, tram) are organized to provide maximum integration.	Transport interchanges and other facilities provide access to the system and facilitate integration. Existing transport networks share resources and maximize coverage.	The SITP system integrates BRT corridors with a network of bus routes. However, the system does not provide full coverage in the city, and future network integration will be necessary. Service and infrastructure improvements are also required. Implementation of the SITP has to be completed.
FARE INTEGRATION	The same fare medium (Oyster card) covers travel by bus, Tube, tram, DLR, London Overground, TfL Rail, Emirates Airline, River Bus services, and most National Rail services in London.	Fare payments are integrated across various transport systems. Two smart cards are available (Tarjeta multi and tarjeta de transporte público); these allow travel via metro, light rail, commuter rail, and urban buses.	Passengers can travel on the city's transport modes at a discounted fare. Two smart cards are available (Tu llave for the SITP; Tajerta cliente frecuente for Transmilenio users). However, passengers pay a supplement when transferring between systems.
INFORMATION INTEGRATION	Information for riders is available from static, print, and real-time sources. Departure and arrival times, trip planning, and special events travel are also available.	Timetables and maps are provided at stops/stations. Real-time information is provided at the busiest stations. The system could benefit from advances in technology.	Stations and terminals areprovided with extensive information on routes, connections, and tickets. Digital information helps customers plan their trips. However, more real time information is needed to ensure integrated information at stops/stations.
INSTITUTIONAL INTEGRATION	An integrated transport authority (Transport for London) is responsible for most aspects of London's transport system (coordination of services, transport network, fares, congestion charge).	A regional public authority (Consorcio de Transportes de Madrid) coordinates the services, networks and fares of the modes of transport operating in the region.	As a result of historical circumstances, a new transit authority was not created to run the SITP system. These responsibilities have been added to the institution that manages the BRT system in the city (Transmilenio S.A). There is a risk of overburdening this institution.

DIMENSION COVERED BY CITY'S INTEGRATION POLICY
DIMENSION COVERED, BUT COULD BENEFIT FROM MINOR IMPROVEMENTS
DIMENSION ONLY PARTLY COVERED AND NEEDS MAJOR IMPROVEMENTS

Source: Authors' elaboration based on Vassallo and Bueno (2019, p. 51).
Note: Dockland Light Railway; SITP = Bogota's integrated public transport system.

3.1.2 CONGESTION PRICING TO FINANCE PUBLIC TRANSPORT

To be effective, improvements in public transport services should be accompanied by policies to restrict the use of private cars. Although there is some evidence that improving public transport can decrease car ownership (Crampton 2006; Mulalic, Pilegaard, and Rouwendal 2015), it cannot be expected that all car users will switch from cars to public transport (Jensen 1999). The view that public transport can be made attractive only by making car use less attractive (Hensher 1998, p. 204) remains valid, with nuances. Of the many policies to discourage car use, congestion pricing has the advantage of encouraging both individuals and firms to adjust their behavior (De Palma and Lindsey 2011).

Congestion pricing has been very successful in several cities around the world, and more (including New York) have plans to implement it. But congestion pricing is not a reality in LAC cities. This mechanism has had positive effects on congestion worldwide, with reductions of 13–30 percent, and on greenhouse gas emissions, with reductions of 15–20 percent in London, Singapore, and Stockholm (Pike 2010). Charging by distance, or pay-as-you-drive, is another example of road pricing.[24] Most charge schemes currently in operation apply to large commercial vehicles, except in New Zealand, where cars are taxed[25] (Kirk and Levinson 2016). European examples of nationwide road pricing systems for trucks include Switzerland, Germany, Austria, and the Czech Republic. In the United States, only small-scale tests have been implemented in a few states (Kirk and Levinson 2016).

Congestion pricing has not yet been implemented in the region. One possible explanation could be the unacceptability of the policy (Ríos et al. 2013). Bogota already has a regulation that permits congestion charges in cities with more than 300,000 inhabitants (Decree 2883 of 2013). But three attempts to implement the regulation (in 2011, 2014, and 2015) failed to gain the approval of the Bogota City Council (Bocarejo, López Ghio, and Blanco 2018). Table 8 presents the potential impacts that the implementation of congestion charges might have in Bogota, Mexico City, and Santiago de Chile, with decreases in congestion of 24 to 28 percent.

Revenues from congestion pricing can be used directly to improve public transport, contributing simultaneously to its public acceptance, effectiveness, and feasibility (Gärling and Schuitema 2007). The successful cases of congestion charges in London, Stockholm, and Singapore share the common pattern of improving public transport supply and quality first and then paying for those improvements with congestion charges. In London this mechanism is enshrined in law (Green, Heywood, and Navarro 2016). This city is an example of why sequence matters: improvements in public transport must come first. New York has proposed to implement congestion pricing to raise an estimated USD 15 billion in revenue (New York State 2019). The revenues would be allocated exclusively to the Metropolitan Transportation Authority's capital program. Revenues from congestion charges in the LAC region could be used to increase public transport subsidies, achieving welfare improvements. As an example, Parry and Small (2009) found that large fare subsidies in Washington, DC, Los Angeles, and London are efficient, and that incremental fare reductions lead to welfare improvements across transport modes and cities.

24 Several insurance companies use pay-as-you-drive pricing in Canada, the United States, Australia, the Netherlands, and South Africa (Litman 2018).

25 Road user charges in New Zealand are paid by all diesel-powered vehicles and others powered by a fuel not taxed at source, regardless of the weight of the vehicle (NZ Transport Agency 2018).

TABLE 8

IMPLEMENTATION OF CONGESTION PRICING IN BOGOTA, MEXICO CITY, AND SANTIAGO DE CHILE COULD REDUCE CONGESTION BY 24 TO 28 PERCENT.

	BOGOTA	MEXICO CITY	SANTIAGO DE CHILE
Optimal congestion pricing[1] per kilometer (USD)	**0.33**	**0.42**	**0.24**
Decrease in congestion (%)	**28.3**	**28.8**	**24.8**
Increase in average speed (km/hour)	**6.5**	**8.4**	**4.7**
Revenues from congestion pricing per day (USD)	**154**	**611**	**447**
■ Equivalent increase in parking prices (%)	121	324	793
■ Equivalent increase in fuel prices (%)	42	78	162

Source: Authors' elaboration based on Bocarejo, López Ghio, and Blanco (2018)

1 Following Pigou's theory, a single tariff that internalizes congestion externalities is estimated on a 12 hour-per-day basis.

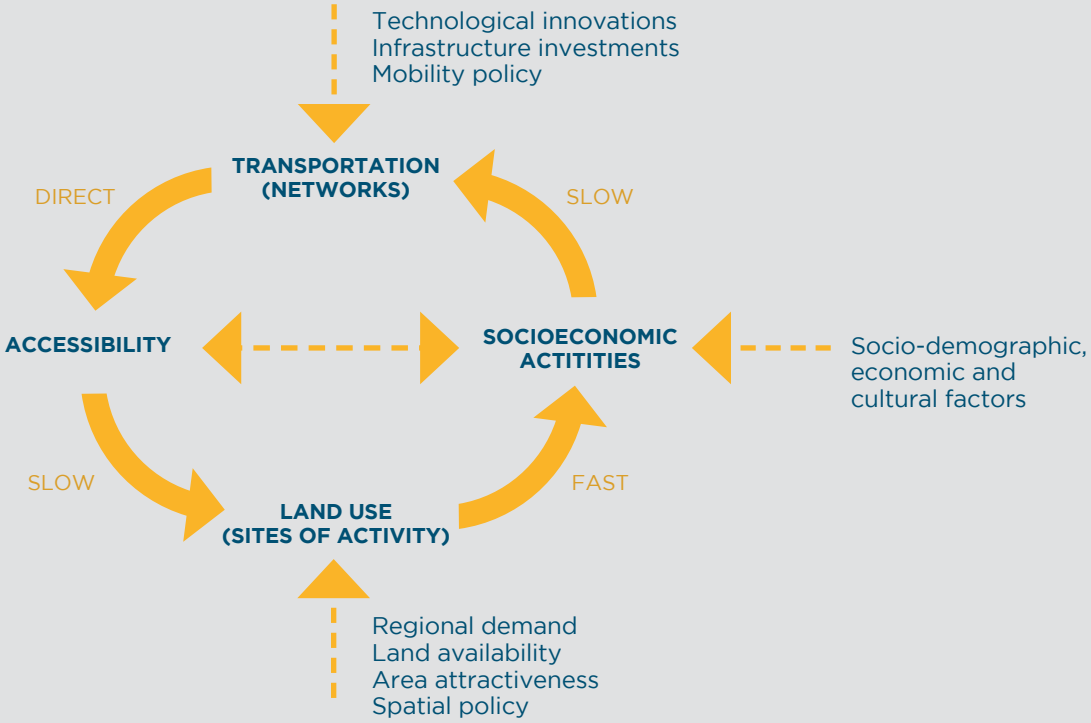
3.1.3 LAND-USE PLANNING

Integrating transit with land development helps to create urban spaces in which motorized travel is less necessary (Suzuki, Cervero, and Iuchi 2013), thereby yielding significant sustainability benefits. The complex relationship between land use and transport is linked to other urban processes, among them macroeconomic development, demography, interregional migration, and technological innovation (Wegener 2014). A comprehensive way to approach these intertwined relationships is through the "land use–transport feedback cycle" (Figure 10). Following Wegener and Fürst (2004), patterns of land use determine the sites of socioeconomic activity. The transport system connects these sites. In turn, the distribution of transport infrastructure fosters spatial interactions that can be measured as accessibility. Finally, the distribution of accessibility in space co-determines siting decisions, generating changes in land use. The cycle should be an open process shaped by multiple factors, wherein responses times vary along the cycle (Bertolini 2012).

The feedback cycle provides a framework for understanding the challenges cities face when weighing land use and transport decisions. Buehler, Pucher, and Altshuler (2017) emphasize that major Western European cities that enjoy sustainable transport have been effective in land-use planning and in the implementation of policies that facilitate dense, mixed-use development through coordination of public transport with the planning process. In particular, Scandinavian countries, the Netherlands, Germany, Switzerland, and Austria impose strict controls on land use, limiting low-density sprawl, promoting dense development around transit stops, and, reciprocally, providing transport services to new dense developments. In addition, Scandinavian countries, the Netherlands, and Germany coordinate land-use planning across levels of government and across jurisdictions, while also integrating land-use, transport, and environmental planning at different levels government. Cultural attitudes and preferences for less car use also help explain the growing preference for living in dense, mixed-use developments or close to the city (Buehler et al. 2017).

FIGURE 10

LAND USE, SOCIOECONOMIC ACTIVITY, THE TRANSPORT SYSTEM, AND ACCESSIBILITY MUST BE APPROACHED IN AN INTEGRAL WAY



Source: Authors' elaboration based on Bertolini (2012) (adapted from Wegener and Fürst 2004).

The benefits of integrating transit and land-use planning include revenue generation. Suzuki, Cervero, and Iuchi (2013) stress that integrating transit and land use can generate revenue to support the costs of integrated development. The successful cases of cities such as Hong Kong, Singapore, and Tokyo show that "value capture" is effective for sustainable finance and for sustainable urbanism. Hong Kong used land sales and leases as its value-capture strategy; Singapore, land-use policy; and Tokyo, privatization of transport services and joint development (Salon and Shewmake 2011).

The LAC region presents both the need and the opportunity to coordinate the planning of land use and transport in the short and long terms. Authorities in the cities of the region would benefit from greater understanding of the relationships of these processes in their local context so as to better address current challenges while simultaneously advancing a long-term vision. Comprehensive, continuous analysis of transport and land-use effects can facilitate the integration process, as policy makers and planners come to understand how transport decisions contribute to the achievement of land-use objectives and vice versa (Litman 2019b).

3.2 SERVICE-ORIENTED TRANSPORT POLICIES: THE IMPORTANCE OF SERVICE QUALITY.

There is an imbalance between asset-oriented and service-oriented transport policies in the region. Advances in public transport in LAC cities are associated primarily with the former—notably infrastructure investment such as BRT, light rail, and cable cars. However, the region has not been effective in providing high-quality public transport services.[26] There is ample room for improvement by implementing policies focused on the quality of service provision rather than on infrastructure per se. The range of possible service-oriented policies is wide; the selection presented here is based on successful international cases and on the identified weaknesses of policies in the LAC region.

There is an urgent need in the region to develop service-oriented transport policies, for which a prerequisite is to improve the measurement and enforcement of service quality. Customers, service providers, and regulators may have varying perceptions of service quality.[27] It is important to acknowledge these perspectives. The customer's view (or "customer satisfaction") is a subjective measure, whereas the service provider's view is an objective measure of success (Anderson et al. 2013). An appropriate assessment of service quality should include both views.

26 Many car-use policies have been oriented to infrastructure interventions, such as efforts to ensure ample parking and the construction and expansion of roadways for vehicles (Ríos et al. 2013).

27 The "service-quality loop" shows the relationship between the perceived, expected, targeted, and delivered quality of service. The first two lie on the customer's side; the other two on the supplier's side. For details see Anderson et al. 2013.

Customer satisfaction surveys, which are not common in the region, should cover the entire transport system and be implemented on a regular basis to monitor changes in satisfaction levels. To register with customers and affect reported levels of satisfaction, improvements in service quality must be based on an understanding of the drivers of travel behavior—that is, on a clear view of customers' needs and expectations (Anderson et al. 2013). Santiago de Chile and Bogota have implemented regular customer surveys to monitor satisfaction levels over time and to identify the main factors behind satisfaction and dissatisfaction.

Mechanisms to track and enforce service quality should be improved. Gómez-Lobo and Briones (2014) demonstrate that payment mechanisms should be based on performance and on operational variables such as kilometers or seat-kilometers. However, the authors highlight that because of monitoring and enforcement problems in the region, this mechanism has been less effective in ensuring good performance. Therefore, the region should devise mechanisms to improve the enforcement and control of service quality. Spelling out quality standards in contracts with providers is one way to ensure high-quality service levels.

To that end, cities in the region should develop reliable and transparent monitoring systems that take into account the views of customers and providers. Some cities are transparent about the performance of their operators, but usually only with respect to light rail and BRT systems. Recently, Transantiago achieved significant improvements in its performance indexes after reassigning routes to new operators (MTT 2019). Management of service quality should include both customers' and operators' indicators, thereby making it possible to measure changes in customer expectations and performance evaluations over time. Monitoring both perspectives on a regular basis is crucial for supporting authorities in transport policy decisions. In this sense, real-time information systems play an important role in monitoring the performance of operators.

Real-time information systems are a relatively low-cost instrument with great potential to improve operator efficiency and customer satisfaction. Location and communication technologies (the basis of automatic vehicle location) help to support operators using real-time information (such as fleet management and operations, transit priority, and user information), and not real-time functions (such as performance measurement and operations planning) (Tilocca et al. 2017). In addition, real-time information for passengers reduces perceived and real waiting time (Schweiger 2013; Harmony and Gayah 2017), makes transit feel safer, and allows users to make informed transport decisions, thus improving their satisfaction (Harmony and Gayah 2017). It can also improve ridership (Tang and Thakuriah 2011), by an estimated 2 percent in Chicago[28] (Tang and Thakuriah 2012) and New York[29] (Brakewood, Macfarlane, and Watkins 2015). In LAC, real-time passenger information is generally not deployed in bus systems—fewer than half of BRT systems provides real-time information.[30] There is room for improvement here.

28 An average increase of 1.8–2.2 percent in ridership for weekday routes.

29 A median increase of 1.7 percent in ridership for weekday routes and 2.3 percent per route on larger routes.

30 Among 21 BRT systems in the region, just three (in Bogota, Cali, and Barranquilla) have real-time information at all bus stops. Five (Rio de Janeiro, Sao Paulo, Buenos Aires, Belo Horizonte, and Montevideo) have partial real-time information (BRT 2019).

BOX 4

TRAFFIC MANAGEMENT CENTERS ENHANCE PUBLIC TRANSPORT SERVICE QUALITY

System-wide traffic management centers can be useful in improving public transport services. By planning services, monitoring the fleet, and collecting and analyzing data (including real-time data on mobility), the Traffic Operation Center in Torino (Italy) cut travel times for public transport by 11 percent in 2012 (Table 9) (Marinetto 2014).

TABLE 9

THE TRAFFIC OPERATION CENTER OF TORINO HAS ACHIEVED SIGNIFICANT IMPROVEMENTS IN TRAVEL TIMES.

BENEFITS MEASURED IN 2000	BENEFITS MEASURED IN 2012
■ Home–work travel times: **–17%**	■ Travel times of private vehicles along Lecce–Potenza–Siracusa route: **–12%**
■ Public transport speed: **+17%**	■ Travel time of transport line 4 along Unione Sovietica–Via Sacchi route: **–11%**
■ Traffic emissions: **–10%**	

Source: Authors' elaboration based on Marinetto (2014).

Several LAC cities have made progress in implementing traffic management centers. Some examples include the Intelligent Transport System in Buenos Aires, the Traffic Control and Management Center (CCGT) in Lima, the Intelligent Mobility System (SIMM) in Medellin, the Traffic Management Center (CGT) in Bogota, the Mobility Management Center (CGM) in Montevideo, the Mobility Management Center (CGM) in Quito, and the Integrated Urban Mobility Center (CIMU) in Rio de Janeiro.

Most traffic management centers in the region are focused on managing traffic lights, real-time dynamic message signs, and traffic camera networks; only a few include public transport in their operations. An opportunity exists for the cities of the region to improve public transport by incorporating its management into traffic management centers.

4 CONCLUSION

The quality of urban transport in the region has declined over time. Cities have not been able to arrest steep increases in motorization and congestion, and the share of city residents and commuters choosing public transport has declined. The region has not succeeded in implementing policies to improve urban transport. An overview of transport policies in the region shows that cities have made progress with asset-oriented policies and, to a lesser extent, with active transport policies (chiefly involving walking and biking), but these have not been accompanied by effective policies to restrict car use, improve the quality of public transport services, and integrate transport policies.

Asset-oriented policies are not enough; there is an urgent need to implement transport integrated policies and to improve service quality. Integrated transport policy implies:

- integration of all the dimensions of transport—equipment, networks, fares, information, and institutions;
- synchronization of policies designed to restrict private transport with others designed to improve public transport; and
- exploitation of the link between transport policies and land-use planning.

Raising service quality will depend on emphasizing the quality of services provided as well as the infrastructure used to provide those services.

In order to develop a sustainable and efficient urban transport system, the region's urban transport planners will have to level the playing field between public and private transport. Only coordinated and integrated policies can produce sustainable transport systems. There is an urgent need to modify the relative costs of public and private transport by increasing the generalized cost of private vehicles and decreasing the cost of public transport. In this sense, service quality, price, and land use are key components of the transport system and should be considered simultaneously to develop sustainable and high-quality systems.

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