



COLOMBIA

TRANSPORT

Sustainable urban mobility, rural accessibility and interurban connectivity: Colombia's 21st century transport challenges

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Sustainable urban mobility, rural accessibility and interurban connectivity: Colombia's 21st century transport challenges

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Once a rural and poorly connected society, today Colombia is highly urban and dynamic. While continuing deforestation represents the main driver of emissions, the growth of transport activity has led to total emissions of 34 MtCO₂ in 2019, representing 36% of all energy emissions. Transportation policy faces a dual challenge of mitigating emissions growth while tackling infrastructure and accessibility deficits. The nation's cities are on the forefront of a sustainable transition that must balance economic development and financial limitations with the goals of accessibility, equity, air quality, road safety and quality of public space.

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Key Takeaways



Colombia's transport emissions represent 35% of total energy-related emissions and have increased

steadily by 2% yearly. Half of road transport emissions are generated by freight transport, reflecting the freight sector's dependence on road transport, use of diesel, and the poor state of vehicles.



Colombia's mountainous geography continues to be a major obstacle to interregional connectivity, despite

significant investment in highway infrastructure. The rural peripheries of the country are poorly connected, with some areas only accessible by river or air.



With no interregional passenger rail networks, aviation has been the

fastest-growing activity in the transport sector, improved airport infrastructure and relative cost decline from low-cost carriers' competition. It now contributes over 5% of total transport emissions, moving nearly 38 million passengers in over 100,000 flights.



Colombia is a highly urbanized country (77.1%) that is experiencing rapid motorization – vehicle fleets

grew by 237% between 2008 and 2019. In major cities, congestion can be severe, poor air quality is common and road deaths have increased. This has made sustainable urban mobility a policy priority.



Urban public transport systems

remain the main mode for travel in dense urban areas, despite poor quality services and declining passenger numbers, with users often changing to use of motorcycles. Formalization efforts have focused on implementation of BRT systems, which have had mixed effects. Though financial constraints are severe, there have been new investments in electrification of busses and intermodal integration with cycling.



Promotion of cycling as urban

transport has been successful in Bogotá, with modal share now equalling use of private cars. Today, most major cities are undertaking steps to improve this mode, ranging from implementation of cycling infrastructure to the creation of public bicycle systems.

1. The development of Colombia's transport sector

With a population of over 48 million, Colombia is the third most populous country in Latin America. Similarly to most other Latin American nations, Colombia is a highly urbanized society, with 77.1% of the population in urban areas ([Departamento Administrativo Nacional de Estadísticas, 2018](#)). Though the country's economic development was historically hampered by poor transportation links and difficulties in developing export industries, Colombia's recent economic growth has been both steady and robust. It is important to note, however, that the country is characterized by very high income inequality as well as spatial fragmentation, leading to highly differing economic and social outcomes depending on social class and geographical location (**Box 1**). This is largely reflected in the differing transportation realities and challenges faced by Colombians, though all are affected by poor infrastructure and technological development to some degree.

KEYS TO UNDERSTANDING

A CHALLENGING GEOGRAPHY: TRANSPORTATION AND CLIMATE CHANGE ADAPTATION IN COLOMBIA

Located along the tropical Andes, Colombia's impressive jungles, rivers and mountain ranges have proved major obstacles to communication and overland trade and continue to shape transportation to this day. This challenging geography has resulted in a significant urban-rural divide in terms of access to basic services and income, as well as significant difficulties in regional connectivity and trade.

The Caribbean coast of Colombia has historically been the most connected part of the country, integrated into the wider Caribbean region and international trade routes. Though Cartagena's historic centre attests to its historic importance, today Barranquilla's strategic location at the mouth of the Magdalena river allowed it to overtake its neighbour as region's major business centre. Historically, this river formed the main transportation link to the Andean interior. The main cities in the Andes are all located at elevation along the country's various mountain ranges: Cali lies at 1,000m along the Western Cordillera; Medellín at 1,500m in the Central Cordillera; and at 2,600m in the Eastern Cordillera, Bogotá, the third-highest capital in the world. Interurban and interregional travel in the Andean region necessarily involves traversing deep valleys and steep slopes - the 400-kilometre route from Medellín to Bogotá takes at least 8 hours by car and involves around 8,000 metres of accumulated altitude gain. Travel to and within the more peripheral and sparsely populated western and eastern lowlands is even more challenging, with few passable road links to the interior and poor connections within the region. Most of the eastern Orinoquia, the southeastern Amazon, and the western Pacific coast is only accessible by plane or boat.

While aviation has dramatically improved national connectivity and ambitious infrastructure projects have sought to overcome these natural barriers, large swathes of rural Colombia remain poorly connected. Even in the more densely populated Andean region, many rural residents depend on poorly maintained roads or paths that can only be traversed by foot, mule, motorcycle or jeep. In more peripheral areas, particularly the Pacific coast, Amazon, Orinoquia and interior of the Caribbean region, no all-season roads exist, making rivers the main access routes and significantly complicating accessibility. By contrast, the transport problems of the relatively well connected core, centered around the main cities of Bogotá, Medellín, Cali in the Andes and Barranquilla and Cartagena on the Caribbean, focus on congestion and pollution instead.

Due to its tropical location, Colombia is highly vulnerable to the effects of climate change, though heterogeneous impacts are expected. Natural disasters such as flooding, droughts



and earthquakes already pose high risks; according to the World Bank, 85% of the Colombian population live in areas with two or more natural risks (Dilley & al., 2005). Natural disasters such as landslides and heavy flooding regularly affect national and urban infrastructure, causing deaths and serious economic effects. Vulnerability to the effects of climate change thus threatens to reverse gains in connectivity (Garcia & Slunge, 2015). The closure of main highways due to landslides is already very common and has grave consequences for regional connectivity. While rural areas with poor infrastructure are most likely to be gravely affected, potential damages are highest in Colombia's urban areas, which often lack resilient infrastructure and feature precarious low-income settlements at risk of flooding or landslides.

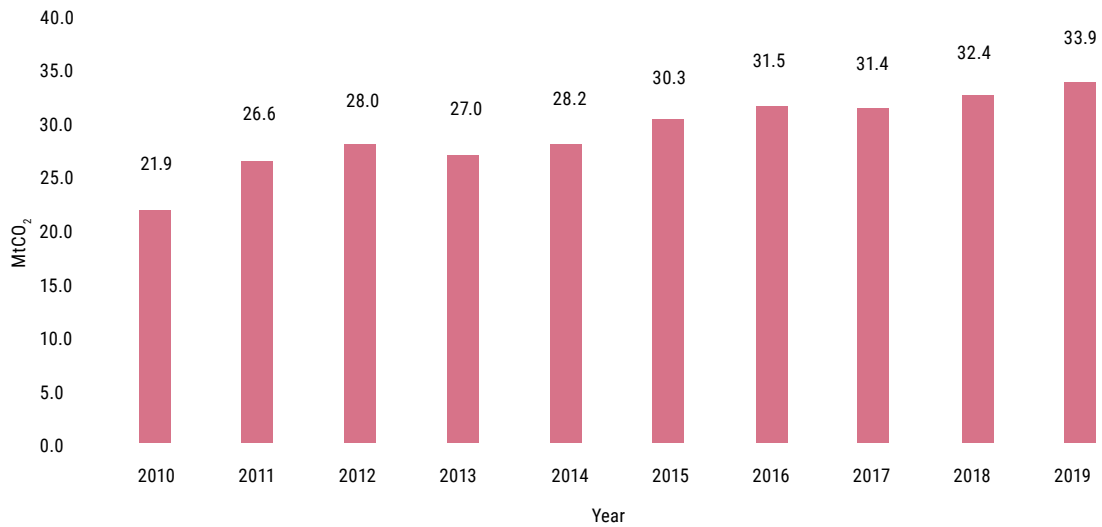
BOX 1

FIGURE 1

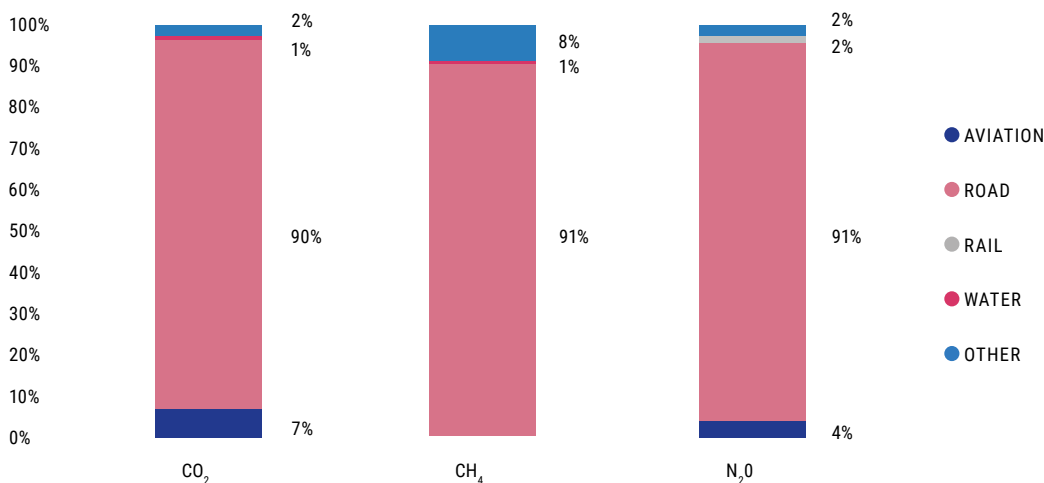
OVERVIEW OF KEY CITIES AND GEOGRAPHICAL FEATURES IN COLOMBIA



• **TRANSPORT SECTOR EMISSIONS: A STEADY GROWTH DOMINATED BY FREIGHT** • Driven by economic growth, Colombian energy sector emissions have shown continuous increases, growing by 34% between 2006 and 2014. Increasing yearly by around 2%, the transport sector's share has remained relatively stable at slightly over one-third of total energy emissions (ranging between 35-39%) and a total of 34 MtCO₂ in 2019 (PNUD & IDEAM, 2018). In line with modal shares for passenger and freight transport, the vast majority of transport emissions can be attributed to road transport; aviation is responsible for a growing share, at around 5%, while shipping and rail transport contribute negligible shares (partly due to their low share of transport volumes, cf. p. 10).

FIGURE 2CO₂ EMISSIONS FROM TRANSPORT (FUEL COMBUSTION ONLY) - Source: IEA & UPME (2019)**FIGURE 3**

EMISSIONS SOURCES PER TRANSPORT SUBSECTOR - Source: PNUD & IDEAM, 2018

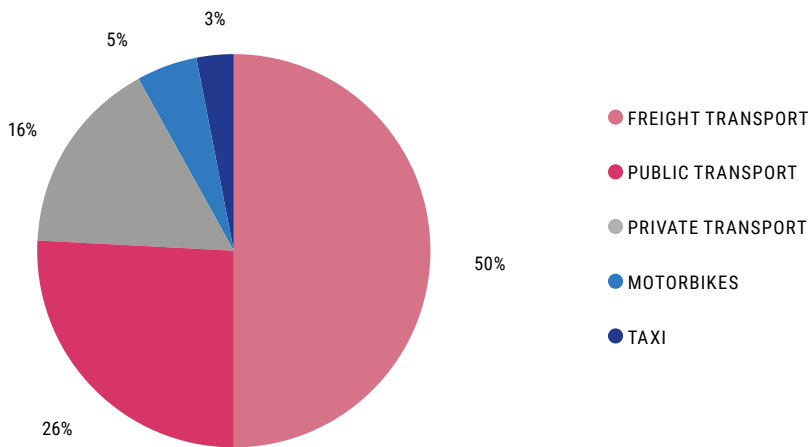


The emissions share of road transport modes show an interesting pattern: half of emissions are generated by freight transport, reflecting the dependence on road transport of freight, the use of diesel by this sector, and the poor state of vehicles. The next most important source of emissions is public transport (urban and interurban) which also relies on diesel fuels and is a key transport mode, particularly in large cities. By contrast, private motorized transport and taxis represent a relatively small share, in line with the moderately low motorization rates (cf. p. 9) and these vehicles being more modern, with superior fuel economy and higher emissions standards. Finally, motorcycles represent a significant and increasing share of road transport emissions, in line with increasing use of these vehicles in urban areas. Of particular concern is the poor emissions standards of these vehicles, which have highly detrimental impacts on air quality as well as greenhouse gas emissions.



FIGURE 4

ROAD TRANSPORT SECTOR EMISSIONS, BY MODE - Source: [Ministerio del Transporte](#), 2018



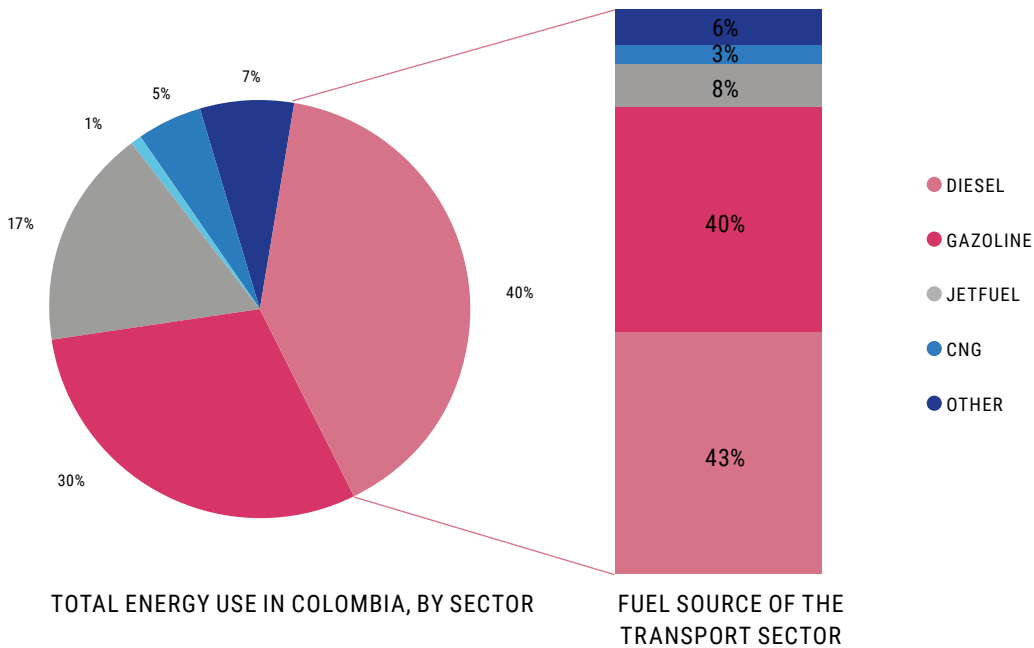
• **FUEL CONSUMPTION: PETROLEUM LEAVES LITTLE ROOM FOR ALTERNATIVE FUELS** • The transport sector is the principal consumer of energy in Colombia and is showing high growth in the order of 7.7% per year. Of all transport energy use, 88% is accounted for by petroleum, with small shares for natural gas (6%) and biodiesels and alcohol (5%). Of petroleum products, the main fuels are gasoline and diesel, followed by kerosene.

FIGURE 5

FUEL CONSUMPTION OF THE TRANSPORT SECTOR PER FUEL TYPE, AS A SHARE OF TOTAL FUEL CONSUMPTION -

Source: [UPME](#), 2018

● TRANSPORT ● INDUSTRIAL ● RESIDENTIAL ● AGRICULTURAL AND MINING ● TRADE AND PUBLIC ● UNIDENTIFIED



Similarly to other countries in the region, Colombia has experimented with the development of alternative fuels, including mixing alcohol fuels with gasoline from 2005 onwards and biodiesel from 2008 onwards. However, the impact has been relatively small and wide-scale adoption has not occurred, even though Colombia is the world's 4th largest producer of palm oil, mostly exported to be used for biodiesel in foreign markets ([Transport & Environment](#), 2020). Other fuel policies, such as the reduction of sulfur in diesel (2013) and the conversion to natural gas of over 500,000 vehicles, have also impacted transport emissions, suppressing the emissions growth of the transport sector and even leading to a reduction in transport emissions between 1997 and 2002 ([PNUD & IDEAM](#), 2018).

Since 2007, the Energy and Environment ministries have sought to regulate diesel fuels to reduce the sulfur content. Since 2013, all diesel distributed in Colombia has less than 50 ppm of sulfur content; however, government policy aims to continue improving fuels to reach a 10 ppm sulfur content in diesel (the same level required by the European law) and 50 ppm in gasoline. Currently, the following fuels are considered clean according to Resolution 2604/2009: hydrogen, natural gas, liquid petroleum gas, diesel under 50 ppm sulfur, biodiesel mixes, gasoline under 50 ppm in sulfur and ethanol blends.

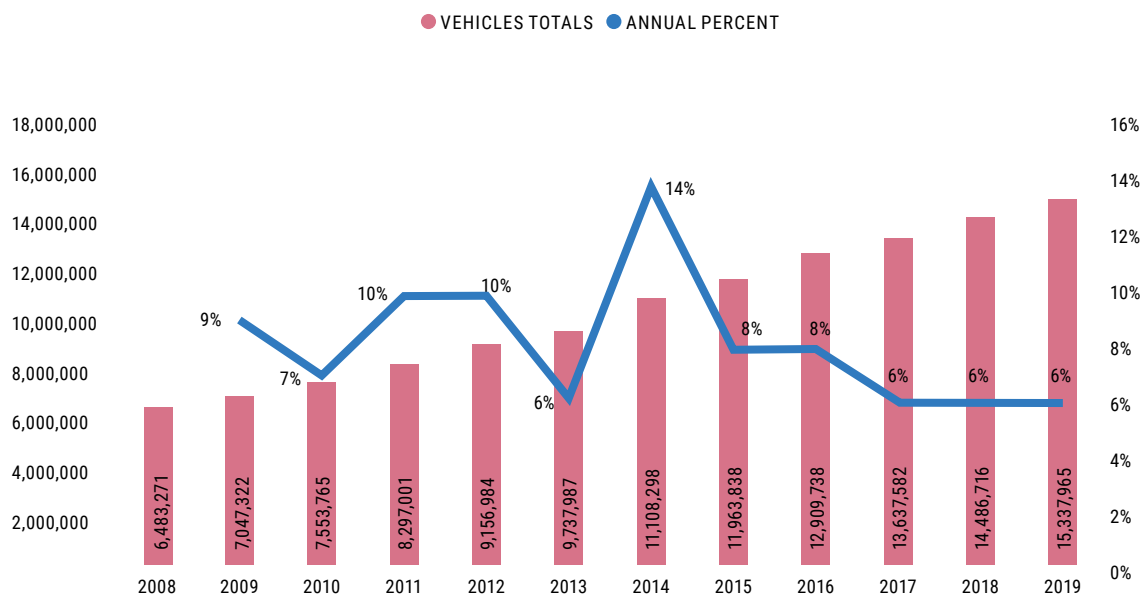
Regarding fuel prices, Colombia, a minor oil-producing country, features average prices of around 0,58 USD/litre, one of the lowest in the region and 24th cheapest worldwide ([Globalpetrolprices](#), 2020). In terms of fuel economy, Colombia has not set specific standards or requirements for vehicles. An important additional factor to consider is that the lack of oxygen at the high elevations of many Colombian urban areas negatively affects internal combustion engines' performance and lowers fuel economy ([Lapuerta et al.](#), 2006).

• FAST-PACED MOTORIZATION PUSHED BY MOTORCYCLES • Growth in emissions has been underlied by motorization, which has seen vehicle fleets grow by 237% between 2008 and 2019, reaching over 15 million vehicles ([RUNT](#), 2020). While this process has led to serious negative impacts on congestion and urban air quality, it is not directly correlated to transport emissions. This is due to the relatively good fuel economy of new motorcycles and automobiles, especially compared to the emissions of the more highly emitting freight and public transport modes.



FIGURE 6

MOTORIZATION RATES 2008-2019 - Source: RUNT, 2020



Motorization is largely driven by an increase in motorcycles. In the first semester of 2020, motorcycles accounted for 72% of new registrations of vehicles (more than 201,000 units), far ahead of cars (12%, 34,000 units). As of November 2020, 59% of registered vehicles in the *Registro Único Nacional de Tránsito* were motorcycles; this does not cover informal vehicles, which suggests the real figure may be higher (RUNT, 2020).

INDICATOR



Over two thirds of newly registered vehicles in Colombia are motorcycles, making them the main driver of motorization.

Source: RUNT, 2020

• FLEET RENOVATION, A PRIORITY TO ABATE THE OVERWHELMING SHARE OF ROAD FREIGHT IN EMISSIONS • While Colombia has historically depended on inland shipping and (to a lesser degree) railways for freight transport, the development of the national highway network during the middle of the 20th century led to a major shift towards road transport, aided by the neglect of the former modes. Currently, over 95% of all freight (excluding coal) is transported by road ([Ministerio de Transporte de Colombia](#), 2018). The sector is characterized by a very high average age of vehicles (21 years, with 21,000 vehicles over 36 years of age) and inefficient operations, leading to high transport costs, poor road safety, and high levels of emissions ([DNP](#), 2019).

In order to modernize and improve the efficiency of the freight transport fleet, economic incentives and regulations have been implemented. The renovation of the fleet through obligatory scrapping led to the replacement of 19,818 old vehicles between 2013 and 2018, a number slightly under

the target of 22,000. This policy is estimated to have reduced emissions by 2.2 MtCO₂ (DNP, 2019). However, most older vehicles are owned by individuals, making the financing of a replacement vehicle difficult.



The amount of emissions saved by replacing 19,818 old freight vehicles between 2013 and 2018.

Source: DNP, 2019

In addition, initiatives have been launched to recover the long-neglected inland shipping and rail transportation. Though there remain substantial investment gaps, these sustainable modes can lower shipping costs and improve efficiency along certain routes. Rail operations along the Bogotá-Santa Marta corridor have increased and investment is underway to recuperate and reconstruct neglected infrastructure. Similarly, shipping on the Magdalena river has recently increased, particularly regarding hydrocarbons. Maintenance and dredging of the Barranquilla port and the Dique canal connecting the river to Cartagena is crucial to improving the viability of this freight route. Inland shipping routes additionally require the development of multimodal transfer connections, as the

• INTERURBAN PASSENGER TRANSPORT: THRIVING DOMESTIC AVIATION TO CONNECT REMOTE PLACES • With no interurban passenger rail network, the most common way to travel between cities in Colombia is by interurban bus. While interurban routes between major cities and departmental capitals feature high-quality busses that traverse the main highway network; along less-traveled routes, bus quality can be much lower and some areas with unpaved roads are still serviced by traditional “Chiva” busses. In 2019, over 100 million passengers departed or arrived at the 49 main bus terminals located in major cities or transit hubs (Ministerio de Transporte, 2020). This heavily underestimates total passenger numbers, as it does not count passengers on rural and local routes nor those that disembark during the voyage.

Nonetheless, bus routes can be very time-consuming and costly on interregional routes (for instance, the 400-kilometre Bogotá-Medellín trip can easily exceed 10 hours), leading to increasing growth of air travel. **Aviation has been the fastest-growing activity in the transport sector, showing double-digit growth.** While the sector as a whole has benefitted from improved airport infrastructure, relative cost has also declined on many routes due to competition from low-cost carriers. Aviation now contributes over 5% of total transport emissions, moving nearly 38 million passengers in over 100,000 flights (Aeronáutica Civil, 2020; PNUD & IDEAM, 2018).

Rural residents of large parts of the Amazon, Llano, Pacific and Caribbean interior lack all-season roads and depend on river boats for access as well as freight traffic. River transport moves between 2 to 5 million passengers a year (Ministerio de Transporte de Colombia, 2021), despite relatively low technological development, high fuel consumption and poor safety standards. Ensuring airline service to remote areas is an important policy area, with ongoing investment in rural airstrips in the Amazon, Orinoquia and Pacific. However, air routes to such destinations are very costly and infrequent, furthermore exclusively connecting to the central region (and as such, generally a poor



option for travelling within a region).

2. Connectivity and road safety as a prerequisite for a climate efficient transport system at national level

Under the terms of the Paris Agreement and its Nationally Determined Contribution (NDC), Colombia has committed to reducing its GHG emissions by 20% respective to a BAU scenario by 2030, recognizing the developing country status and leaving room for reduced growth in emissions. Various mitigation scenarios were considered, including the possibility of receiving international aid towards more ambitious mitigation (between 25% and 45% by 2030). The country assumed sole responsibility for mitigation with costs under 20 USD/tonCO₂eq, selecting 71 measures to achieve the 20% target. Though the main contributor to Colombia's emissions is land use, mainly deforestation and cattle ranching, the transport sector is a significant and steadily growing source of emissions, leading to it being a focus for mitigation policies with at least 13 national mitigation programs ([Presidencia de la República de Colombia](#), 2015).

In urban areas, road transport is one of the main sources of GHG emissions, representing over 45% of total emissions in Bogotá ([IDEAM, PNUD, MADS, DNP](#), 2018) and 60% in Cali ([Corporación Regional Autónoma del Valle de Cauca](#), 2015), making it a priority sector for city-level mitigation efforts. Moreover, at the city level, mitigation strategies often align with wider transport policy goals, including promotion of non-motorized transport, reduction of air pollution and congestion, strengthening of public transport systems and electrification of transport. As this section will show, national and urban policies on sustainable transport have many overlaps and mutually influence each other. However, there is also a lack of sufficient action by the national government on issues that exceed the city scale; similarly, many cities have difficulty or face a lack of capacity in implementing national programs.

• **NATIONAL MITIGATION POLICIES FOR TRANSPORT** • Led by the Ministry of Transport, the Colombian national government has implemented Nationally Appropriate Mitigation Actions (NAMAs)¹ to fulfill its climate commitments, including:

- National strategy for electrification of the transportation sector, with programs for promotion of electric and/or hybrid automobiles, taxis, motorcycles and buses through financial incentives, substitution of old vehicles and the electrification of official government vehicles ([Gobierno de Colombia](#), 2019). This includes the reduction of tariffs and taxes on such vehicles.
- Promotion of natural gas fuels for public transport, freight transport and private vehicles
- Renovation and reduction of vehicle fleets, particularly of freight transport vehicles.
- Six no car-days a year in the 5 major cities of the country.
- Infrastructure for intermodality and operation of public transport systems, with pilots in 6 cities.
- Improvement of navigability and intermodality of freight transport on the River Magdalena.
- Promotion of non-motorized transport and implementation of transport demand management

1 - Nationally Appropriate Mitigation Actions (NAMAs) refer to "any action that reduces emissions in developing countries and is prepared under the umbrella of a national governmental initiative". They can be supported by the international community. NAMAs were introduced during COP13 in Bali in 2007 to encourage developing countries to increase mitigation activities by 2020, in parallel with the recognition of common but differentiated responsibilities in climate change which mostly puts mitigation efforts down to developed countries.

measures in 19 cities (NAMA TAnDem).

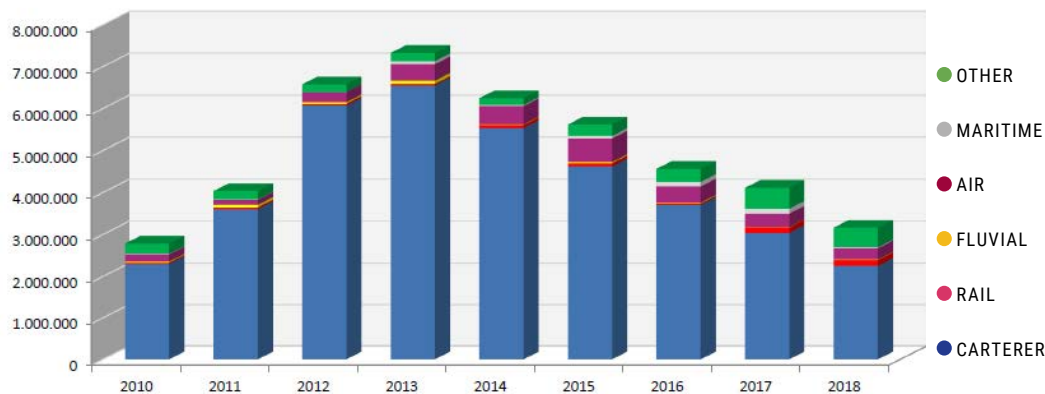
In addition, Colombia has developed a Sectoral Action Plan (PAS) including measures such as optimization of logistical chains in cities, payment for congestion and pollution, scrapping of freight vehicles over 20 years old, promotion of non-motorized and multimodal transport, transport demand management and improvement of fuels ([Ministerio de Transporte](#), 2018). The national government has also promoted and funded the implementation of integrated and formalized public transport systems in over 20 cities (cf. p. 18).

However, many of these efforts are recent and have not been fully implemented or demonstrated results yet. For instance, despite recent growth, electric vehicle penetration remains minimal with 2019 seeing less than 1,000 new electric vehicles ([ANDI](#), 2020); however, progress is being made regarding e-buses (cf. p. 19). The various initiatives to promote sustainable transport and decarbonize the transport sector are largely unarticulated and under administration of different ministries and government institutions. There is a similar lack of coordination between national and local governments. Finally, there are no measures focused on the aviation sector, which is growing steadily, nor the regionally important fluvial freight and passenger transport sector.

• NATIONAL INFRASTRUCTURES, A STRATEGIC INVESTMENT FOR THE COLOMBIAN STATE IN A CONSTRAINING GEOGRAPHY AND SOCIO POLITICAL ENVIRONMENT • The poor quality of much of the interurban and rural road network, as well as the overwhelming dependence on road transport for freight and passenger transport, has made road building a continuing transport infrastructure priority for national and departmental governments. The difficulties imposed by Colombia's geography and sometimes weak institutions mean these projects are often costly and lengthy, and several construction disasters have been heavily publicized ([Deutsche Welle](#), 16/01/2018).

Progress has been mixed: major inter-urban highways have been improved via concessions, including the implementation of dual-carriageway highways, however, these have also increased tolls ([Ministerio de Transporte de Colombia](#), 2021). However, expansion of the road network to rural and sparsely populated areas has been less successful, not least due to the lower transport volumes to generate toll revenue. Most of the secondary and tertiary connections of the national highway network remain unpaved.

While road infrastructure has attracted over 80% of national investment in recent years, investments have been ramped up in port, rail and airport infrastructure as well (**fig. 7**). With support from the national government, recent private-sector investments in ports, shipping canals and railways have sought to improve the capacity and efficiency of these infrastructures. Substantial investment has been made in airport infrastructure as well, similarly organised through concessions and private-public partnerships coordinated by the National Infrastructure Agency (ANI). Upcoming airport projects include various new or expanded terminal buildings and runways.

**FIGURE 7**PUBLIC INVESTMENT IN THE TRANSPORT SECTOR - Source: [Ministerio de Transporte de Colombia, 2021](#)**KEYS TO UNDERSTANDING****CONNECTIVITY, CONSERVATION AND CONFLICT IN COLOMBIA**

During the nineties and early 2000's, during the apex of Colombia's internal conflict, the country was bordering collapse: large swathes of the countryside were controlled by leftist guerilla groups, paramilitaries or drug cartels (Safford & Palacios, 2002). Travel on many highways was severely limited, with the chance of roadblocks and kidnappings ever present. As the government reasserted control (often with indiscriminate use of violence) during the late 2000's, "the possibility to transit the country's militarized roads became the means as well as the proof that the peace had finally arrived" (Bocarejo & Ojeda, 2015, p. 1).

However, despite the supposed "disarmament" of paramilitaries between 2004-2006 and the 2016 peace accords between the Colombian government and the FARC – the main guerilla group –, conflict and violence has continued in certain regions – driven by illicit activities, in particular cocaine production. Though many former "red zones" have become safe for travel, state control is poor or absent in areas such as the Catatumbo and northern Cauca (Andes region), the south of Cordoba department (Caribbean region), the interior of Guaviare, Caqueta and Putumayo departments (Amazon region), and the southern Pacific coast. A common characteristic of these areas is poor connectivity and poverty, which in turn drive production of coca and other narcotics. In contrast to other potential cash crops, coca does not require export infrastructure to cultivate profitably (Mejía & Rico, 2010).

While coca cultivation and other illicit activities such as gold mining have resulted in deforestation in some areas, the arrival of peace and the expansion of road infrastructure also have potential negative effects: potentially leading to increases in deforestation and habitat degradation, legal and illegal mining, and smuggling of narcotics (Baptiste et al., 2017). The lack of progress on plans to create road links through ecologically important areas such as the Pacific coast and the Amazon rainforest (see for instance Uribe, 2018) can be said to have benefitted the conservation of these ecosystems and prevented the acceleration of deforestation and mining.

In addition to financial difficulties, large mega-projects to expand infrastructure in environmentally sensitive areas increasingly face political and legal opposition. A high-profile example is the controversial Tribuga port project, which would see a new deepwater port being opened on the Pacific coast, with a direct road link to Medellín and the centre of the country. However, the proposed site is highly ecologically significant and the project does not have the support of local communities who depend on mangroves for fishing and highlight the social risks of infrastructure expansion. While the project has been halted due to legal challenges, the site has attracted the attention of local and international activists and has been declared a “Hope Spot” by international marine conservation organisation Mission Blue ([Mission Blue](#), 2019).

BOX 2

• **ROAD SAFETY, A STINGING ISSUE AS THE TOLL CONTINUES TO GROW** • Colombia has committed to action on road safety, and increasing focus on safe infrastructure is becoming an important factor in transportation policies in urban areas in particular. Led by the National Agency for Road Safety (ANSV), Colombia aims to reduce road deaths by 2022. However, this statistic continues to increase, with 2019 having a record number of deaths at over 6,300. The majority of deaths are in urban areas and the most frequent victims are pedestrians and motorcyclists. The rapid increase in the use of the latter mode, involved in a majority of all deadly accidents, is particularly concerning and threatens to undermine efforts to improve safety. At an urban level, initiatives have been undertaken to reduce speed limits and improve safety at intersections (p. 16).

3. Challenges and opportunities for sustainable urban mobility

The proposed national mitigation strategies include many measures that specifically focus on the urban level, in recognition of the fact that transport emissions are highly clustered in major cities. This leads to important responsibilities for local governments, many of which lack capacities for implementation and face political and financial obstacles. However, these are also spaces for innovative policymaking, and many cities benefit from international development cooperation and involvement in policy-making networks such as C40 (with Bogotá and Medellín as full members). In the following, the current state of urban mobility in Colombia is presented, followed by a discussion of developments and projects regarding specific modes and issues.

KEYS TO UNDERSTANDING

COLOMBIA'S URBAN NETWORK

In contrast to many other Latin American countries, Colombia is not dominated by a single “primate” city. Though Bogotá is clearly the largest and most important city and dominates the Central-Eastern zone of the country, the regional importance of Medellín (Northwestern Colombia), Cali (Southwestern Colombia) and Barranquilla (Caribbean Coast) has resulted in a balanced constellation of cities, complemented by various smaller regional centres such as Villavicencio, Cúcuta and Neiva (Safford & Palacios, 2002). Each city is strongly integrated with its surrounding region, however, transport links between regions have often proved more challenging (Box 3).

Colombian cities are highly socially segregated, with high and middle-income residents concentrated in a few exclusive areas, generally close to centres of high-income employment (CBDs or office districts), shopping and restaurant districts, and key amenities. Lower-middle income housing is located in less attractive areas, often much further away and with poorer transport links, while the lowest incomes are concentrated in peripheral “slum” areas, often on



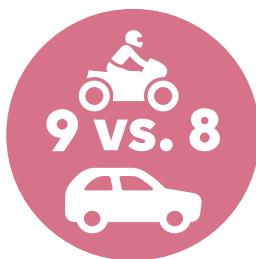
poorly accessible mountain slopes. Mixed uses are very common across all areas, with small shops and local restaurants located in most neighborhoods; however, key “central” functions such as office districts and government facilities are generally concentrated in the urban core (see [Arellana, Oviedo, Guzman, & Alvarez, 2020](#); [Guzman & Bocarejo, 2017](#)).

Colombian cities are generally very densely populated compared to similar cities in the region and feature relatively little suburban sprawl². In theory, higher population densities shorten travel distances, facilitate sustainable mobility and make travel by car less attractive. Indeed, most urban Colombians are within close reach of services and basic goods. However, the most densely populated neighbourhoods are largely low-income with poor transportation links to employment centres, while residents of richer neighbourhoods within walking or cycling distance prefer private automobiles nonetheless. The urban poor thus face major obstacles to commuting to work, often forced to travel for hours and spend large shares of their income on transport ([Oviedo & Dávila, 2016](#)).

BOX 3

• **THE STATE OF URBAN MOBILITY IN COLOMBIA** • **Urban mobility in Colombian cities remains dominated by public transport and active modes, though ownership and use of motorized vehicles and particularly motorcycles is increasing rapidly (fig. 6).** The characteristics of public transport can vary from city to city, with major cities featuring formalized systems that have successfully expanded capacity, speed and reliability (though parallel informal services continue to exist). Smaller cities with less established systems will tend to rely more on collective taxis and informal motorcycle taxis for public transport. Similarly, walking remains a very important mode, though conditions are generally poor and pedestrians form the main victims of road crashes.

Though there are significant differences between cities, modal share for automobiles is generally low, with rates ranging from a mere 8% of trips in Montería ([CAF, 2018](#)) to 13% in Medellín ([Área Metropolitana del Valle de Aburra, 2020](#)) and 15% in Bogotá ([Secretaría Distrital de Movilidad de Bogotá, 2019](#)), with taxis generally representing an important additional share (around 5%).

INDICATOR

In Montería, bike modal share (9%) is higher than that of automobiles.

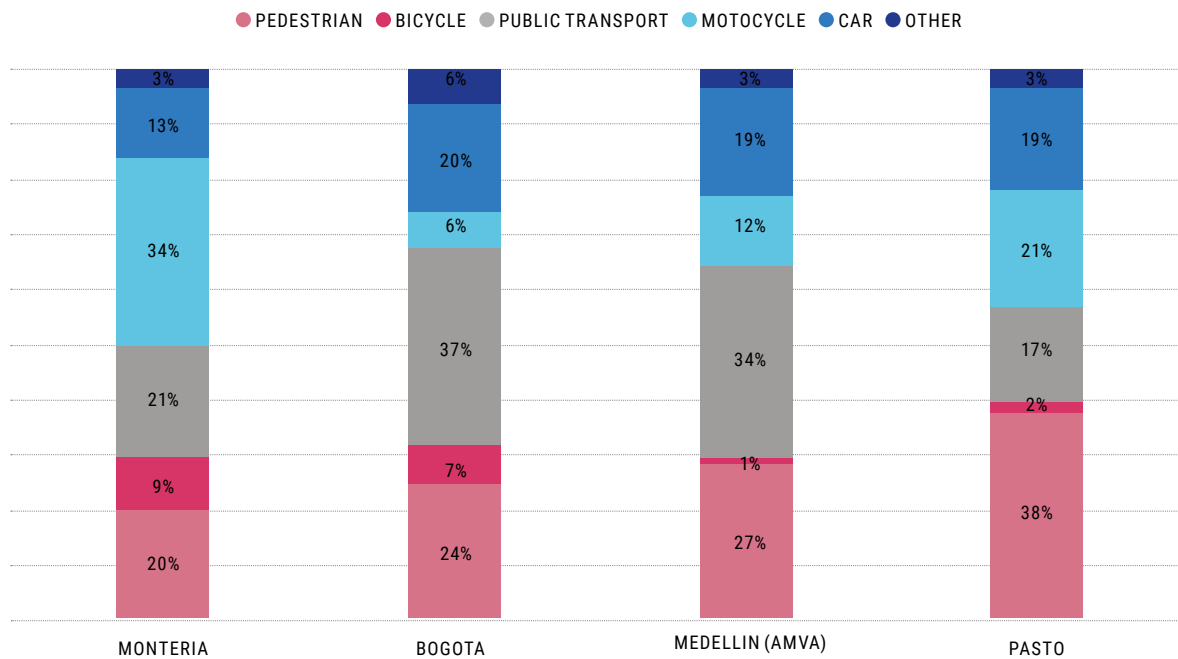
Source: CAF, 2018

Facing poor public transport provision and severe congestion, many citizens have responded by increasing use of motorcycles. Motorcycle usage varies by region, with cities in the Caribbean region and smaller towns and rural areas having very high usage shares (up to 34% in Montería), while larger Andean cities such as Bogotá and Medellín have recently seen steep increases. This trend has significant consequences, such as an increase in transport related emissions and informality ([Rodríguez, Santana, & Pardo, 2015](#)), and has an important negative impact on public transport ridership in these cities and deteriorating road safety.

² - According to the Demographia Urban Atlas, cities such as Bogotá, Medellín and Ibagué have estimated densities over 15,000 residents per sq. km, well above similarly sized cities in the region and only surpassed by certain Asian and African megacities, see Demographia (2020).

FIGURE 8

MODAL SHARE IN SELECTED CITIES. DATA FOR MONTERÍA FROM 2014 - (CAE, 2018); BOGOTÁ 2019 (Alcaldía de Bogotá, 2019); MEDELLÍN 2019 (Área Metropolitana del Valle de Aburrá, 2019); PASTO 2017 (Alcaldía Municipal de Pasto, 2017)



1. A deficit of quality road networks affecting fluidity and safety of mobility

Due to topography and development patterns, Colombian cities are generally highly dense with relatively little low-density suburban development. A common feature of all cities is that buildings line nearly every road, even major arterials, with relatively few open spaces or limited-access roads. Urban road networks are further characterized by small block sizes, predominance of one-way traffic flow and little to no legal on-street parking. Circulation on both arterial and local roads is thus affected by frequent intersections and chaotic informal parking and loading activity. Due to these characteristics and despite relatively low motorization, **traffic congestion in Colombian cities can be severe, with the country's major cities ranking as among the most congested in the world.**³ Endemic congestion has serious consequences including poor competitiveness, higher air pollution and increased travel times for public transport users, and is a key factor in putting sustainable transport on the political agenda.

Though these structural challenges make rapid motorized traffic flow very difficult, the improvement of arterial road networks for motorized traffic has long been a municipal policy priority. Large-scale infrastructure projects such as tunnels, interchanges and urban “highways” are common in larger cities such as Bogotá and Cali, as well as certain intermediate cities such as Bucaramanga. However, true limited-access motorways are uncommon and generally not designed for speeds over 80 km/h. Similarly, no major Colombian city can claim to have a true arterial “ring road”, with freight and intermunicipal traffic forced to enter fully into urban areas to interconnect to other highways. Many smaller towns have grown along national highways and feature constant traffic passing through the “main street”. This means that major urban roads often double as key national highways, increasing traffic congestion and pollution, and making sustainable interventions more difficult.

³ - The INRIX Global Traffic Scorecard ranks Bogotá as having the worst congestion impacts in the world, with the average driver losing over 191 hours in traffic and last-mile speeds at 9mph (INRIX, 2019).



Another common characteristic among Colombian cities is the poor state of pedestrian infrastructure. Sidewalks are often non-existent, of very poor quality and/or occupied by illegally parked vehicles, street vendors or business activities. Most sidewalks are built and rebuilt in an ad-hoc manner by the owners of adjacent buildings, leading to a patchwork of uneven and discontinuous infrastructure. Safe pedestrian crossings are similarly lacking, and governments have relied on pedestrian bridges along many arterial roads, creating unsafe conditions. However, progress has been made in terms of pedestrianization and improvement of sidewalks in certain commercial districts.

Cities have differed more in terms of implementation of cycling infrastructure, with leading cities such as Bogotá, Cali and Montería boasting city-wide (albeit not complete) networks, while other cities have lagged behind. Such infrastructure only appeared as recently as the 90's, and much technical progress has been made in addition to quantitative expansion. For many years, the preferred location for such infrastructure has been the sidewalk, leading to frequent conflict with pedestrians and uncomfortable conditions for both modes. However, leading cities such as Bogotá and Montería have recently experimented successfully with on-street cycling lanes, though political opposition has been heavy to perceived reductions of road capacity. During the Covid-19 pandemic, Bogotá significantly expanded its use of such on-street lanes, transforming large parts of the 80-km "emergency" network into permanent additions to its cycling network ([El Tiempo](#), 20/05/2020). Nonetheless, even Bogotá's network is still very much incomplete and of varying quality, and cyclists across the country must still navigate congested and dangerous roads to reach most destinations.

2. Air pollution in major urban centres

Colombia's major cities have serious air quality problems which have become more clear as monitoring improves; of 78 municipalities with monitoring systems, 60 exceed acceptable concentrations of $30\mu\text{g}/\text{m}^3$ (DNP, 2018). Local concentrations, particularly in industrial areas and along major arteries, can be much worse. This has negative consequences for respiratory health, with poor air estimated to cause over 10,000 annual deaths. A majority of Colombian citizens believe poor air quality is the most important environmental problem facing the country ([DNP](#), 14/02/2018).

These issues are seasonal: the dry season (January and February) can significantly worsen air quality, due to lack of rain and, in the Andean region, frequent thermal inversion effects that trap pollution contaminants. The areas with worst air quality in the country include the Medellín metropolitan area, located in a valley with poor air circulation, the industrial south-west of Bogotá, and certain smaller industrial municipalities ([IDEAM](#), 2018). In the two main cities as well as regional capitals such as Cali and Bucaramanga, air quality alarms have become frequent, often caused by the combination of dry weather and entry of smoke from forest fires, combined with existing sources from industry and transport. During environmental alarms, local governments have tended to implement restrictions on the circulation of these vehicles in certain areas, which have sometimes been met by protests. Another policy is the extension of *pico y placa measures* (cf. p. 22) to include weekends or restrict more vehicles.

With local policy unable to affect the weather and deforestation, reducing pollution from transportation has become an increasingly important political goal. Within urban transport emissions, the main source of air pollution is freight transport (cf. p. 5) characterized by poor emissions standards and technologies. Increased use of motorcycles is another source of concern, due to their high emissions of particulate matter, but has not been subject to controls. Citizen pressure in some cities has focused on public transport systems, which generate highly localized and visible air pollution (particularly along BRT corridors with high volume of busses), though emissions per passenger are relatively low. Nonetheless, one of the political drivers for electrification of bus fleets is the citizen

pressure for cleaner public transport.

• **PROMOTING SUSTAINABLE URBAN MOBILITY** • Facing a complex mobility situation and the urgent needs of their citizens affected by poor public transport provision, congestion, and air pollution, **Colombian municipal administrations' interest in promoting sustainable urban mobility focuses on finding ways to resolve these needs, rather than achieving decarbonization.** Therefore, the benefits of sustainable mobility measures in terms of efficiency, reducing inequality and improving access, and improved air quality are foregrounded. This practical approach to such measures, as well as the relatively high share of current use of sustainable transport which makes measures more urgent, have made some Colombian cities cases of "transformational change to low carbon and sustainable development" ([Pardo, 2015](#)).

With some areas of policy, such as travel demand management, having yet to be implemented in Colombia, major progress has been made regarding the promotion of urban cycling and the strengthening of public transport services, and measures are being taken to reduce the impact of urban freight transport.

1. Facing declining usage rates, cities prove innovative to improving public transport systems

Colombian cities remain reliant on public transportation, but declining usage rates are a major concern. Strengthening existing systems and expanding their intermodal integration is one of the main pillars of Colombia's transport mitigation strategy, and much of national and municipal financing is directed towards this end, with differing results. The country's major cities all have integrated and formalized systems focused on BRT trunk lines and efforts are underway to implement similar projects in intermediate cities ([Gobierno de Colombia, 2009](#)). Medellín is the only city to successfully implement a rail-based system, the Medellín Metro, while Bogotá has recently started the implementation of a centrally located metro system and a commuter rail line to the western edge of the metropolitan area. Pioneered by Medellín's *Metrocable*, which boasts 6 lines, cable cars are now present on the southern periphery of Bogotá and hilly Manizales as well.

Though the level of government oversight and control varies, nearly all public transport services are offered on a completely privately-run basis, by companies ranging from small-scale local operators to large conglomerates including international operators such as Connexión Móvil. Even in large cities such as Bogotá, formalization has happened only recently and is still partial, plagued by contractual issues with small bus operators ([Ardila, 2007](#)). Even where the competition by busses for passengers between informal services (dubbed "war of the cents") has been put to an end, services remain relatively expensive, characterized by crowding, poor maintenance and no integration of fares and connections. User satisfaction on many systems has reached record lows, with 87% users of Bogotá's *TransMilenio* unhappy with the service, despite still being referred to as an example of best practices ([Bogotá Como Vamos, 2018](#)).

The implementation of formalized bus systems, often based around BRT trunk lines, has been influenced by these financial constraints and the secondary goal of renovating fleets and gaining control over previously informal operations. Where public transportation is dominated by under-regulated private bus operations, these use poor quality buses that generate high levels of pollution, yet are also highly efficient in terms of coverage and frequency of routes. The new formalized systems, which generally aim to be financially self-sufficient as well, tend to have difficulties in achieving similar levels of service. BRT trunk lines are particularly controversial - while they have been highly effective in reducing travel times along certain corridors in large cities such as Bogotá,

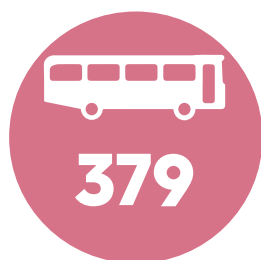


in smaller cities and more dispersed areas, the trunk-feeder model has led to longer overall travel times and more transfers ([Ferro & Behrens, 2015](#); [Hidalgo, van Laake, & Quiñones, 2020](#)).

However, transport formalization has also led to improved infrastructure, particularly along BRT corridors. These projects have led to improved road safety, the implementation of parallel cycling infrastructure and improved pedestrian conditions. **One particularly promising line of action is the strengthening of intermodal integration, particularly with bicycles.** In Bogotá, over 20 stations of the *TransMilenio* BRT offer bicycle parking free of charge, thereby reducing the load on the feeder bus network, and every station of the planned metro will have a similar facility. Informal last-mile feeder services have grown around mass transit, ranging from bicycle taxis (mostly in Bogotá) and scooter hire (Medellín and Bogotá) to motorcycle taxis and informal collective taxis.

The country's main formalized bus systems are also leading the way in introducing low-emissions and electric busses. Cali's *MIO* system was the first to implement electric busses with the first of a total of 136 electric vehicles starting operations in 2019. In Bogotá, where the pollution caused by the *TransMilenio* system has been a highly salient political issue, a major step was taken towards electrification with the arrival of 379 e-buses in 2020, forming the largest such fleet on the continent. These vehicles are expected to cut emissions by 21,900 tons of CO₂ ([Sustainable Bus, 2019](#)). Manufactured by Chinese automaker BYD, these orders of e-buses in Colombia illustrate China's automakers massive entrance into the South American electric vehicle market since 2019 ([Diálogo Chino, 20/06/2020](#)). As of yet, e-bus operations are on local routes, but electrification is planned for new phases of the *TransMilenio* BRT system as well, with tenders open for over 2,000 electric and low-emissions buses.

INDICATOR



379 new e-buses added to the cities fleet are making Bogotá's e-buses fleet the largest in South America. These are mostly provided by Chinese automaker BYD

Source: [Diálogo Chino, 20/06/2020](#)

2. Cycling and micro-mobility spread across the country as Bogotá leads the way

Over the past decades, Colombian cities have increasingly promoted urban cycling as a solution to congestion and a sustainable development goal. A once neglected and "invisible" mode mostly used by day labourers, neighborhood watchmen and gardeners is now highlighted as good policy, largely due to the success of Bogotá in mainstreaming bicycle use. Two decades of pro-bicycling policy have left the city with over 600 kilometres of dedicated cycling infrastructure ([IDRD, 2020](#)). The city's success story starts with the Sunday "Ciclovía" open streets event, founded in 1974, which currently draws up to over 2 million people every weekend to enjoy a 127-kilometre network of streets closed to motorized traffic ([Pardo, 2013](#)). The implementation of cycling infrastructure consolidated cycling as a transport mode and steady growth has seen usage rise to around 7% in the 2019 traffic survey ([Secretaría Distrital de Movilidad de Bogotá, 2019](#)). Outside the capital, many other cities are also implementing cycling networks, open street days, and public bicycle systems (**Box 4**).

FIGURE 9

CYCLISTS AND JOGGERS TAKE ADVANTAGE OF A CAR-FREE STREET DURING BOGOTÁ'S SUNDAY CICLOVÍA. Photo: Thomas van Laake



EXPERIENCE FEEDBACK

PRESERVING RATHER THAN PROMOTING CYCLING: THE CASE OF MONTERÍA

Montería, an intermediate and quickly growing Caribbean city of around 500,000, demonstrates the diversity of urban cycling in Colombia. Here, the bicycle has traditionally been one of the principal transportation modes, currently representing over 9% of trips (CAE, 2018). This usage rate, perhaps the highest in the Americas, is nonetheless under heavy pressure as the motorcycle has become the main transportation mode in the city. Over 60% of vehicles in the city are now motorcycles, leading to informal taxi services undercutting public transportation provision and yearly increases in deadly crashes. In Montería, the challenge for urban cycling promotion is very distinct from Bogotá - here, current usage rates must be preserved, the main threat to more use is modal change to motorcycles, and climatic conditions mean that shade, rather than protected lanes, can be more critical to user comfort. Attention to such local specificities will be key to promoting cycling at a national scale.

BOX 4

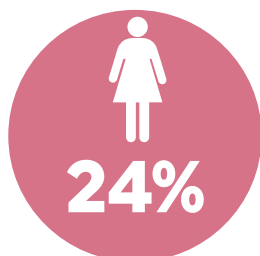
These urban initiatives enjoy support at a national level, where much progress has been made to create favourable conditions for the promotion of the bicycle, not least with the "Law 1811" of 2016, which adjusts traffic laws to specify the rights of bicyclists and defines various benefits for bicycle use (for instance, public servants can obtain a day off for every thirty days of commuting by bicycle).

Major obstacles remain to consolidating the bicycle as a mainstream transport mode in Colombian cities, particularly regarding women's use: in Bogotá, only 24% of users are female, and rates are similar or even more skewed in other cities. This indicates a serious lack of safety on the road, where motorized vehicles still pose a frequent threat and obstacle, sexual harassment is common, and the threat of robbery is ever present - particularly in the larger cities. Despite the continuing implementation of cycling infrastructure, conditions in most parts of most cities are generally very difficult



and require high levels of confidence on the bicycle to traverse comfortably. However, a shift of emphasis from quantity to quality in leading cities such as Bogotá has seen cities focus on filling in gaps in the network and improving personal safety (van Laake & Calderón Peña, 2021). Bogotá's 50-50 pledge explicitly aims to achieve equal usage by gender, an ambitious target that would involve dramatically growing female ridership and highlights the interrelationship of Sustainable Development goals 5 (Gender Equality) and 11 (Sustainable Cities).

INDICATOR



**24 % of bike users in Colombia are female.
Bogotá has pledged to reach 50-50**

Source: van Laake & Calderón Peña, forthcoming

While the promotion of cycling as a broad goal enjoys wide support and is not politically controversial, significant progress on specific projects is difficult in a context of lack of resources, competition for scarce road space, lack of technical capacity in local governments and poor coordination with national government. For instance, an initiative by the Ministry of Transport to implement bicycle sharing systems, following the model of Medellín's successful EnCicla system, has not shown results with beneficiary cities not progressing from pilot projects (see GAADS, 2016). However, with technical and financial support from international development cooperation, various intermediate cities may now be able to launch systems in the coming year (C40, 04/11/2020). Medellín' 1900-bicycle system, which generates over 17 thousand trips daily, forming a key part of the city's bicycle promotion ([AMVA](#), 2019), demonstrates that such systems could have positive effects.

Similarly, it has proven difficult to improve the quality of cycling infrastructure: the publication and subsequent legal adoption of a cycling infrastructure manual by the Ministry of Transport ([Ministerio de Transporte de Colombia](#), 2018) is an important step forward; however, political opposition to projects that "remove" road space for motorized transport has grown stronger, particularly against cycling infrastructure built during the Covid-19 pandemic. Such debates are likely to intensify as efforts to improve transport sustainability increasingly involve interventions in the circulation of motorized transport.

A new development that has the potential to accelerate development of cycling infrastructure and modal shift is the entrance of micromobility services in the urban mobility landscape of the country's major cities. The arrival of e-scooter companies such as Grin, Lime and MOVO to exclusive areas of Bogotá, Medellín and Cali from 2017 onwards did not have a strong effect on travel behavior, however, and the latter two companies have since exited the market. The costs of these services posed a high barrier to use, but their appearance may have had the longer-term effect of accelerating sales of personal e-scooters, e-motos and e-bikes, which have shown strong growth ([Revista Dinero](#), 2020).

3. Shifting urban freight transport towards soft mobility in the last miles

The vast majority of freight in Colombia is moved by road in trucks with poor emissions standards (cf. p. 9), making this sub-sector a heavy contributor to both air pollution and sectoral emissions. This has particularly dangerous results in Colombian cities, where the contribution of trucking to poor air quality and road deaths is considerable. Freight traffic is heaviest in industrial and logistical areas, for instance Bogotá's Calle 13 access corridor, which generally coincides with low-income areas. Local governments have responded with temporary restrictions (during periods of high pollution, see previous section), and specific restrictions to older vehicles and special types of freight transport (see, for instance [Alcaldía de Bogotá](#), 2020). These measures also include policies to regulate loading and unloading of freight vehicles.

Last-mile delivery by bicycle has traditionally been common in Colombian cities, especially with practical and cheap "cargo bike" models which are ubiquitous in commercial and industrial districts. Companies such as Ramo (snacks) and Servientrega (deliveries) operate tricycle or electric cargo bicycle fleets for urban logistics, attracted by low costs and quicker deliveries in congested areas. In Bogotá, recent government initiatives have included distribution electric tricycles to waste collectors ([Giraldo](#), 30/12/2019) and launching a e-cargo bike pilot program with support of the World Bank ([Secretaría Distrital de Movilidad de Bogotá](#), 2020).

Bicycles have also been the main mode for food delivery workers for apps; this sector, which has boomed during the pandemic, is dominated by Rappi, a delivery platform founded in Bogotá in 2015 now the country's sole "unicorn" billion-dollar startup. Nonetheless, these services, largely done by Venezuelan immigrants, have been criticized for their labor practices (Rueda, 2019).

4. Travel demand management and road safety

The pressing need to mitigate traffic congestion has led all major Colombian cities to implement "pico y placa" (peak [hour] and [license] plate) vehicle restrictions over the past two decades, which prohibit driving of private vehicles by alternating license plates during peak hours (specific arrangements depend on the city). Such measures have had perverse effects including acquisition of secondary, cheaper vehicles to avoid restrictions (and for those who can afford it, armoured cars which are exempt) and increased traffic in off-peak hours ([Despacio & ITDP](#), 2013). As an alternative to such systems, congestion charging measures have been under consideration, though no significant progress has been made (though in Bogotá, vehicles can pay to avoid the pico y placa restriction, effectively generating a usage charge).

As mentioned above, most cities feature no legal on-street parking, though enforcement is lax. A few pilot initiatives for regulated parking have been launched in cities including Cali. Meanwhile, rates for off-street parking, though regulated by authorities, have not risen in line with inflation.

Vehicle restrictions are more complete, however, on the various car-free days held by Colombian cities. In 2001, Bogotá was the first city in the region to implement this measure city-wide, and was followed by various other Colombian cities with the backing of the national government ([Despacio & ITDP](#), 2013, p. 57). These days see all private vehicles banned, with only public transport and taxis operating, with the aim of generating awareness about mobility problems and incentivizing the use of alternative modes.

In terms of road safety, major cities such as Bogotá and Medellín have adopted or follow Vision Zero guidelines (see [Secretaría Distrital de Movilidad](#), n.d.) and speed reduction measures and norms



are becoming more common around the country. Bogotá, in particular, has shown the importance of lowering maximum speeds on major traffic arteries: having reduced speeds to 50 km/h from 60 km/h, traffic deaths dropped by 38% along 10 major roads ([Secretaría de Movilidad de Bogotá, 2020](#)). The measure has now been extended to all traffic arteries. Meanwhile, Medellín has led the improvement of pedestrian crossings, recently knocking down or improving 16 pedestrian bridges to improve pedestrian safety ([Marulanda, 2020](#))

CONCLUSION

Colombia's transport sector is at a critical juncture. While ongoing transport emissions growth is to be expected as economic development continues, there is ample opportunity to decouple transport activity from emissions by improving efficiency, reorganizing transport flows and promoting sustainable urban transport. In addition, numerous co-benefits could be realized, including improved health, equitable access and road safety. By contrast, continuing expansion of transport volumes along the current development model risks entrenching current problems and failing to meet emissions reductions targets.

The main obstacles to a sustainable transition are the lack of financial resources, political inefficiencies (particularly failures of planning) and resistance to change. Though there is no lack of government initiatives and programs, these have failed to deliver the desired results. In Colombia's major cities, sustainable mobility initiatives have obtained significant political support as a solution to the interconnected and highly visible issues of air pollution, congestion and poor road safety. Successful policies and innovations have the potential to be scaled up, particularly with effective planning and coordination from the national government. Nonetheless, the major issue of Colombia's high-emitting, unsafe and inefficient freight transport remains intractable, and the nationwide trend of rapidly increasing motorcycle use threatens to reverse gains in air quality and road safety. Moreover, there is no specific policy for the steadily growing aviation sector. Colombia's progress on sustainable transport is thus partial and highly fragile, and an effective and long-term strategy that achieves decarbonization and improved urban and rural connectivity is not yet available.

Please do not hesitate to respond to this document, or to suggest any relevant additional reports or data by writing to the following address: contribution@climate-chance.org

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