

BARCELONA LOW EMISSION ZONE

Annual monitoring report 2024



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Barcelona, October 2025

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Glossary of terms

‘NO_x’ or ‘Nitrogen oxides’: A group of highly reactive gases containing nitrogen and oxygen in various proportions that are formed when fuels are burned. The main sources of these pollutants are cars (road traffic), industry, commerce and domestic activities where fuel is burned.

‘NO₂’ or ‘Nitrogen dioxide’: Brownish gas with an irritating odour, toxic at high concentrations, involved in the formation of photochemical smog and emitted mainly by road traffic in large cities, although it can also be produced by industrial activities, commerce or certain domestic activities.

‘PM_{2.5}’: Particulate matter passing through the size-selective head, defined in the UNE-EN 12341’s reference method for the sampling and measuring PM_{2.5}, for an aerodynamic diameter of 2.5 µm.

‘PM₁₀’: Particulate matter passing through the size-selective head, defined in the UNE-EN 12341’s reference method for the sampling and measuring PM₁₀, for an aerodynamic diameter of 10 µm.

‘BC’ or ‘black carbon’: Air pollutant formed from the incomplete combustion of organic materials, such as fossil fuels, biomass or wood. In large cities it is a major indicator of traffic’s contribution to air pollution.

‘CO₂’: An insipid, colourless and odourless gas. It is not toxic and so is not considered to be directly harmful to health. However, it is a greenhouse gas and it does have a direct effect on global warming and climate change. It is produced by combustion in engines, heating, etc.

‘Limit value’: Pollution level set based on scientific knowledge aimed at preventing or reducing harmful effects on human health, the environment as a whole and other goods of any kind, to be achieved within a specified period and not to be exceeded once achieved.

‘µg’ or ‘microgram’: A unit of mass in the International System of Units which is equivalent to one billionth of a kilogram (10⁻⁹ kg) or one millionth of a gram (10⁻⁶ g).

‘GHG’: Greenhouse gases.

‘Emission’: Emissions are linked to the release of pollutant substances into the atmosphere from an emission source (traffic, industry, homes, natural sources, etc.).

‘Immission’: Immission refers to the air we breathe. It is also known as air quality and can affect people, animals, vegetation or materials depending on the type and concentration of different pollutants.

Executive summary

Air quality is a key determinant of public health and well-being. In the city of Barcelona, the persistent presence of air pollutants such as nitrogen dioxide (NO₂) and particulate matter (PM₁₀ and PM_{2.5}) regularly exceeds the limits recommended by international bodies such as the World Health Organization (hereinafter, WHO). This situation has a direct impact on public health, leading to a growing incidence of respiratory and cardiovascular diseases, as well as an increase in premature deaths associated with prolonged exposure to air pollution.

To tackle this issue and with the aim of reducing NO₂ emissions, a Low-Emission Zone (hereinafter LEZ) was introduced in the city of Barcelona in 2020.

Alongside the implementation of the LEZ, a monitoring system was launched, with a set of indicators defined to track progress, assess effectiveness and evaluate whether the targets set for air quality, climate change mitigation, public health and the shift towards more sustainable modes of transport, among others, are being met.

The most recent data confirm the trend observed since the introduction of the LEZ. In 2024, the city saw the lowest air pollution levels on record, and for the second year in a row, all monitoring stations met the limit values set by Directive 2008/50/EC. This improvement can be partly attributed to the accelerated renewal of the city's vehicle fleet as a result of the LEZ. The removal of the most polluting vehicles has led to reductions in NO₂ and black carbon emissions of 49% and 57% respectively.

The percentage of vehicles without an environmental label has stabilised at around 1%, while the number of vehicles with a B label continues to decline. As of December 2024, vehicles with a B label accounted for 14.5% of the city's fleet, while the number of vehicles with a 0 or ECO label continues to rise steadily.

Looking ahead, it is important to consider that the current framework for compliance with the limit values established in Directive 2008/50/EC may change, given its update through Directive (EU) 2024/2881 of 23 October 2024 on ambient air quality and a cleaner atmosphere in Europe. This new directive further tightens standards towards 2030 and brings the various limit values closer to those recommended by the WHO, thereby encouraging the continuation of initiatives such as the LEZ, aimed at reducing pollutant emissions caused by road traffic.

1. Introduction

Air pollution is a major public health issue affecting millions of people worldwide. According to the World Health Organization (WHO), air pollution is responsible for more than seven million premature deaths every year.¹ At the European level, the European Environment Agency (EEA) warns that air pollution remains the leading environmental health risk, with more than 200,000 deaths annually in the European Union attributed to exposure to fine particulate matter (PM_{2.5}).² Despite emission reduction policies, many European cities continue to exceed the limits set by the European Union, putting public health at risk.

The city of Barcelona was systematically exceeding nitrogen dioxide (NO₂) air quality limit values since before 2005, failing to meet the requirements set out in the relevant regulations,³ as well as the guideline values recommended by the World Health Organization (WHO).⁵ This prompted the implementation of decisive measures to reverse the situation and improve the quality of the air people breathe in the city.

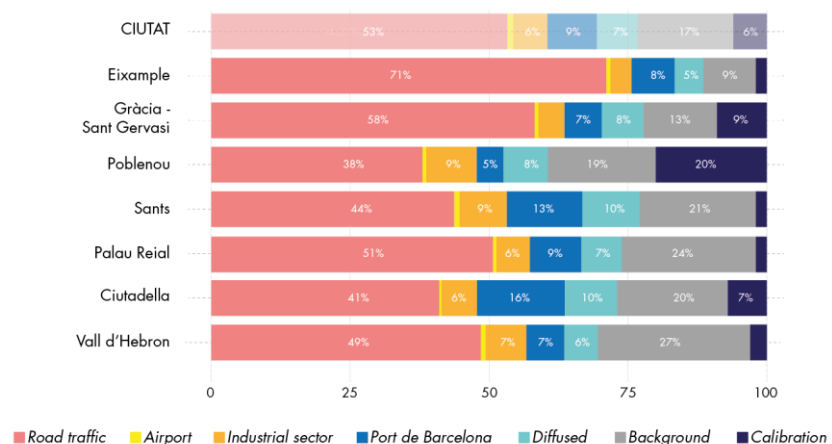
In 2017, prior to the implementation of the LEZ, road traffic was the main contributor to air pollution in Barcelona, making it necessary to introduce bold measures to reduce emissions.

[Figure 1]

FIGURE 1

Source of NO₂ emissions by sector [2017].

Source: Barcelona Regional



Thus, to help reduce NO₂ emissions caused by road traffic, a LEZ was introduced in Barcelona in 2020.

This report examines the state of the LEZ in the city for 2024, providing updated indicators to track progress, assess the effectiveness of the measures adopted and evaluate whether the targets set for air quality, climate change mitigation, public health, the shift towards more sustainable modes of transport and other urban issues are being met.

2. Context

2.1 Health impact of air pollution

Air pollution is the primary environmental risk to health, as it increases premature mortality and shortens life expectancy. Air pollution is particularly severe for the most vulnerable groups, including children, the elderly, pregnant women, and individuals with health problems.

In Barcelona, the Barcelona Public Health Agency (hereinafter ASPB) estimates the impact of air pollution on health in the city (based on exposure to annual levels of PM_{2.5} and NO₂). Air quality is assessed using fixed monitoring points (stations) that form part of the Catalan Atmospheric Pollution Monitoring and Forecasting Network (hereinafter XVPCA). [\(Annex I\)](#) These monitoring stations are representative of the various pollutant emission and dispersion conditions found in the city's streets and are classified as either traffic stations or background stations. Traffic stations are located near roads with high vehicle density and reflect pollution levels primarily caused by vehicle emissions. By contrast, background stations are located away from major pollution sources and reflect ambient pollution levels not directly influenced by any specific source. Together, the measurements taken across the monitoring network reflect the full range of air pollution situations present in the city of Barcelona.

Based on the pollution levels recorded by the XVPCA in recent years (2020–2024), air pollution in the city is estimated to be responsible for around 8% of natural deaths – roughly 1,300 deaths per year. Additionally, air pollution is also responsible for 36% of new cases of childhood asthma (around 800 per year) and 12% of new lung cancer cases (around 120 per year).

Meeting the future legal limits for PM_{2.5} and NO₂ would reduce mortality by 38%, childhood asthma cases by 40% and lung cancer cases by 42%.⁶

2.2 What is an LEZ?

An LEZ (Low-Emission Zone) is a defined area established by a public authority, within its jurisdiction and in the exercise of its powers, where restrictions on vehicle access, circulation and parking are applied on an ongoing basis in order to improve air quality and reduce greenhouse gas emissions. These restrictions are based on the emissions classification of vehicles in accordance with the applicable General Vehicle Regulations.

LEZs are an air quality improvement measures that have already been implemented in more than 200 cities across Europe with similar air pollution problems. They have been approved by the scientific community and significantly reduce pollutant emissions from traffic. *[Map 1]*

The LEZ defines a geographic area with traffic restrictions for the most polluting vehicles – that is, those that produce the highest levels of harmful emissions.

This measure is based on the requirement for vehicles registered in the European Union must comply with specific emissions standards (the EURO regulations). Restricting the circulation of

vehicles approved under the more permissive EURO standards (pre-EURO, EURO 1, and subsequent standards) means that the vehicles still on the road emit fewer pollutants, thereby contributing to cleaner air in the city.

MAP 1

Map of cities with Low Emission Zones

Source: <https://urbanaccessregulations.eu/userhome/map> [updated in 2025]



2.3 The LEZ in Barcelona

2.3.1 Purpose

The aim of Barcelona's LEZ is to reduce road traffic emissions in order to improve air quality, bring pollution levels closer to those recommended by the World Health Organization (WHO) and comply with the air quality limits established in current legislation. It also seeks to improve acoustic quality and make the city more pleasant and liveable.

2.3.2 Regulatory context

In 2020, an LEZ was implemented in Barcelona through the Byelaw on restrictions on the circulation of certain vehicles in the city of Barcelona in order to preserve and improve air quality, passed on 20 December 2019.

On 27 December 2022, Royal Decree 1052/2022, of 27 December, regulating Low-Emission Zones, was passed, building on Article 14 of Act 7/2021, of 20 May, on climate change and energy transition. This act requires all Spanish cities with more than 50,000 residents to establish an LEZ by 2023.

Although Barcelona City Council had already approved an LEZ before Royal Decree 1052/2022 came into force, a new byelaw was passed on 27 January 2023 to align the regulations with the

new legal framework. On 27 January 2023, the Byelaw establishing the criteria for access, circulation and parking of vehicles in the city's LEZ, while also promoting zero-emission mobility replaced and repealed the previous regulations.

This new byelaw establishes the objective and purpose of the LEZ beyond strict compliance with air quality limit values, aligning the measure with the fight against climate change and the reduction of CO₂ emissions. It also aims to improve other environmental indicators and enhance quality of life in the city of Barcelona.

With the current LEZ byelaw in effect, Decree 132/2024, of 30 July, enacting the Air Quality Plan – Horizon 2027, the short-term action plan for high levels of air pollution and the regulatory provisions needed to meet air quality targets was passed on 30 July 2024. These regulations set out the criteria for the implementation and management of low-emission zones in Catalonia and define a timeline for future restrictions. Barcelona's current LEZ complies with the requirements set out in this new decree.

2.3.3 Scope of application

The Barcelona LEZ covers the entire municipal area of the city, with the exception of the neighbourhood of Vallvidrera, el Tibidabo i les Planes, as well as the Zona Franca industrial area. It is defined as a zone with restricts on the most polluting vehicles. The LEZ in the city alone covers an area of approximately 77 km² (76% of the municipal area) and includes nearly all its residents (1,636,193 as of 2022).

Given the cross-border nature of air pollution and the characteristics of the Barcelona metropolitan area – where several municipalities are interconnected within a single urban ecosystem – the LEZ was initially established to include other cities in the Barcelona Metropolitan Area (L'Hospitalet de Llobregat, Cornellà de Llobregat, Esplugues de Llobregat and Sant Adrià de Besòs). As a result, the zone covers more than 95 km² and affects a population of over two million people. [Map 2]

MAP 2

Scope of application of the Barcelona LEZ (striped area): The municipal area of Barcelona, except for the neighbourhood of Vallvidrera, el Tibidabo i les Planes, as well as the Zona Franca Industrial Estate. It covers 77 km² (76% of the municipal area), which expands to more than 95 km² when including the other cities in the Barcelona Ring Roads LEZ (L'Hospitalet de Llobregat, Cornellà de Llobregat, Esplugues de Llobregat, and Sant Adrià de Besòs).

Source: Barcelona City Council



2.3.4 Permitted vehicles

Since the LEZ came into effect on 1 January 2020, the most polluting vehicles – those not eligible for a DGT environmental label – have been prohibited from driving within this area.

TABLE 1

Vehicle classification table by DGT environmental label

Source: Barcelona City Council

No environmental label	<p>Petrol-driven passenger cars (M1) and vans (N1) before Euro 3 and diesel-driven passenger cars before Euro 4.</p> <p>Motorcycles and mopeds (L) before Euro 2.</p> <p>Petrol- and diesel-driven buses (M2 and M3) and lorries (N2 and N3) before Euro 4.</p>

B	Petrol-driven passenger cars and vans must comply with Euro 3 and diesel-driven passenger cars and vans must comply with Euro 4 or 5. Lorries and buses must comply with Euro 4 or 5. Motorcycles and mopeds: Euro 2.
C	Petrol-driven passenger cars and vans must comply with Euro 4, 5 or 6, and diesel-driven passenger cars and vans must comply with Euro 6. Lorries and buses must comply with Euro 6. Motorcycles and mopeds: Euro 3 or Euro 4.
Eco	Mopeds, motorcycles, passenger cars, light vans, vehicles with more than 8 seats and goods vehicles classified in the Vehicle Register as plug-in hybrid vehicles with a range of less than 40 km, non-plug-in hybrid vehicles (HEV and PHEV), vehicles powered by natural gas (CNG and LNG) or liquefied petroleum gas (LPG). In any event, they must comply with the criteria of the C label.
Zero	Mopeds, tricycles, quadricycles, passenger cars, light vans, vehicles with more than 8 seats, and goods vehicles classified in the DGT Vehicle Register as battery electric vehicles (BEV), range extended electric vehicles (REEV), plug-in hybrid electric vehicles (PHEV) with a minimum range of 40 kilometres, or fuel cell vehicles.







2.3.5 Permits and exemptions

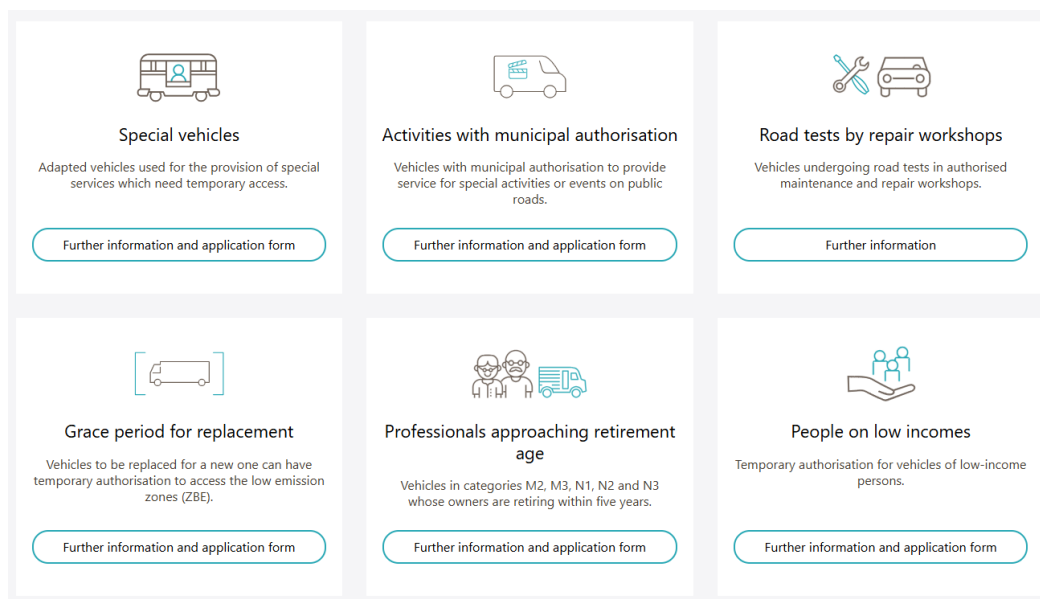
The LEZ is complemented by a set of exemptions and access permits that allow certain vehicles to continue to be used sporadically, with a focus on the most vulnerable groups. Therefore, vehicles for people with reduced mobility (VPRM), emergency services (police, fire brigades, ambulances) and essential services (doctors, funeral services) are permanently exempt from LEZ restrictions, regardless of whether they have a DGT environmental label or not. Furthermore, permits are offered for low-income individuals, for individuals nearing retirement age who still need the vehicle for work, among many others.

FIGURE 2

List of current permits and exemptions.

Source: Barcelona Metropolitan Area (AMB)

 <p>Daily permits</p> <p>Registration of vehicles to be able to request up to 24 driving permits per year</p> <p>Further information and application form</p>	 <p>People with reduced mobility</p> <p>Vehicles transporting people with reduced mobility.</p> <p>Further information and application form</p>	 <p>Emergency and other essential services</p> <p>Medical services, funeral services, civil protection, firefighters, police and law enforcement agencies.</p> <p>Further information and application form</p>
 <p>Foreign vehicles</p> <p>Register of vehicles with foreign number plates. All vehicles with foreign number plates need to be registered in order to drive in the low emission zones (ZBE).</p> <p>Further information and application form</p>	 <p>Medical conditions or disabilities</p> <p>Vehicles for people with health requirements or recognised disabilities that affect their ability to use public transport.</p> <p>Further information and application form</p>	 <p>Periodic medical treatments</p> <p>Vehicles that transport persons to undergo periodic medical treatments within the ZBEs.</p> <p>Further information and application form</p>



Anyone who wants to apply for a permit or exemption must be registered in the Metropolitan Register of Foreign and Other Authorised Vehicles:

<https://zberegistre.ambmobilitat.cat/en>

2.3.6 Monitoring and enforcement

Compliance with the measure is monitored through cameras, which cross-check the licence plates with the corresponding DGT environmental label and with the Register. The automated control system, which currently has more than 100 number plate reading cameras at various points in the metropolitan area (entry points to the LEZ and interior areas), provides local authorities with a list of vehicles identified in their area that may be subject to fines. This system also allows for the regular monitoring and updating of the fleet of vehicles circulating in the city, making it possible to assess the benefits of the measures implemented.

At the end of 2023, 42 new control points were implemented in Barcelona's LEZ, equipped with number plate reading cameras, thanks to funds from the Next Generation programme. The equipment was installed in October 2023, and commissioned during the first quarter of 2024.

3. Regulatory Framework

The regulatory framework necessary for implementing a measure such as the LEZ includes EU, Spanish, Catalan and even local regulations. Understanding all the regulations that must be followed is key to understanding the implementation of the measure itself.

TABLE 2

Reference regulatory framework
Source: Barcelona City Council

European Union regulations	
Directive 2008/50/EC , of the European Parliament and of the Council, of 21 May 2008, on ambient air quality and cleaner air for Europe	
Spanish regulations	
Spanish Constitution (CE)	Articles 43 and 45 of the Spanish Constitution – The right to health protection and to a suitable environment
Spanish sectoral legislation	Act 7/2021 , of 20 May, on climate change and the energy transition
	Royal Decree 1052/2022 , of 27 December, regulating low emission zones
	Act 34/2007 , of 15 November, on air quality and atmospheric protection
	Royal Decree 102/2011 , of 28 January, on the improvement of air quality
	General Public Health Act 33/2011 , of 4 October
	Royal Legislative Decree 6/2015 , of 30 October, enacting the consolidated text of the Act on traffic, the circulation of motor vehicles and road safety
Catalan regulations	
Statute of Autonomy of Catalonia (EAC)	EAC – Art. 27 – On the right to live in a balanced, sustainable and health-friendly environment
	EAC – Art. 46 – On the obligation for environmental policies to focus on reducing the different forms of pollution
Sectoral legislation of the Government of Catalonia	Act 22/1983 , of 21 November, on protection of the atmospheric environment
	Decree 226/2006 , of 23 May, on the declaration of special atmospheric protection zones
	Act 18/2009 , of 22 October, on public health in Catalonia
	Decree 132/2024 , of 30 July, enacting the Air Quality Plan – Horizon 2027, the short-term action plan for high levels of air pollution and the regulatory provisions needed to meet air quality targets
Local regulations	
Barcelona LEZ byelaw	Byelaw establishing the criteria for vehicle access, circulation and parking in the LEZ and promoting zero-emission mobility

Special regulatory framework for Barcelona	The Municipal Charter of Barcelona, enacted by Act 22/1998, of 30 December
	Act 1/2006, of 13 March, regulating the special regulatory framework for the municipality of Barcelona

3.1 European Union legislation

Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe.

The goals of the Directive are as follows:

- Defining and establishing objectives for ambient air quality designed to avoid, prevent or reduce harmful effects on human health and the environment as a whole.
- Assessing the ambient air quality in Member States on the basis of common methods and criteria.
- Ensuring that information on ambient air quality is made available to the public and promoting increased cooperation between the Member States in reducing air pollution.

3.2 Spanish legislation

Spanish Constitution:

CE, Articles 43 and 45 – The right to health protection establishes the obligation of public authorities to safeguard public health through the adoption of preventive measures and necessary services. It proclaims the right to enjoy an environment suitable for personal development, as well as the duty to conserve it. Public authorities are obligated to ensure the rational use of all natural resources to protect and improve quality of life, and to protect and restore the environment. The law provides for penalties, both criminal and administrative, along with the obligation to compensate for any damage caused.

Spanish sectoral legislation:

Act 7/2021, of 20 May, on climate change and the energy transition, which aims to ensure Spain's compliance with the objectives of the Paris Agreement, signed by Spain on 22 April 2016, and to promote adaptation to the impacts of climate change and the implementation of a sustainable development model, among other aspects. Article 14.3 establishes the obligation for certain local governments – including Barcelona – to adopt, before 2023, sustainable urban mobility plans that introduce mitigation measures to reduce emissions caused by mobility itself, including, among others, the establishment of low emission zones.

The obligation set out in Article 14.3 of Act 7/2021 applies to cities with more than 50,000 residents, as well as those with more than 20,000 residents where air quality limit values are exceeded. Meanwhile, at the 3rd Air Quality Summit held on 18 March 2022, the Government of Catalonia decided to go a step further by committing to work towards the implementation of LEZs in all Catalan cities with over 20,000 residents by the end of 2025.

Royal Decree 1052/2022, of 27 December, which regulates low emission zones, implementing Article 14 of Act 7/2021 of 20 May, on climate change and the energy transition.

Act 34/2007, of 15 November, on air quality and atmospheric protection, Article 5 of which establishes that local authorities are responsible for exercising air quality and atmospheric protection powers that are attributed to them within the scope of their specific legislation, as well as others that are attributed to them within the framework of the relevant Spanish and regional legislation.

Royal Decree 102/2011, of 28 January, on the improvement of air quality, which implements Law 34/2007, and, inter alia, defines and establishes air quality objectives and regulates the assessment, maintenance and improvement of air quality in relation to certain harmful substances, in order to avoid, prevent and reduce harmful effects on human health, the environment as a whole and other assets of any kind.

General Public Health Act 33/2011 of 4 October, Article 19 of which provides that public institutions, within the scope of their powers, must direct preventive actions and policies on the determinants of health, defined as the social, economic, occupational, cultural, nutritional, biological and environmental factors that influence people's health.

Royal Legislative Decree 6/2015, of 30 October, enacting the consolidated text of the Act on traffic, circulation of motor vehicles and road safety, which, among other aspects, specifically allows the appropriate authorities to order the total or partial prohibition of access to roads, both for all purposes and for certain vehicles, or the closure of certain roads for environmental reasons.

3.3 Catalan legislation

Statute of Autonomy of Catalonia (EAC):

EAC – Art. 27 – Establishes that everyone has the right to live in a balanced, sustainable and health-friendly environment, in accordance with standards and levels of protection determined by law. They also have the right to equal enjoyment of natural resources and the landscape, and the duty to use them responsibly and avoid waste. The article also establishes the right of all people to protection against different forms of pollution, in accordance with the standards and levels determined by law, as well as the duty to help conserve the natural heritage and contribute to initiatives designed to eliminate different forms of pollution, with the aim of maintaining and conserving this heritage for future generations. And finally, it guarantees the right of all individuals to access environmental information held by public authorities.

EAC – Art. 46 – Establishes that public authorities must ensure protection of the environment by adopting public policies based on sustainable development and collective and intergenerational solidarity. It requires environmental policies to focus on reducing various forms of pollution, establishing standards and minimum levels of protection, and implementing measures to remedy environmental impacts, among other objectives.

Sectoral legislation of the Government of Catalonia:

Act 22/1983, of 21 November, on protection of the atmosphere, which aims to establish and regulate the instruments and procedure considered necessary for effective action by the public institutions of Catalonia in the field of prevention, monitoring and remedying of atmospheric pollution and which grants local authorities their own powers in the matter (Art. 11). It includes the possibility of implementing measures to reduce the polluting effects of urban and intercity traffic in the affected area (Art. 10.5 d).

Decree 226/2006 of 23 May declared several municipalities in the Barcelonès, Vallès Oriental, Vallès Occidental and Baix Llobregat counties special protection zones for the pollutant nitrogen dioxide (NO₂) and for suspended particles, specifically those with a diameter of less than 10 microns (extended by Decree 203/2009 of 22 December). This Decree was repealed by the Decree 152/2007 of 10 July (currently in force) enacting the Action Plan for the improvement of air quality in areas declared special atmospheric protection zones.

Act 18/2009, of 22 October, on public health in Catalonia, aims to coordinate health actions and services to ensure the monitoring of public health, promote individual and collective health, prevent disease, and protect health. The public health services defined include the promotion and protection of health, and the prevention of risk factors related to air and water, as well as environmental aspects that may impact human health (Art. 7. 3 e).

Decree 132/2024, of 30 July, enacting the Air Quality Plan – Horizon 2027, the short-term action plan for high levels of air pollution and the regulatory provisions needed to meet air quality targets, sets out the criteria for the implementation and management of low-emission zones throughout Catalonia.

3.4 Special regulatory framework for Barcelona

The Municipal Charter of Barcelona (hereinafter, the CmB), enacted by Act 22/1998, of 30 December: The preamble states that the Act aims to “prioritise environmental concerns in municipal government initiatives”, a commitment later specified in its provisions (Article 103.1.a). Article 42 of the CmB establishes that all city residents have the right to be informed about the data held by the City Council concerning environmental conditions within the municipal area, particularly regarding air, soil, and water pollution levels, as well as noise pollution. Within the framework of the Charter of Environmental Rights and general environmental legislation, the City Council must develop its environmental policy and exercise all its powers with regard to their impact on environmental quality. It also stipulates that the City Council must encourage the use of non-polluting vehicles over those that may cause pollution. The specific measures for the application of these regulations must be established in the municipal byelaws.

Act 1/2006, of 13 March, establishing the special regulatory system for the municipality of Barcelona, emphasises local government powers in the area of mobility. In its preamble, several paragraphs discuss the problems caused by traffic in Barcelona, stemming from the

city's centralisation effects, particularly concerning neighbouring cities within the metropolitan area. The high population density in this area results in a constant influx and outflux of a large number of vehicles from other cities.

4. Monitoring of the Ring Roads LEZ

As per Article 12 of Royal Decree 1052/2022, of 27 December, regulating low emission zones, and Article 18 of the Byelaw establishing the criteria for access, circulation and parking of vehicles in Barcelona's low emission zone while promoting emissions-free mobility, local authorities must establish a continuous monitoring and tracking system. This system aims to assess the effectiveness of measures adopted and ensure compliance with objectives related to air quality, mitigation of climate change impacts, public health, modal shift towards more sustainable transport modes, and other aspects of urban life.

In this context, the following set of monitoring indicators is updated annually. A new addition this year is the inclusion of an analysis of tropospheric ozone concentration trends, as required under Decree 132/2024, of 30 July, enacting the Air Quality Plan – Horizon 2027, the short-term action plan for high levels of air pollution and the regulatory provisions needed to meet air quality targets.

TABLE 3

Barcelona Low Emission Zone Monitoring Indicators

Source: Barcelona City Council

INDICATOR	FREQUENCY	DATA SOURCE
Air quality linked to road traffic		
Annual evolution of NO ₂ , PM ₁₀ , PM _{2.5} and O ₃ pollutants.	Annual	Barcelona Public Health Agency (ASPB)
Emissions inventory for the PM _{2.5} , PM ₁₀ , NO ₂ .pollutants.	Annual	Barcelona local pollution model
Analysis of the contribution of the PM _{2.5} , PM ₁₀ , NO ₂ .pollutants.	Annual	
Climate change mitigation		
Evolution and breakdown of energy consumption by sector	Annual	Barcelona Energy Agency
Evolution of GHG emissions by sector	Annual	
CO ₂ emissions by type of vehicle	Annual	
Promoting a modal shift		
Evolution of mobility		
Trends in annual mobility (Mveh-km/year)	Annual	Barcelona City Council Mobility Directorate
Modal share		
Modal share (internal and connecting)	Annual	Barcelona City Council Mobility Directorate
Vehicle fleet characteristics: road traffic emissions		

Evolution of annual emission factors for the PM _{2.5} , PM ₁₀ , NO ₂ and Black Carbon pollutants	Annual	Barcelona Regional Barcelona City Council Mobility Directorate
Evolution of annual road traffic emissions for the PM _{2.5} , PM ₁₀ , NO ₂ and Black Carbon pollutants	Annual	
Vehicle fleet characteristics: environmental labels		
Analysis of the vehicle fleet by environmental label	Monthly	Barcelona City Council Mobility Directorate
Age of registered passenger cars		
Average age of registered passenger cars in Spain	Annual	Directorate General of Traffic (DGT)
Average age of registered passenger cars in Barcelona	Annual	Municipal Institute of Statistics (Barcelona City Council)
Noise quality		
A-weighted equivalent continuous sound pressure level (LAeq) between 7 am and 8 pm, based on annual data from four control points	Monthly	Barcelona Noise Monitoring Network (Barcelona City Council)
A-weighted equivalent continuous sound pressure level (LAeq) pre-LEZ/post-LEZ	Monthly	
LEZ register		
Trends in the number of applications	Monthly	AMB Informació
Trends in the number of applications by type	Monthly	
Daily permits	Monthly	
New permits:	Monthly	
Trends in the number of green cards	Monthly	
Fines		
No. of monthly fines imposed/paid	Weekly	Municipal Tax Office (Barcelona City Council)

Monitoring reports from previous years can be found at the following link:

<https://ajuntament.barcelona.cat/qualitataire/ca/actualitat-i-recursos/estudis-i-informes>

4.1 Air quality linked to road traffic

4.1.1 Average immissions recorded by the XVPCA stations

Air quality in Barcelona has improved significantly in recent years, particularly in terms of nitrogen dioxide (NO₂) levels, which are primarily associated with road traffic. Notably, in 2024 the city saw the lowest air pollution levels on record, and for the second consecutive year, all monitoring stations complied with the limit values set by Directive 2008/50/EC.

As shown in the following figure [Figure 3], over the past decade annual NO₂ immission levels have followed a downward trend in the city, especially at traffic monitoring stations. Having achieved compliance with the limit value established by the currently applicable European reference legislation, efforts are now focused on meeting the targets set by Directive 2024/2881, which must be fulfilled by January 1, 2030, and on getting as close as possible to the levels recommended by the WHO. The annual average values for the year 2024 already meet the 2030 targets at 3 out of the 7 stations in the XVPCA network. [Table 4]

TABLE 4

NO₂ levels (in µg/m³) at monitoring stations in Barcelona during 2024

Source: Barcelona Public Health Agency

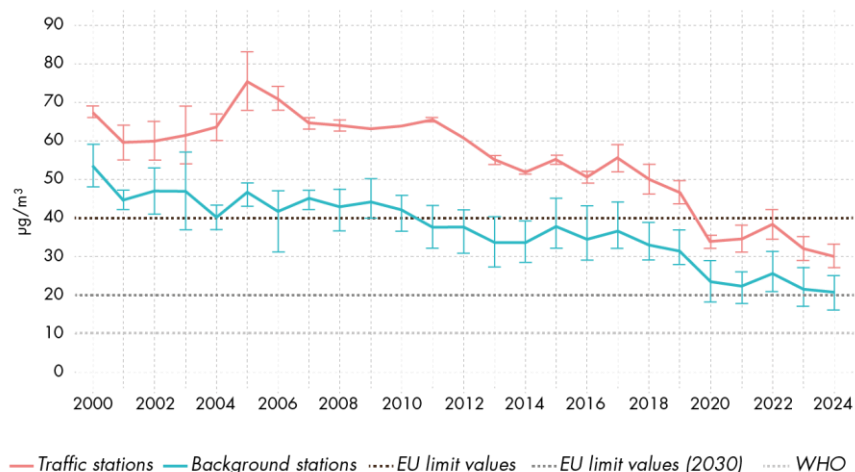
NO ₂ (µg/m ³)	Traffic stations			Background stations			
	Eixample	Gràcia – Sant Gervasi	Poblenou	Sants	Palau Reial	Ciudadella	Vall d'Hebron
Annual mean 2024	33	27	23	19	16	25	20

EU limit value (applicable): 40 µg/m³ EU limit value (2030): 20 µg/m³ WHO recommendation: 10 µg/m³

FIGURE 3

Annual average for immissions of NO₂ recorded by the XVPCA stations [2000-2024]

Source: Barcelona City Council with data from the Barcelona Public Health Agency



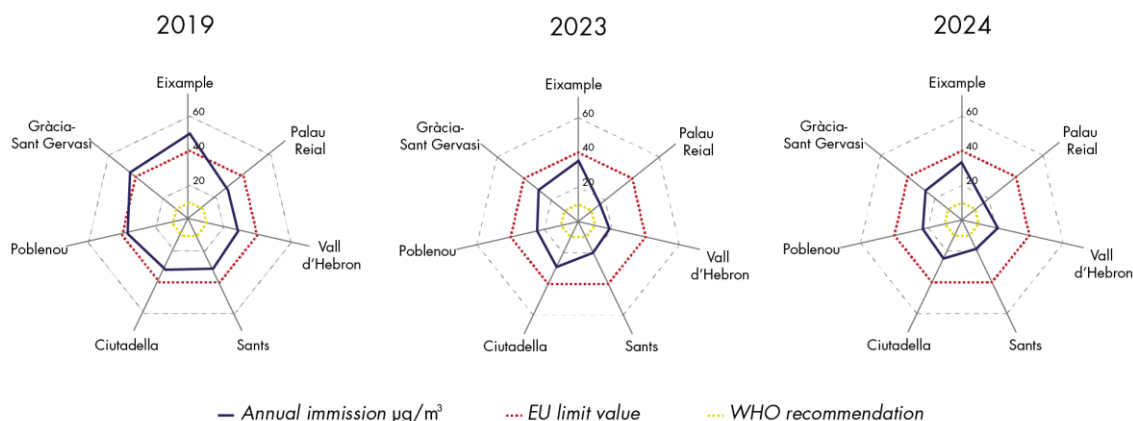
In 2023 and 2024, the city of Barcelona met the current NO₂ limit value at all XVPCA monitoring stations. Specifically, in 2024, the annual average at traffic stations was 33 µg/m³, and 27 µg/m³ at the Eixample and Gràcia–Sant Gervasi stations, respectively, showing an improvement over the previous year's figures.

A comparison of values across all XVPCA stations [Fig. 4] shows that the improvement in 2024 compared to 2017 was substantial at all locations, especially at traffic stations.

FIGURE 4

Annual NO_2 average by station

Source: Barcelona City Council with data from the Barcelona Public Health Agency



Both natural sources such as Saharan dust and sea salt and emissions from human activity, such as road traffic, contribute to PM_{10} particles. This wide range of sources, including secondary particles, means that recent reductions have been more moderate than those recorded for NO_2 , which is more directly linked to changes in traffic emissions.

Over the past decade, PM_{10} levels have followed a slightly downward trend at both traffic and urban background stations, remaining within the current legal limit ($40 \mu\text{g}/\text{m}^3$). Between 2015 and 2024, the reduction in PM_{10} concentration across the city average has been 21%. When comparing the annual average concentration with the new values set by Directive 2024/2881 for the year 2030, it can be seen that the 2024 recorded values already meet the 2030 targets at some stations.

TABLE 5

PM_{10} levels (in $\mu\text{g}/\text{m}^3$) at monitoring stations in Barcelona during 2024

Source: Barcelona Public Health Agency

PM_{10} ($\mu\text{g}/\text{m}^3$)	Traffic stations				Background stations			
	Eixample	Gràcia – Sant Gervasi	Plaça Universitat	Poblenou	Sants	Palau Reial*	Zona Universit.	Vall d'Hebron
Annual mean 2024	22	23	24	20	22	15	21	18

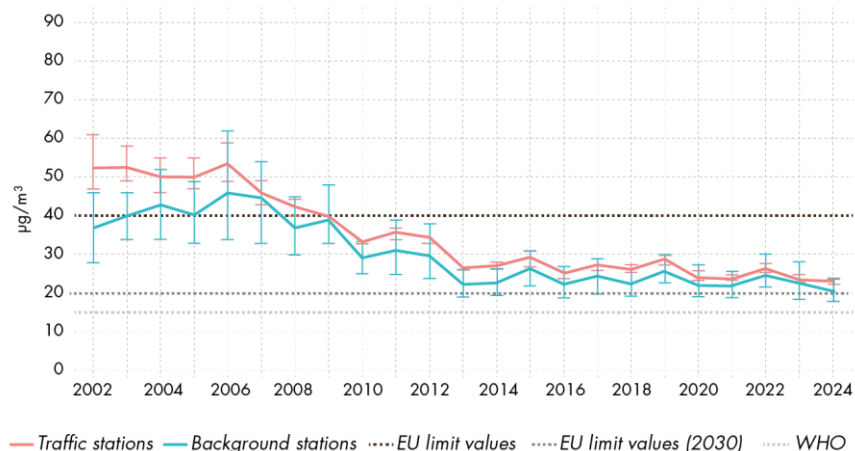
EU limit value (applicable): $40 \mu\text{g}/\text{m}^3$ EU limit value (2030): $20 \mu\text{g}/\text{m}^3$ WHO recommendation: $15 \mu\text{g}/\text{m}^3$ ·

*Indicative measurements (GRIMM)

FIGURE 5

Annual average for immissions of PM_{10} recorded by the XVPCA stations [2002-2024]

Source: Barcelona City Council with data from the Barcelona Public Health Agency

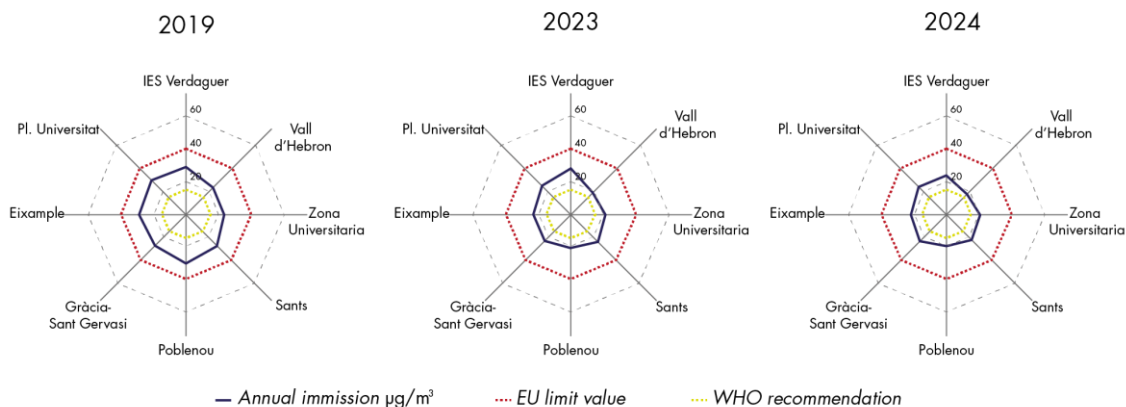


A station-by-station analysis shows that in recent years, values have inched closer to WHO recommendations, while the gap between traffic and background station readings has narrowed.

FIGURE 6

Annual average of PM_{10} by station

Source: Barcelona City Council with data from the Barcelona Public Health Agency



The situation for $PM_{2.5}$ is similar to that of PM_{10} . Over the last 10 years, $PM_{2.5}$ levels have gradually decreased, remaining below the current legal limit of $25 \mu\text{g}/\text{m}^3$. [Figure 7] Between 2015 and 2024, there has been a 23% reduction in average $PM_{2.5}$ concentrations at the city level. When comparing the annual average at each monitoring point with the new values set by Directive 2024/2881 for the year 2030, it can be seen that the 2024 recorded values already meet the 2030 targets at some stations of the XVPCA network.

TABLE 6
PM_{2.5} levels (in µg/m³) at monitoring stations in Barcelona during 2024
Source: Barcelona Public Health Agency

PM _{2.5} (µg/m ³)	Traffic stations			Background stations		
	Eixample	Gràcia – Sant Gervasi	Plaça Universitat	Poblenou	Ciutadella	Vall d’Hebron
Annual mean 2024	15	15	15	13	12	10

EU limit value (applicable): 25 µg/m³ EU limit value (2030): 10 µg/m³ WHO recommendation: 5 µg/m³ .

FIGURE 7
Annual average for immissions of PM_{2.5} recorded by the XVPCA stations [2010-2024]
Source: Barcelona City Council with data from the Barcelona Public Health Agency

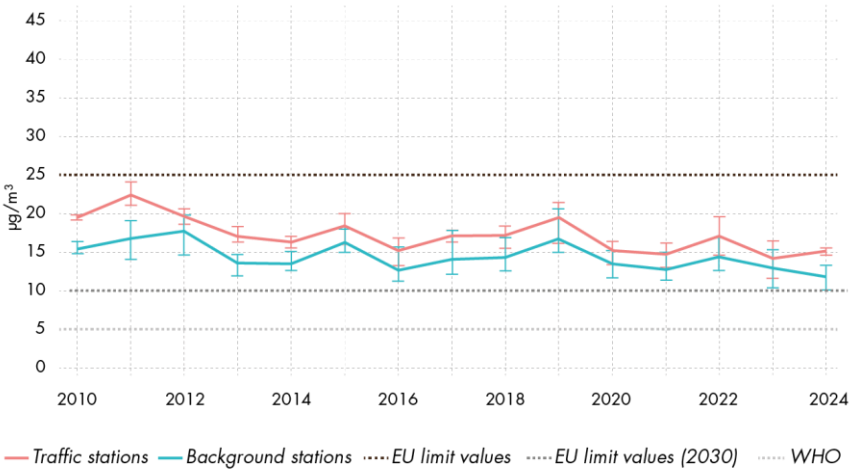
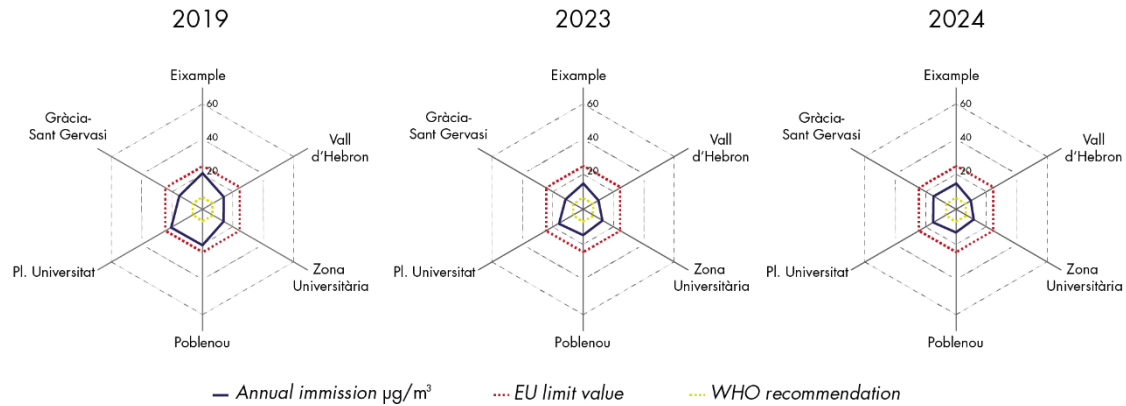


FIGURE 8
Annual average of PM_{2.5} by station
Source: Barcelona City Council with data from the Barcelona Public Health Agency



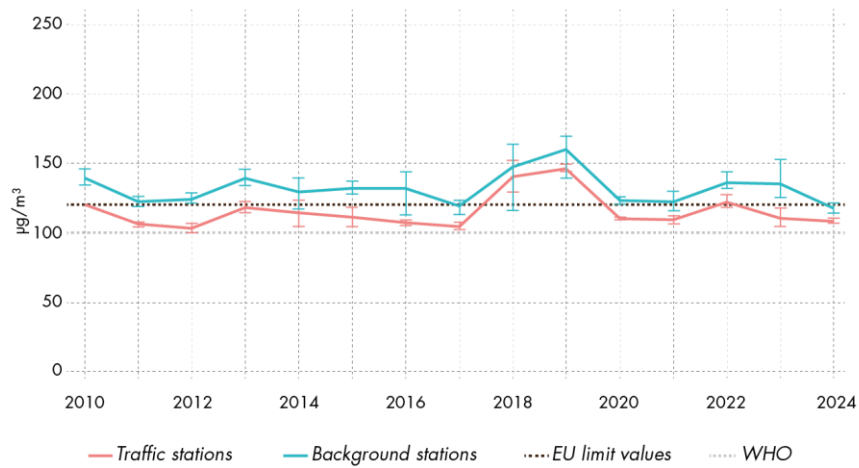
Regarding ozone, the maximum 8-hour value is analyzed. During 2024, ozone levels in the city exceed the WHO 8-hour guideline value (100 µg/m³), which coincides with the limit value set by the EU for 2030. However the current target values are met.

Ozone patterns differently from the other pollutants discussed: in this case, background stations show higher levels than traffic stations. Ozone is a secondary pollutant – it is not emitted directly, but rather forms through photochemical reactions (triggered by sunlight) involving primary pollutants. Specifically, ozone forms when nitrogen oxides (NO_x) and volatile organic compounds (VOCs) interact under intense solar radiation over a sustained period (at least several hours).⁷ This is why ozone peaks typically occur in spring and summer. Moreover, the same precursors that create ozone also help break it down, which is why ozone levels in Barcelona tend to be higher in areas with lower traffic intensity.

FIGURE 9

Annual maximum 8-hour ozone values at XVPCA stations (2010–2024)

Source: Barcelona City Council with data from the Barcelona Public Health Agency



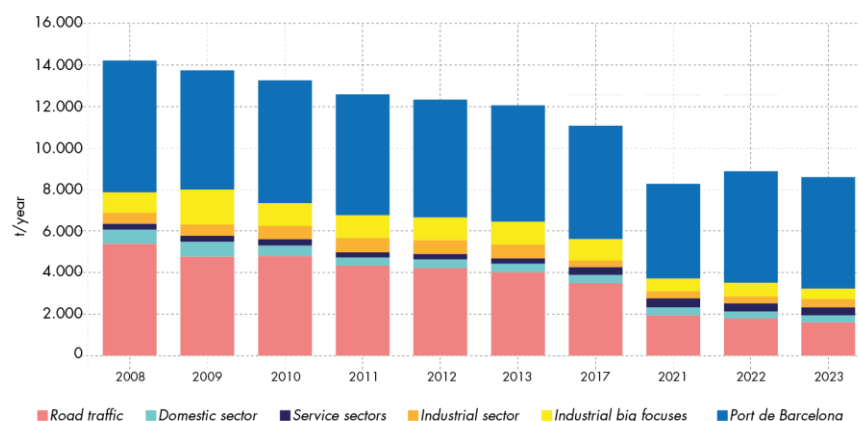
4.1.2 Emissions inventory

Below are the total NO_x emissions in the city of Barcelona broken down by sectors of economic activity.

FIGURE 10

Evolution of NO_x emissions in the city of Barcelona, 2008–2023

Source: Barcelona Regional



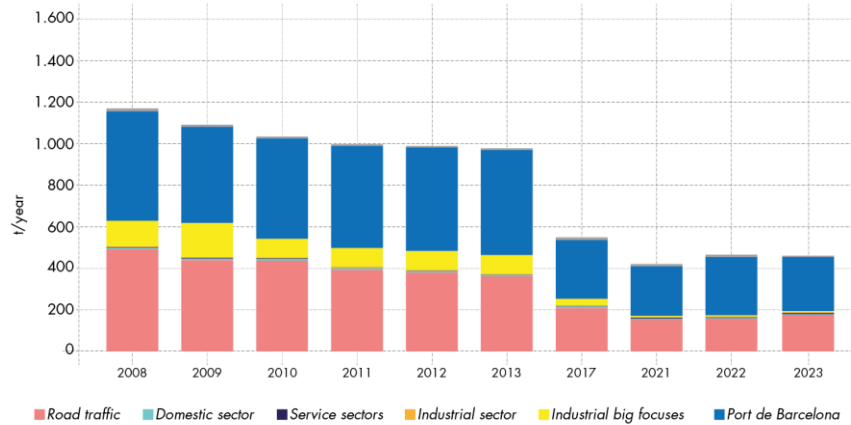
As shown in Fig. 10, NO_x emissions in Barcelona have decreased steadily since 2008. The data from 2021, which shows a sharp decline compared to the values in 2017, reflects the impact of the COVID-19 pandemic. Data from 2022 and 2023 confirm that emissions from road traffic have continued to fall compared to previous years.

For PM₁₀ particle [Fig. 11], emissions from all sectors – including road traffic – have remained relatively stable year-on-year.

FIGURE 11

Evolution of PM₁₀ emissions in the city of Barcelona, 2008–2023

Source: Barcelona Regional

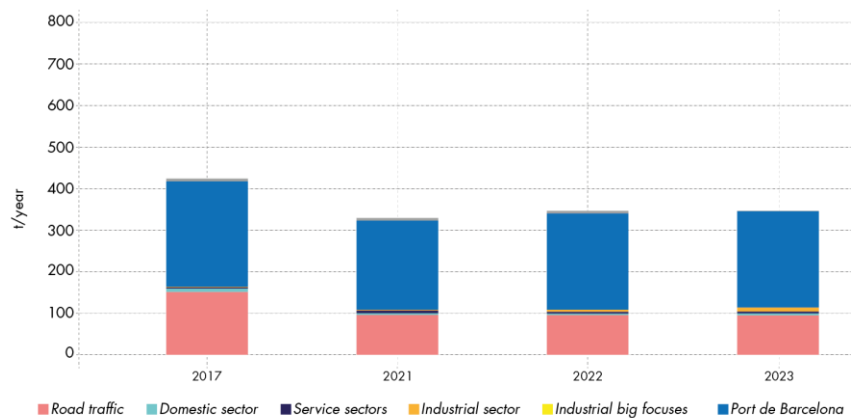


Regarding PM_{2.5} emissions, in 2023 emissions from all sectors remained fairly stable compared to the values of previous years.

FIGURE 12

Evolution of PM_{2.5} emissions in the city of Barcelona, 2017–2023

Source: Barcelona Regional



4.1.3 Contribution analysis

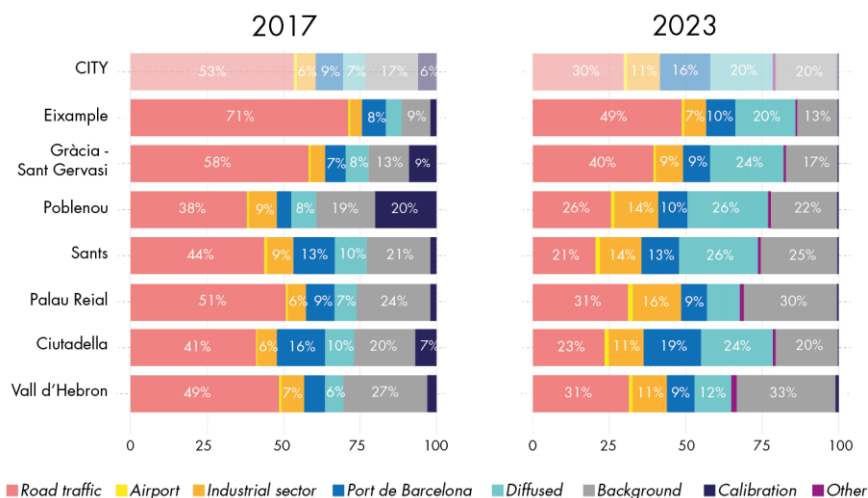
The analysis of the sources of the main atmospheric pollutants analysed (NO₂, PM₁₀ and PM_{2.5}) shows the primary emitting source contributing to the pollution levels recorded at each measurement point in the XVPCA in the city of Barcelona.

When comparing the sources contributing to the recorded NO_x levels between 2017 and 2023, it can be seen that the contribution from road traffic at all stations has significantly decreased, while the contribution from emissions from other sectors has increased. In particular, there is a noticeable rise in the contribution from the domestic, commercial, and services sector. It is worth noting that within the XVPCA network for the city of Barcelona, the Eixample station continues to have the highest contribution from road traffic; however, between 2017 and 2023, this share has dropped from 71% to 49%. [Fig. 13]

FIGURE 13

Contribution of NO_x recorded by the XVPCA stations

Source: Barcelona Regional

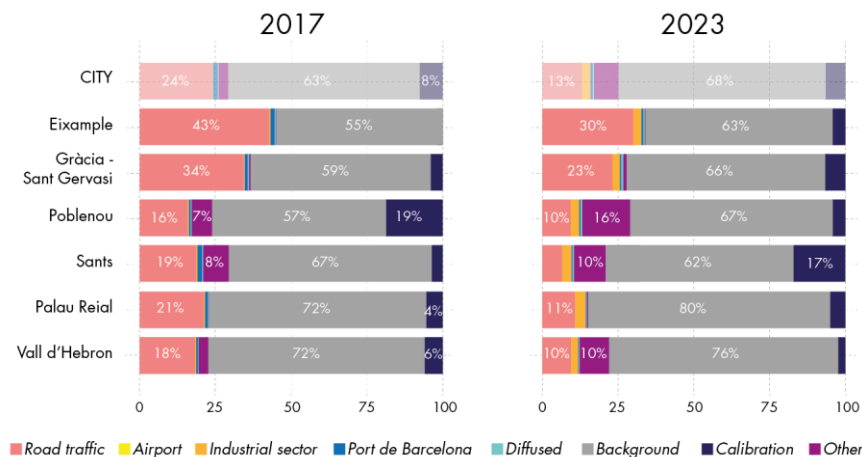


In the case of PM_{10} , a decrease in the contribution from road traffic is observed compared to the values prior to the implementation of the LEZ (2017). Consequently, this has led to an increase in the percentage contribution from background sources, which mainly consist of regional background, secondary pollutants, natural sources such as marine aerosols and Saharan dust, wildfire ash, or volcanic eruptions, among others. [Fig. 14] It is also worth noting the emergence of the industrial sector's contribution, which in 2017 was practically negligible. The increase in the share of these sources does not mean that their absolute contribution has grown.

FIGURE 14

Contribution of PM_{10} recorded by the XVPCA stations

Source: Barcelona Regional

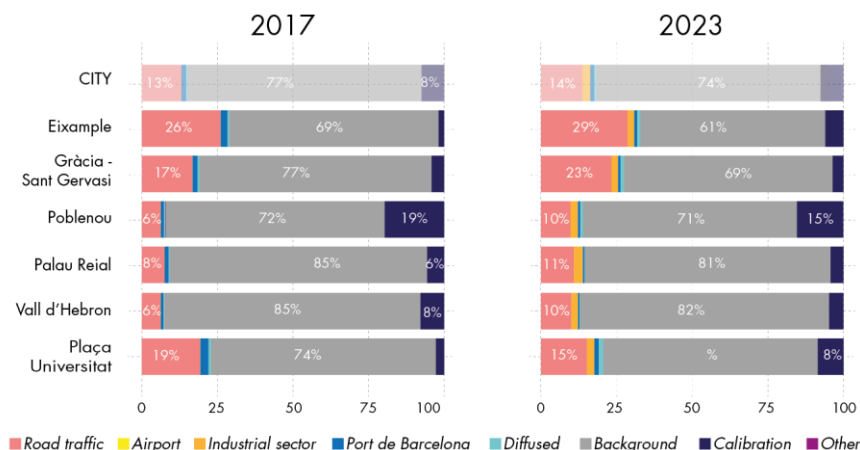


In the case of $PM_{2.5}$, the main contributing source is background, which comes primarily from secondary aerosols. At the city level, the contribution from road traffic remains practically stable. [Fig. 15]

FIGURE 15

Contribution of $PM_{2.5}$ recorded by the XVPCA stations

Source: Barcelona Regional



4.2 Climate change mitigation

Periodic monitoring indicators of energy consumption and greenhouse gas (GHG) emissions have been incorporated to analyse the impact of the low emission zone on climate change mitigation.

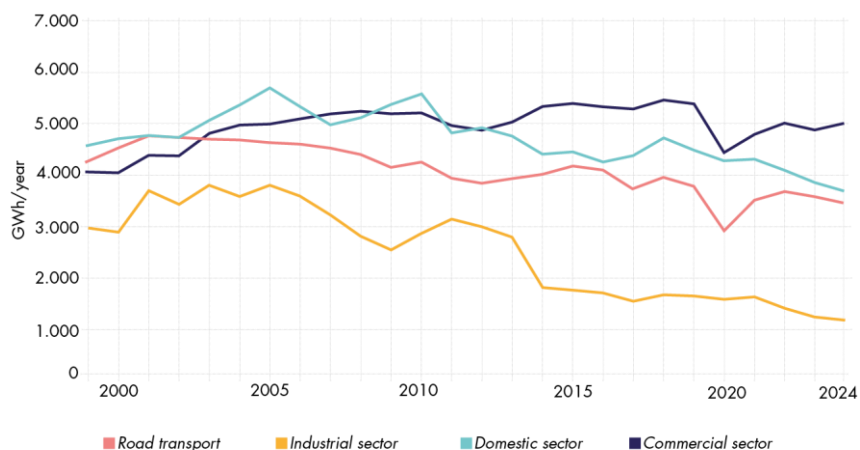
4.2.1 Evolution of energy consumption

An analysis of energy consumption by sector shows that in the transport sector, the downward trend seen in the previous year has continued, with energy use decreasing further compared to 2022 levels.

FIGURE 16

Evolution of energy consumption by sector (preliminary data)

Source: Barcelona Energy Agency

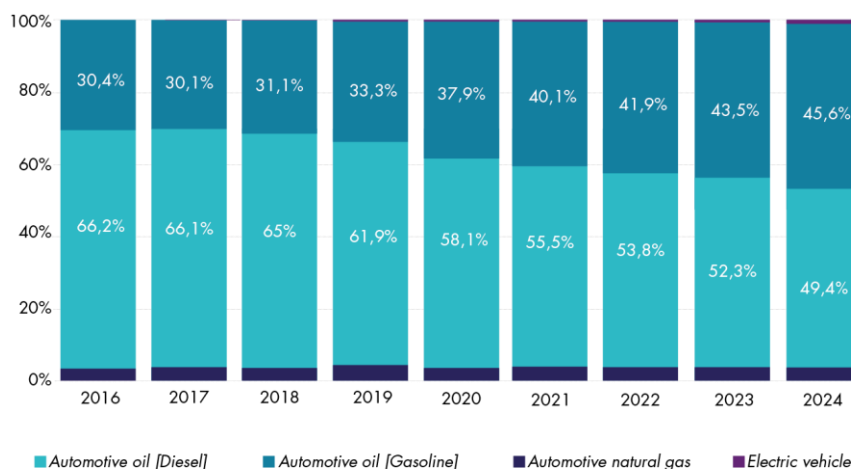


In terms of automotive energy use, diesel consumption continues to fall, dropping below 50% for the first time in 2024. The share of natural gas has remained stable, while electric vehicle use has increased slightly.

FIGURE 17

Structure of automotive energy consumption

Source: Barcelona Energy Agency



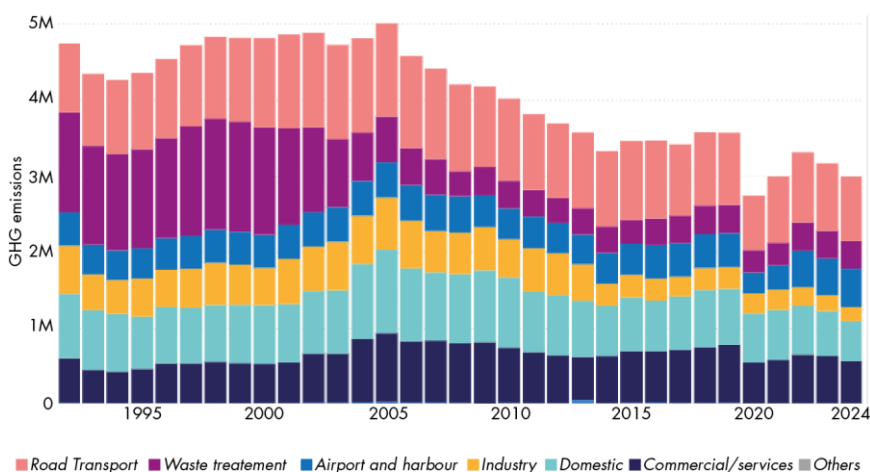
4.2.2 Evolution of GHG emissions by sector

Greenhouse gas (GHG) emission trends are broadly in line with energy consumption patterns, as the two are directly related. Emissions have been decreasing steadily since 2005, stabilising around 2015, with a slight uptick in 2018 and 2019 linked to increased mobility. Data for 2024 indicate a continued slight decline compared to the previous year.

FIGURE 18

Evolution of greenhouse gas emissions by sector (preliminary data)

Source: Barcelona Energy Agency

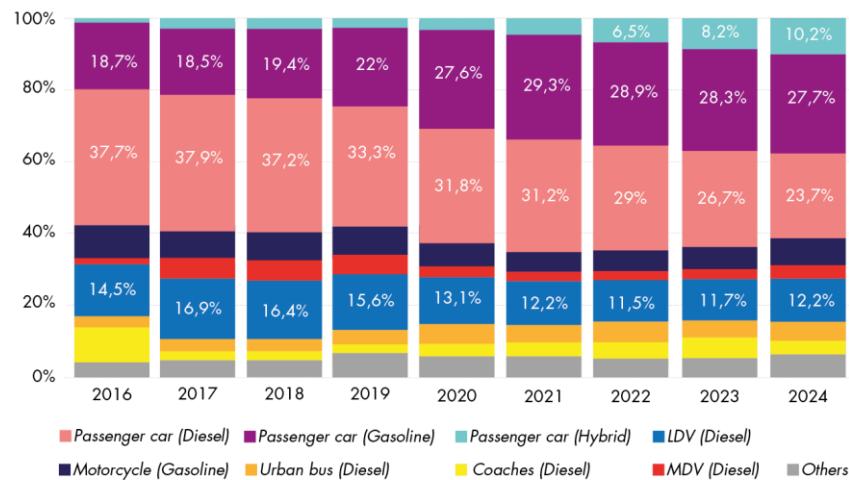


In terms of CO₂ emissions by vehicle type, the trend seen in recent years also remains unchanged. Emissions from petrol and diesel vehicles continue to decrease, while those from hybrid cars have increased.

FIGURE 19

CO₂ emissions by vehicle type.

Source: Barcelona Energy Agency



4.3 Promoting a modal shift

One of the aims of the LEZ is to encourage a shift towards more sustainable modes of transport. As such, there must be monitoring indicators in this area that allow us to monitor both trends in mobility and its characteristics.

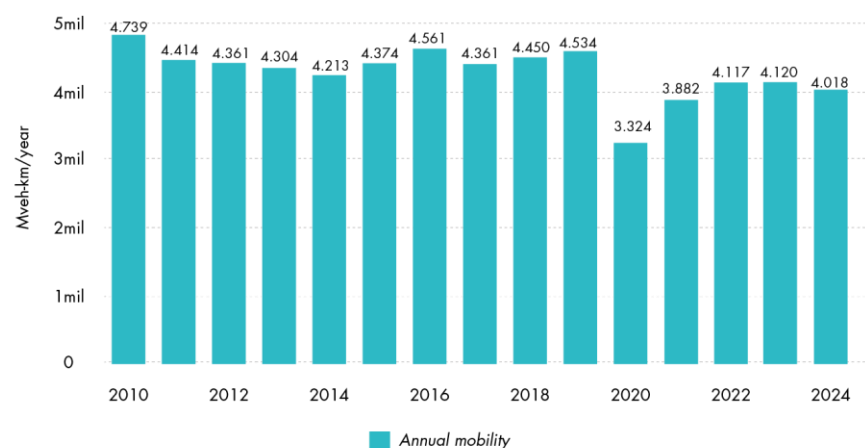
4.3.1 Trends in annual mobility

Annual mobility in 2024 is showing signs of stabilising after the decline caused by COVID-19-related travel restrictions, although levels are still slightly lower than in the two previous years. The figures for the last three years are above those recorded in 2020 and 2021 but have not yet returned to pre-pandemic levels.

FIGURE 20

Trends in annual mobility (Mveh-km/year)

Source: Barcelona City Council



4.3.2 Modal share

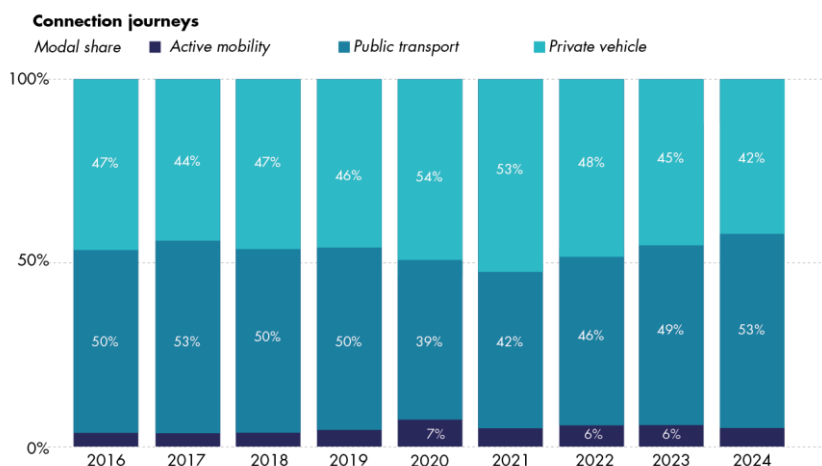
To analyse modal share, data are broken down between internal trips (origin and destination both within Barcelona) and connecting trips (either origin or destination in Barcelona).

There has been an increase in the number of connecting trips made using public transport, at the expense of private vehicles. [Fig. 24]. Active mobility accounts for 5% of trips, a figure higher than pre-pandemic levels.

FIGURE 21

Modal share of connecting journeys

Source: EMEF

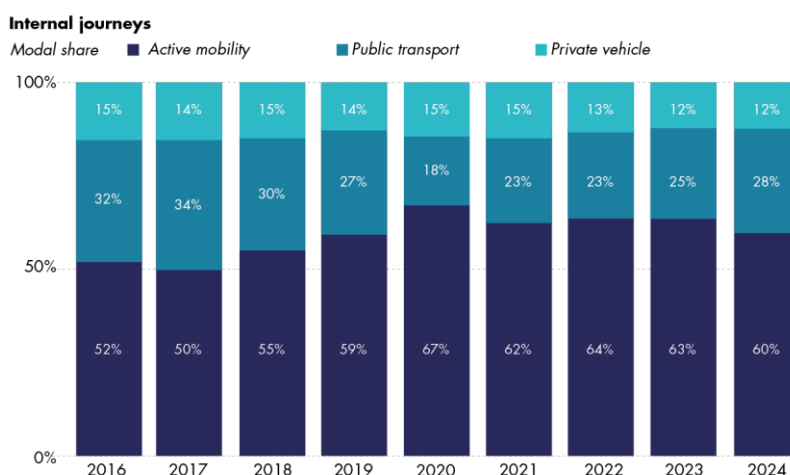


As for internal trips, data for 2024 show an increase in public transport use. Private vehicle use stands at 12%, while active travel remains the most common mode of transport for internal journeys [Fig. 22]

FIGURE 22

Modal share of internal journeys

Source: EMEF



4.3.3 Characteristics of the vehicle fleet: Evolution of annual emission factors

The evolution of the average emission factor [g/km] allows us to understand (excluding the influence of mobility levels) whether improvements in vehicle emission levels are mainly due to technological improvements introduced in vehicles themselves.

To analyse the evolution of emission factors, the data from vehicles detected by the ZBE control system are used as a starting point. These data are estimative and represent the circulating fleet detected at these control points. An analysis of the 2024 data shows that the emission factors for NO_x and Black Carbon (hereinafter, BC) continue to decrease compared to

the previous year. In the case of PM₁₀ and PM_{2.5} particles, there is also a reduction, although of a smaller magnitude.

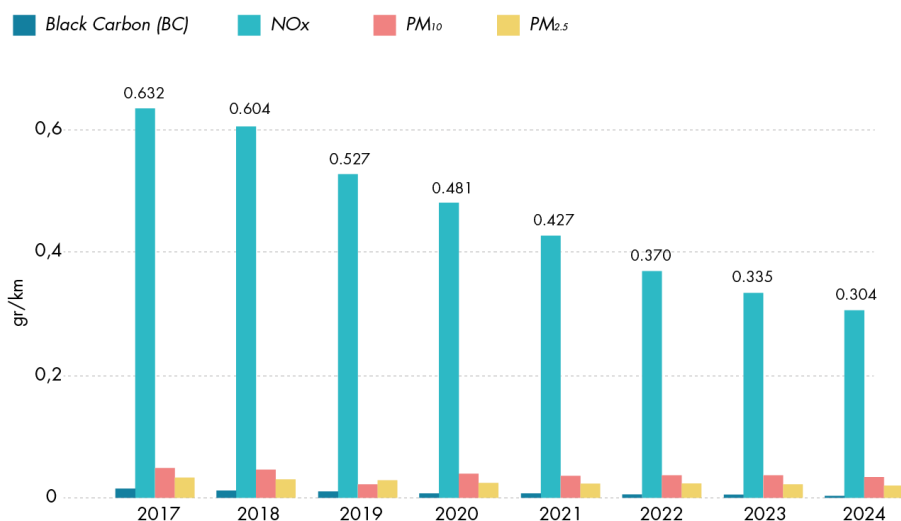
If the values for 2024 are compared to the year before the implementation of the measure (2019), the reduction in emission factors stands at 42% for NO_x and 55% for BC.

FIGURE 23

Evolution of annual emission factors

Source: Barcelona Regional with data from LEZ cameras

	2017	2018	2019	2020	2021	2022	2023	2024
NO _x (gr/km)	0,632	0,604	0,527	0,481	0,427	0,370	0,335	0,304
PM ₁₀ (gr/km)	0,048	0,045	0,042	0,039	0,037	0,037	0,036	0,035
PM _{2.5} (gr/km)	0,033	0,031	0,027	0,025	0,023	0,022	0,022	0,021
BC (gr/km)	0,012	0,012	0,009	0,007	0,006	0,005	0,005	0,004



4.3.4 Evolution of road traffic emissions

Emissions, however, depend on the characteristics of the vehicle fleet and also on the annual mobility figure. The reference fleet is the one detected by the ZBE control system.

As shown in the following table [Fig. 24], mobility in 2024 decreased slightly compared to the previous year, and emissions have fallen accordingly.

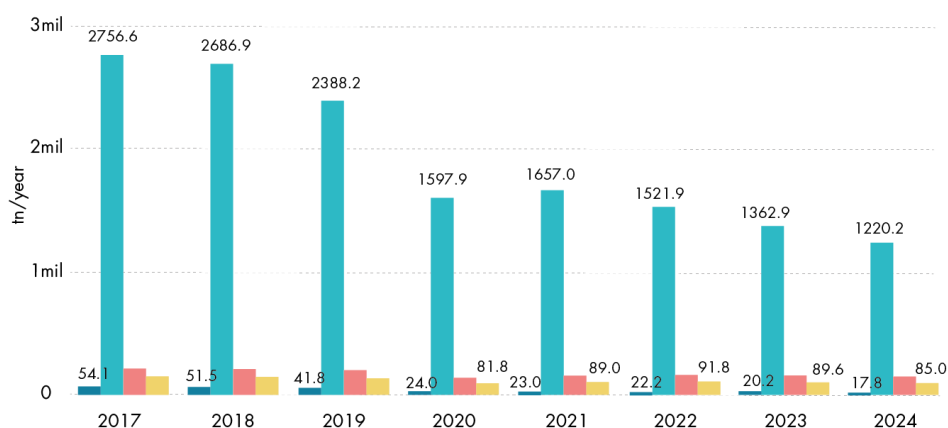
If the values for 2024 are compared to the year before the implementation of the measure (2019), it can be seen that NO_x emissions have decreased by 49% and BC emissions by nearly

57%. In the case of particles, the difference is smaller, and between 2019 and 2024, there was a reduction of 25% in PM₁₀ emissions and 31% in PM_{2.5} emissions.

FIGURE 24

Evolution of annual road traffic emissions

Source: Barcelona Regional with data from LEZ cameras



4.3.5 Analysis of the vehicle fleet by environmental label

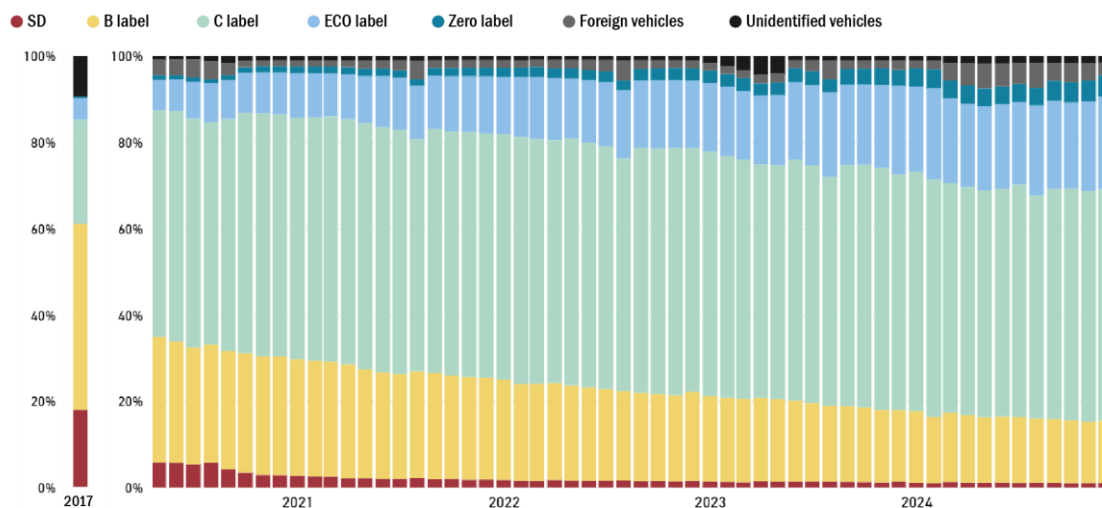
The evolution of the vehicle fleet by environmental label in 2024 follows a trend similar to that of the previous year.

The percentage of vehicles without an environmental label has stabilised at around 1%, while the number of vehicles with a B label continues to decline. As of December 2024, vehicles with a B label accounted for 14.5% of the fleet in circulation.

Meanwhile, 0 and ECO label vehicles continue to increase slightly. The number of foreign vehicles also rose and is no longer concentrated solely in the summer months.

FIGURE 25
Distribution of the fleet in circulation by environmental label

Source: Barcelona City Council


TABLE 7
Distribution of the fleet in circulation by environmental label

Source: Barcelona City Council

Labels	May 2017	May 2020	May 2021	May 2022	May 2023	May 2024	Dec. 2024
SD	17.92%	5.74%	2.51%	1.53%	1.35%	1.18%	1.06%
B	43.08%	29.15%	26.64%	22.56%	19.12%	15.17%	14.48%
C	24.16%	52.55%	56.91%	56.70%	54.28%	52.59%	53.64%
ECO	5.05%	7.04%	9.94%	14.40%	16.27%	19.46%	21.43%
0	0.33%	1.06%	1.55%	2.31%	2.91%	4.16%	4.94%
Foreign vehicles	0.00%	3.60%	1.53%	1.64%	2.06%	5.71%	2.98%
Unidentified vehicles	9.46%	0.88%	0.98%	0.90%	4.10%	1.82%	1.52%

4.3.6 Analysis of non-labelled vehicles

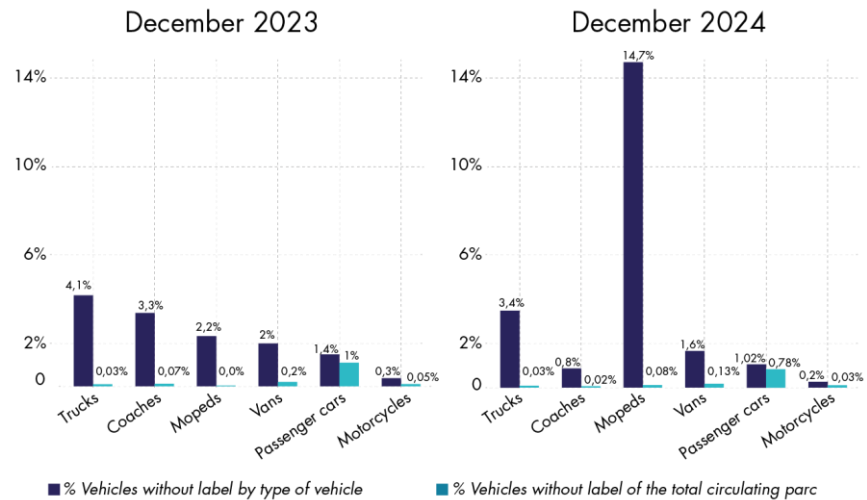
A detailed analysis of the non-labelled vehicle fleet shows a continued slight decrease in the percentage of buses, vans, passenger cars and motorcycles compared to previous years.

Notably, the number of coaches without an environmental label fell from 3.3% to 0.8%.

FIGURE 26

Comparison of the breakdown of vehicles without a label

Source: Barcelona City Council



In the case of mopeds, a significant variation in the percentage of non-labelled vehicles was detected. This change is due to the installation of a new camera system, which has made identification of this type of vehicle more reliable.

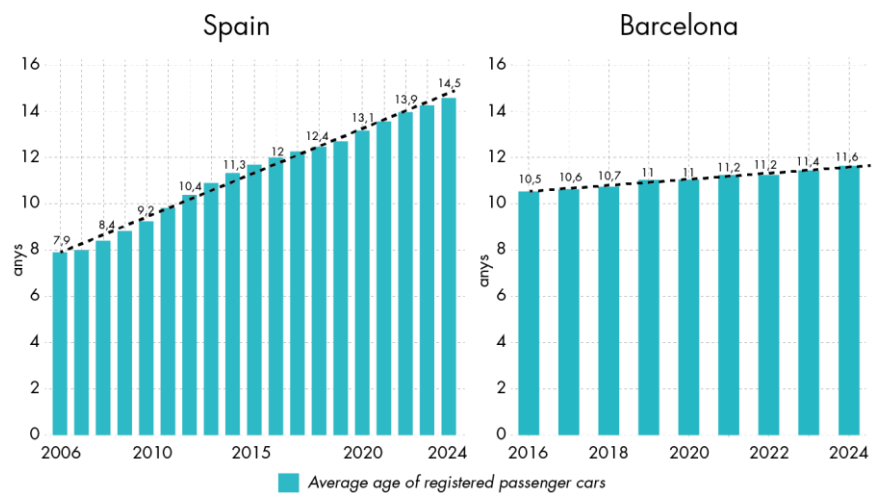
4.3.7 Registered fleet data

Analysing the evolution of the average age of the registered fleet can give us an idea of the pace at which the fleet is being renewed.

FIGURE 27

Average age of registered passenger cars

Source: Barcelona City Council



According to statistics provided by the DGT, the average age of registered passenger cars in Spain has been increasing since 2006, reaching 14.5 years in 2024. [Fig. 27]

Regarding the average age of the registered fleet in the city of Barcelona [Fig. 27], this indicator continues to follow a slightly upward trend. However, the gap between the average vehicle age in Spain and in Barcelona has remained relatively large. Between 2016 and 2024, the average age difference was 1.1 years in Barcelona, compared to 2.5 years across Spain.

4.4 Acoustic quality

In order to analyse whether the implementation of the LEZ has any impact on the city's noise levels, 4 traffic noise measurement points from Barcelona's noise monitoring network have been selected as reference points. [Map 3]

This analysis compares average noise levels before the implementation of the LEZ (2018–2019) with those recorded after it came into force (2022–2024), excluding the years when mobility was affected by the COVID-19 pandemic (2020–2021).

The noise levels recorded in 2024 show a slight downward trend at all monitoring points analysed. [Fig. 28] The difference compared to pre-LEZ levels ranges between 0 and 1.1 dB(A). [Table 5]

MAP 3

Measurement points in Barcelona's noise monitoring network

Source: Barcelona City Council

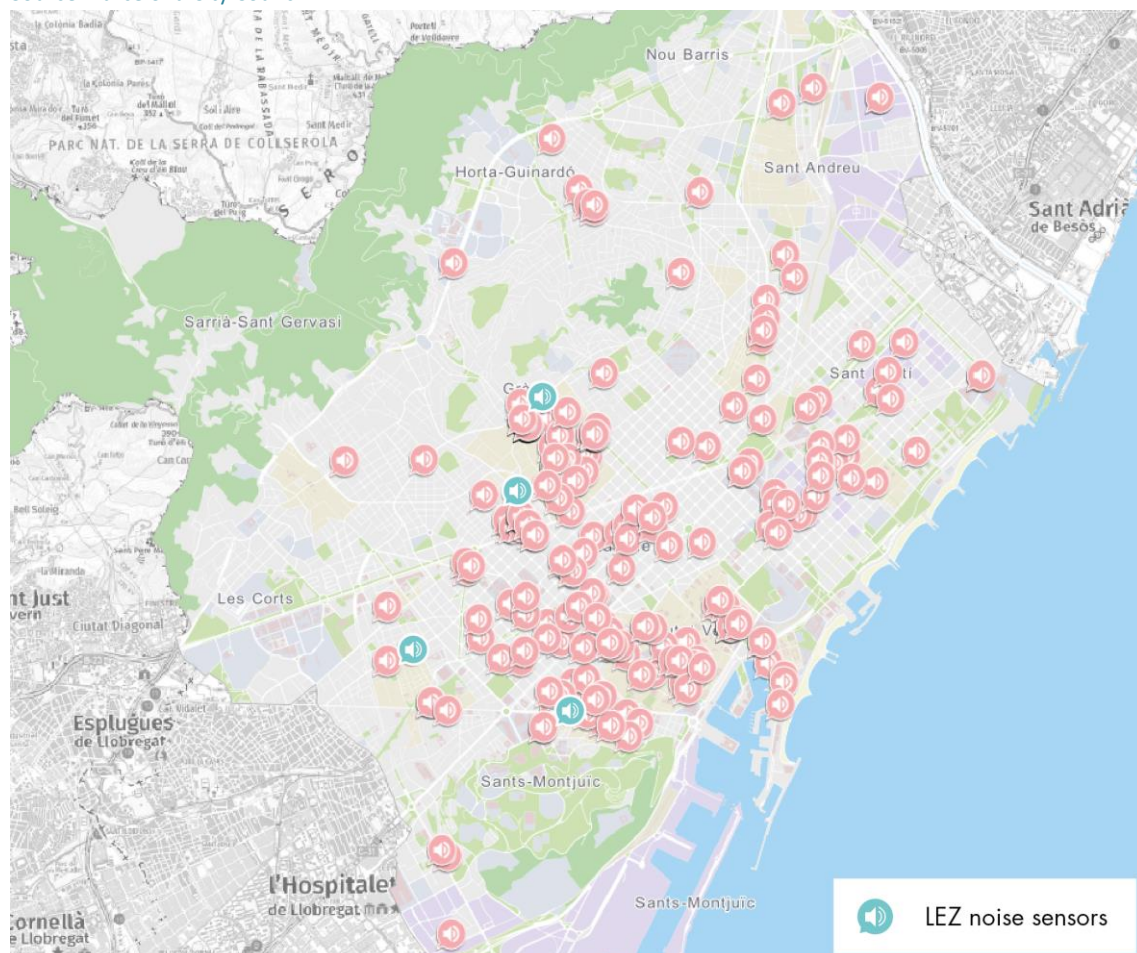
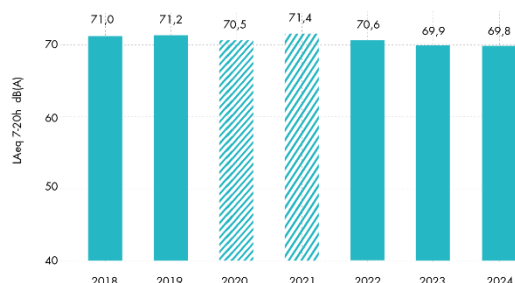


FIGURE 28

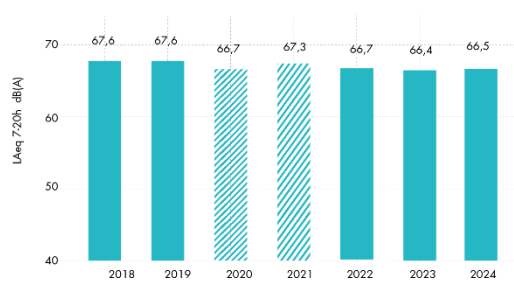
Annual evolution of the equivalent level LAeq7-20h

Source: Barcelona City Council

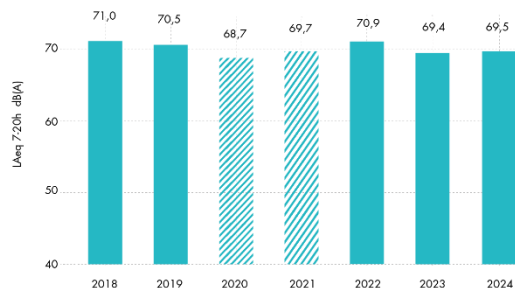
c/Balme - c/Marià Cubí



Pl. del Centre



Av. Paral·lel - c/Tamarit



Travessera de Dalt, 48

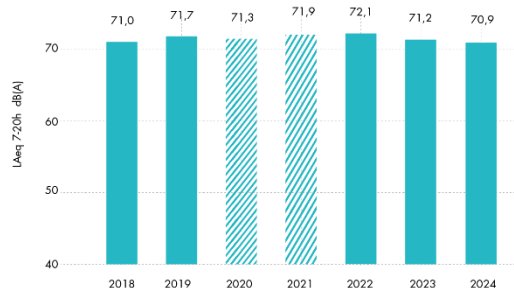


TABLE 8

Comparison of sound levels before and after the implementation of the LEZ

Source: Barcelona City Council

Measuring point	Sound pressure level Pre-LEZ	Sound pressure level Post-LEZ	Difference
c/Balme - c/Marià Cubí	71.1dB(A)	70.1dB(A)	-1dB(A)
Av. Paral·lel - c/Tamarit	70.7dB(A)	69.9dB(A)	-0.8dB(A)
Plaça del Centre	67.6dB(A)	66.5dB(A)	-1.1dB(A)
Travessera de Dalt, 48	71.4dB(A)	71.4dB(A)	0dB(A)

4.5 LEZ register

The data presented in this section of the report were provided by AMB Informació and cover all permits and exemptions requested for any of the LEZs in the Barcelona Metropolitan Area, not only for vehicles entering the Barcelona LEZ.

The active LEZs within the Barcelona Metropolitan Area in 2024 are as follows:

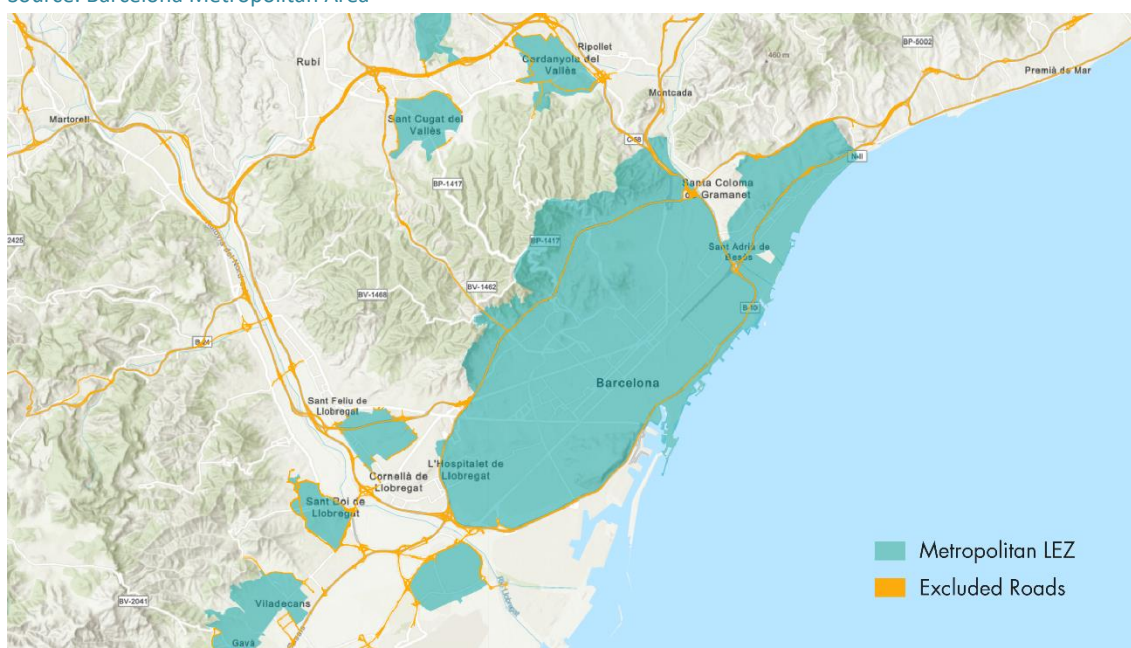
- **LEZ Rondes** (Barcelona, L'Hospitalet de Llobregat, Cornellà de Llobregat, Esplugues de Llobregat and Sant Adrià de Besòs) → Fines began in September 2020

- **LEZ Sant Cugat** → Fines began in November 2021
- **LEZ Sant Joan Despí** → Fines began in January 2022
- **LEZ Gavà** → Fines began in January 2025
- **LEZ Viladecans** → Fines began in January 2025
- **ZBE Sant Boi de Llobregat** → Fines began in January 2025
- **ZBE El Prat de Llobregat** → Fines began in January 2025
- **ZBE Cerdanyola del Vallès** → Fines began in January 2025

MAP 4

Low-Emission Zones in the Barcelona Metropolitan Area

Source: Barcelona Metropolitan Area



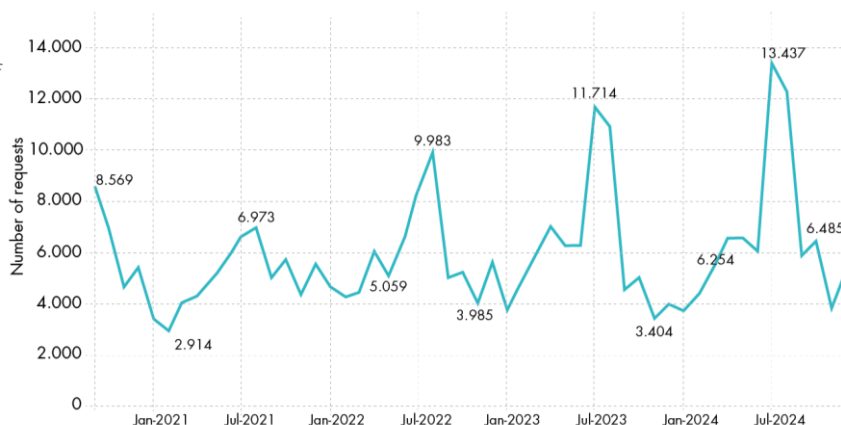
4.5.1 Trends in the number of applications submitted

The number of applications submitted to the LEZ register continues to grow year on year. A significant increase is observed during the summer months, due to the high number of foreign vehicles.

FIGURE 29

Trends in the number of applications

Source: AMB Informació



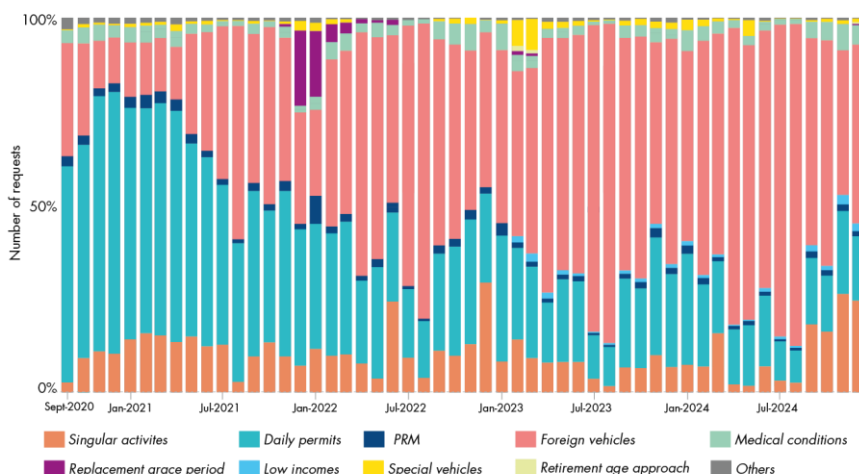
4.5.2 Trends in the number of applications by type

An analysis of permit requests by type shows a similar pattern to previous years. The most common request is for access by foreign vehicles, followed by daily permits and applications for special vehicles.

FIGURE 30

Trends in the number of applications by type

Source: AMB Informació



4.5.3 Daily permits

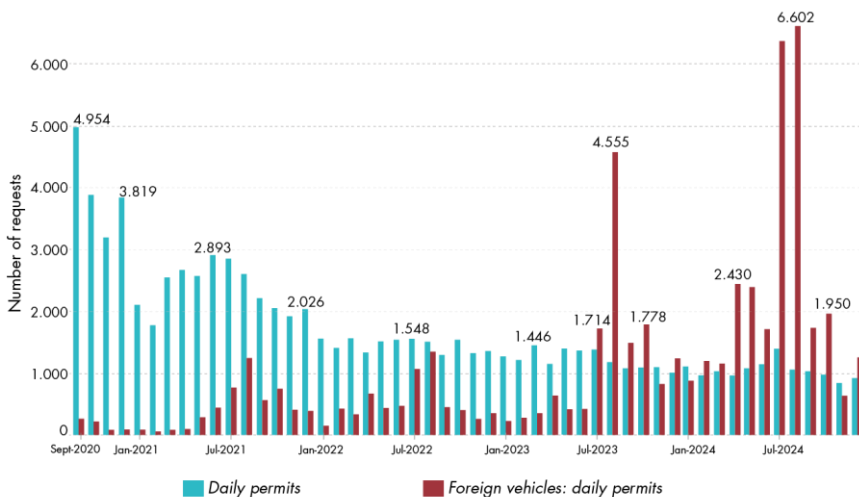
Vehicles without an environmental label from the DGT can request daily permits to enter the LEZ if they are previously registered in the Metropolitan Register of Foreign Vehicles and Other Vehicles Authorised in Low-Emission Zones. Non-foreign vehicles applying for registration in order to obtain a daily permit to enter and drive within the LEZ occasionally stabilised during 2022, but from mid-2023 onwards a slight downward trend can be detected.

The number of foreign vehicle registration requests rose significantly throughout 2024, particularly during the summer months (July and August).

FIGURE 31

Evolution of the number of applications for registration in the daily permits register

Source: AMB Informació



A total of 47,987 vehicles requested daily permits in 2024. Of these, 22,534 are vehicles without a label that occasionally enter the LEZ and 25,453 are foreign vehicles [Table 6].

The number of non-foreign vehicles without an environmental label entering the LEZ has remained stable since 2021.

Regarding the number of daily authorisations requested by local vehicles accessing the ZBE, there has been a 9% increase compared to the previous year. This has caused the average number of authorisations requested per vehicle to slightly increase.

In the case of foreign vehicles, both the number of vehicles and total number of permits rose significantly. The number of foreign vehicles requesting daily permits increased by 111%, and the total number of authorisations requested by these vehicles rose by 107%. The average number of permits requested per vehicle remained stable at around 2 requests per year.

TABLE 9

Annual data on the number of vehicles applying for daily permits and the number of applications

Source: AMB Informació

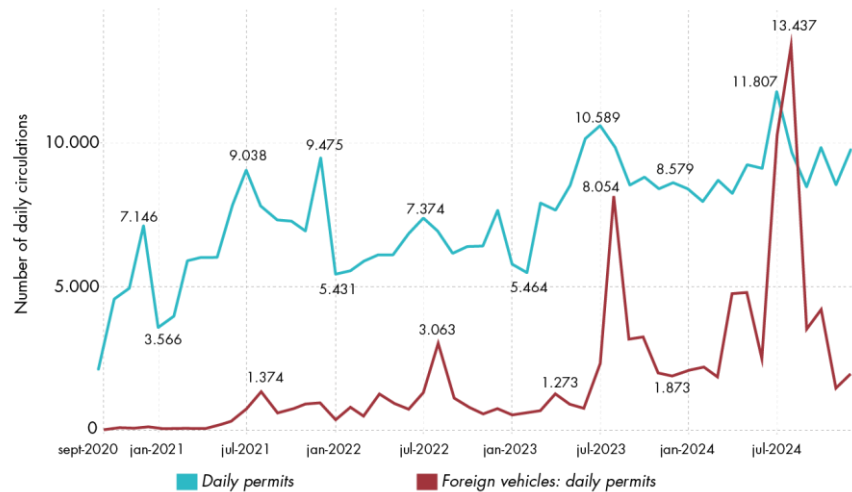
			2020	2021	2022	2023	2024
Number of vehicles requesting permits	Vehicles without a label that occasionally enter the LEZ		8.483	23.513	23.213	23.184	22.534
	Foreign vehicles requesting daily permits		176	3.188	5.235	12.040	25.453
Total permits requested	Vehicles without a label that occasionally enter the LEZ		18.867	80.989	76.722	100.016	109.425
	Foreign vehicles requesting daily permits		338	6.171	12.272	25.391	52.702
Average permits requested per vehicle	Vehicles without a label that occasionally enter the LEZ		2,22	3,4	3,3	4,3	4,9
	Foreign vehicles requesting daily permits		1,92	1,94	2,34	2,1	2.1

Analysing the distribution of days when daily authorisations were used by both local and foreign vehicles, it can be seen that these permits are most frequently used in the summer. July saw the highest level of local vehicle traffic, while the peak in daily permits requested by foreign vehicles was recorded in August.

FIGURE 32

Monthly trends in the use of daily permits (circulation)

Source: AMB Informació



4.5.4 New permits

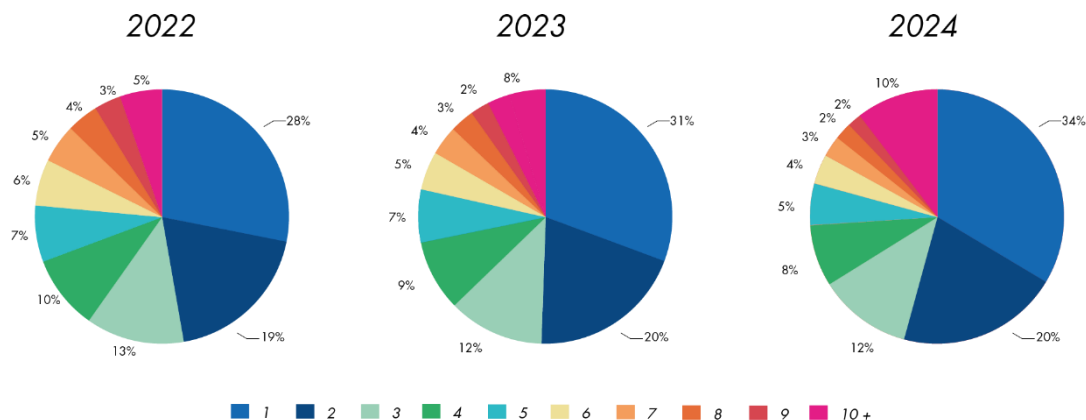
- **Vehicles occasionally entering or driving in the LEZ**

With the approval of the new Byelaw regulating Barcelona's low emission zone, starting 27 January 2023, vehicles that occasionally enter or drive in the LEZ have 24 daily permits per year, compared to the previous allowance of 10 daily authorisations per year.

FIGURE 33

Histogram of the number of daily permit requests per vehicle

Source: AMB Informació



To assess whether user patterns have changed following the update, the number of daily permits used by each vehicle registered in 2022, 2023 and 2024 was analysed. [Fig. 33]

Data from 2024 show an increase in the number of vehicles that requested 1 or 2 daily permits, now accounting for 54% of all requests. This confirms the occasional use of daily permits.

The number of vehicles requesting 10 or more permits also increased, rising from 8% to 10%.

- **Special vehicles**

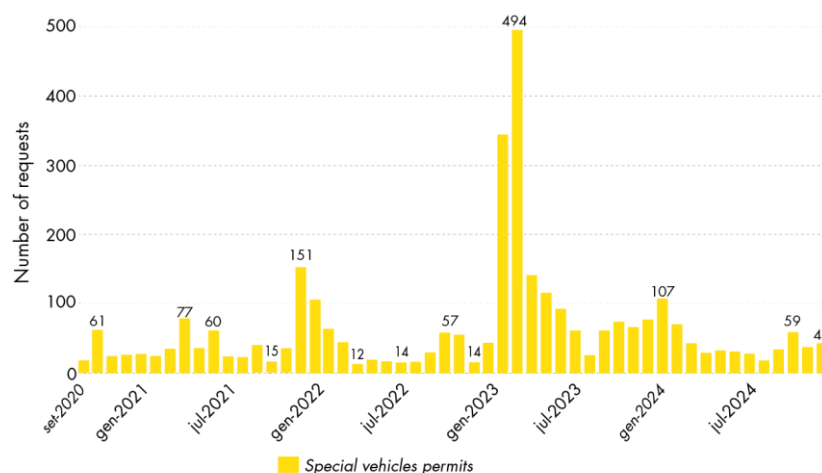
The revised byelaw for Special vehicles, according to classification by criteria of use, defined in accordance with Annex II of the General Vehicle Regulations, approved by Royal Decree 2822/1998, of 23 December, added several categories to the original list, primarily for vehicles used exclusively for construction works.

This change led to an increase in the number of permits in 2023, although numbers fell again in 2024.

FIGURE 34

Trends in the number of permit requests for special vehicles

Source: AMB Informació



- **Professionals close to retirement age**

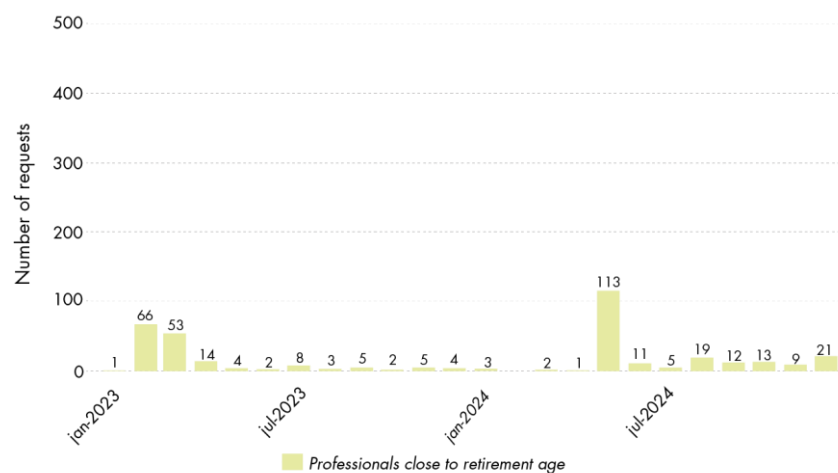
The new byelaw also introduced a permit for vehicles essential to a professional activity, provided the owner can prove they are within five years of reaching the legal retirement age under the Special Scheme for Self-Employed Workers (RETA), the General Social Security Scheme or another scheme, according to current legislation.

The number of accepted applications within this category was 167 in 2023, and 209 in 2024.

FIGURE 35

Trends in the number of permits for professionals nearing retirement

Source: AMB Informació



- Low-income individuals

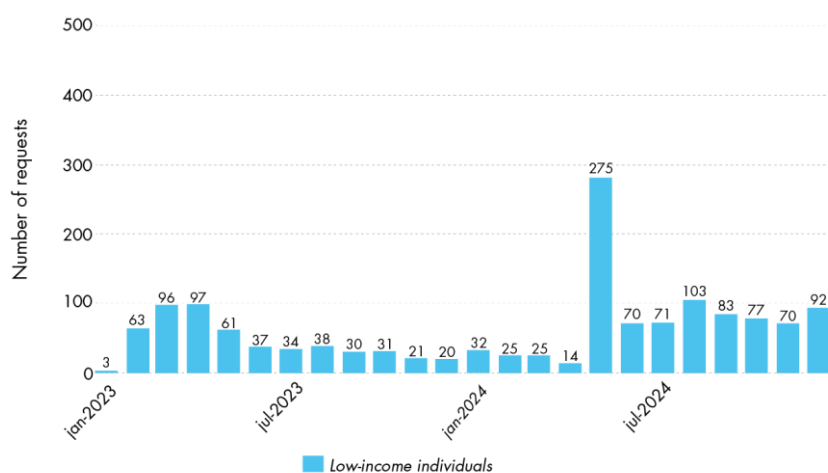
To provide support for low-income individuals, a new permit was introduced for vehicles whose owners can demonstrate that their total annual income (including pensions, benefits, earnings, assets, interest, etc.) is less than twice the Public Income Index (IPREM), adjusted for household size and calculated based on total household income.

The annual number of accepted applications within this category was 531 in 2023 and 937 in 2024. The increase observed in mid-2024 is due to the incorporation of new ZBEs into the metropolitan registry.

FIGURE 36

Trends in the number of permit requests for low-income individuals

Source: AMB Informació



- Moratorium for replacement

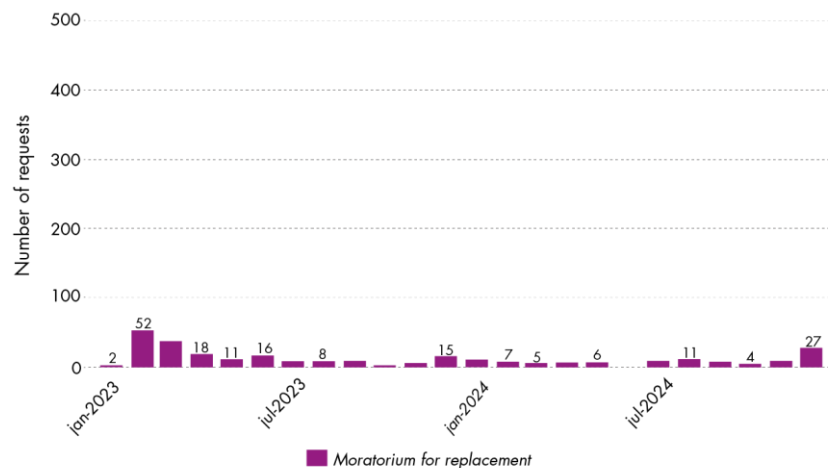
To address the situation in the electronic components market for the automotive sector, which has led to longer delivery times for new vehicles, a new permit was introduced for vehicles whose owners can provide proof of purchase of a new motor vehicle that meets the technological and emissions requirements equivalent to the environmental labels.

There were 182 requests under this category in 2023, with the number falling to 99 in 2024.

FIGURE 37

Trends in the number of vehicle replacement moratorium permits

Source: AMB Informació



4.5.5 Trends in the number of green cards

Green cards are a free transport pass granted to residents of the metropolitan area when they deregister and scrap a vehicle without an environmental label.

The number of green cards issued can give an indication of the number of vehicles without a label that have been scrapped.

As shown in the following chart, the number of green card requests decreased slightly in 2024 compared to previous years, stabilising at around 50 approved requests per month.

FIGURE 38

Trends in the number of green card applications

Source: AMB Informació

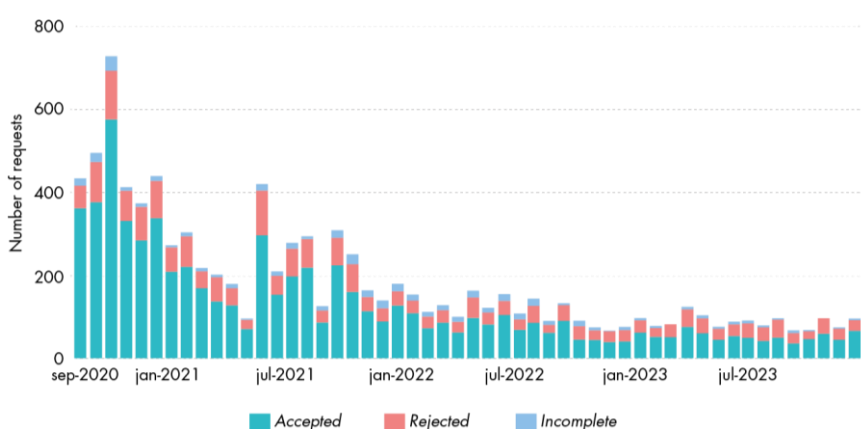


TABLE 10

Annual data on the number of vehicles applying for the green card.

Source: AMB Informació

		2020	2021	2022	2023	2024
Green card applications	Accepted	4,872	2,426	1,322	731	617
	Rejected	967	757	459	352	383
	Incomplete	184	97	166	97	40

4.6 Fines

To assess compliance with the measure, the Municipal Tax Office of Barcelona City Council provides weekly updates on the status of fines.

4.6.1 Number of fines

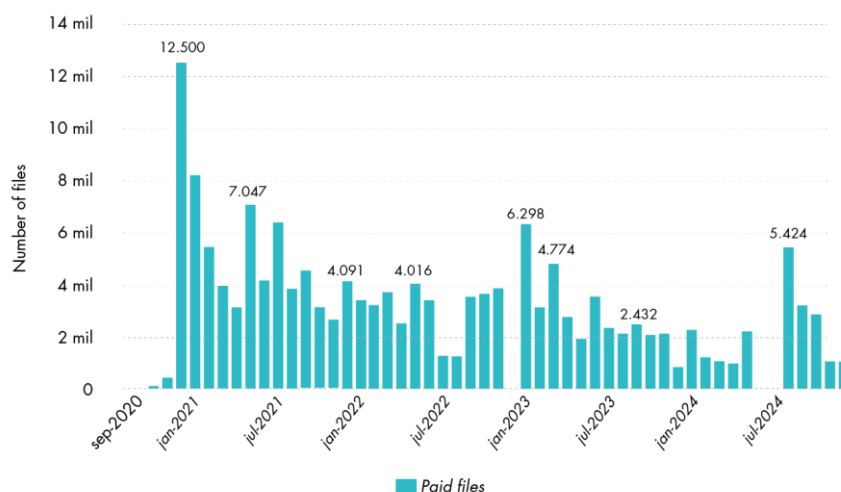
The number of fines per month has patterned as expected, taking into account what has been seen in other cities. Concluded proceedings are those for which payment has been completed.

The number of fines imposed has gradually decreased since the introduction of the measure. In 2024, a total of 61,426 fines were imposed – the lowest number recorded since the measure was implemented.

FIGURE 39

Trends in the number of fines paid

Source: Municipal Tax Office Barcelona City Council

**TABLE 11**

Annual data on the number of pending and paid fines

Source: Municipal Tax Office

	2020*	2021	2022	2023	2024
Number of fines imposed	68,231*	139,527	90,100	82,163	61,426
Number of paid fines	12,882*	56,263	33,498	33,977	21,148

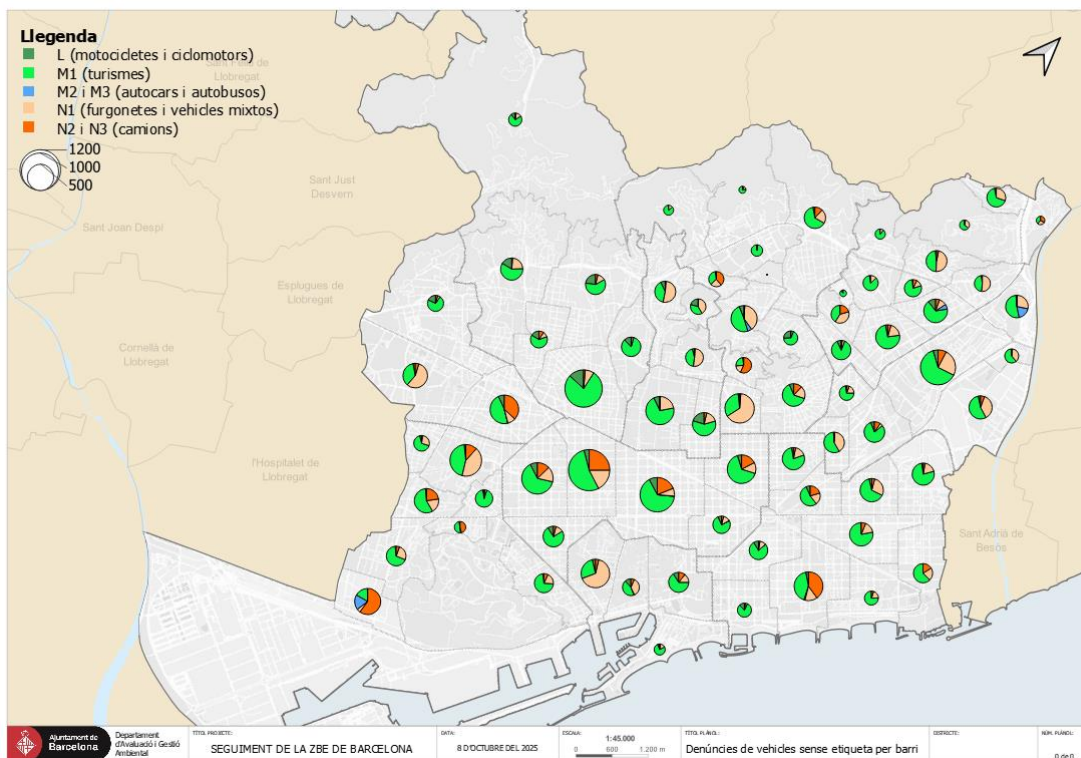
*Data for the last quarter of 2020

An analysis of the distribution of fines by the neighbourhood where the vehicle is registered shows that most cases involve vehicles registered in central areas of the city, which also have the highest population densities. When the analysis is broken down by vehicle type, the distribution varies depending on the predominant uses within each neighbourhood. In La Marina del Prat Vermell, for example, most reported vehicles are professional vehicles (lorries), whereas in more residential areas, most are passenger cars. The motorcycles and mopeds with the highest number of fines are registered in the Sarrià–Sant Gervasi district.

MAP 5

Distribution of fines by vehicle type

Source: Barcelona Metropolitan Area



5. Conclusions

1. In 2024, restrictions within the Barcelona LEZ remained in force for vehicles without a DGT environmental label. In terms of regulation, Decree 132/2024, enacted on 30 July 2024, defined the criteria for the implementation and management of LEZs across Catalonia, setting out a timeline of future restrictions through to 2028.
2. In 2024, the city recorded the lowest levels of air pollution since records began, and for the second consecutive year, it complied with the limit values established by Directive 2008/50/EC at all monitoring stations across the city. Specifically, in 2024, the annual average at traffic stations was $33 \mu\text{g}/\text{m}^3$ at the Eixample station and $27 \mu\text{g}/\text{m}^3$ at the Gràcia – Sant Gervasi station, improving on the figures from the previous year. The NO_2 levels currently measured at some XVPCA stations in Barcelona exceed the new limit values set by Directive 2024/2881, which must be met by January 1, 2030. However, the remaining stations already comply with these future requirements.
3. Regarding PM_{10} and $\text{PM}_{2.5}$ particles, the last decade shows a slightly downward trend, remaining within the current legal limit, and aiming to meet the new values set by Directive 2024/2881 by 2030 ($20 \mu\text{g}/\text{m}^3$ for PM_{10} and $10 \mu\text{g}/\text{m}^3$ for $\text{PM}_{2.5}$).
4. For the first time, ozone data were included in the annual monitoring report, in compliance with Decree 132/2024. While ozone levels exceeded the WHO's 8-hour guideline value of $100 \mu\text{g}/\text{m}^3$, they remained within the current EU's target thresholds.
5. NO_x emissions from road traffic continued to decrease compared to previous years, while levels of particulate matter remained stable over the past year compared to previous years.
6. With regard to the climate change mitigation monitoring indicators, energy consumption in the transport sector decreased slightly compared to the previous year, with diesel accounting for less than 50% of automotive energy consumption for the first time. Greenhouse gas emissions also continued to decline slightly.
7. Annual mobility in 2024 showed signs of stabilisation after the decline during the COVID-19 pandemic. Figures for the past three years are higher than in 2020 and 2021, but have not yet returned to pre-pandemic levels.
8. The modal share for 2024 showed an increase in public transport use, both for internal and connecting trips. Private vehicle use continued to account for 12% of internal trips, and dropped slightly to 42% in the case of connecting trips.
9. Annual emission factors of the vehicle fleet detected by the ZBE control cameras continued to decrease, maintaining the same trend. When comparing the 2024 values with those from the year before the measure was implemented (2019), there is a clear

and significant reduction in NO_x and black carbon emission factors. As a result, emissions of these pollutants have fallen by around 50%. In the case of particulate matter (PM_{10} and $\text{PM}_{2.5}$), the reduction is smaller but still stands at around 25%.

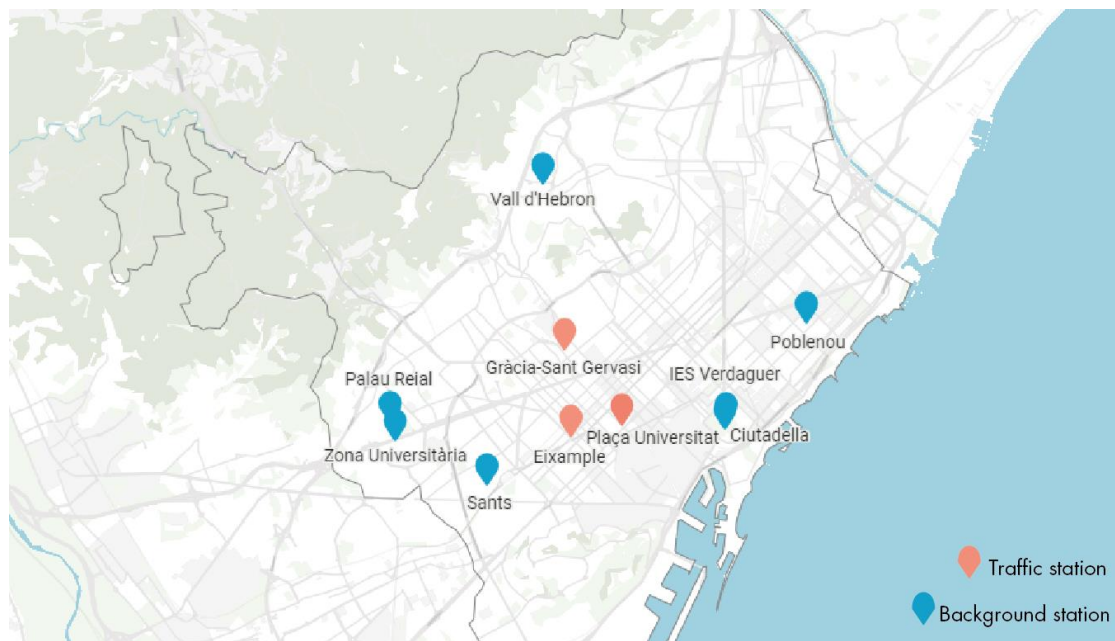
10. The evolution of the vehicle fleet by environmental label in 2024 follows a trend similar to that of the previous year. The percentage of vehicles without an environmental label has stabilised at around 1%, while the number of vehicles with a B label continues to decline. As of December 2024, vehicles with a B label accounted for 14.5% of the fleet in circulation. Meanwhile, 0 and ECO label vehicles continue to increase slightly. The number of foreign vehicles also rose and is no longer concentrated solely in the summer months. The most notable decrease was observed in the number of non-labelled coaches.
11. The average age of registered vehicles in Barcelona increased by 0.2 years, reaching 11.6 years. The national average age of registered passenger cars is considerably higher at 14.5 years.
12. Sound pressure levels recorded at control points in 2024 show a slight decline across all locations.
13. Data from the metropolitan register of authorisations and exemptions show that the most common request continues to be for foreign vehicle access, followed by daily permits and special vehicle applications. Occasional use of daily permits is confirmed, with 54% of registered vehicles having requested only 1 or 2.
14. There was a decline in green card requests, with around 50 received per month.
15. The number of fines has continued to fall since the LEZ was introduced.

Annex 1. Locations of fixed monitoring points

MAP

Location of the Barcelona Air Pollution Monitoring and Forecasting Network (XVPCA) stations.

Source: Barcelona City Council



TABLE

Location of the Barcelona Air Pollution Monitoring and Forecasting Network (XVPCA) stations.

Source: Barcelona City Council

	Location	Type
Ciutadella	Parc de la Ciutadella	Background
IES Verdaguer	Parc de la Ciutadella (IES Verdaguer)	Background
Eixample	Av. Roma - c/Comte Urgell	Traffic
Gràcia – Sant Gervasi	Plaça de Gal·la Plàcidia (Via Augusta – Travessera de Gràcia)	Traffic
Poblenou	Jardins de Josep Trueta (c/ Pujades – c/ Lope de Vega)	Background
Sants	Jardins de Can Mantega (c/ Joan Güell)	Background
Plaça de la Universitat	c/Balmes – Gran Via de les Corts Catalanes	Traffic
Zona Universitària	Av. Diagonal, 643– Biology Faculty	Background
Vall d'Hebron	Parc de la Vall d'Hebron (c/ Martí Codolar – c/ de la Granja Vella)	Background
Palau Reial	c/John Maynard Keynes – c/ Jordi Girona	Background

References

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- ¹ World Health Organization. 2021. *New WHO Global Air Quality Guidelines aim to save millions of lives from air pollution*. Available at: <https://www.who.int/en/news/item/22-09-2021-new-who-global-air-quality-guidelines-aim-to-save-millions-of-lives-from-air-pollution>
- ² European Environment Agency (EEA). 2024. *Health and environment impacts of air pollution exposure remain high across Europe*. Available at: <https://www.eea.europa.eu/en/newsroom/news/health-and-environment-impacts-of-air-pollution>
- ³ Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe. Available at: <https://www.boe.es/buscar/doc.php?id=DOUE-L-2008-81053>
- ⁴ Royal Decree 102/2011, of 28 January, concerning the improvement of air quality. Available at: <https://www.boe.es/buscar/act.php?id=BOE-A-2011-1645>
- ⁵ World Health Organization. 2021. *WHO global air quality guidelines*. Available at: <https://www.who.int/publications/i/item/9789240034228>
- ⁶ Barcelona Public Health Agency. 2025. *Avaluació de la qualitat de l'aire a la ciutat de Barcelona 2024* [Assessment of air quality in the city of Barcelona 2024]. Available at: https://www.aspb.cat/wp-content/uploads/2021/07/Informe_qualitat-aire-Barcelona-2024-250709.pdf
- ⁷ Government of Catalonia. 2025. *Què és l'ozó troposfèric?* [What is tropospheric ozone?]. Available at: https://mediambient.gencat.cat/ca/05_ambits_dactuacio/atmosfera/qualitat_de_laire/avaluacio/campanya_ozo/que_es_lozo_troposferic/index.html