EXPECTED EFFECTS FROM THE **LOW EMISSIONS ZONE** ON **CAR FLEET** AND **AIR QUALITY** IN THE BRUSSELS REGION

AUGUST 2018

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INTRODUCTION

Air pollution from road traffic affects everyone's health and living standards. It is the cause of premature deaths and major health problems (respiratory and cardio-vascular illnesses, etc.) and affects especially the most vulnerable people, like children and the elderly. In 2014, Belgium recorded 8,340 premature deaths due to exposure to fine particles, 1,870 premature deaths due to exposure to nitrogen dioxide and 190 premature deaths due to exposure to the ozone.[1]

The aim of the Low Emission Zone (LEZ) is to improve air quality by gradually banning the most polluting vehicles from being driven in the Brussels-Capital Region (BCR). The LEZ covers the entire region except for the Ring and certain routes providing access to park and ride facilities. This involves cars, vans (≤ 3.5 t), buses and coaches.

The purpose of this analysis is to estimate the impact of the LEZ on cars registered in the Brussels-Capital Region (RBC), on pollutant emissions from road transport and on air quality in RBC.

[1] Annual report from the European Environment Agency, 2017.

1.
IMPACT OF THE LEZ ON THE REGION'S CAR FLEET

VEHICLES REGISTERED IN THE BRUSSELS REGION

We do not currently have precise information on vehicles that are *driven* in RBC. Conversely, we know what types of vehicle are *registered* in the Region.[2]

- An estimated 600,000 **motor vehicles** iare registered in RBC, including some 80% cars, 12% goods vehicles, 6% motorbikes and less than 1% buses and coaches.[3]
- Of the 500,000 **cars** registered in RBC, about 37% are company cars compared with 15% for the whole of Belgium.[4] This can be explained by the large concentration of leasing companies based in Brussels. These company cars are also normally far newer than privately-owned cars.[5]
- In 2017, cars registered in RBC were broken down into 57% **diesel cars** and 40% **petrol cars.** Note that the proportion of diesel cars has been dropping since 2015. The less polluting **alternatives** to traditional cars (hybrids, natural gas (CNG), and electric vehicles) account for about 2% of the total car population.[6]
- Private cars registered in RBC are on average older than in the rest of the country (12 years in RBC against 9 years in Belgium).[7]
- Lastly, an estimated 45% of Brussels households do not own a car (compared with 17% for the whole of Belgium).[8]

[2] Caution, the place of registration does not necessarily provide information on the vehicles being driven in the Brussels Region. Also, many company vehicles are not being driven in the regional territory despite being registered in the Brussels Region. Conversely, many commuters travel into the Brussels Region by car but their vehicle is registered elsewhere. Add to that the foreign vehicles entering the RBC.
[3] Data as at 1 August 2017, IBSA, available here: http://ibsa.brussels/themes/mobilite-et-transport/mobilite-et-transport#.Wq-_QmrOW70
[4] FEBIAC 2016. The FEBIAC classification includes three categories of vehicle: «company cars», «leasing» and «self-employed». Half the company cars in RBC are leased, with a very low average age (1.5 years).
[5] About 3 years old for company cars and 12 for privately-owned cars (Analysis of the Belgian Car Fleet, May 2016, VITO, available here: http://ecoscore.be/files/Analysis_CarFleet2016.pdf).
[6] Data for 2017 (IBSA, August 2017).
[7] Analysis of the Belgian Car Fleet, May 2016, VITO, available here: http://ecoscore.be/files/Analysis_CarFleet2016.pdf
[8] Average of surveys conducted in 2012, 2014 and 2016. Source: Statbel (EBM) via IBSA (Mini-Bru, «La Région de Bruxelles-Capitale en chiffres» 2018).

WHICH VEHICLES ARE AFFECTED BY THE LEZ?

The LEZ involves **cars, vans (≤ 3.5t), buses and coaches**.[9] Access restrictions depend on **the fuel and Euro standard** (therefore the age) of the vehicle. Diesel vehicles are the most affected, starting with the oldest as they are the most polluting (see box «Diesel engines and air quality», page 12).

The LEZ access criteria and timetable are established as follows:

DIESEL	2018	2019	2020	2021	2022	2023	2024	2025
EURO : 6, 6b, 6d, temp / VI	Access	Access	Access	Access	Access	Access	Access	Access
EURO : 5, 5a, 5b / V or EEV	Access	Access	Access	Access	Access	Access	Access	**No access***
EURO 4 / IV	Access	Access	Access	Access	**No access***	**No access***	**No access***	**No access***
EURO 3 / III	Access	Access	**No access***	**No access***	**No access***	**No access***	**No access***	**Pas d'accès***
EURO 2 / II	Accès	**No access***	**No access***	**No access***	**No access***	**No access***	**No access***	**No access***
EURO 1 / I	**No access***	**No access***	**No access***	**No access***	**No access***	**No access***	**No access***	**Pas d'accès***
No EURO standard	**No access***	**No access***	**No access***	**No access***	**No access***	**No access***	**No access***	**No access***

** A maximum of 8 days per year and per vehicle is possible by purchasing a paid-for day pass.*

PETROL/LPG/CNG	2018	2019	2020	2021	2022	2023	2024	2025
EURO : 6, 6b, 6d, temp / VI	Access	Access	Access	Access	Access	Access	Access	Access
EURO : 5, 5a, 5b / V or EEV	Access	Access	Access	Access	Access	Access	Access	Access
EURO 4 / IV	Access	Access	Accès	Access	Access	Access	Access	Access
EURO 3 / III	Access	Access	Access	Access	Access	Access	Access	Access
EURO 2 / II	Access	Access	Access	Access	Access	Access	Access	**No access***
EURO 1 / I	Access	**No access***	**No access***	**No access***	**No access***	**No access***	**No access***	**No access***
No EURO standard	Access	**No access***	**No access***	**No access***	**No access***	**No access***	**No access***	**No access***

** A maximum of 8 days per year and per vehicle is possible by purchasing a paid-for day pass..*

[9] Vehicles of more than 3.5 t designed for transporting goods are exempted due to the fact that they are already subject to a kilometric tax which is implemented since April 1st, 2016 in the BCR.

The Euro standard is used to assess the age of the vehicle that will be denied access :

	2018		2019		2020		2022		2025	
Affected vehicles	Euro standard	Age (years)	Euro standard	Age (years)	Euro standard	Age (years)	Euro standard	Age (years)	Euro standard	Age (years)
Diesel	0/1	≥ 22	0/1/2	≥ 19	0/1/2/3	≥ 15	0/1/2/3/4	≥ 12	0/1/2/3/4/5	≥ 9
Petrol			0/1	≥ 23	0/1	≥ 24	0/1	≥ 26	0/1	≥ 25

Based on various conditions, certain exemptions are planned for specific vehicles, for example for the «oldtimers». An overview of all exemptions is available on the site www.lez.brussels.

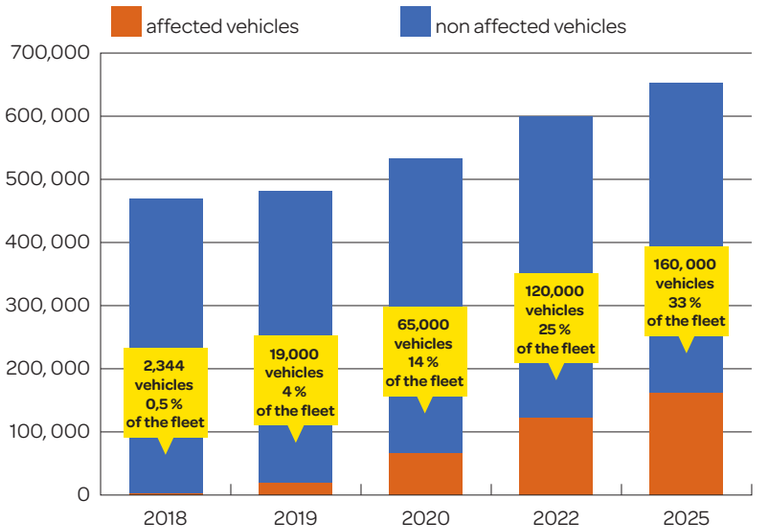
IMPACT OF THE LEZ ON THE CAR FLEET IN BRUSSELS

To understand the impact of the LEZ on the car population in Brussels, Bruxelles Fiscalité, Bruxelles Environnement and Bruxelles Mobilité have modelled changes to the population in business-as-usual conditions, i.e. where the LEZ is not established. This model estimates the number of vehicles deemed «too» polluting between 2018 and 2025 according to the criteria established by the LEZ.

[10] Vehicles with a Belgian «O» registration plate (or which have been registered with the DIV as «oldtimer» (classic car)) and which are more than thirty years old are exempt, as are vehicles used for commercial purposes, where the «oldtimer» vehicle is part of the business concept and is more than thirty years old. For information, there were 3182 vehicles registered in the Brussels region under a Belgian «O» plate in 2016 (FEBIAC, 2016).

Thus, the table below indicates the number of non-compliant Brussels cars[11], vans, buses and coaches which, between 2018 and 2025, would have continued to be driven if the LEZ had not been introduced. This model has been calibrated on the composition of the vehicle population in September 2016, and among other things, of data from the Direction de l'Immatriculation des Véhicules (DIV - Belgian Vehicle Registration Division)[12] . The impact on vehicles which are not registered in Brussels (Belgian and foreign vehicles) is not included the analysis due to the lack of reliable information on the number and the environmental characteristics of those vehicles.

Changes in the number of vehicles (cars, vans, buses/coaches) registered in RBC and affected vehicles by the driving ban between 2018 and 2025 (in a non-LEZ situation)



In an evolving situation without LEZ, an estimated 0.5% of cars registered in Brussels (leasing excluded) would be affected by the driving ban in 2018. This proportion would gradually increase and reach about one third of the vehicle population in 2025.

The majority of Brussels vehicles affected by the driving ban are cars (57% in 2018, 80% in 2020). In 2018, 40% of non-compliant vehicles are vans, but this proportion diminishes over time (20% in 2019 and 18% in 2020)[13]. It is difficult to determine the proportion of buses and coaches registered in Brussels that are affected. Especially given their low numbers and the poor quality of data available about old vehicles in the DIV database.

[11] Leased vehicles which, given their low age, could falsify the representation of the vehicle population, have been excluded from the analysis on the impact of the LEZ on the vehicle population.

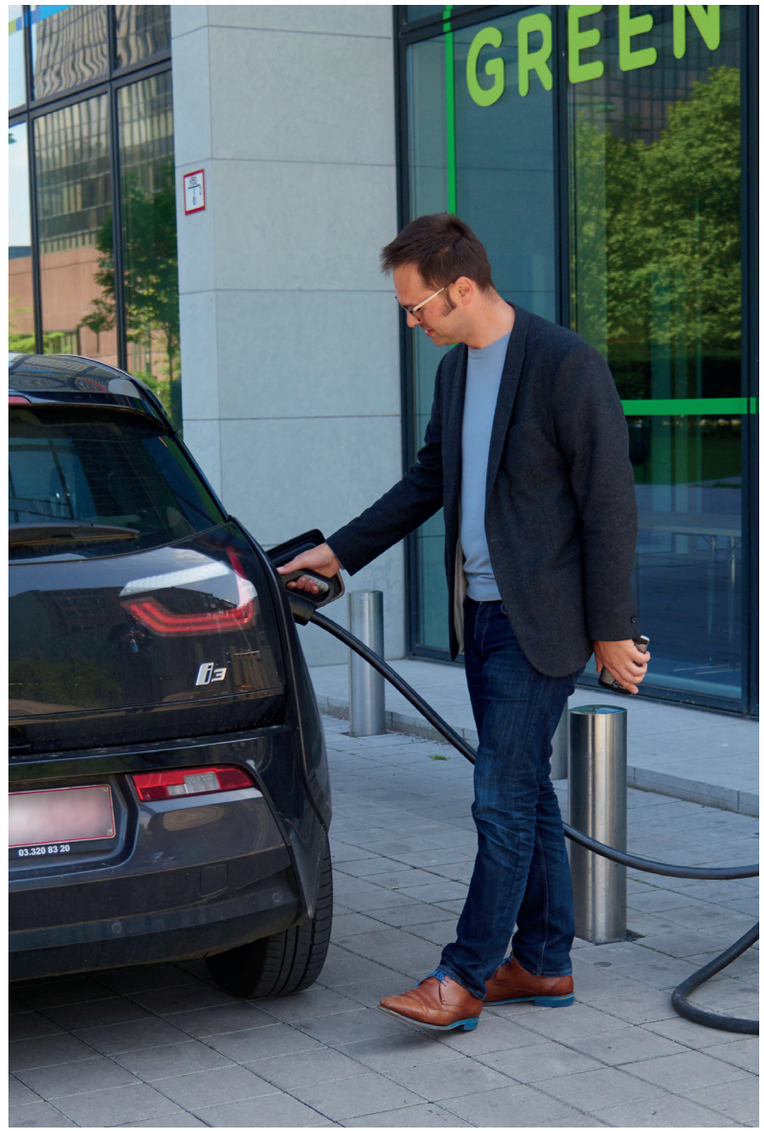
[12] For the purposes of our analysis, we have made a correction to the DIV database that involves removing many old vehicles from the database as they are no longer on the road. Based on the SPF Mobility and Transport analysis of data from technical testing stations and data on collecting traffic taxes (SPF Finance), the result is an 80% reduction in the number of diesel and petrol pre-Euro vehicles concerned by the LEZ in the first year. Note: this correction has little impact on our estimations of polluting emissions presented further on given the low number of kilometres travelled by these vehicles.

[13] Conversely, the proportion of vehicles affected is higher among vans than among cars: 15% of vans will be affected by the LEZ in 2020, against approximately 9% for cars. Source: analysis of TRAJECT and Transport & Mobility Leuven on support measures under implementation of a low emissions zone in Brussels-Capital Region, August 2017.

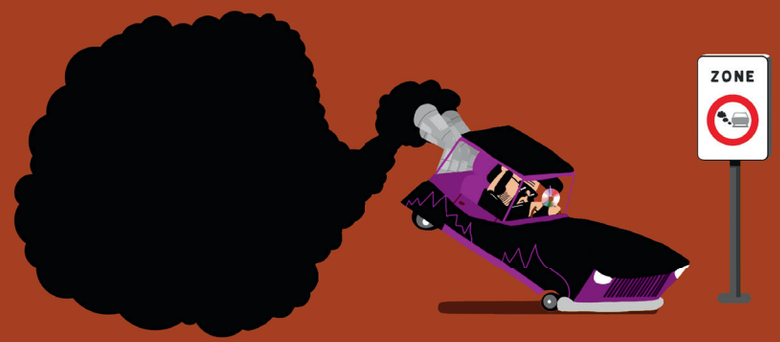
Note that these projections are based on a certain number of hypotheses, namely:

- The growth rate of the vehicle population is a linear extrapolation of past years.
- Changes in the composition of the vehicle population (fuel and Euro standard) do not take account of possible changes in behaviour and purchasing choice, both of which could be influenced by the LEZ or other mobility policies.
- In the model, no consideration is given either to the fact that certain vehicles, for example certain cars over thirty years old, can be exempt from the driving ban.

These hypotheses make our analysis a "hard-line" estimation of vehicles affected. In other words: for the years to come, we are expecting the number of people facing the driving ban to be lower in reality, thanks to changes in behaviour induced by the LEZ or other mobility policies.



2.
IMPACT OF THE LEZ ON AIR QUALITY IN BRUSSELS REGION



AIR QUALITY IN BRUSSELS REGION

Outdoor air quality in Brussels Region has improved over the last decades. PM_{10} emissions have dropped radically, with a 72% reduction between 1990 and 2016, all sectors together. NO_X emissions dropped by approximately 52% between 1990 and 2016.[14]

Given that, there are still problems. In particular, the average annual concentrations of **nitrogen dioxide (NO_2)** in the air are still higher than the European legal limit in places where road traffic is at its densest. The European Commission has launched an infringement action against Belgium for failure to comply with this standard. In addition, despite the Region complying with European standards for **fine particles (PM_{10} et $PM_{2.5}$)**, it nevertheless exceeds the guide values recommended by the World Health Organisation for these pollutants.

Emissions and concentrations: what is the difference ?

When talking about air pollution, a distinction is to be made between pollutant *emissions* and *concentrations*.

- Pollutant emissions are amounts of pollutants discharged into the atmosphere, for example by cars, heating or farming. They are often expressed in tons or kilotons per year.
- Pollutant concentrations relate to the quality of the air we are breathing. They are normally expressed in micrograms per cubic metre (µg/m³).

Ambient air quality standards

Concerned with protecting public health, the European countries, including Belgium, have committed to complying with **European standards on ambient air quality**.[15] For PM_{10}, the countries must comply with a limit of 50 µg/m³ as a daily average (with a maximum of 35 days overrun permitted per year) and a limit of 40 µg/m³ cas an annual average. They must comply with a maximum annual concentration of 25 µg/m³ for $PM_{2.5}$ and 40 µg/m³ for NO_2. Despite improvements, compliance is not yet achieved everywhere throughout the RBC territory, which is why the European Commission has launched an infringement procedure against Belgium.

The European standards are different from **the World Health Organisation (WHO) guidelines** (see table below) which are based on epidemiological and toxicological studies to determine recommended concentrations and have no regulatory value.[16]

European standards and WHO guide values

Air quality standards (concentrations, annual averages)		
	European directive	**WHO guide values**
NO_2	40 µg/m³	40 µg/m³
PM_{10}	40 µg/m³	20 µg/m³
$PM_{2.5}$	25 µg/m³	10 µg/m³

[14] Inventories of RBC emissions, 2018. There are many factors that explain these reduced emissions. The technological improvement of lorry engines and (to a lesser extent) car engines, standardisation of autocatalysts, installing a filter in the incinerator, installing a fume washing system («DeNOx») in the Neder-Over-Heembeek waste incinerator and the closing of the Marly coke plant are some of the main reasons for reduced NO_x et PM_{10}. For more information, see l'Etat de l'Environnement of Bruxelles Environnement.

[15] Directive 2008/50/EC available here http://eur-lex.europa.eu/legal-content/en/ALL/?uri=CELEX:32008L0050

[16] All WHO guide values are available here: http://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health

ROAD TRANSPORT AND AIR QUALITY

Road transport is one of the main sources of greenhouse gases in RBC. Locally, it is also responsible for atmospheric pollutant emissions that impair air quality and affect our health. There are two types of emissions :

- **Exhaust gases** contain toxic substances such as nitrogen oxides (NO_x), fine particles (PM_{10} and $PM_{2.5}$), sulphur oxides (SO_x), carbon monoxide (CO) and several heavy metals. These emissions vary according to the type of fuel and the Euro standard (and age) of the vehicle.
- **Tyre, brake and road surface abrasion** produce emissions of fine particles and heavy metals that vary especially according to the weight of the vehicle.

Pollutant emissions from road transport impact human health in various ways, mainly:

- Exposure to **fine particles (PM_{10} and $PM_{2.5}$) and black carbon (BC**) contributes to a rise in the number of premature deaths from cardio-vascular or respiratory afflictions, especially in sensitive subjects (children and the elderly). The fine particles are so small that they can reach the narrowest airways in bronchial tubes and pulmonary alveoli and cause respiratory complications. The smallest paticules go as far as passing through the cell membrane and can cause cardio-vascular problems. The particles can also convey toxic, allergenic, mutagenic or carcinogenic compounds such as polycyclic aromatic hydrocarbons and heavy metals.

- **Nitrogen dioxide (NO_2)** is a gas can that can cause respiratory difficulties and bronchial hyper-reactivity in sensitive people. It can also increase the sensitivity of the bronchial tubes in infections in children.

- Certain exhaust gases like the NO_x react in air and help to form **ground-level ozone**. Exposure to this ozone can irritate the eyes, mucous membranes and respiratory tract.

In RBC, road transport is the main source of NO_x and BC emissions and a major source of PM. (see graphs below).

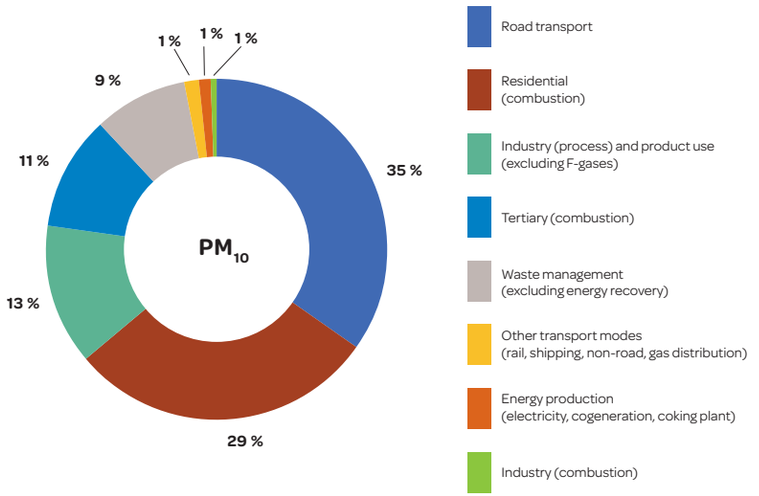
Diesel engines and air quality

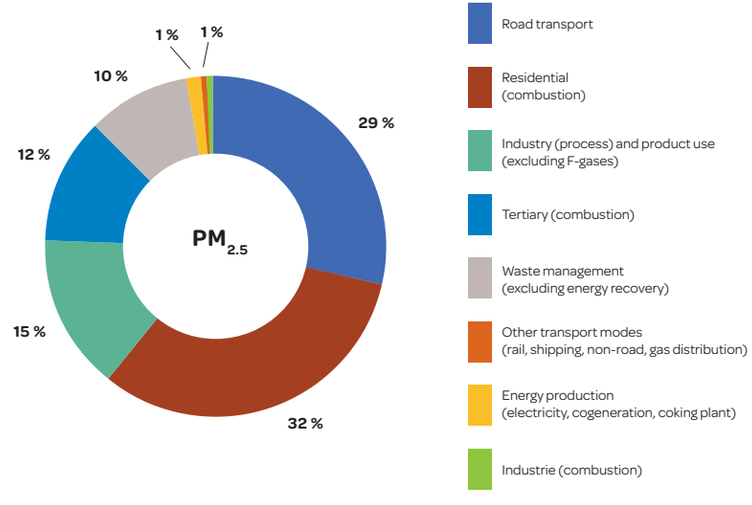
Diesel cars account for the largest share of the Brussels car population before petrol cars, despite a downward trend since 2015.[17]
Vehicles with diesel engines produce emissions that are especially harmful to human health. In 2012, the WHO International Agency for Research on Cancer classified diesel engine exhaust gases as “certainly carcinogenic to humans”.[18] In particular :

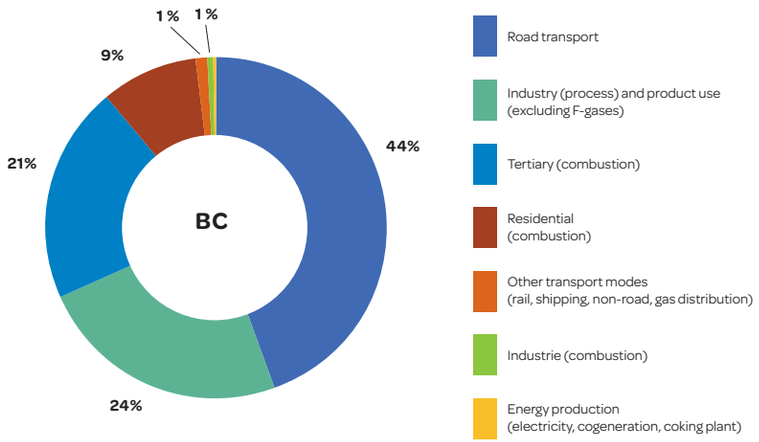
- **NO_x emissions** from diesel engines measured in real conditions are more than 10 times greater than from petrol engines, even for recent Euro 6 vehicles.[19] (see box “Problems of “real” NO_x emissions for diesel cars ”, page 16).
- Diesel vehicles are a major source of **fine particle (PM) and black carbon (BC)** emissions. Note nevertheless that recent diesel vehicles (Euro standards 5 and 6) are now fitted with particle filters that reduce PM and BC emissions.[20]

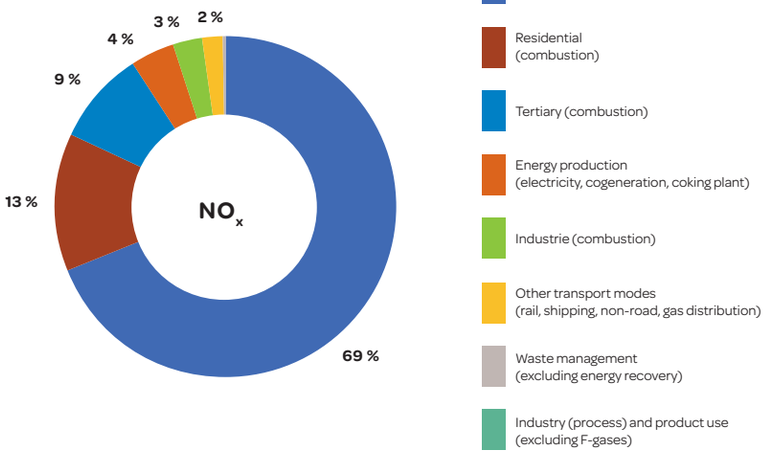
[17] IBSA statistics : http://ibsa.brussels/fichiers/chiffres/13.1_mobilite_transport_vehicules_reseau.xls
[18] Diesel engine exhaust carcinogenic, Press release n°213, IARC, 12 June 2012
[19] A diesel-engine Euro 6 car is estimated to emit approximately 11 times more NOx that an equivalent petrol Euro 6 car («old» test cycle, for a car between 1.4 and 2 l). Source: Brussels Region transport inventory 2017.
[20] Particle filters function however less well in an urban context given the greater number of short journeys that clog the filter more quickly.

Emissions of atmospheric pollutants (BC, PM_{10}, $PM_{2,5}$ and NO_x) for 2016









Source: Bruxelles Environnement

IMPACT OF THE LEZ ON ROAD TRANSPORT EMISSIONS

To quantify the anticipated emission reductions induced by the LEZ, we focused on the characteristic pollutants of road transport: nitrogen oxides (NO_x), fine particles (PM_{10} and $PM_{2.5}$) and black carbon particles (BC).
The table below indicates the projected changes in road transport emissions[21] by 2025 based on "without LEZ" and "with LEZ" scenarios. The results have been calculated with the projection model for road transport atmospheric emissions developed within Bruxelles Environnement[22]. The vehicle population taken into account this time is larger than the one considered above (impact on car population, pages 7-9) : it relates to all motorised vehicles, including leased cars, heavy goods vehicles and two-wheelers.

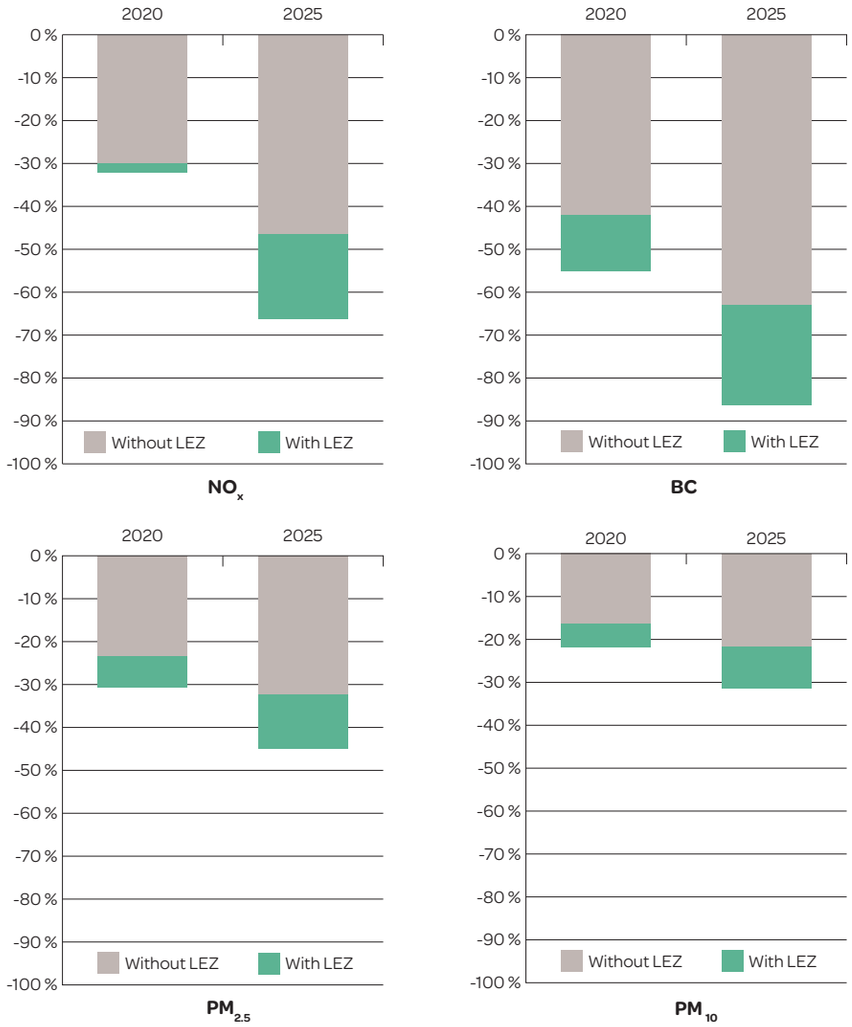
Projected change in road transport emissions compared with 2015

	2020		2025	
	Without LEZ	**With LEZ**	**Without LEZ**	**With LEZ**
NO_x	-30,10%	-32,20%	-46,50%	-66,17%
BC	-42,00%	-55%	-63,00%	-86,31%
$PM_{2.5}$	-23,40%	-30,60%	-32,40%	-44,95%
PM_{10}	-16,30%	-21,80%	-21,80%	-31,43%

These calculations estimate that with the LEZ, the RBC will reduce its NO_x emissions from road transport by approximately 66% by 2025 compared with the 2015 emissions. The BC emissions from road transport should drop by approximately 55% by 2020 and 86% by 2025. In 2025, the LEZ will account for a reduction of 9 to 23 additional points in relation to a scenario without LEZ.[23]

[21] This includes cars, vans, heavy goods vehicles, buses, coaches and motorised two-wheelers.
[22] This model is based among other things on reference studies concerning the evolution of global demand for road transport, the mix of road fuels used, and the relative distribution of vehicles by Euro standard («survival curves»). The emissions are calculated using the COPERT 4 model. For NO_x, the emissions of Euro 6 diesel vehicles put into circulation after 2015 take into account the expected effect of the new combined WLTP-RDE cycle (see box «Problems of«real» NO_x emissions for diesel cars» page 16).
[23] 9 points for the PM_{10} (31.43% reduction with LEZ against 21.80% without LEZ) and 23 points for the BC (86.31% reduction with LEZ against 63% without LEZ).

Projected change in NO_x, PM_{10}, $PM_{2.5}$ and BC emissions from road transport in RBC compared with 2015



Reduction in pollutant emissions compared with 2015 if the LEZ was not in place

Additional reduction due to the introduction of the LEZ

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These projections are based on a certain number of hypotheses, namely :

- The LEZ will have no influence on the behaviour of Brussels residents in their choice of mobility: it is estimated that the number of kilometres travelled remains identical per vehicle category.[24] **Nevertheless, by urging the citizens in question to opt for alternatives to the car, the goal of the LEZ is to contribute to a reduced number of kilometres travelled**.
- An estimated 25% of banned vehicles will continue to be driven taking into account exemptions, «daypass» purchases and potential infringements.[25]
- Our estimations take account of the effect of new vehicle approval procedures that should allow better control of NO_x emissions from diesel vehicles in real conditions in the months and years to come (see box «Problems of «real» NO_x emissions for diesel cars», below).

Problems of «real» NO_x emissions for diesel cars

Although diesel cars comply with the maximum permitted emission limits (Euro standards) for nitrogen oxides (NO_x) when laboratory tested, they emit on average over ten times more NO_x in real driving conditions. When being driven, recent diesel vehicles meeting Euro standards 5 and 6 can emit almost as much NOx as older vehicles (and even more for certain models).[26]

New European legislation has been introduced in response to this problem to test real vehicle emissions. Since 1 September 2017, vehicles must undergo a **longer, fuller «laboratory» test (WLTP test) and a test in real driving conditions (RDE test)** using Portable Emissions Measurement Systems (PEMS)[27]. Both tests are mandatory since September 2017 for all new models launched onto the European market and are introduced gradually for all new cars in September 2018 (WLTP) and 2019 (RDE). These tests are expected to lead to significant emission reductions in real driving conditions, even if they will only involve the vehicles marketed after these dates.

[24] Hypothesis from the study by TML (Studie betreff ende de relevantie van het invoeren van Lage Emissizones (LEZ) in het BHG en van hun milieu, socio-economische en mobiliteitsimpact, 2011). The mobility of people aff ected by the driving ban is reported proportionally for the entire existing vehicle population.

[25] Hypothesis from the study by TML. Given the price of fines (350 euro), the automatic enforcement (via ANPR cameras) and the conditions for derogations and day passes, this percentage may in fact be overestimated.

[26] IRCELINE, http://www.irceline.be/fr/nouvelles/impact-du-dieselgate-et-de-la-fraude-aux-filtres-a-particules-de-sur-la-qualite-de-lair

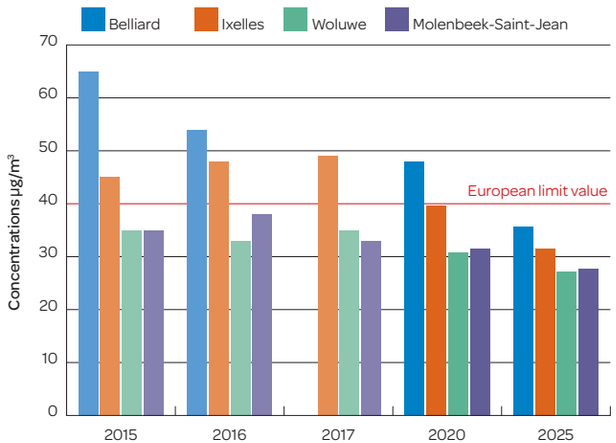
[27] It must be stated that the RDE test tolerates a deviation from the legal NO_x emission standard: 168 g/km up to 2020 then 120 mg/km after 2020 for new vehicle models and 168 g/km between 2019 and 2020 inclusive and 120 mg/km from 2021 for all new vehicles. Diesel vehicles could therefore still emit more NO_x than petrol vehicles.

IMPACT OF THE LEZ ON CONCENTRATIONS OF POLLUTANTS IN THE AIR

The graphs below illustrate the estimated impact of the LEZ on air quality at four locations where traffic has a major influence on local pollution. This involves 3 stations reported to the European Union (Ixelles, Molenbeek-Saint-Jean and Woluwe-Saint-Lambert). We are adding the Belliard station (not reported to the European Union in the context of Directive 2008/50) because of its specific location.

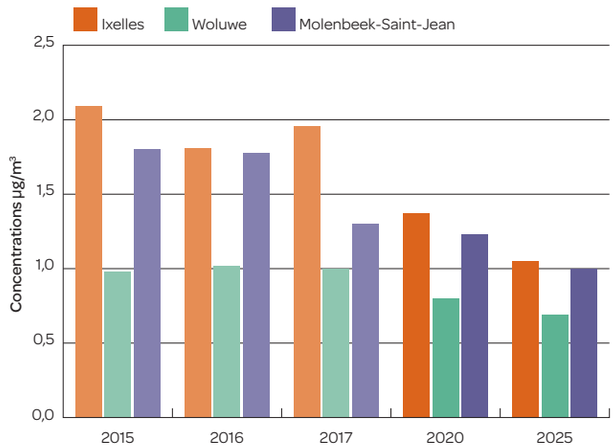
The estimations relate to the pollutant ***concentrations*** in the air, calculated from road traffic ***emissions*** (see box «emissions and concentrations - what is the difference?», page 11). It is assumed that the concentrations diminish in proportion to the reduction in emissions[28]. This methodology applies only to pollutants with a strong link to road traffic, such as NO_2 and BC.[29]

Annual NO_2 concentrations noted in 2015, 2016 et 2017 and forecast concentrations at the Belliard, Ixelles, Molenbeek Saint-Jean and Woluwe St Lambert stations - with LEZ



	2015	2016	2017	2020	2025
Belliard	65	54	*	47,9	35,7
Ixelles	45	48	49	39,7	31,6
Woluwe	35	33	35	30,8	27,1
Molenbeek-Saint-Jean	35	38	33	31,6	27,7

Annual BC concentrations noted in 2025, 2016 and 2017 and forecast concentrations at the Ixelles, Woluwe St Lambert and Molenbeek-Saint-Jean - with LEZ



	2015	2016	2017	2020	2025
Ixelles	2,09	1,81	1,96	1,37	1,05
Woluwe	0,98	1,02	1	0,8	0,69
Molenbeek-Saint-Jean	1,8	1,78	1,3	1,23	1

* Data unavailable given the temporary shutdown of the Belliard station managed by the European Parliament under obligations relating to its operating licence

[28] For every monitoring station, the concentrations are calculated by adding together the input of Belgian and regional background pollution linked to traffic and pollution from traffic at the station itself, to which is applied the reduction in traffic. These inputs are assessed by comparing the concentrations measured at various stations representative of a type of environment. Source: Bruxelles Environnement, 2018: «Assessment of the impact of reduced pollutant emissions on their concentrations, methodological report ».

[29] This tool cannot be used to assess the impact of reduced road traffic emissions on the $PM_{2.5}$ and PM_{10} concentrations, as these are pollutants with fewer links to road traffic and that in the main come from outside the region.

The next two tables indicate the effect of the LEZ with respect to a situation without LEZ at the two stations with the highest NO_2 concentrations.

Annual NO_2 concentration at the Belliard station - with and without LEZ ($\mu g/m^3$)	2020	2025
Without LEZ	48,7	42,8
With LEZ	47,9	35,7

Annual NO_2 concentration at the Ixelles station - with and without LEZ ($\mu g/m^3$)	2020	2025
Without LEZ	40,2	36,3
With LEZ	39,7	31,6

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The NO_2 and BC concentrations are showing a downwards trend in all the Region's monitoring stations, with or without the LEZ. The LEZ emphasises this trend, especially where the traffic is at its densest.

Our analysis shows that at the Ixelles station, which is characteristic of an urban environment with major traffic influence, the NO_2 concentrations will drop by 33% by 2025 compared with 2015.[30] The LEZ will account for an additional reduction of 1 point in 2020 and 10 points in 2025 compared with a scenario without LEZ.[31]

At the same station, the BC concentrations will drop by 30% by 2020 and 46% by 2025 compared with the 2015 concentrations.[32] The LEZ will therefore account for an additional reduction of 7 points in 2020 and 12 points in 2025 compared with a scenario without LEZ.[33]

At the Woluwe station, our analysis also highlights a drop in concentrations; this is nevertheless less than at the Ixelles station given the more moderate influence from the traffic and the configuration of the station, which has a more open environment than Ixelles.

[30] As reference for 2015, an average of concentrations noted in 2015, 2016 and 2017 has been taken.
[31] Scenario with LEZ: 16% drop in annual NO_2 concentrations by 2020 and 33% drop by 2025. Scenario without LEZ: 15% drop in annual NO_2 concentrations by 2020 and 23% drop by 2025.
[32] As reference for 2015, an average of concentrations noted in 2015, 2016 and 2017 has been taken.
[33] Scenario with LEZ: 30% drop in annual BC concentrations by 2020 and 46% drop by 2025. Scenario without LEZ: 23% drop in annual BC concentrations by 2020 and 34% drop by 2025.

Compliance with the legal European standard set for NO_2 is expected in all monitoring stations reported to the European Union in 2020. This will be between 2020 and 2025 for Belliard.[34] Note that at the Belliard station, the standard for NO_2 would be exceeded in a scenario without LEZ, which underlines the importance of the LEZ in improving air quality.

Remember, our estimations take account of the effect of new vehicle approval procedures that should allow better control of NO_x emissions from diesel vehicles in real driving conditions in the months and years to come (see box «Problems of «real» NO_x emissions for diesel cars», page 16). As a sensitivity test, we have also developed a scenario to assess the impact of the LEZ on the NO_x emissions in a situation where the new mandatory test cycles do not produce the expected results. In this case, the drop in emissions thanks to the LEZ compared with a scenario without LEZ remains proportionally unchanged and positive, despite logically lower reductions in absolute figures.[35] The same is true for the impact of the LEZ on the NO_2 concentrations.[36]

Effectiveness of LEZ in improving air quality: observations from abroad

There are currently over two hundred LEZ throughout Europe, some of which have been in place for over 10 years.[37] The impact of these LEZ on air quality varies according to several parameters: access criteria, size of the zone, exemptions, control method (manual or by camera), amount of fines, sources of emissions and background pollution of the city in question. A LEZ that is ambitious enough can result in major reductions in emissions from road transport (NO_x and BC). In Berlin, for example, the LEZ has resulted in 52% drop in BC concentrations and 12% drop in NO_2 concentrations between 2007 and 2010.[38]

[34] In 2020, all the stations will comply with the thresholds excluding the Belliard station. This will reach the limit standard between 2020 and 2025. The projection model used is based on five-year increments, which is why it is impossible to be more accurate in terms of the precise date of compliance with the NO_2 standards.

[35] Using a factor of compliance of 6 for the NO_x in 2020 and a factor of compliance of 3 in 2025 (instead of factors of compliance of 2.1 in 2020 and 1.5 in 2025) gives a drop in emissions of NO_x from road transport of 25.3% by 2020 and 53.6% by 2025 (compared with 2015 emissions). In a scenario without LEZ, this reduction would be 23.6% by 2020 and 37.6% by 2025. For information, a factor of compliance of 6 corresponds to a factor of emissions of 480 mg NO_x/km.

[36] In such a scenario, the annual concentrations of NO_2 in 2020 would be as follows: 50.6 µg/m³ at the Belliard station, 41.5 µg/m³ at the Ixelles station, 31.6 µg/m³ at the Woluwe station and 32.4 µg/m3 at the Molenbeek-Saint-Jean station. In 2025, the annual concentrations of NO_2 would be as follows: 40.6 µg/m³ at the Belliard station (against 46 µg/m³ in a situation without LEZ), 35 µg/m³ at the Ixelles station (against 38.4 µg/m³ in a situation without LEZ), 28.5 µg/m³ at the Woluwe station and 29.1 µg/m³ at the Molenbeek-Saint-Jean station. In this theoretical alternative scenario, the legal threshold of 40 µg/m³ would be met in 2020 in two of the four stations and in three of the four stations in 2025.

[37] A view of all European LEZ can be found here http://urbanaccessregulations.eu/

[38] Senatsverwaltung für Gesundheit, Umwelt und Verbraucherschutz, 2011. Ein Jahr Umweltzone Stufe 2 in Berlin.

CONCLUSION

The LEZ seems like an effective method of reducing pollutant emissions from road transport in the Brussels Region and helping to improve air quality.

The number of cars, vans, coaches and buses in Brussels affected by the LEZ will be limited at first, but, by reinforcing its criteria, it will act on about a quarter of vehicles registered in RBC in 2022 and a third of this number in 2025 (compared with a situation evolving without LEZ).

Our projections suggest that the LEZ should result in a significant drop in pollutant emissions from road transport by 2020 and 2025. It is estimated that, thanks to the LEZ especially, the RBC will reduce its NO_x emissions from road transport by approximately 32% by 2020 and 66% by 2025 (compared with the 2015 emissions). BC emissions from road transport should drop by approximately 55% by 2020 and 86% by 2025.

In terms of air quality, reduced concentrations of NO_2 and BC are anticipated in all monitoring stations in the Region. The improvements are the most significant where the road traffic is at its most dense. In 2025, these reductions would reach 33% for NO_2 and 46% for BC at the «street canyon» Ixelles station, still compared with 2015. The NO_2 concentrations will therefore reach the legal threshold of 40 µg/m³ in all measuring stations reported to the European Union in 2020. The limit is met at the Belliard station thanks to the LEZ between 2020 and 2025.

Over and beyond the projections detailed in this note, the LEZ represents a major step towards more sustainable mobility, serving health and living standards in the Brussels Region.

The LEZ may well be a flagship measure in combating atmospheric pollution, but it must also be supported by measures to reduce the number of kilometres travelled by car and promote alternatives to the individual car (walking, cycling, public transport, etc.), as provided for especially in the Region's regional mobility plan.[39] It must also be accompanied by measures to tackle the sources of emissions other than transport, such as measures relating to heating, as provided for in the Region's Air Climate Energy Plan.[40] Lastly, since pollution has no boundaries, the Region calls for cooperation between the various levels of governance (regional, federal, European/international) to improve air quality.

[39] A new regional mobility plan is being prepared («Good Move»): http://goodmove.brussels/fr/plan-regional-de-mobilite/

[40] Air Climate Energy Plan, June 2016 .

The LEZ is a project involving the collaboration of several government bodies and stakeholders, in particular: Bruxelles Environnement, Bruxelles Fiscalité, Bruxelles Mobilité, le Centre d'Informatique pour la Région Bruxelloise and Bruxelles Prévention Sécurité.

All information on the LEZ is available on the website
www.lez.brussels

Responsible editors : Frédéric Fontaine & Barbara Dewulf - Tour et Taxis - 86C Port Avenue,1000 - 1000 Brussels - Printed using vegetable-based inks and recycled paper - Date : March 2018

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