Belgian City Ranking
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Final Report | August 2018

Living. Moving. Breathing

Ranking of 5 major Belgian cities on Sustainable Urban Mobility

This report is the result of a study commissioned by Greenpeace Belgium. The sole responsibility for the report's contents and data lies with the authors.

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Project duration: October 2017 – August 2018

Acknowledgements:

The authors would like to express their appreciation to the colleagues at Greenpeace Belgium and to the colleague in the Wuppertal Institute for proofreading the report and ensuring that we have stated the facts based on the information available.

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1 Sustainable Urban Mobility in Europe and Belgium

Despite being known for their progressive approaches and standards in sustainability, European cities have an increasing trend in motorisation. Figure 1-1 shows the new registrations of passenger cars in the European Union (EU) as indicated by the European Automobile Manufacturers' Association (ACEA). Though the share of electric vehicles has moderately increased between 2016 and 2017, the car market has equally increased. In 2017, 15.1 million new passenger cars (all vehicles) were registered in the EU.

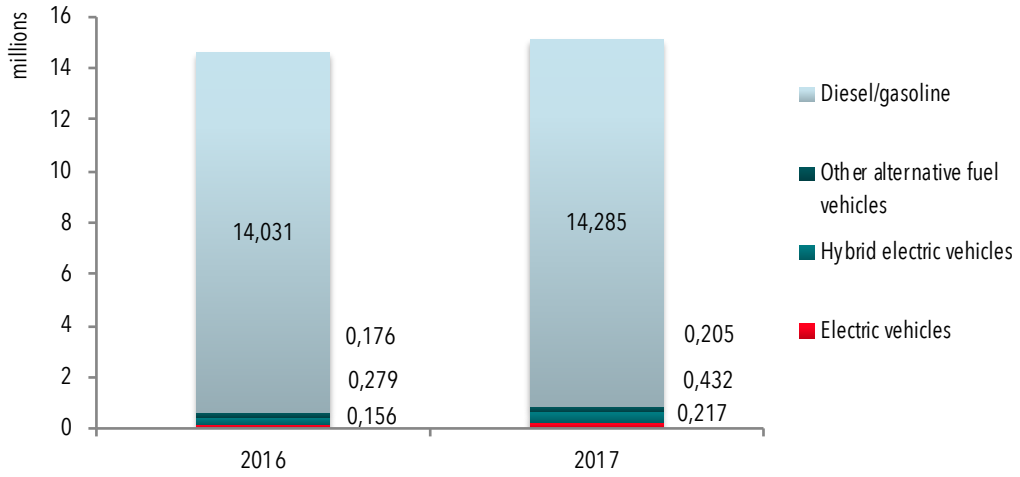

Figure 1-1: Registrations of new passenger cars in the EU in 2016 and 2017. Source: Website ACEA

European cities, some burdened by deteriorating air quality and some with a 'green minded' leadership, have embarked upon practices to create people friendly urban mobility i.e. promoting more walking, cycling and public transport. The European Union has enabled and encouraged planning, developing and implementation of sustainable urban mobility through its Sustainable Urban Mobility Plan (SUMP) initiative. The strategies in a SUMP include policies and projects to push motor vehicle drivers away from using personal vehicles in the city centres and making public transport and active transport more attractive.

Cities have realised that increasing dependence on personal motorisation will result in worsening air quality as a large share of motorised vehicles still run on (imported) fossil fuels. Cities acknowledge that an increase in motorisation also leads to lower quality of life due to loss of urban space to automobiles and economic losses due to congestion.

1.1 Trends in Belgium

In 2016, Belgian passenger cars made a total of 84.3 billion kilometres, a 0.4% increase compared to 2015. There was a 2% increase in travel by cars registered in Flanders and 0.3% increase in cars registered in Wallonia. Overall, there was a 10% reduction in trips by cars from the Brussels Capital Region, potentially due to the relocation of the head offices of 2 large leasing companies from the Brussels region. The 2% increase in the Flemish travel can also be related to the relocation.

The increase in the number of kilometres is due to the increase in the number of vehicles in Belgium as there was an overall decrease in distance travelled per car. In 2016, there were 539,519 new car registrations in Belgium. Nationally this amounts to an approximate 1.5% increase of vehicle fleet, while Flanders and Wallonia experienced a 2.4% and 1.5% increase in the number of registered cars. The increase in the vehicles triggered the increase in kilometres travelled. As the average number of kilometres travelled per car decreased overall, with a 1% nationwide, 0.2% in Flanders, and 0.8% in Wallonia. Data shows that the increase is mainly in the petrol car sector and there has been a decrease in diesel cars in 2016 (Kwanten, 2017). The ACEA reports that a 7.7% decrease in the purchase of diesel cars from 2015 to 2016 occurred in Belgium[1].

Apart from a recent UITP study pointing that Belgian authorities have steadily increased investments in public transport systems, we haven't found reliable data to support the investments in public transport. The study grouped Belgium together with France, China, Canada, Australia, Turkey, Brazil and Malta, as countries where there is low/medium demand for public transport in the beginning but a potential for mild/large growth. The study also identifies that Belgium and other countries in the group acknowledge the vital role of public transport and its role in addressing congestion and economic growth (UITP, 2017).

Our consultation with experts in Belgium reveals that there are is no clear picture of investments in public transport as the information is with various departments and a single source for the information is unavailable. Yet, there has been a strong reduction in rail investment at a federal level (since 2015). At a regional level there was a slight increase in public transport investment especially in the Brussels Region and in Flanders. In Flanders, the investments in public transport are still low compared to the investment in road infrastructure[2].

In terms of road fatalities, the overall trend between 2001 to 2015 shows that Belgium has fewer road accidents and fatalities. Though the number of fatalities has halved since 2001 until 2015, there is an increase of 0.7% in fatalities between 2014 and 2015. In 2015, there were 92 (about 12.7%) pedestrian fatalities and 83 bicycle fatalities (11.34%) across Belgium.

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[1] https://www.acea.be/statistics/tag/category/share-of-diesel-in-new-passenger-cars

[2] Communication with TreinTramBus VZW through Greenpeace Belgium.

In Belgium, road transportation contributes to 25.8 Mtoe[3] (or 53%) of the transport related national GHG emissions (**Error! Reference source not found.**) and 52.7% of transport related CO_2 emissions in 2015 (European Union, 2017, pp. 137 & pp. 153 respectively).

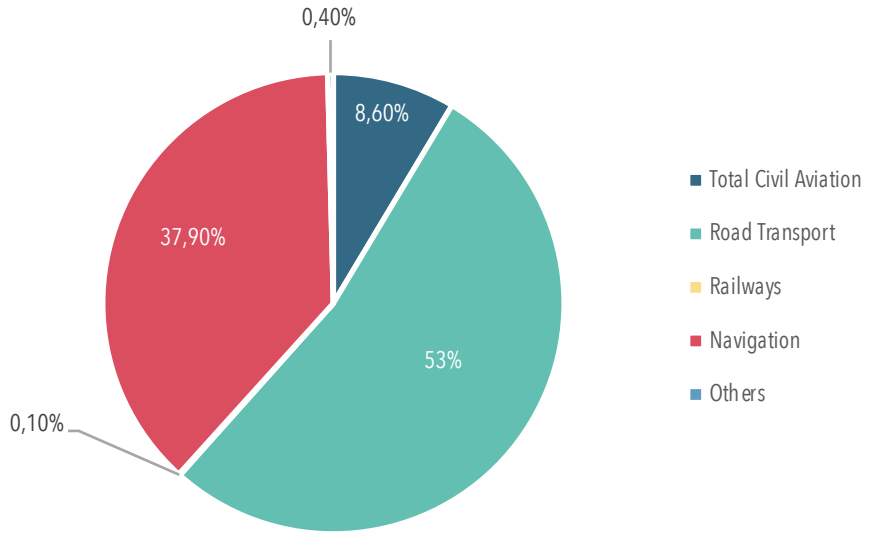

Figure 1-2: GHG Emissions from the Transport sector in the Belgium for 2015
Source: (European Union, 2017) pp. 137

At a city level, there have been positive trends in promoting transport that cater for the needs of the people. Investments are being made to improve the current public transport and extend the public transport network. There is an increased effort from the cities to encourage cycling and walking in the cities. Several city mobility plans have integrated cycling and walking and have set performance goals.

This study is an effort to document the current state of urban mobility in five major Belgian cities based on information that is readily available and provide encouragement to cities to advance their urban mobility agenda.

2 Cities, objectives and methodology

The current study is conducted in the 5 major Belgian cities. Table 2-1 provides an overview of the cities that are ranked in this study.

The report's underlying study had the following objectives:

- Develop, review and revise sound indicators for measuring urban mobility performance in European cities;
- Implement the indicators to measure the urban mobility in the five biggest Belgian cities;
- Compare the project cities and rank them;
- Highlight good practices and policies that encourage sustainable urban mobility.

Table 2-1: Belgian cities compared in the study.

City	Population	City Area (km^2)	Urban Density (p/km^2)
Brussels	1,175,173.00	161.38	7,282.02
Antwerp	524,501.00	204.51	2,564.67
Ghent	256,235.00	157.96	1,622.15
Liège	196,970.00	69.39	2,838.59
Charleroi	201,256.00	102.08	1,971.55

2.1 Methodology

This study focusses on measuring and ranking the urban mobility performance of 5 major Belgian cities. The ranking of the sustainable urban mobility performance has been developed from a number of categories, namely the cities' overall modal shares, characteristics of the public transport system, active mobility, road safety, air quality and mobility management. Under each of the named categories, a set of indicators was selected and corresponding data was collected. Based on this, an overall rank and categorical ranks were allotted.

In measuring the performance of urban mobility, 21 indicators were categorised into in five categories. Each category has a maximum score of 20 points and a minimum score of 0 points. Hence, the total maximum score a city can receive is 100 and the least score that a city can receive is 0.

The five categories are mentioned below, the number of indicators in each category are mentioned in parenthesis:

1) Public Transportation (4 indicators)
2) Road Safety (4 indicators)
3) Air Quality (3 indicators)
4) Mobility Management (7 indicators)
5) Active Mobility (3 indicators)

The indicators in each category have an individual score. Table 2-2 gives an overview of the indicators under each category. The sum of the scores of all the indicators in a category gave the categorical score, and the sum of all categorical scores gave the overall score. The overall score was then used for the overall ranking and the categorical scores were used for categorical ranking.

It is important to note that this study compares the cities' sustainable mobility performance against each other. That is, a city with a high rank aims to encourage sustainable mobility and has plans and measures in place with results. While, the lower ranking cities may have ambitious plans but at the time of our study these actions and plans have not yet yielded results.

However, the real objective should be to develop sustainable transport and mobility, which demands the replacement of the fossil-fuelled internal combustion engine. Cities ranking high deliver better on their sustainable mobility objectives and are making evident strides to move away from individual motorised mobility.

This methodology is originally developed by Wuppertal Institute to score urban mobility performance in 13 European cities for Greenpeace[4]. The methodology is adapted to be used to analyse the Belgian cities.

As the methodology is adapted, we cannot directly compare the scores of the Belgian cities with the scores from the other study. Yet, some indicators can be compared and we have elaborated them in the respective sections of this report.

[4] The study can be downloaded from https://www.greenpeace.de/sites/www.greenpeace.de/files/publications/living.moving.breathing.20180604.pdf

Table 2-2 City ranking indicators. Source: own methodology

Ranking category	Indicators used	Unit
Public transport	% of public transport trips	Public transport modal share in %
	Cost of a single journey on Public Transport	Euros
	Annual trips per person	Trips per capita
	Station density	Stations per km^2
Road safety	Fatalities for bicycles	Fatalities/1m bicycle trips
	Fatalities for pedestrians	Fatalities/1m walking trips
	Crashes for bicycles	Crashes/ 1m bicycle trips
	Crashes for pedestrians	Crashes/ 1m walking trips
Air quality concentrations (annual average)	NO_2 / Nitrogen dioxide	$\mu g/m^3$
	PM_{10} / Particulate Matter 10 μm	$\mu g/m^3$
	$PM_{2.5}$ / Particulate Matter 2.5 μm	$\mu g/m^3$
Mobility management	Congestion charge	Yes/no
	Cost of 1hr of parking	Euros
	Innovative transport policies (LEZs and circulation plans)	Yes/No
	Public Transport apps	Ticketing / Scheduling / Both
	Congestion Index	% of travel time lost due to congestion
	Shared cars per km^2	Cars / km^2 of service area
	Shared bicycles per km^2	Bicycles / km^2 of service area
Active Mobility	% of walking in the city	Walking trips modal share in %
	% of cycling in the city	Cycling trips modal share in %
	Urban green cover	% of green spaces in the city

Data availability and caveats

The data, on which this analysis is based, was obtained from official sources available either in the public domain or through direct communication with city officials working in relevant departments. A ranking relying on different external sources comes with the caveat that there is a risk that the original sources have collected this data with differences in methodology or scientific rigour. Even though sufficient care has been taken to ensure comparability and data consistency, it cannot absolutely be ruled out that this might have an effect on the ranking.

An important caveat with respect to the modal split must be pointed out: cities use different methods to identify their modal split and the respective method can influence the final result. Most importantly, the modal share can either be obtained from a household survey, which delivers the inhabitants' mode share; or it can be obtained from traffic counts, a method which considers all travellers and thus also includes mobile persons, other than the inhabitants, such as tourists and commuters.

In this study, no adjustment methods were applied for any of the given modal split data (unless explicitly stated), irrespective of the underlying data collection method. This due to the fact that any adjustment would need considering additional disaggregated data for analysis, which was not available. However, the modal split data was deemed comparable, as it is a common approach to rely on public authorities' studies in any comparison of urban mode shares. In all cases, the modal split includes any trip within the city's boundaries and any regional (short distance) trip with the origin or destination within the respective city.

In this study Brussels denotes the Brussels Capital Region (BCR), comprised of 19 municipalities including the city of Brussels, the capital of Belgium. The decision to consider the BCR for this study was mainly due to the fact the entire capital region of Brussels is often being perceived as one large city-region. It has to be highlighted that considering BCR as a region in this study also poses a challenge as the urban mobility decision making in the region lies partly with the Brussels Regional Government but also partly with each of the 19 municipalities. Thus, making the Brussels Capital Region complex to implement comprehensive sustainable urban mobility.

We would like to point that for Liège and Charleroi the modal share data we obtained is from 2008, and for Brussels the modal share data is from 2010, as we were unable to find any reliable source for obtaining more recent data. We presume that the data gap is due to the absence of recent published studies on modal share data in these cities.

3 Overall ranking for the Belgian cities

In the overall ranking Ghent scored the first rank with an overall 46 points, followed very closely by Brussels with 45.75 point and Antwerp with 45 points. Charleroi scored the last with 27 points. Performance of the cities is explained in each of the categories and elaborated in the next chapters along with recommendations for each category.

Overall the categories that made large swings in scores were public transport, active mobility and road safety. Certain assumptions were made in some of the categories to deduce the data. These calculations were essential as direct data pertaining to the indicator were not available. The respective sections detail about these assumptions.

Table 3-1 Belgian city ranking overview **Source: Wuppertal Institute Analysis**

City	Overall Rank	Public transport	Road safety	Air quality	Mobility management	Active Mobility
Ghent	1	2	2	3	1	1
Brussels	2	1	3	3	3	3
Antwerp	3	2	1	5	2	1
Liège	4	5	4	1	5	4
Charleroi	5	2	5	1	4	5

Table 3-2 Belgian city ranking points.

City	Overall points	Public transport	Road safety	Air quality	Mobility management	Active Mobility
Ghent	46.00	5.50	13.00	14.00	8.00	5.50
Brussels	45.75	9.00	12.00	14.00	5.75	5.00
Antwerp	45.00	5.50	14.00	13.00	7.00	5.50
Liège	31.75	3.75	6.50	14.50	4.50	2.50
Charleroi	27.00	5.50	0.00	14.50	5.00	2.00

4 Modal Share

Modal share (or modal split) depicts the usage of a particular transport mode for trips in a city represented as percentage (%) share of trips. Cities with a high share of sustainable modes (walking, cycling and public transport) have a higher possibility to further increase the share of these modes, if right policies and practices are encouraged.

The most often reported categories are public transport (includes bus, metro rail, trams, waterways), active mobility (walking and cycling), and personal automobiles (cars and motorised two wheelers). Some cities also document taxis and shared cars as a separate category. In this ranking, wherever taxi data is available it is included as a part of the public transport share.

In terms of the share of sustainable mobility i.e. combined share of walking, cycling and public transport, both Antwerp and Ghent have almost 59% share, followed by Brussels at 56%. On the contrary, Charleroi has the highest share of car use (84%) followed by Liège (76%).

In terms of urban density, Ghent has the lowest urban density with 1,622 inhabitants/sq. km and Brussels has the highest density with about 7,282 inhabitants/sq. km. It is to be noted that for this study we have considered the entire Brussels Capital Region (see the methodology section for justification).

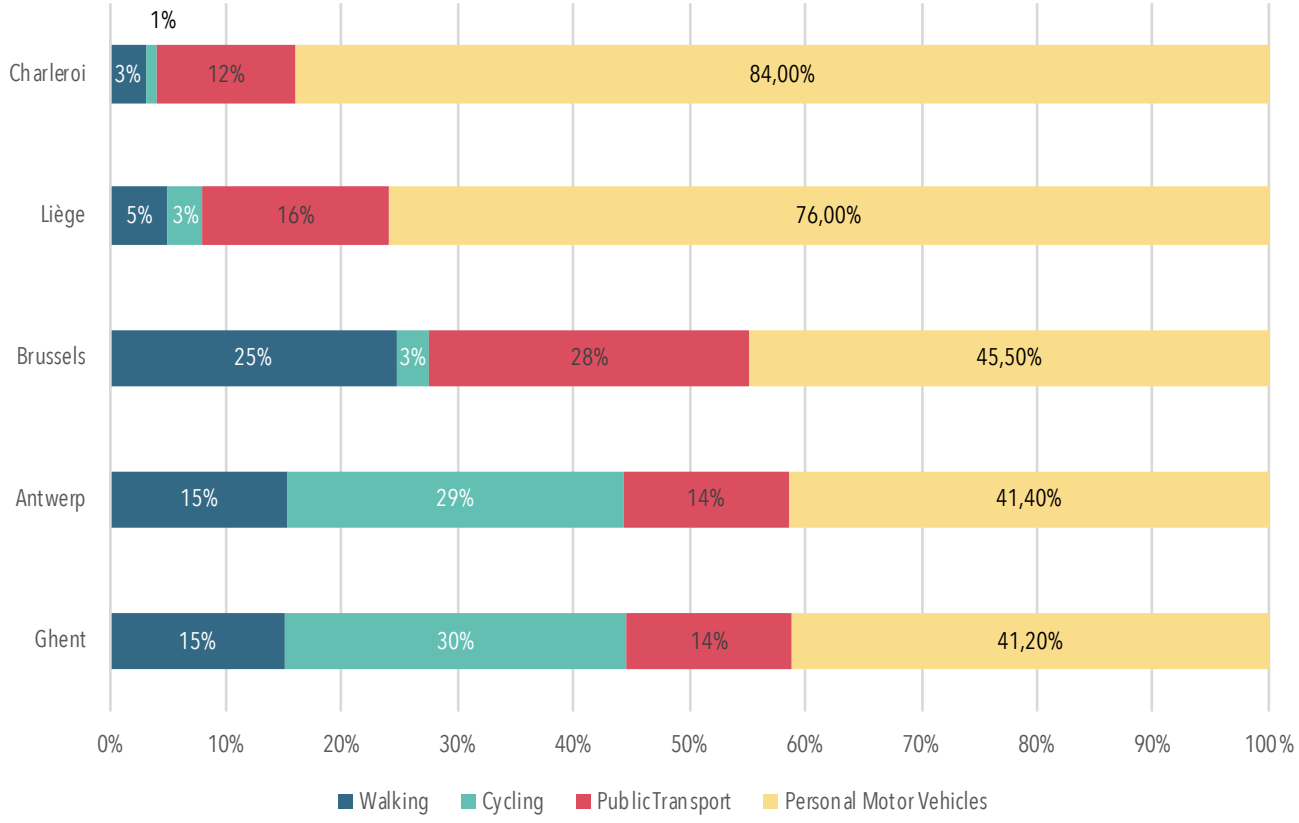

Figure 4-1: Transport modal shares in the Belgian cities analysed **Source: Modal shares from cities**

5 Public Transport

Public transportation, irrespective of whether it is rail or road based, is the backbone for any successful urban transport system. Public transport has the ability to move large numbers of people when compared to personal automobiles and thus uses the available road space more effectively, in addition to per capita transport emissions reduction. A higher share of public transport in a city tips the scales towards sustainable mobility. When coupled with a higher share of active mobility i.e. walking and cycling and proper urban planning, the need for the usage of personal automobiles is reduced.

Literature and experience show that attracting people to use public transport and maintaining the existing ridership of public transport depend on various factors such as the fare, coverage, frequency, comfort and reliability of the public transport ((Currie & Wallis, 2008); (Abrate, Piacenza, & Vannoni, 2009); (Loader & Stanley, 2009); (Mantero, Freitas, & Quintal, 2013); (Fearnley, 2013); (Walker, 2012)).

Public transport in Antwerp and Ghent is operated by De Lijn, and by TEC in Charleroi and Liège-Verviers. In Brussels, the system is mainly operated by Brussels Intercommunal Transport Company (STIB-MIVB). The STIB operates the trams and the metro system and the buses. The De Lijn network (in Flanders) and the TEC network (in Wallonia) also operate buses in Brussels, bringing the commuters from Flanders and Wallonia to Brussels. Though there is a physical integration of infrastructure there is still a lack of integrated ticketing between the operators i.e. a ticket purchased on one operator cannot be used on another even for transfers in a common area of service.

To further analyse, we have compared the cost of public transport tickets (when purchased on board[5]) among all the 5 cities. A single journey public transport ticket costs 2.4 Euros for a trip in Liège and Charleroi and 3 Euros in Ghent and Antwerp. A single trip in Brussels costs 2.50 Euros. In all the cities the ticket provides unlimited transfers within 60 min. for a single trip i.e. a user can shift from bus to a tram in order to complete the journey until the 60th minute after validating the ticket.

[5] On board ticket purchase was chosen as it indicates the attractiveness of using public transport by an occasional user when compared to paying for parking (for example). Monthly tickets, contactless card payments, and multiple journey tickets could denote that the user is already attracted to the public transport system.

Table 5-1 Public transport ranking. **Source: Wuppertal Institute Analysis**

Rank	City	Public Transport Share (%)	Annual Trips per person	Cost of a single journey public transport ticket	Station Density	City Area in km²
1	Brussels	28%	341	2.50 €	13.86	161.38
2	Antwerp	14%	146	3.00 €	6.17	204.51
2	Ghent	14%	144	3.00 €	6.75	157.96
4	Charleroi	12%	117	2.40 €	8.56	102.08
5	Liège-Verviers	16%	69	2.40 €	0.63	3,862.31**

** the data available is only for the Liège-Verviers region | ** the Liège and Verviers service area for which the numbers are reported*

In our analysis we found Brussels to be a more public transport friendly city in terms of the share of public transport use. Ghent and Antwerp ranked second and Liège-Verviers ranked the last.

Brussels's success is from the various modes of public transport available in the city, a good station density and an affordable public transport ticket. The annual number of trips per person in Brussels is about 341 trips. This means that every year a citizen of Brussels makes about 341 trips by public transport. Brussels also has the lowest cost per public transport trip in comparison with other 4 cities. Both Antwerp and Ghent have a high public transport fare and around 140 public transport trips per person.

De Lijn, the public transport operator in Flanders, reports annual number of passengers transported at a provincial level. Hence, we calculated the approximate number of annual public transport trips through the average daily trips in Antwerp and Ghent[6]. We could have arrived to the annual trips per capita by dividing the annual trips reported by De Lijn over the population of the province, but that method would not give an accurate estimate as there are other popular destinations in the reported provinces than Antwerp and Ghent.

Further, Table 5-1 shows that Liège has 69 annual trips per person. It has to be noted that the annual trips and the station density for Liège is calculated for the Liège-Verviers region. The TEC Liège-Verviers region covers an area of around 3,862 km2, covering over 84 municipalities, including Liège.

We believe from the data that the high car use in Charleroi and Liège denote that the mobility infrastructure in these cities is automobile focussed. The high use of personal automobiles denotes that using these modes is much more attractive due to favourable policies supporting personal automobiles. To promote sustainable mobility, effort is required to discourage personal automobile use. Cities promoting sustainable mobility implement automobile

[6] Annual trips by public transport = average daily trips (i.e. 2.77) * 365 * modal share of public transport * population of the city

restraining measures that charge the motorist the real cost of travel, through congestion pricing and higher parking fees. The revenue from these measures is used to improve public transport and promote cycling. For example, London invests the revenue from congestion charge into public transport and cycling. Making public transport cheaper through subsidies, without improving the infrastructure for walking and cycling, or without charging motorists will not yield positive results for sustainable mobility and on a longer term could even be detrimental for public transport performance.

5.1 Comparison with other European cities

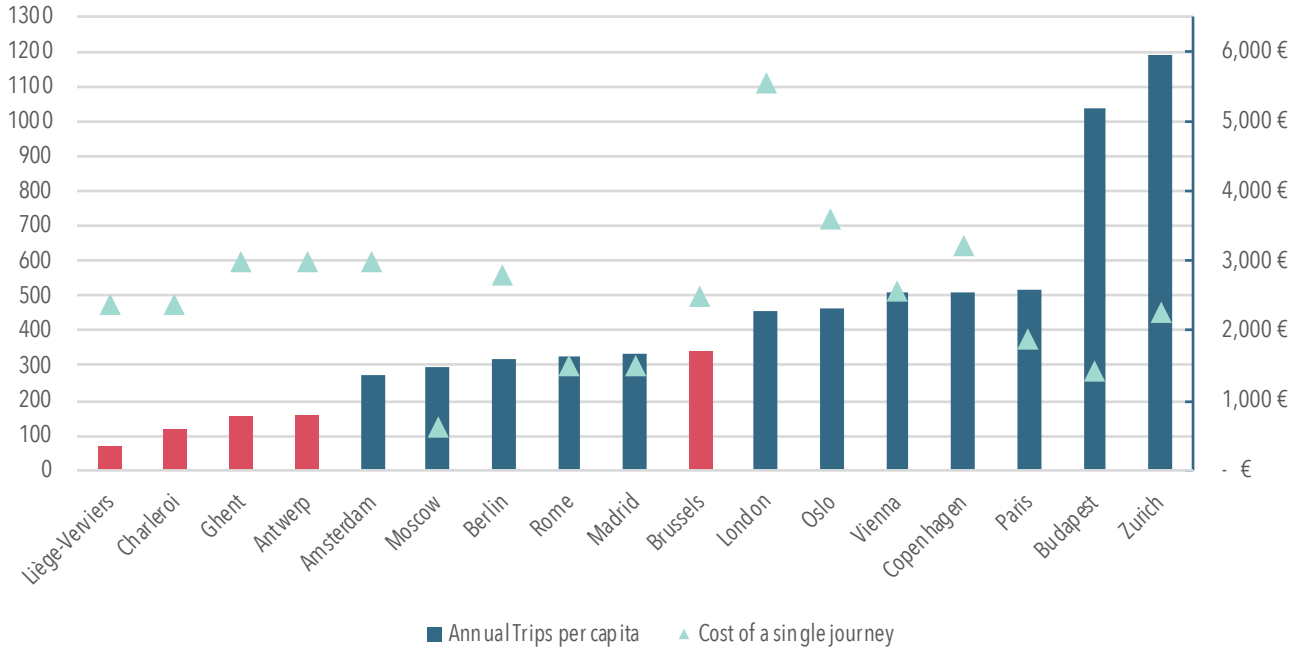

Figure 5-1 Annual trips per capita and cost of public transport in 17 European cities

Based on the European study we conducted we have compared the annual trips per capita of the Belgian cities in this study against the 12 European cities[7]. Among the 17 European cities, Liège-Verviers has the least annual trips per capita, only 69 trips/person/year, probably also partly explained by the fact that the data we obtained is for a large area of operation of TEC in Liège-Verviers covering over 84 municipalities. In the graph (Figure 5-1) the price of a single journey public transport ticket is also denoted with a red triangle. London has the highest cost per trip of public transport, when the ticket is paid in cash. London also employs a different fare for tickets purchased through contactless cards and credit cards. A similar ticketing strategy can be seen in the TEC, STIB/MIVB and De Lijn operations. A user with MOBIB card, which is used for contactless payments, pays a lower fare than a paper ticket or a ticket

[7] The original European study has 13 cities analysed. Since we are again analysing Brussels we compare the results against the remaining 12 cities.

purchased on the vehicle. Further, the graph does not denote a relation between the price of the ticket and the annual trips as the cost of the ticket is not normalised.

5.2 Recommendations on Public Transport

Brussels, Antwerp and Ghent, have a good public transport system compared to Liège and Charleroi. Both Liège and Charleroi have a large scope for promoting public transport.

Lessons from Zurich, Vienna and Paris, show that public transport as a network has higher usage. All successful cities have developed a dense public transport network with integration between buses, trams and metro lines. While there is an integration of fares already in the Belgian cities, there is still scope for network expansions and integrating innovative technology options.

STIB-MIVB intends to expand the tram network in Brussels to make public transport more accessible.

Reports show that Liège is also planning to increase its public transport system by implementing a tram system in the city. The operations are expected to begin in 2022, the route will have 21 stations and with a maximum capacity of 4000 pphpd[8]. If the city is able to operate at the expected frequency of 3 minutes, the system will carry about 6000 pphpd. Expanding public transport is essential in cities like Liège as the city has a 76% share of car use and 64% of the households in Liège have a car[9].

[8] pphpd = passengers per hour per direction

[9] https://www.liege.be/fr/vie-communale/services-communaux/mobilite/projets/tram

6 Road Safety

Though there has been a steep decline in most of the developed world in fatalities compared to a decade or two ago, there are still high numbers of people injured or killed in road accidents. In cities, these persons are mainly pedestrians or cyclists. Road safety is a key determinant for the use of active mobility. People in a city perceive walking and cycling safe if there are less crashes/fatalities among cyclists and pedestrians. High crashes and fatalities, coupled with lack of safe infrastructure, strengthens the negative perception of walking and cycling and leads to a vicious cycle, resulting in low walking and cycling volumes.

In all the 5 cities we have analysed Charleroi has the highest number of crashes and fatalities among pedestrians and cyclists. Incidentally, Charleroi also has the lowest share for walking and cycling among the 5 cities. Both the cities with a high share of cycling namely Antwerp and Ghent have a relatively low share of bicycle and pedestrian fatalities and crashes.

Charleroi has about 59 pedestrian crashes every 1 million walking trips and about 64 cycling crashes every 1 million cycling trips. The high share of accidents and fatalities for active mobility users in Charleroi are in the range for receiving the least score (0) in our scoring. Hence, the total score obtained for Charleroi is 0.

It has to be noted that if absolute numbers of bicycle and pedestrian fatalities are seen in isolation, Antwerp and Ghent will have a high share of pedestrian and cycling fatalities compared to Liège and Charleroi. The reality is evident only when considering the crashes and fatalities in relation to the number of trips made by cyclists and pedestrians.

Table 6-1 Road safety ranking **Source: Wuppertal Institute Analysis based on data from StatBel**

Rank	City	Share of walking (%)	Pedestrian fatalities / 1m walking trips*	Pedestrian crashes / 1m walking trips*	Share of Cycling (%)	Cycling fatalities / 1m cycling trips*	Cycling Crashes / 1m cycling trips*
1	Antwerp	15%	0.05	4.96	29%	0.02	5.78
2	Ghent	15%	0.10	5.18	30%	0.01	8.19
3	Brussels	25%	0.03	3.70	3%	0.06	19.95
4	Liège	5%	0.20	11.42	3%	0.17	6.01
5	Charleroi	3%	1.14	59.36	1%	1.46	64.40

** To calculate the trips, we assumed that there are 2.77 trips made by each person per day.*

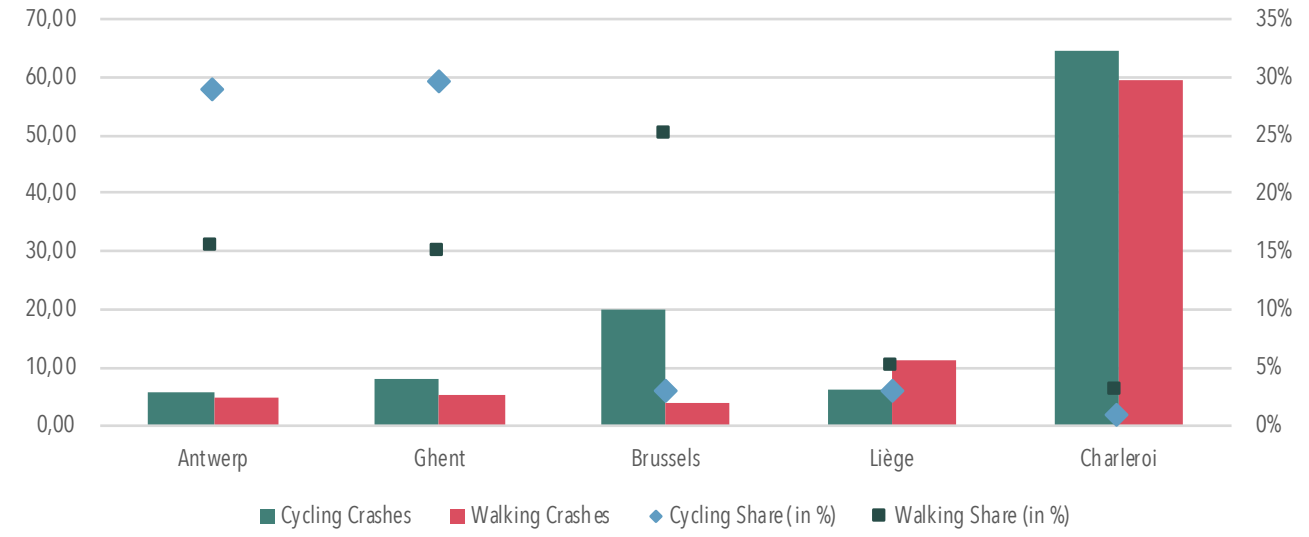

Figure 6-1 Crashes per million walking and cycling trips

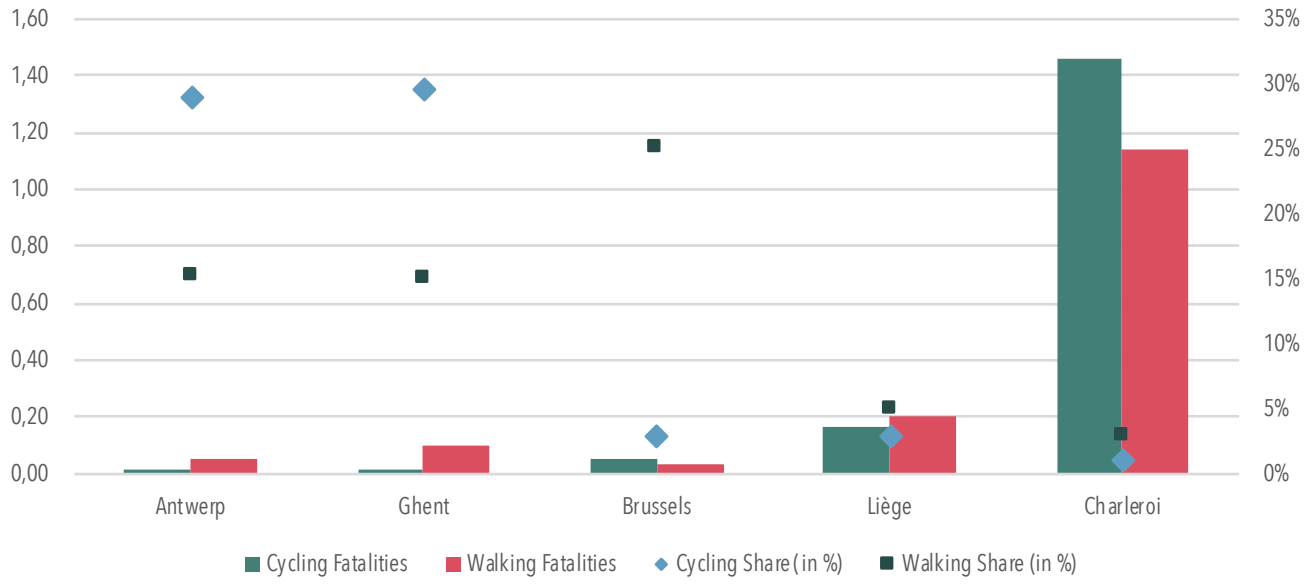

Figure 6-2 Fatalities per million walking and cycling trips

6.1 Recommendations for Road Safety.

The road safety situation among the 5 analysed cities is very different. The rather active mobility friendly cities such as Antwerp, Ghent and Brussels (only for pedestrians) are safer for cyclists and pedestrians than the cities with very low pedestrian and cycling numbers.

The data proves once again the results from various international studies. Providing infrastructure and creating policies that encourage walking and cycling will not only result in higher shares of walking and cycling but also make the city safer for cyclists and pedestrians.

From the data we observe that though Ghent and Antwerp have a high share of walking and cycling, they also have a high share of pedestrian and bicycle fatalities, when absolute

numbers are considered. Both the cities should further increase their ambition in road safety for pedestrians and cyclists.

Cities have the power to avoid road fatalities and reduce road accidents, as every life lost in a road accident is one-too-many. In order to address road safety, cities need to tame fast-moving automobiles and adopt very ambitious road safety targets e.g. *The Vision Zero* policy adopted by many cities in Nordic countries (Elvebakk, 2007).

In addition to policies, promoting active mobility (i.e. walking and cycling) is crucial for the development of sustainable urban transport. Walking and cycling, together with public transport form the 3 essential pillars of sustainable transport. From our analysis of the best cases for walking and cycling across Europe, we found that cities that have successfully increased their walking and cycling shares have dedicated space allocated for walking and cycling. The results we find are in line with various international studies ((Jacobsen, 2003); (Correia, Oliveira, & Guerra, 2012); (Loo & Tsui, 2010)).

Further, the traffic speed plays a crucial role in saving lives of pedestrians and cyclists. Researches have shown that when motor vehicle speed is over 30 kmph (Grundy et al., 2009) there is a high risk of death to a cyclist or a pedestrian upon collision with the motor vehicle. Several cities that encourage cycling and walking have reduced the motor vehicle speeds to 30 kmph in busy areas in the city and in residential areas the speed is even lower.

7 Air Quality

Urban air pollution is the evidence and first-hand experience of the effects of the increased combustion of fossil-fuels, which are predominantly used in motorised vehicles. On the contrary to the belief that car users are shielded from air pollution, studies show that car commuters have a higher exposure to air pollution as cars act as boxes filling with toxic gases that are drawn from other vehicles when stuck in traffic. An analysis of 4037 studies (Cepeda et al., 2017) on transport air pollution levels showed that while cyclists and pedestrians have high inhalation doses, motorists lost up to 1 year of life expectancy (YLE). This is due to a high exposure to toxic gases building up in the cars. Hence, addressing urban air quality is not just important for pedestrians and cyclists but just as much for motorists.

To score cities on air quality, we compared the latest available data on the annual mean concentrations of 3 major pollutants, namely Nitrogen dioxide (NO_2), Particulate Matter with 10 µm (PM_{10}) and Particulate Matter with 2.5 µm ($PM_{2.5}$).

These 3 pollutants cause the greatest harm to human health and to the environment. The annual mean EU standard for NO_2 and PM_{10} is 40 µg/m^3 and for $PM_{2.5}$ it is 25 µg/m^3. The World Health Organisation (WHO) guideline for NO_2 is 40 µg/m^3, for PM_{10} it is 20 µg/m^3 and for $PM_{2.5}$ it is 10 µg/m^3. The WHO guideline for particulate matter is more stringent than the EU standard.

In our methodology we have taken the average of the annual means obtained from all urban stations measuring the 3 pollutants in each city.

The comparison of the averages of the annual means in 5 cities shows that on average all the cities are in line with the EU regulation for NO_2, PM_{10} and $PM_{2.5}$ annual mean concentrations (Table 7-1). Among the 5 cities, Antwerp has the highest average annual mean of 39 µg/m^3, which is extremely close to the EU limit.

Data shows that one station in Brussels and two stations in Antwerp have exceeded the EU's annual mean NO_2 concentration limit. These stations are located in dense urban areas and denote that the air quality for a significant number of inhabitants in Brussels and Antwerp is poor.

Additionally, data collected shows that Brussels did not have any data reported in 2017 for a monitoring station 41B008 – Bruxelles (Rue Belliard). Data between 2013 – 2016 shows that this station reported values higher than the EU limit. In 2016, the station had an annual mean value of 54 µg/m^3.

In regard to particulate matter concentrations, some cities exceed the WHO guideline for PM_{10} and some exceed the $PM_{2.5}$ concentration limit of the WHO guidelines. However, the cities are within the EU limit for particulate matter concentrations, this is because the WHO guidelines are more stringent than the EU limits for particulate matter.

The data we obtained show that Liège and Charleroi have rather low air pollution concentrations of the 5 cities, despite Liège and Charleroi being the highly car dependent cities. We were informed that the measuring stations in Liège and Charleroi are not located near

centres with high traffic activity and hence report low air pollution concentrations that do not represent the air quality in dense urban areas. There are various civil society organisations demanding from the Walloon Region to take steps in order to better report the actual situation in air quality in urban areas.

Table 7-1 Air Quality ranking of the 5 Belgian cities. Source: Wuppertal Institute Analysis

Rank	City	NO_2 Annual Mean (in µg/m³)	PM_{10} Annual Mean (in µg/m³)	$PM_{2.5}$ Annual Mean (in µg/m³)
1	Liège	26.50	14.50	8.50
1	Charleroi	23.00	15.80	9.80
3	Brussels	35.35	18.96	13.93
3	Ghent	28.00	23.00	14.00
5	Antwerp	39.00	23.00	14.00

The high concentration of NO_2 is of grave public health concern, and needs to be controlled by reducing the number of diesel motor-vehicles, as they are a primary source for urban NO_2 emission. Excessive dependence on diesel and petrol fuel is also a contributor to particulate matter, though to a lesser extent by petrol engines. Though there has been a negative trend in new diesel passenger car registrations, further pressure from cities through access restrictions (LEZ's or ULEZ's) can accelerate the decrease of diesel car use.

Though all the cities are within the EU limit for PM_{10} concentrations, two of them exceed the more stringent WHO guideline (Figure 8-2). Antwerp and Ghent exceed the WHO guideline for PM_{10} concentrations, Brussels is very close to exceeding the guideline. The high particulate matter poses a serious public health risk for inhabitants in the city. On a positive note, the Flemish government has announced to strive towards the WHO-guidelines for all these pollutants as well as a stricter annual target for NO_2 annual mean concentration at 20 µg/m³, awaiting the foreseen revision of the WHO guideline for NO_2[10]. The implication of this announcement at an urban level is unclear.

Similarly, in terms of the $PM_{2.5}$ concentrations three cities (Brussels, Antwerp and Ghent) exceed the WHO guideline, but all the five cities are within the EU limit.

[10] Ontwerp Luchtbeleidsplan 2030. Vlaamse Gewest, Departement Omgeving. VR 2018 2007 DOC.0831/2BIS https://www.lne.be/sites/default/files/atoms/files/20180720_luchtbeleidsplan.pdf

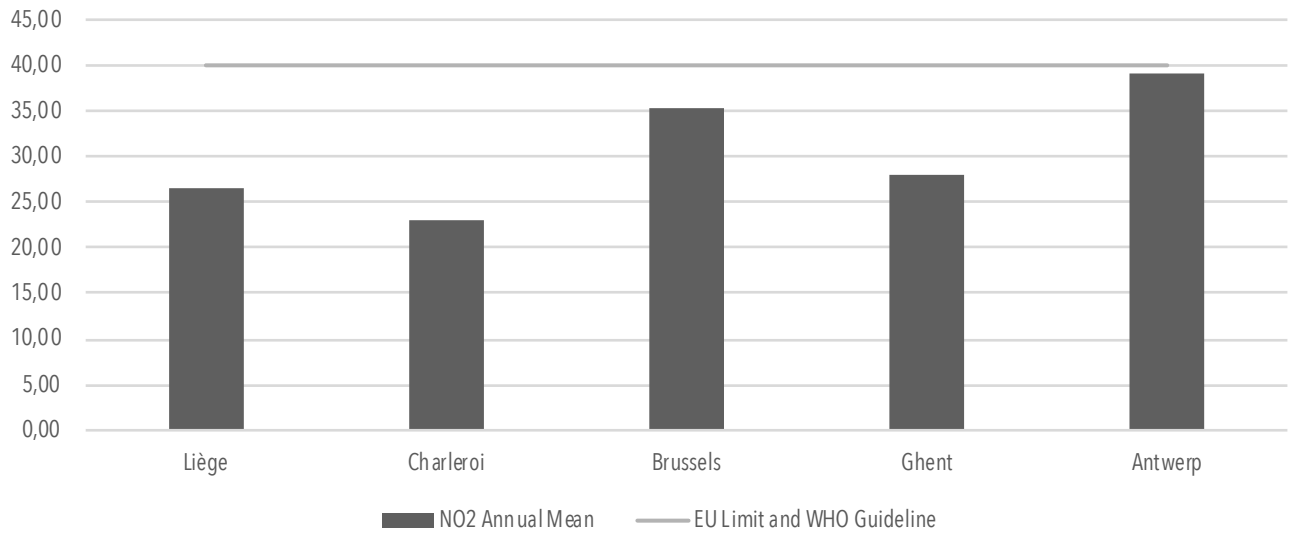

Figure 7-1: Annual mean of NO_2 concentrations in the 5 Belgian cities

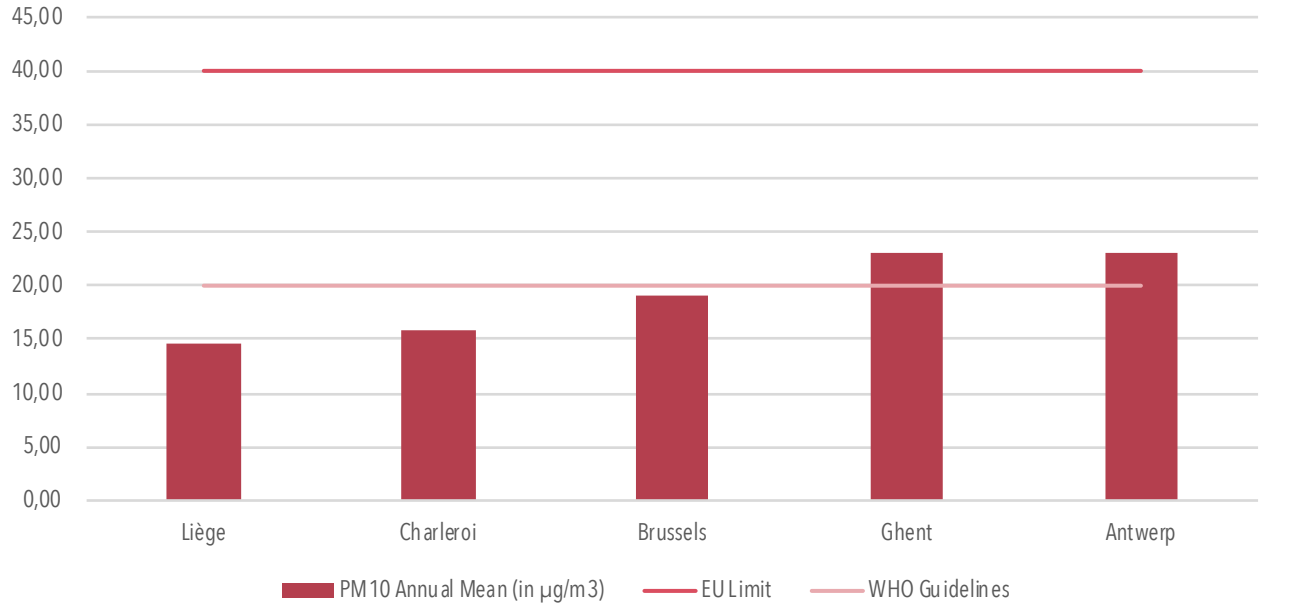

Figure 7-2: Annual mean PM_{10} concentrations in the 5 Belgian cities

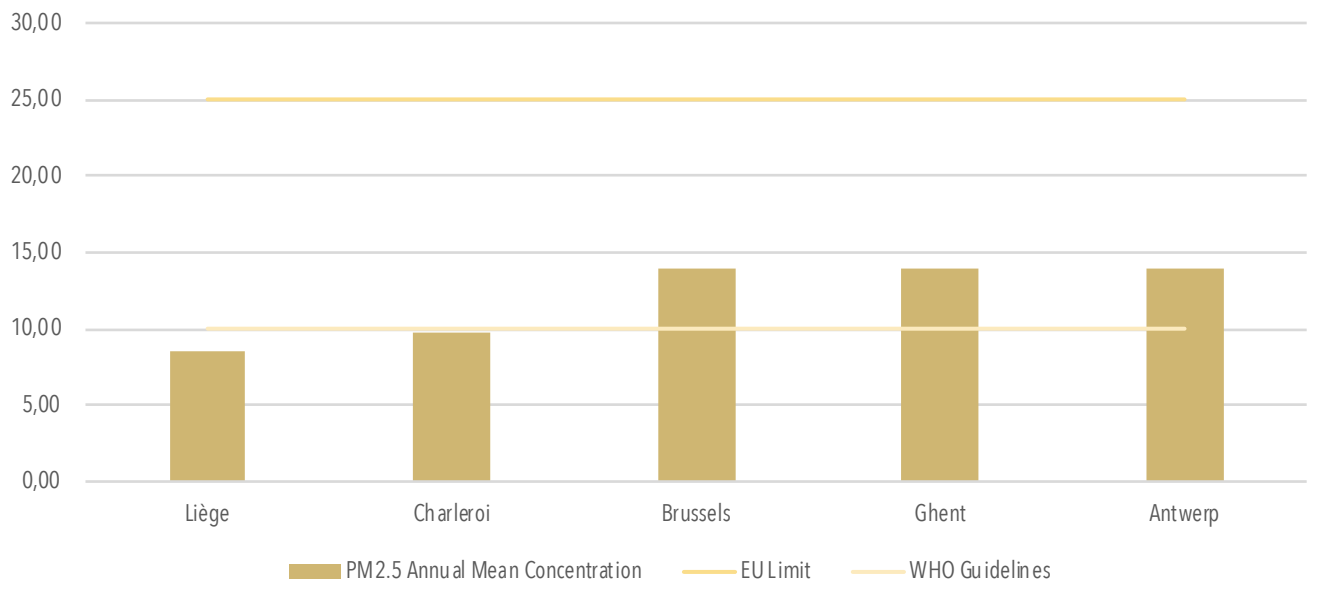

Figure 7-3: Annual mean of the $PM_{2.5}$ concentrations in the 5 Belgian cities.

7.1 Comparison with other European cities

The graph (Figure 7-4) is based on the city comparison study conducted by Wuppertal Institute for Greenpeace. It can be seen that Oslo is the only city that meets both the EU limit and the WHO guideline. Though the numbers obtained show Liège and Charleroi also to have very low air pollution, the reporting station in each city is located significantly away from traffic activity. Hence, we infer that the air quality reported by Liège and Charleroi does not depict reality. We presume, due to the high share of automobile use, both Liège and Charleroi have poorer air quality than reported.

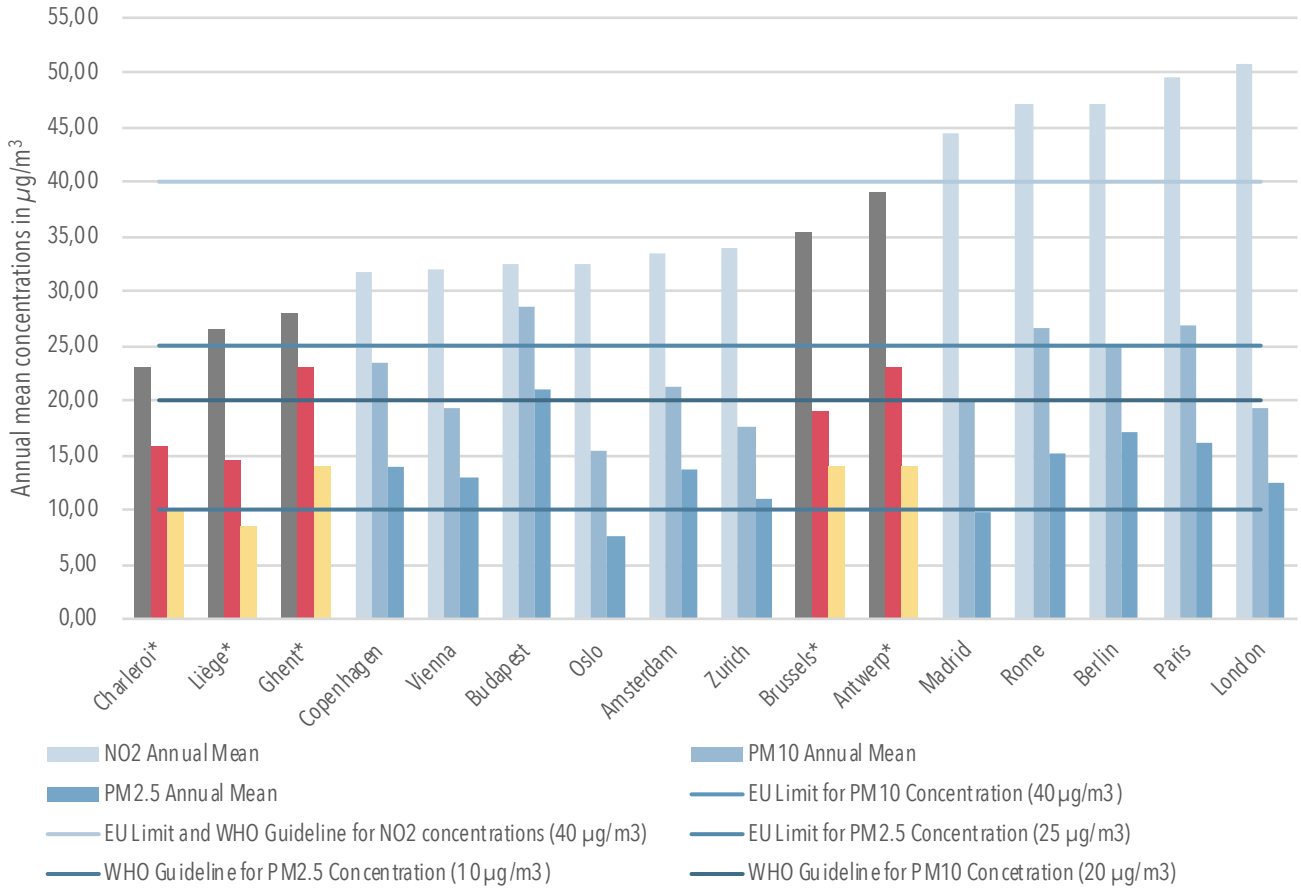

Figure 7-4 Comparison of air quality in 17 European cities.

*(Belgian cities are denoted by *)*

Already, two stations in Antwerp and one station in Brussels exceed the EU limit. The average of the NO_2 annual means in Brussels and Antwerp is very close to exceeding the EU limit. Though the particulate matter concentrations are below the EU limit, cities have a chance to take better and bolder actions if the target for particulate matter is set to the WHO guidelines.

7.2 Recommendations on Air Quality:

As we mentioned certain stations in Antwerp and Brussels exceed the EU limit for NO_2 concentrations. All the cities have high $PM_{2.5}$ concentrations compared to the WHO guidelines. Though there is a decreasing trend of pollution in Belgian cities, we see a growth in the number of kilometres travelled. An increased use of fossil-fuel powered vehicles will have deteriorating impact on air quality.

All the cities in the analysis have city centres that are (partly) closed for cars. Some of the cities have also introduced low emission zones, in order to restrict polluting vehicles. A regular revision of the entry restrictions to include high polluting vehicles would ensure the efficacy of the LEZ.

Further, a need for consistent and coherent data collection is essential to reflect the reality. For example, it is reported that Charleroi and Liège do not have measuring stations in dense urban areas and the so-called urban stations are located outside the actual urban area. Hence, the data reported by Liège and Charleroi may not denote the reality.

Overall, cities need to take a bold stance against the polluting vehicles and implement stringent regulations that limit these polluting vehicles. It is reported that the Flemish government aims to strive towards a stricter annual target for NO_2 of 20 $\mu g/m^3$, awaiting the foreseen revision of the WHO guideline for NO_2. Though the impact of this at a city level is unclear, the notion of adopting WHO guidelines is commendable. Indeed, the WHO is also expected to tighten their annual mean guidelines for NO_2 concentration. Should this happen the Belgian city leaders and regional governments are suggested to adopt the lower WHO guideline to put forward a bold and firm commitment to clean air in cities. Additionally, the Flemish government recently announced[11] a new legal framework that will allow cities to introduce ultra-low emission zones (ULEZs) that will phase-out all fossil-fuel powered cars. Cities should use this to take the lead in the transition away from internal combustion engine and individual motorised transport.

[11] https://www.lne.be/ontwerp-luchtbeleidsplan-2030

8 Mobility Management

Mobility Management is also called Transport Demand Management or Travel Demand Management. It is a practice in which the demand for travel through personal automobiles is controlled through various physical restraints, policy measures and financial instruments.

In our ranking and analysis, we have included both restrictions for car usage and incentives to use alternatives to the car:

- the cost for one hour of parking;
- innovative policy measures, namely whether a city has implemented a fiscal measure like the congestion charge, a low emission zone or a stringent policy measure to restrict personal cars like circulation plans;
- incentives to facilitate the usage of public transport, namely whether smartphone apps for scheduling and ticketing are available;
- the TomTom congestion index, indicating an average increase in travel time for cars due to congestion;
- shared cars and bicycles per km^2 of the service area.

Antwerp and Brussels have a low emission zone (LEZ), this zone restricts the entry of certain kinds of vehicles. The Brussels LEZ was open since 01 January 2018 and no data was available on the effectiveness of the LEZ in Brussels. The LEZ in Brussels will initially be on a 9-month transition period i.e. during this period (until October 2018), violators will not be fined but warned. Starting October 2018, LEZ violators will be fined. We expect that by the end of 2018 there will be more data on the LEZ available for public consumption.

Ghent has implemented a circulation plan. In simple terms the circulation plan is a transport management plan, but with more functionality and focus on sustainable mobility. The plan was introduced in April 2017 with a focus to increase the accessibility for cyclists, buses and public transport users and pedestrians. The plan explicitly aims to discourage car use and providing tortuous peripheral routes for car users. The introduction of the circulation plan received opposition, as with all policies that discourage car use. Yet, the city of Ghent has embarked on public consultations through information evenings and won over the public support. The circulation plan is currently implemented in the city centre of Ghent and is planned to be increased to larger areas (Ghent, 2018)[12].

[12] https://stad.gent/sites/default/files/page/documents/20161024_CirculatieplanBinnenstadGent.pdf

Table 8-1 Mobility management ranking. **Source: Wuppertal Institute Analysis**

Rank	City	Congestion charge	Cost of 1 h parking	Innovative transport policies	Scheduling and ticketing apps	Increase in travel time (%)	Shared cars/km^2	Shared bicycles /km^2	Shared Cars / 1000 inhabit-ants*	Shared Bikes / 1000 inhabit-ants*
1	Ghent	No	2.20 €	Yes	Scheduling and ticketing	18.00	3.48	0.63	2.15	0.39
2	Antwerp	No	1.60 €	Yes	Scheduling and ticketing	30.00	2.76	24.07	1.08	9.39
3	Brussels	No	1.50 €	Yes	Scheduling	38.00	5.51	32.62	0.76	4.48
4	Charleroi	No	1.00 €	No	Scheduling	16.00	0.05	0.00	0.02	0.00
5	Liège	No	1.00 €	No	Scheduling	23.00	0.52	0.10	0.18	0.04

** Column data for information not used for scoring*

None of the 5 cities have any kind of fiscal instrument to restrict cars such as a congestion pricing (like in London and Stockholm). In terms of smartphone applications, all the cities allow users to plan their trips through smartphones, purchase of tickets is available currently to the users of the De Lijn fleet i.e. in Antwerp and Ghent.

In terms of shared mobility, all cities except Charleroi have shared bicycle schemes. Brussels has the highest number of shared bicycles followed by Antwerp. Similarly, Brussels also has the highest number of shared cars per square kilometre. Ghent on the other hand has the highest number of shared cars per 1000 inhabitants followed by Antwerp. Ghent also has the

Figure 8-1 Comparison of parking price with public transport ticket

highest number of car-sharing providers and is planning to increase the access to car-sharing services.

Availability and affordability of parking plays and important role in car use (Shoup, 2005). The highly car dependent cities of the five cities, i.e. Liège and Charleroi, have very cheap parking at 1 Euro per hour. There are also areas in these cities where parking is provided at no cost. Correlating the automobile dependence in Charleroi and Liège, with the road safety situation and the car friendly policies that the cities have, we deduce that both the cities have a considerable amount of work that needs to be done to reduce automobile dependence and this can be achieved through policies that **disincentivise** automobile use. Discouraging automobiles needs to be done in parallel with encouraging public transport, walking and cycling.

8.1 Comparison with other EU cities

The graph below (Figure 8-2) shows the hourly parking in 17 European cities and the cost of a single public transport ticket. The graph also shows the modal share on public transport and share of personal automobiles. It can be seen that cities with high share of public transport have a higher cost of hourly parking in comparison to a single journey ticket, and a lower share of personal automobiles.

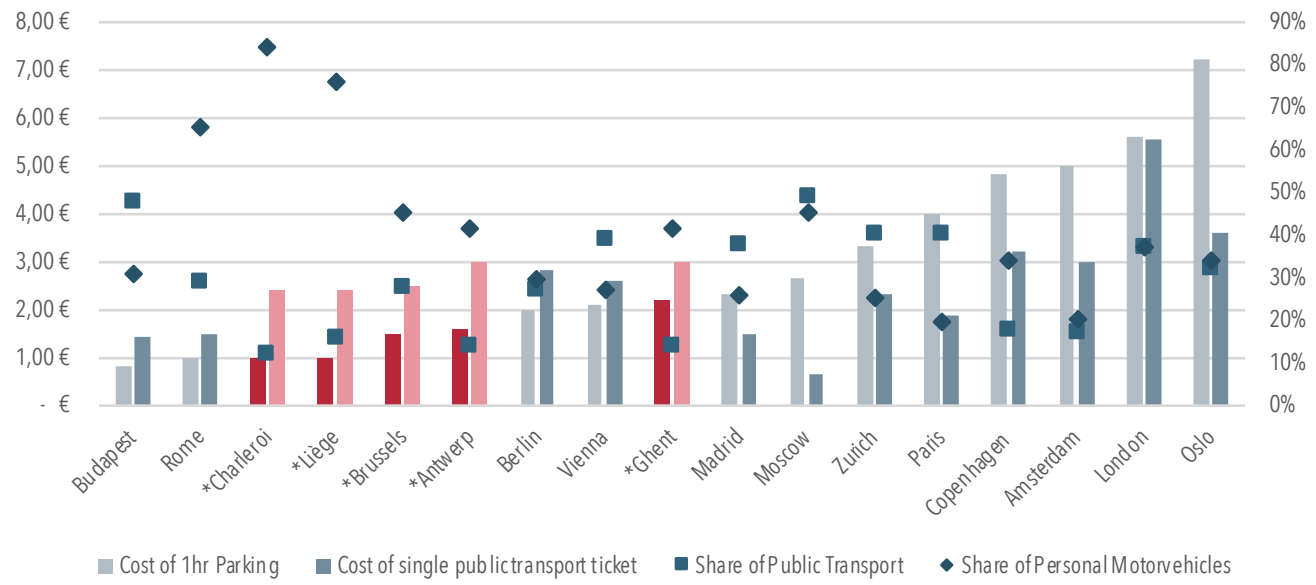

Figure 8-2 Comparison of parking price and public transport ticket in European cities

*(Belgian cities are denoted by *)*

Experience in parking management shows that if parking is properly managed and priced such that it is higher than the cost of the price of public transport there could be an increase in public transport use. For this to happen other factors such as the attractiveness and efficiency of public transport also needs to be improved. The improvement in public transport will also have a positive effect on congestion in cities.

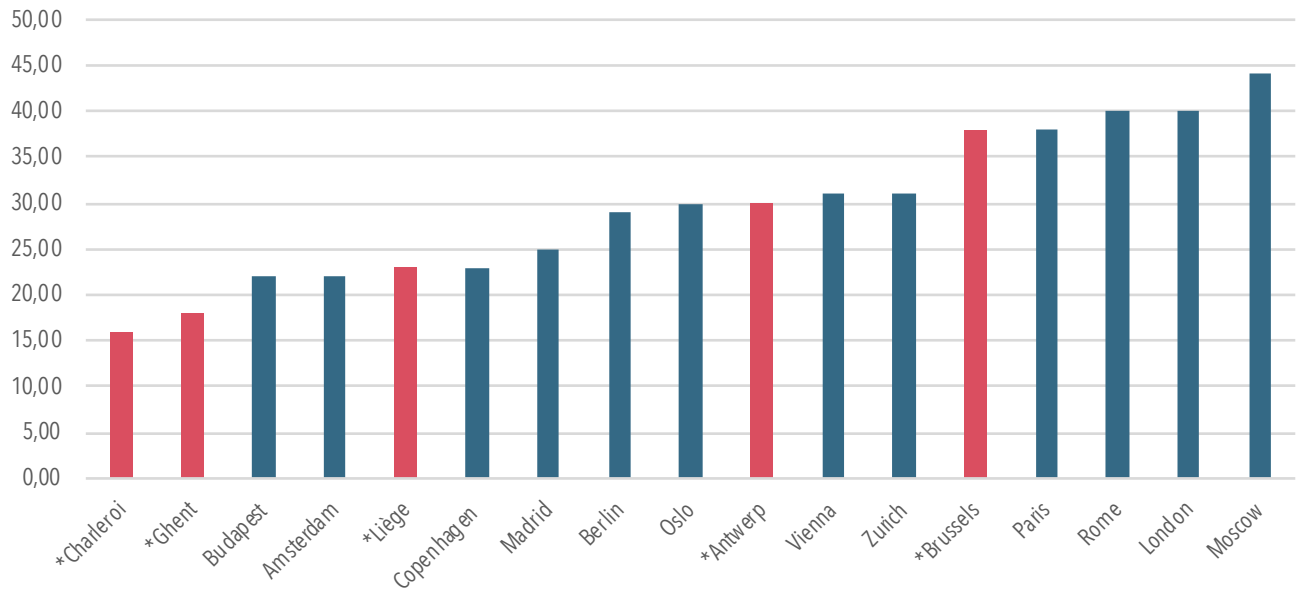

Figure 8-3 Percent increase in travel time due to congestion. Source: TomTom

*(Belgian cities are denoted by *)*

Figure 8-3 shows the percent travel time increase in cities due to congestion. Cities with high automobile dependence and use have higher traffic volumes and thereby congestion. Besides, cities that have excessive automobile infrastructure may initially have results of congestion easing but over time the problem returns and worsens. Especially Antwerp and Brussels, have about 30% or higher increase in travel time due to congestion.

8.2 Recommendations for mobility management

We find that Ghent is the only city among the five analysed with a high cost of hourly parking. Brussels and Antwerp have affordable parking, while Charleroi and Liège have very cheap parking. Various studies have shown that free or cheap parking encourages automobile use in cities ((Shoup, 2005); (Deakin et al., 2004); (Petrunoff, Rissel, & Wen, 2017)). Experience also shows that if on-street parking is much more expensive than off-street parking (i.e. parking garages) there will be fewer vehicles parked on-street. On-street spaces offer much more potential than just being a space occupied by a car. Copenhagen and Oslo have reclaimed the on-street parking spaces and have turned them in bicycle lanes and public spaces, increasing the overall utility of the parking space.

In addition to incentivising sustainable transport modes, disincentivising personal automobiles is essential. Restrictions can be in the form of physical restriction through closing streets, or through policies and fiscal instruments such as congestion pricing. None of the 5 cities in our analysis have congestion pricing or any fiscal instrument to deter automobile use. Shared mobility also provides an opportunity to shift short motorised trips to shared bicycles.

Promoting shared mobility has the potential to reduce the excessive use of personal automobiles and it is especially true for short motorised trips ((Cheyne & Imran, 2016); (Fulton,

Mason, & Meroux, 2017); (Jäppinen, Toivonen, & Salonen, 2013)). These short trips can be shifted to shared bicycles if proper infrastructure and integration with public transport is provided.

Except for Liège and Charleroi, shared mobility is being actively taken up in the other 3 cities analysed. Brussels and Antwerp have extensive shared bicycle facilities and fleet. Ghent is actively pursuing shared car schemes and use. Ghent currently has 550 shared cars and 10 providers of car-sharing. The city aims to double their car-sharing subscriptions to 20,000 inhabitants by 2020.

9 Active Mobility

Active mobility is a collective term for walking and cycling. People friendly cities tend to have a high share of active mobility. Walking and cycling can only increase in cities when there is infrastructure and policies that favour walking and cycling (Pucher & Buehler, 2017).

In our study we have scored the cities on their current share of walking and cycling trips, urban green cover i.e. the share of green spaces in the city. We also have collected data on the shared bicycle availability in the city, for information to the reader.

It has to be noted that cities with already high shares of bicycling will need a smaller number of shared bicycles as there is already a high bicycle ownership and usage in the city. Cities with higher cycling and walking infrastructure were also safer than the ones with high automobile-oriented infrastructure.

Table 9-1 Active Mobility ranking of the Belgian cities **Source: Wuppertal Institute Analysis**

Rank	City	% of Walking trips	% of Cycling Trips	Urban green cover	Number of Shared Bicycles*
1	Ghent	15%	30%	5%	100
1	Antwerp	15%	29%	5%	4923
3	Brussels	25%	3%	21%	5264
4	Liège	5%	3%	18%	7
5	Charleroi	3%	1%	12%	0

** Column not used for scoring only for information.*

Among the five cities, Brussels has the highest share of walking, Ghent and Antwerp have a high share of cycling. Antwerp and Ghent are also very actively promoting shared bicycle schemes and have plans in place to promote cycling in the city on par with the cycling in the neighbouring Netherlands. In terms of shared bicycles, Brussels has the highest number of shared bicycles followed by Antwerp. Liège has a small bike sharing system operated by BlueBike.

Both Liège and Ghent have a bicycle rental system where users can rent a bicycle for medium- and long-term use. In Liège, a bicycle can be rented for minimum of 3 months up to 1 year. The system in Liège is called Vélocité. In Ghent, a similar system is operated by the city under its "*De Fietsambassade Gent*" project, which started in July 2017. The project aims to stimulate further bicycle use in the city. Ghent has ambitions to become the leading city in bicycling. The future plans for encouraging cycling and creating a pedestrian friendly city can be seen in the Mobility Plan of Ghent for 2030.

With almost 540 kilometres of bicycle paths, Antwerp is also in the race to become a bicycle friendly city. Bicycle use in Antwerp is about 29% and the city has an extensive bike sharing

system with over 4,900 shared bicycles. The city aims to increase the number of shared bicycles in the coming years and also has plans to promote e-scooter sharing.

We believe that neither Charleroi nor Liège have extended facilities for cycling. Charleroi has only 45 kms of bicycle paths and data for Liège are not available. The poor or lack of coherent bicycle infrastructure decreases the appeal to cycle and increases the risk of having a bicycle accident, this is already seen in the poor road safety for cyclists in Charleroi.

9.1 Comparison with European cities

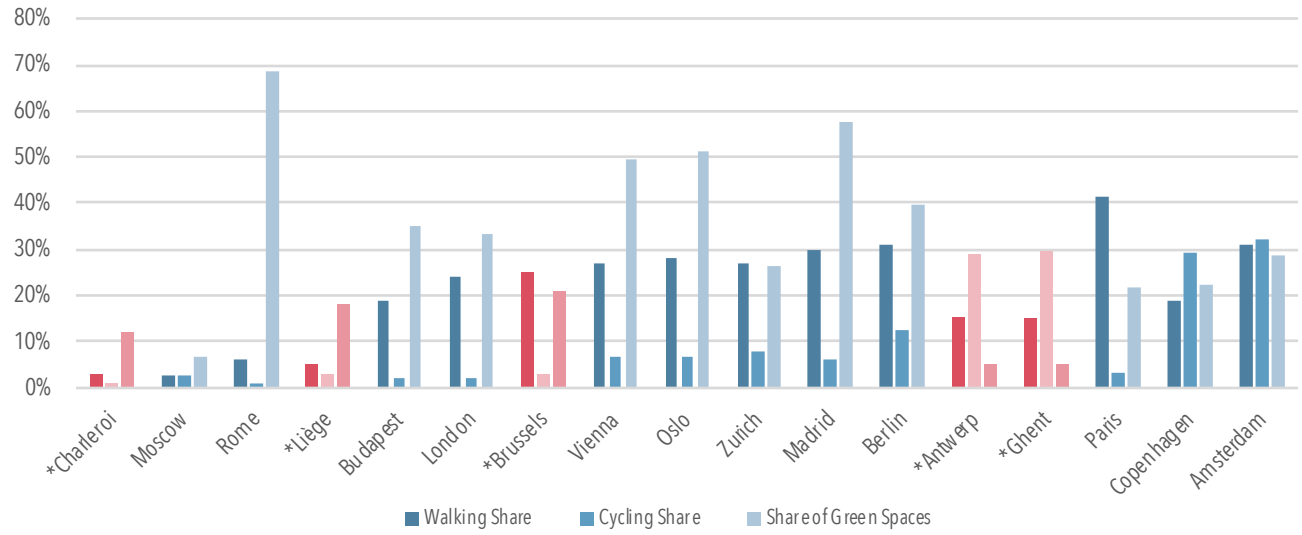

Figure 9-1 Active Mobility in 17 European cities

*(Belgian cities are denoted by *)*

From the graph above it can be seen that Amsterdam and Copenhagen have a high share of walking and cycling. Ghent and Antwerp are approaching the standard of Amsterdam and Copenhagen. In order to reach this level both Ghent and Antwerp need to scale up their efforts in promoting walking and cycling. A very strong political will is crucial for Antwerp or Ghent to advance their active mobility agenda.

Brussels has already identified cycling as an area for improvement and is investing in promoting and encouraging cycling. Liège and Charleroi have identified potential in cycling yet our research shows that much more effort is essential especially in discouraging automobile use and encouraging bicycling through effective policies and physically reclaiming space from automobiles in favour of cyclists and pedestrians.

9.2 Recommendations on Active Mobility

Antwerp and Ghent are the only cities of the 5 analysed to have bicycle shares at 30%, the remaining 3 cities have bicycle shares lower than 4%, denoting that considerable work is required to promote active mobility in these cities.

Though Brussels is making efforts to advance cycling, we recommend a coordinated approach in Brussels's decision making will be beneficial in advancing the cycling agenda. As we pointed in the start of this report, the area we considered for Brussels is the Brussels Capital Region, which is a combination of 19 municipalities, that is to say 19 decision-makers and the Brussels regional government.

The sheer number of decision-makers make the situation of Brussels more complex than other cities. We hope that the decision-makers will favour developing more democratic modes of transport i.e. walking and cycling, thus creating a city that prioritises people over passenger cars.

For best practices the cities don't need to look very far for inspiration: many Dutch and Danish cities have some of the best infrastructure for cycling ((Gössling, 2013); (Vedel, Jacobsen, & Skov-Petersen, 2017); (Gao, Helbich, Dijst, & Kamphuis, 2017); (Pucher & Buehler, 2008)). Fortunately, cities like Amsterdam and Copenhagen publicly share the recipe for their success. The Danish and the Dutch design standards for cycling and walking are applicable to any city that intends to promote walking and cycling. A crucial ingredient for promoting active mobility is a very strong and unwavering political will.

While people centred urban design is definitely one factor for encouraging active mobility, disincentivising personal motorised transport is also essential to encourage the uptake of alternative modes of transport.

In Copenhagen and Amsterdam, bicycles and pedestrians are physically segregated from fast moving motor vehicles. City streets are designed with pedestrians and cyclists in mind. This can be seen in many Dutch cities where car users need to travel longer distances to reach their destinations than bicycle users.

Copenhagen is building over 10 kms of dedicated bicycle superhighways, in addition to the already existing 400 km of bicycle lanes. These superhighways allow regular cyclists to travel into the city with minimum or no interference with motorised traffic.

10 Conclusions and recommendations

From our analysis of the five cities in Belgium our conclusions range from provision of basic sustainable mobility measures to measures that give cities the extra nudge to advance further in sustainable mobility.

Liège and Charleroi have a long way to go in terms of achieving sustainable mobility, putting them at a lower end of the sustainable mobility spectrum. Both cities have to firmly implement car-restraining policies and encourage active mobility and public transport. Road safety has been a particular weakness in Charleroi. Physically segregating automobiles and controlling speed of the motor vehicles can increase road safety. Further, providing dedicated and segregated facilities for bicycles and pedestrians will exclude them from interactions with fast moving vehicles. Doing so will be beneficial for the city and the residents, the benefits are in the form of cleaner air, safer streets and higher quality of life.

Brussels lies in the middle of the spectrum on sustainable mobility. The city performs better than Liège and Charleroi, and can work more to reach to the levels of Antwerp and Ghent on some factors, such as active mobility and road safety. Brussels performs very well on the public transport front, yet has a high dependence on personal automobiles. As we do not have information on the trip patterns, we cannot definitively argue, but from experience on reviewing cities with similar modal share numbers and other factors we presume that many of the motorised trips in Brussels are generated from outside the city.

In terms of active mobility, Brussel region needs to increase priority for active modes by designating continuous space for walking and cycling that is safe and segregated from fast moving vehicles. Dedicating road space for public transport i.e. buses and trams will also benefit the uptake of public transport further. Increasing priority for public transport and active mobility means that urban space for cars needs to be reduced and car travel needs to be made unattractive.

While the conclusions we make here for Brussels sound easily implemented, decision-making for and in Brussels Capital Region is complicated. The BCR is an assortment of 19 municipalities. The region by itself can only influence sustainable mobility to a basic extent without a coordinated decision-making. For a widespread and successful implementation of sustainable mobility, a bold and unwavering support of the local decision makers is crucial.

The current efforts by the Brussels Region to expand the tram network, implementing a large bicycle sharing system, a low emission zone, and idea to promote park and ride systems for the uptake of public transport are commendable and they will have a greater impact if there is more political buy-in from the local decision-makers.

Ghent and Antwerp have a more advanced sustainable transport system than Brussels (except for public transport and walking), Liège and Charleroi. Both the Flemish cities have more developed walking and cycling systems, and their cycling modal share is rather high compared to other European cities. Ghent and Antwerp have plans to further encourage cycling and integrate cycling with public transport better. Public transport in Ghent and Antwerp needs further encouragement, potentially by expanding the network of the system to reach a

larger urban population. Innovative concepts such as the annual ticket from Vienna[13] can be explored to increase public transport ridership. In terms of road safety in Ghent and Antwerp, additional effort is required to reduce the crashes to pedestrians and cyclists. Reducing the road traffic speed to 30 kmph or less in residential and core city areas could be beneficial.

A common thread in all the 5 Belgian cities we have analysed is the availability of data. While some of the cities have detailed data for some indicators, some cities do not have publicly available data. Further, among all the cities certain data that is available is not recent e.g. the modal share data for Brussels is from 2010, the data for Liège and Charleroi is from 2008.

In some cases, the data is not coherent e.g. public transport operators do not report actual passenger numbers at a local level. In other cases, the data reporting is incomplete and does not represent the reality. This is particularly true in the case of air quality monitoring, e.g. Brussels does not report the air quality from all the stations and we were informed that the reporting for Liège and Charleroi does not reflect that actual urban area.

Overall, we draw the following conclusions for promoting sustainable transport in the 5 Belgian cities under review:

1. *Priority for Public Transport:* Encouraging public transport use by making public transport extensive and expansive is essential. To initiate a shift from personal automobiles to public transport, the public transport system needs to be safe, affordable, attractive and punctual, and provided as a network. Better results are obtained if public transport is also integrated with other modes of public transport i.e. integration between busses, trams and metro.
2. *Active mobility*: In addition to public transport, cities need to provide infrastructure and policies encouraging walking and cycling. Safe and segregated cycling and walking infrastructure increases the appeal to use these modes and increases their use. Cycling can be further encouraged by providing ample secure parking facilities at major destinations e.g. universities, train stations, shopping areas, etc.
3. *Automobile restraining policies:* Coupled with promoting public transport, walking and cycling, it is paramount to have policies and measures that make automobile use difficult. Without automobile restraining policies and measures the success of promoting sustainable transport will be very limited and can also be undermined. Automobile users need to know the true cost of their travel and not receive subsidies for using their cars, in the form of free and cheap parking, or not being charged for the air pollution caused by the motor vehicles.
4. *People centric planning and projects*: The ultimate purpose of cities and streets is for people and hence they need to be (re-)designed to fit the needs of the people. Cities need to be designed to increase the quality of life and liveability. Automobile dependent cities do the opposite. Highly car dependent cities are unsafe, have poor air quality and have a low quality of life. People centred projects such as reclaiming city centres to increase people activity, converting car parks to

[13] The annual public transport ticket in Vienna costs 365 Euros or a euro a day, for unlimited trips on public transport within the core city area. More info: https://www.wienerlinien.at/eportal3/ep/channelView.do/pageTypeId/66533/channelId/-47408

green parks, reclaiming motor traffic lanes for bicycles and reducing the automobile speeds to 30 kmph or less creates safer and convivial urban areas.

5. *Political will:* The most crucial and important element for implementing sustainable urban mobility is a strong and unwavering political will. In the absence of political will there is no vision for mobility and sustainable mobility cannot thrive. A strong political will over a period of time can make sustainable urban mobility a norm in cities and thus decision making with people as the centre becomes fundamental. A political will is strengthened through a coordinated support, this would mean that a unanimous support to advance democratic and people centred mobility modes i.e. public transport, walking and cycling.
6. *Integration:* Another important factor for success that many cities overlook is the importance of modal integration among the various transport modes in the city. Cities implement various kinds of public transport (trams, buses, metro, etc.), design designated bicycle lanes and walking facilities. Failing to integrate these modes will result in a small shift to sustainable modes. If modes were to be integrated a whole journey can be planned easily. For example, if active mobility is integrated with public transport, a pedestrian can walk on a designated space to the public transport station and take the public transport. Similarly having proper bicycle paths and secure bicycle parking at the tram station, enables a cyclist to use their bicycle for commute. Even better is allowing bicycles on trams, trains and buses. Though this is difficult during rush hours. Similarly, integrating public transport with a park and ride[14] facility that is located far from the city centre allows long distance commuters to use public transport.
7. *Data availability and coherence:* In order for cities to develop local sustainable mobility plans proper data that reflects the actual situation in the city needs to be the basis. Lack of coherent and recent data results in improper decisions and monitoring the progress becomes difficult. Successful cities have a defined methodology for collecting data at regular intervals and took data driven decisions and established tangible targets. Regular monitoring of mobility in cities will also give a chance to decision-makers to inform the public on the progress that happened during their term as a consequence of their decisions.

In our analysis we have also come across proposals and actions that are being taken at regional level and at city levels to advance sustainable mobility. The Flemish Government have introduced the concept of "*Basisbereikbaarheid*" or Basic Accessibility (loosely translated), with a central idea of having a better and more efficient public transport through better local decision making in Flanders. The Flemish government will enable the creation of 15 transport regions, each transport region will monitor, control and evaluate the transport in their region. The transport region will also be responsible for developing a mobility plan with a core objective of making public transport and active mobility attractive. The regions will also have more decision-making role in the budget allocation for transport.

[14] We would like to express caution with park-and-ride systems. If the P+R is located close to the city centre, users would typically not use the system and rather drive to the destination.

In Liège and Charleroi, we have found plans to increase the public transport network. Liège is extending the tram network[15], while Charleroi intends to expand the metro network[16]. There are plans to increase the extent of pedestrian areas and cycling facilities (in Charleroi). As in this study we analysed the existing situation of urban mobility, it is possible future similar studies would note the change in the state of mobility in these cities.

Similarly, we believe that the circulation plan in Ghent covers a wider range of sustainable transport options rather than mere restriction to cars. By opening up a city centre to more active mobility and public transport the area is made more people friendly.

[15] https://www.liege.be/fr/vie-communale/services-communaux/mobilite/projets/tram

[16] https://www.charleroi.be/sites/default/files/kcfinder/files/projet-de-ville/Projet-de-ville-charleroi-2017.pdf

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