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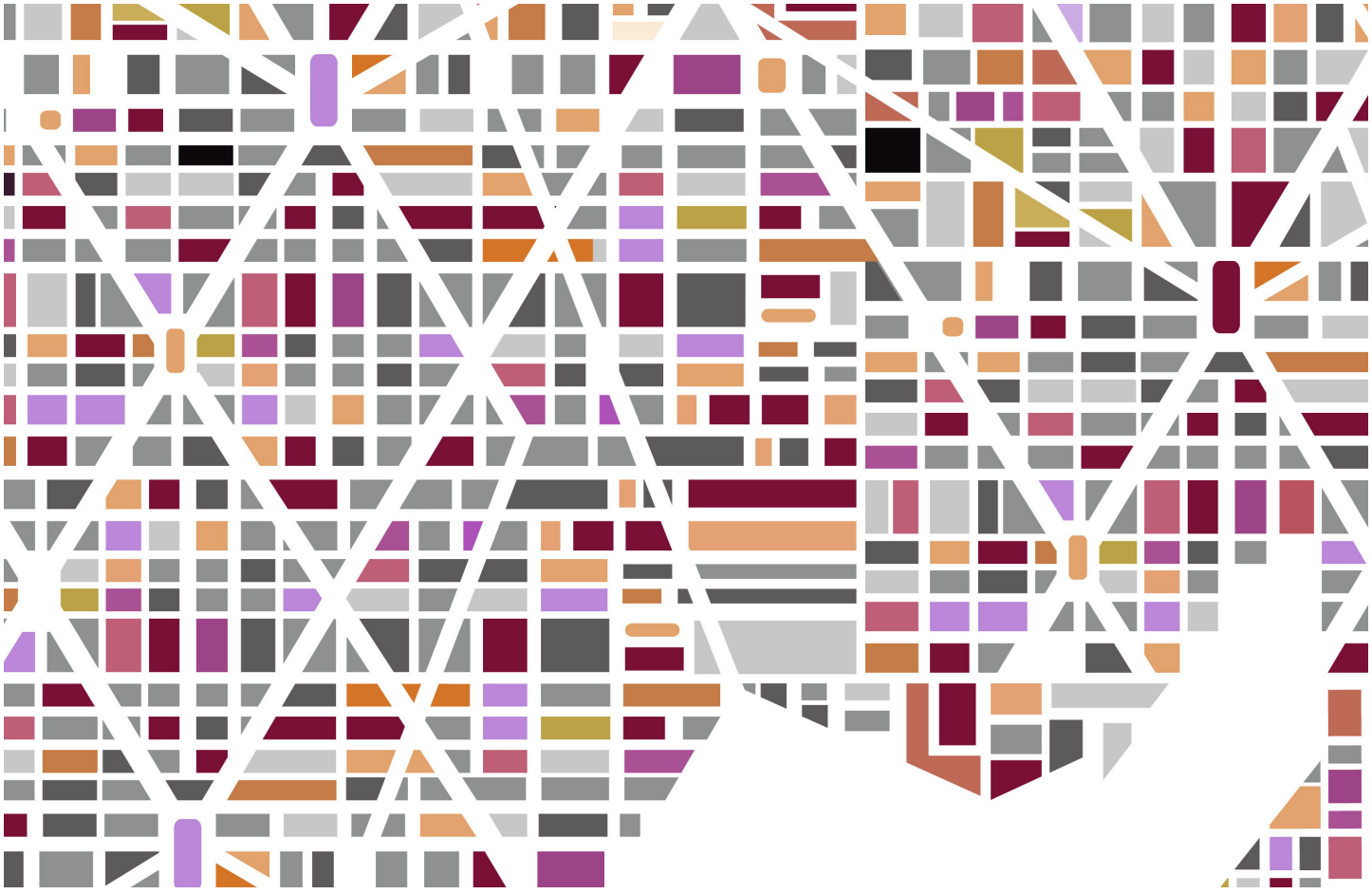

Monitoring Progress in Urban Road Safety

Safer City Streets

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The International Transport Forum

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Foreword

Every minute, someone in the world dies in urban traffic. To put the brakes on needless road deaths, cities are taking the lead in the battle for road safety. Their actions – speed limit reductions and radical changes in street design, for example – are delivering measurable results. In 2019, two major European capital cities, Helsinki and Oslo, reduced the number of pedestrians and cyclists killed in traffic to zero.

Safer streets are crucial for making cities more liveable. If streets are dangerous, efforts to promote walking and cycling are undermined. Reducing the risks of urban traffic not only saves lives, it opens doors to sustainable forms of transport, which can reduce pollution, cut emissions, fight congestion and improve citizens' physical and mental health.

Cities offer countless opportunities for experimentation and policy innovation. Their efforts complement important actions led by other stakeholders, including national governments and inter-governmental organisations, who have substantial impact on vehicle design standards, research and training. Carefully considered road safety policies ensure that cities have a critical and growing role in achieving the United Nations Global Sustainability Goals and implementing the New Urban Agenda.

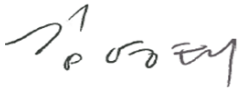
The International Transport Forum (ITF) launched the ITF Safer City Streets initiative at the UN Habitat III conference in 2016. It brings together road safety experts working in cities and explores the solutions developed at a local level. Cities in the network improve their urban road safety performance by sharing data, experience and knowledge and learning from each other.

Safer City Streets replicates at city-level the International Road Traffic Safety Analysis and Data (IRTAD) group, a global road safety network of countries hosted by the ITF, which has run for more than 25 years. The IRTAD group has been commended by the World Health Organization as "a model of a multicounty effort".

Only measurable results provide evidence of best practice. At the core of the ITF Safer City Streets initiative is data collection, with the development and maintenance of a city-level database on mobility and road safety statistics.

Thanks to the Safer City Streets programme, the ITF published in 2018 the world's first road safety benchmark at city-level to include meaningful risk indicators for each road user type. The ITF used this network and database again in 2020 to investigate the safety of micromobility.

The present report updates the benchmark first published in 2018. Once again, it highlights best practice and identifies room for progress towards better urban road safety policies. A complete list of the cities mentioned in this report is available in Annex A.



Young Tae Kim

Secretary-General
International Transport Forum

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The author is grateful for the support of the POLIS network in organising joint meetings with the ITF on urban road safety. The author also benefitted from direct conversations with Jan Jakiel, City Road Administration in Warsaw; Maja Cimmerbeck, City Environment Agency in Oslo; and Tony Churchill, Joanna Domarad and Alex Caufield, City of Calgary.

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Members of the Safer City Streets network, mostly found in local governments' road safety teams, dedicated their time to collect and share their local road safety figures. National and European level government officers and experts from research institutes kindly complemented the data collection where gaps were identified. In particular, the Danish Technical University submitted data from the Danish National Travel Survey.

The Safer City Streets initiative is funded by the International Automobile Federation (FIA) Road Safety Grant Programme and delivered by the ITF. This work benefits from the guidance and support of the ITF's permanent working group on road safety data, the group for International Road Traffic safety Analysis and Data (IRTAD). The IRTAD group organised the pilot stage and established the methodological framework. Funding from the European Commission supported further database development and the elaboration of new risk indicators.

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Executive summary

What we did

This report tracks the progress in reducing the number of road traffic fatalities and serious injuries in cities since 2010. It presents traffic safety data collected in 48 cities participating in the ITF Safer City Streets network and compares urban with national road safety trends. It provides indicators for the risk of traffic death for different road user groups, thereby enhancing the evaluation, monitoring and benchmarking of road safety outcomes.

What we found

The cities examined have achieved large reductions in the number of road deaths since 2010. That said, very few are improving traffic safety at a pace that will cut road deaths by 50% in the decade leading up to 2030, in line with UN road safety targets. In most cities, the number of road deaths fell between 18% and 29% in the period 2010-18. Reductions for vulnerable road users were slower. In large cities, the number of traffic fatalities among pedestrians fell consistently slower than for occupants of cars and trucks.

The number of serious cycling injuries increased in most cities. Paradoxically, cycling has become safer over time, at least in cities for which data on cycling trips are available. The growth in the number of bicycle trips in these cities far outweighs any increases in the number of cyclist deaths or injuries.

The number of road deaths per inhabitant varies; some cities are ten times safer than others. Such differences also exist for the risk of death among pedestrians, cyclists and motorcyclists. Making such gaps between well-performing and not-so-well-performing cities transparent, as this report does, can help lagging cities to catch up with the safest of their peers, and set the right targets.

What we recommend

Set ambitious targets to reduce the number of casualties

Cities should adopt targets for the rapid reduction in the number of fatalities and serious injuries. Large gaps in road safety performance exist between cities. Drawing attention to these can help secure political support for ambitious casualty reduction targets. These should aim at the behaviours most critical for improvement, most importantly speeding.

Create joint mobility and safety observatories in cities

Local governments should collect urban mobility data alongside crash data in a regular fashion. This will make the interpretation of road safety trends easier. The analysis should include data on behaviour, attitudes and enforcement. Dedicating staff and budget to establish a road safety observatory is most likely to deliver a robust and consistent set of indicators over time. A sustainable urban mobility plan (SUMP)

can provide mandate and funding for an observatory. The changes in mobility patterns triggered by the Covid-19 pandemic strengthen the case for systematic collection of urban mobility data.

Put the focus on protecting vulnerable road users

Cities should intensify their efforts to improve the safety of vulnerable road users. These are most at risk in city traffic and constitute the vast majority of fatalities on urban roads. Cities should manage streets in better ways that provide safe conditions for walking and cycling. Adopting a Safe System approach when setting speed limits is particularly recommended: this includes 30 km/h limits where motor vehicles mix with vulnerable road users. Automated enforcement and adequate street design principles will maximise compliance with speed limits. Reallocating road space in dense urban areas will make city centres safer if the reallocation succeeds in replacing a share of short car and motorcycle trips by walking, cycling and other forms of low-speed micromobility.

Measure the safety of vulnerable road users in cities with appropriate indicators

Analysts should control for the volume of travel to assess the level of risk experienced by a specific road user group. This is particularly important for micromobility, given the rapid growth of cycling in many cities at the current time. Analysts should monitor the number and length of trips made by each mode with household travel surveys or other means. Where funding for monitoring is a problem, local governments should explore partnerships with national authorities and public health bodies. Simplified, innovative, standardised survey methods can also reduce costs.

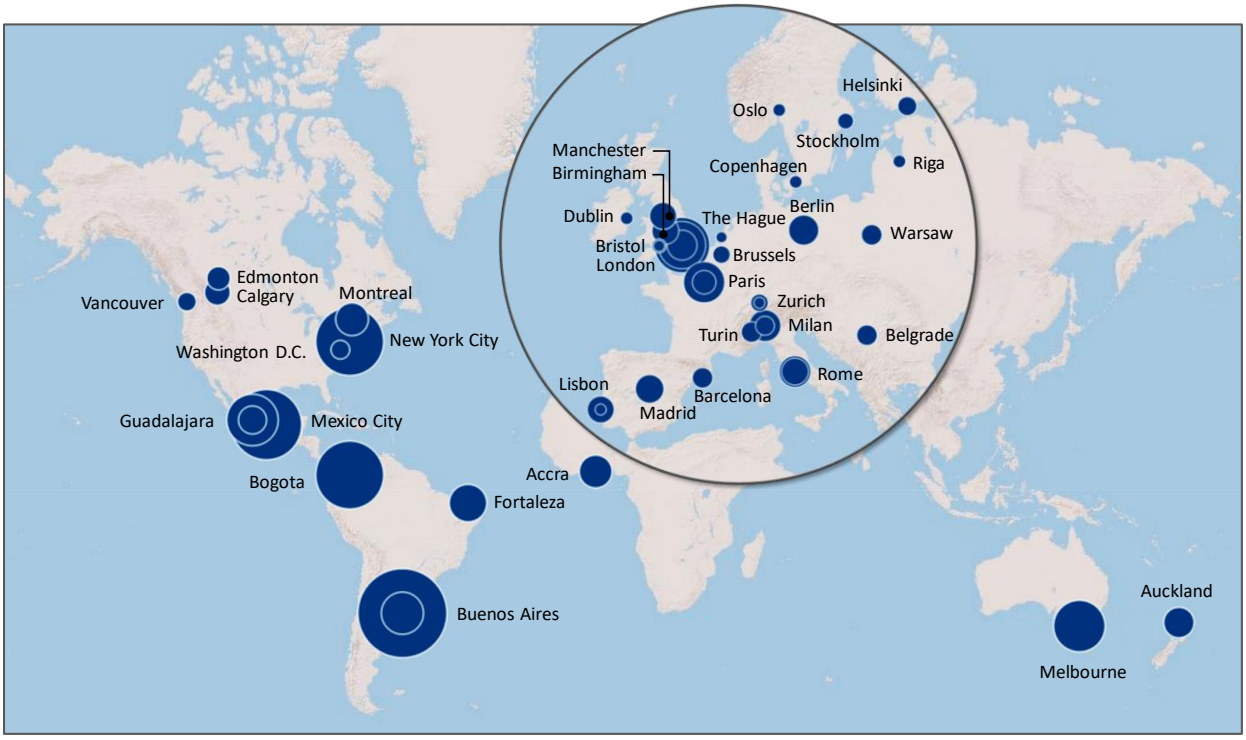
About the cities in this report

This report builds on data from 48 cities in 26 countries, mainly in Europe and the Americas (Figure 1). Annex A provides the full list of the cities mentioned in this report. The selection includes cities of various shapes:

- land area ranges from 80 square kilometres in The Hague to more than 8 800 in Melbourne
- resident population varies from just over 400 000 in Zurich to over 14 million in Greater Buenos Aires
- resident population per square kilometre varies from 330 in Auckland to nearly 21 000 in Paris.

Out of the 48 cities, ten have their boundary defined by their functional urban area[1] (FUA). The FUA consists of a city plus its commuting zone, according to the definition jointly adopted by the OECD and the European Commission (OECD, 2012). For a detailed comparison of road safety performance across FUAs in Europe, see ITF (2019).

Figure 1. Cities contributing to the ITF Safer City Streets database



Note: Circle area is proportional to resident population. Concentric circles occur where data is available at multiple geographic levels. Three levels exist in London for instance: Inner London, Greater London and the London Functional Urban Area.

Source: ITF Safer City Streets database, Esri basemap.

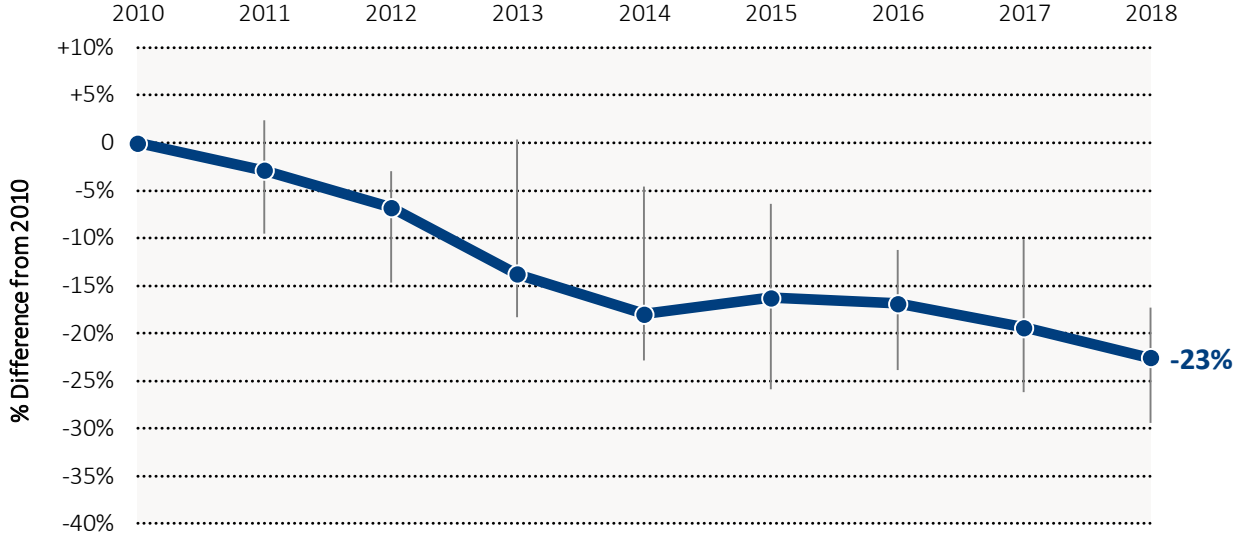
Reducing road deaths and serious injuries: Progress made

Most cities (26 of the 28 that have data from the entire 2008 to 2018 period) have reduced the number of road deaths between 2010 and 2018. Some cities have more than halved that number. Fewer cities have achieved a reduction in serious injuries over the same period. Overall, however, very few cities are progressing at a pace sufficient to deliver the UN's goal of a 50% reduction in road deaths over the decade[2]. This chapter examines the trends since 2010, separates progress by mode of transport and compares city-level with national-level trends.

Road deaths drop 3.2% annually

Two cities, Oslo and Warsaw, have reduced the number of road deaths by more than 7% a year between 2010 and 2018. Such progress sets them on track to deliver the UN road safety target to halve the number of road deaths in a decade.

Figure 2. Road traffic deaths since 2010



Note: For each year, the dot represents the median percentage change since 2010 across 28 cities. Vertical bars represent the inter-quartile range: observations between the 25th and the 75th percentiles. The number of deaths is captured by a three-year average – for instance, a 2010 value represents the 2008-2010 average. Source: ITF Safer City Streets database.

All other cities fall short of this target. Across 28 cities, the median annual reduction in road deaths is 3.2%, which equates to a 23% reduction over the eight-year period for which data is available[3]. Most cities delivered a reduction between 2.4% and 4.2% per year. Aggregated data across all cities shows no

consistent sign of acceleration: the rate of reduction in road deaths was relatively stable over the years considering the distribution of results (Figure 2).

Box 1. Can cities make Vision Zero a reality? Lessons from Helsinki and Oslo

In 2019, both Oslo and Helsinki achieved zero deaths of pedestrians and cyclists. Lessons from Oslo and Helsinki serve as valuable guidance for eliminating road deaths in urban areas. So far, none of the 158 cities over 500 000 inhabitants in the *Dekra Vision Zero Map* has achieved zero road deaths across all user groups.

The implementation of safe speed limits was a key factor in the success of both cities. Helsinki lowered maximum speeds in 2018, and the new limits took force in 2019. As a result, streets in residential areas and the city centre are limited to 30 km/h. On trunk roads, the speed limit is 50 km/h in suburban areas and 40 km/h in the inner city. Oslo adopted similar speed limits, supported by Norway's 2001 Vision Zero strategy.

Cities act in multiple areas simultaneously to reduce road danger. Helsinki not only changed speed limits, but also worked on street design, increased traffic police resources, facilitated the uptake of vehicle safety technologies and improved emergency post-crash response. Oslo has also invested in limiting car use to make streets safer for pedestrians and cyclists. The city reduced parking opportunities in the city centre, built speed bumps, closed some streets to car traffic and implemented car-free zones around schools. Large and long-term investments in public transport, walking and cycling facilities accompanied this transformation.

Source: Dekra (2020), City of Helsinki (2020) and SmartCitiesWorld (2020).

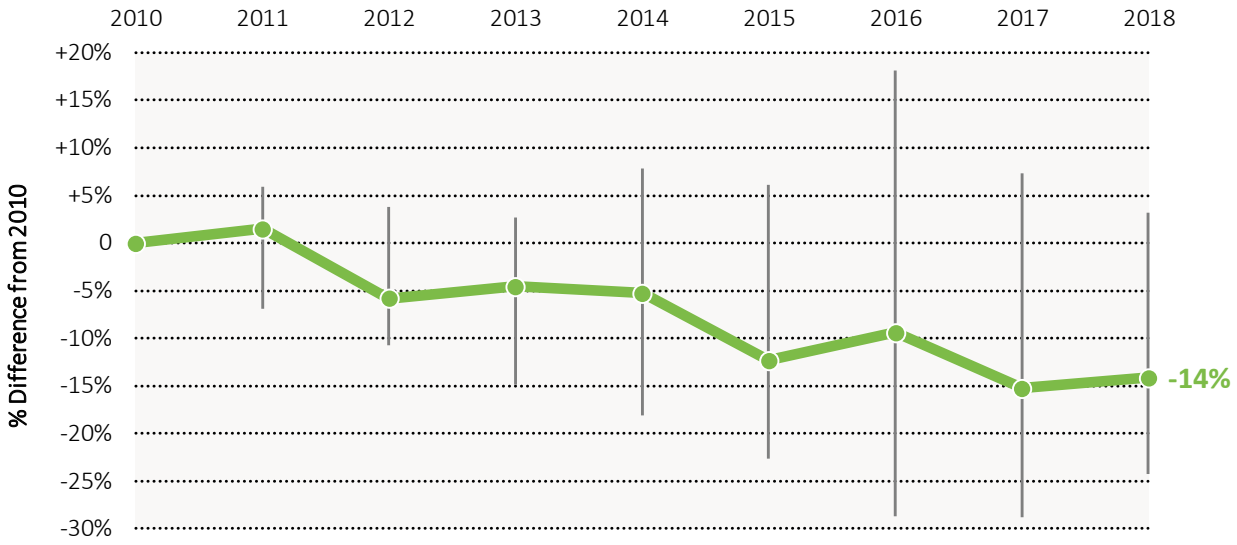
Serious injuries drop 1.9% annually

Most cities achieved some reduction in serious injuries between 2010 and 2018: the median annual reduction stands at 1.9%, resulting in a -14% change over eight years (Figure 3). However, the number of serious injuries increased between 2010 and 2018 in seven out of 19 cities for which data is available. Here again, the trend does not suggest any faster reduction in serious injuries in recent years.

One should bear in mind the difficulties of injury data collection and the difficulties in making comparisons due to cities adopting different definitions. The ITF Safer City Streets database monitors two indicators for the number of serious injuries:

1. the number of people hospitalised for 24 hours or more, excluding those who die within 30 days (Figure 3)
2. the number of people whose injuries are assessed at level 3 or more on the Maximum Abbreviated Injury Scale (MAIS), which is optimal for international comparisons but is used in fewer cities.

Figure 3. Serious injuries since 2010



Note: For each year, the dot represents the median percentage change since 2010 across 19 cities. Vertical bars represent the inter-quartile range: observations between the 25th and the 75th percentiles.

Source: ITF Safer City Streets database.

Cycling casualties follow a different trend

Trends in traffic safety figures vary across transport modes. The reduction in the number of deaths and serious injuries is slower among vulnerable road users and slowest among cyclists.

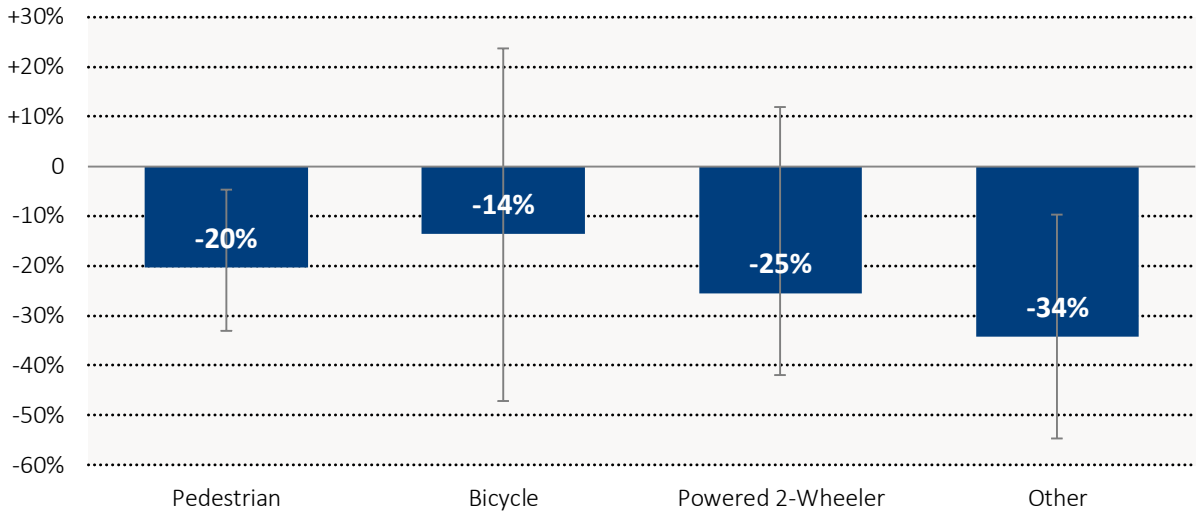
Since 2010, the number of pedestrian fatalities has fallen in 21 out of 26 cities. The rate of improvement, however, is relatively low. Across all cities, pedestrian fatalities fell typically by 2.8% per year, adding up to 20% over eight years, using median values (Figure 4).

In *each* of the seven cities[4] with the highest absolute numbers of fatalities, the number of pedestrian deaths fell more slowly than car and truck occupant deaths. The rationale for looking at the largest cities, those where road fatality numbers are highest, is to make the statistical analysis less vulnerable to the natural fluctuation of small numbers.

Since 2010, the number of cycling fatalities has fallen in only 14 out of 26 cities. Considering median values across 26 cities, the reduction in cycling fatalities stands at 1.8% per year, adding up to 14% over eight years. In comparison, the number of car and truck occupant fatalities fell nearly three times faster, by 5.1% per year, or 34% over the same period (Figure 4).

Serious injuries trends diverge even more across transport modes. The number of serious cycling injuries increased in 11 cities, was stable in two cities, and fell in only four. Considering median values across 17 cities, the number of serious cycling injuries increased by 3.5% per year, or 32% over the eight-year period. In comparison, the number of seriously injured fell across all other user groups. Among car and truck occupants, they fell by 1.8% per year or 14% over the period (Figure 5).

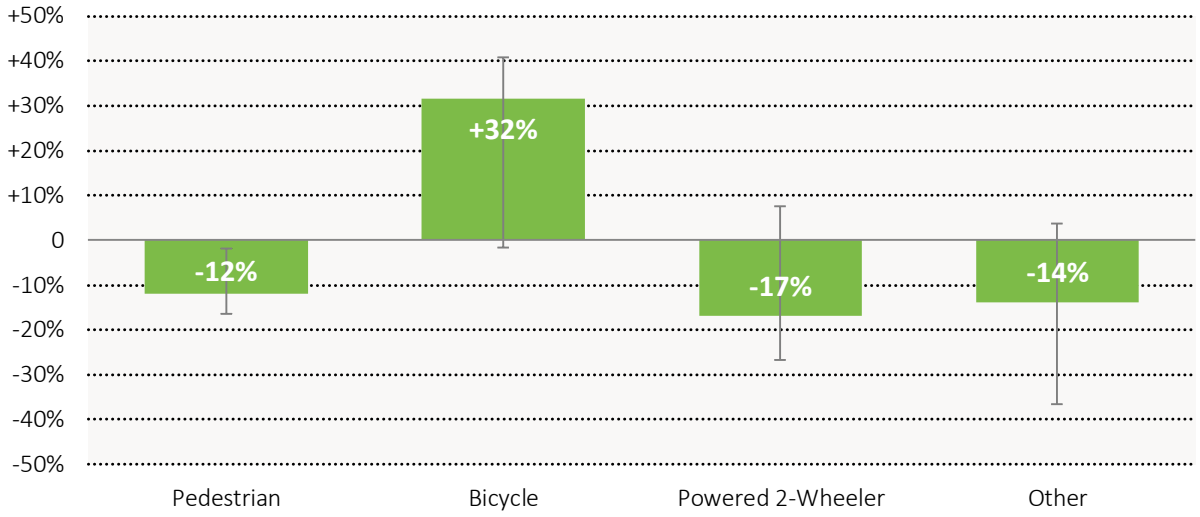
Figure 4. Road traffic deaths by mode, 2010-2018



Note: For each mode, the chart represents the median percentage change across 26 cities. Vertical bars represent the inter-quartile range, which is the range of values observed in half of the cities. The number of deaths is captured by a three-year average – i.e., a 2010 value represents the 2008-2010 average.

Source: ITF Safer City Streets database.

Figure 5. Serious injuries by mode, 2010-2018



Note: For each mode, the chart represents the median percentage change across 17 cities. Vertical bars represent the inter-quartile range. The number of deaths is captured by a three-year average – i.e., a 2010 value represents the 2008-2010 average.

Source: ITF Safer City Streets database.

Is cycling getting more dangerous over time?

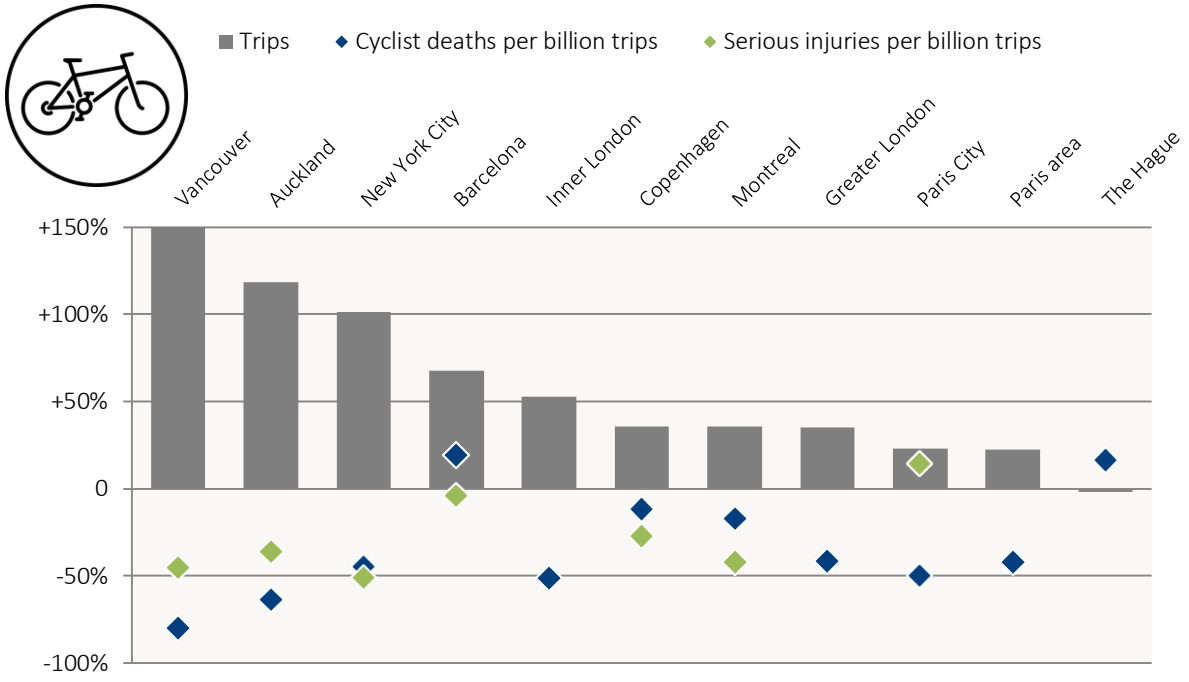
The share of cyclists is going up in the total number of road traffic victims, according to the trends presented above. This raises the question: is cycling becoming more dangerous or more popular?

The number of bicycle trips increased in most cities between 2010 and 2018. It more than doubled in New York City, Auckland and Vancouver. In nearly all cities, the number of trips increased more than the number of cyclist deaths and injuries. As a result, the risk of death or injury per trip went down in most cities (Figure 6).

Cycling is becoming safer over time in cities taking part in the Safer City Streets initiative. But, is it safe enough for policy makers to encourage it? From the perspective of personal health, cycling is safe: it brings health benefits that extend life expectancy even after the risk of collision is accounted for (Mueller et al. 2018). In addition, cycling is far safer than riding a motorcycle or a moped, as shown in the next chapter.

Some pieces of analysis include third-party crash victims for a more complete assessment of the risks imposed on *all* road users. Shaun et al. (2018) examined mode choice in the male population aged 17-25 and found cycling to be safer than driving. Earlier research in the Safer City Streets programme concluded that a bicycle trip in a dense urban area is less likely to result in road deaths than a car trip, regardless of gender and age (ITF, 2019). City centres would become safer if walking, cycling and other forms of low-speed micromobility replaced car and motorcycle trips (ITF, 2020c).

Figure 6. Cycling trips and risk per trip, 2010-2018



Note: The numbers of trips, deaths and injuries are captured by a three-year average. The chart, therefore, represents the percentage change from the 2008-2010 average to the 2016-2018 average. Montreal: change in trip numbers assumed equal to change in kilometres travelled.

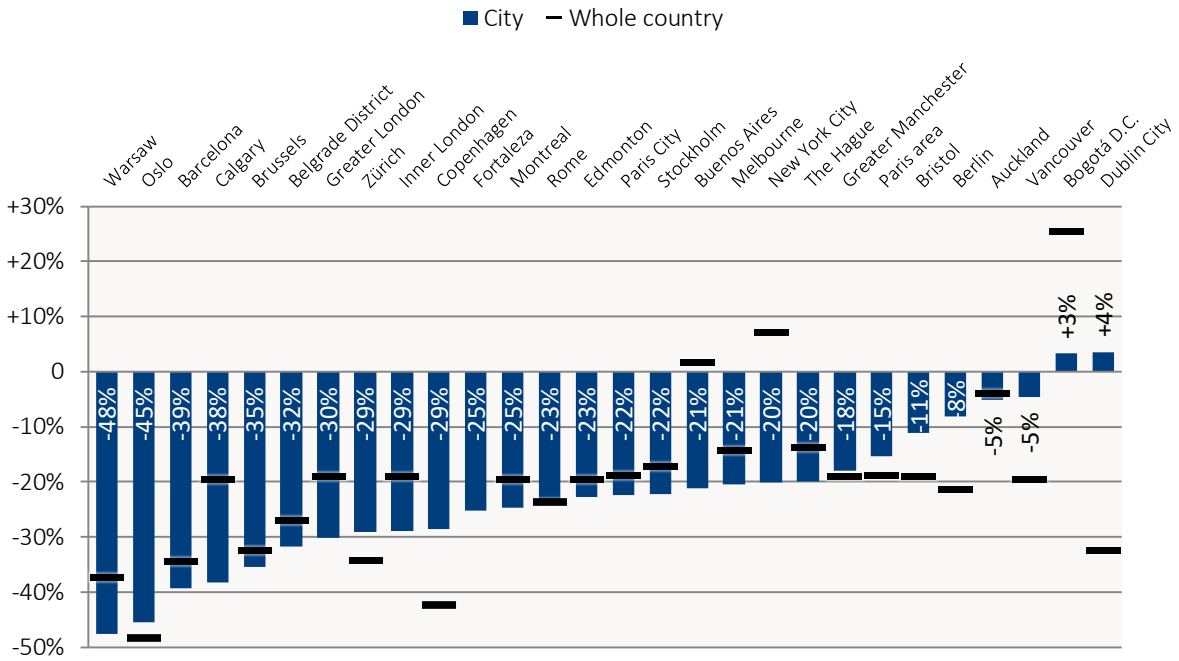
Source: ITF Safer City Streets database.

The recent increase in the number of cycling injuries hides substantial progress in cycling safety, but shows that all stakeholders could do more. The Covid-19 pandemic has further accelerated growth in cycling, underlining the case for road space redistribution (ITF, 2020b). With e-bikes, cargo-bikes, urban logistics, e-scooters and other low-speed micro-vehicles on the rise, the demand for wide and safe cycle routes could quickly outpace current supply. Cities need wide and safe cycle routes to accommodate the predictable growth in cycling and need to support policies that allow for modal shift towards cycling.

Cities can outperform the national average

Several cities have outperformed the national-level fatality reduction figures: this is most remarkable in Calgary, Buenos Aires, New York and Bogotá. The phenomenon is particularly striking in Calgary, thanks to a combination of province and city-level factors. The province of Alberta upgraded its sanctions against impaired driving in 2018 with the immediate suspension of a driver's license on the roadside. Calgary identified road safety as a priority and adopted Vision Zero with the launch of the city's Safe Mobility Plan (City of Calgary, 2015). The city implemented hundreds of 30 km/h zones, using traffic calming measures to increase compliance with the lowered speed limits. The police created a new unit in 2016 dedicated to traffic safety in high-risk areas such as school zones and other locations with high pedestrian activity (Calgary Police Service, 2018).

Figure 7. Road traffic deaths by city and country, 2010-2018



Note: The number of deaths is captured by a three-year average, in both cities and countries. The chart, therefore, represents the percentage change from the 2008-2010 average to the 2016-2018 average.

Source: ITF's IRTAD database, ITF's Safer City Streets database.

Buenos Aires, New York City and Bogotá also outperform the national casualty reduction figure in their countries, thanks to consistent efforts to elaborate ambitious, data-driven road safety policies. Several aspects of their work stand out as best practice and feature in a separate report by the ITF (2020a).

Progress was the fastest in Warsaw, Oslo and Barcelona. Warsaw shows rapid improvement from a low base. Several initiatives have contributed to the rapid reduction in the number of road deaths. A bike share system and a new metro line opened in 2012 and 2015 respectively. The network of cycle routes grew from less than 200 km in 2010 to 640 km in 2019 (Warsaw Public Roads Authority, 2020). The design of the new cycle routes includes physical separation from motorised traffic. The City Road Administration is completing a safety audit and upgrade of more than 4 000 pedestrian crossings, collecting data on traffic volume and speed distribution. Much room for further progress remains in Warsaw, as in the whole of Poland, where inflation has eroded penalties for infringing traffic regulations, which have reportedly lost their deterrent effect for speeding violations[5].

Box 2. Functional Urban Areas: A common definition

The OECD and the European Commission have jointly developed a methodology to define functional urban areas (FUAs) consistently across countries. A harmonised definition of urban areas as "functional economic units" overcomes the limitations of administrative boundaries. This facilitates international comparisons and policy analysis at the urban level. (OECD, 2012)

Functional urban areas are relevant units for territorial policy and spatial planning. An FUA consists of a densely inhabited city and a surrounding area (commuting zone) whose labour market is highly integrated with the city. For that, the methodology uses population density to identify urban cores and travel-to-work flows to identify the hinterlands. (OECD, 2012)

Ten European FUAs are included in sections of this report focussed on benchmarking the risk of fatality experienced by vulnerable road user groups (figures 9, 11 and 12). The ITF Safer City Streets database contains a total of 41 FUAs. ITF (2019) has previously reported the road safety performances of those FUAs.

In Oslo, decades of policies towards safe and active mobility have contributed to the rapid drop in road fatalities. Since 1990, Oslo has had a congestion-charging zone, generating income that supports investment in public transport. The city has also made notable efforts to cut speeds around schools and to build protected bike routes. As a result, travel surveys reveal a rapid change in the mobility of residents. The share of trips travelled by car dropped rapidly, from 37% in 2014 to 32% in 2018. People instead make more trips on public transport and by bicycle (Oslo Municipality, 2020). Not a single pedestrian or cyclist died in Oslo in 2019 (Murray, 2020).

Barcelona has received global media coverage for its programme of "superblocks", which replaces motorised through-traffic with people-friendly outdoor space for the community (Roberts, 2019). However, this programme does not explain all of the rapid reduction in road fatalities between 2010 and 2018. Consistent long-term efforts to foster safe active and public transport options explains much of the change observed. Engaged since 2012 with the ITF for the pilot phase of the Safer City Streets initiative, Barcelona has developed a strong expertise for injury data analysis and elaborated effective data-driven road safety policies (ITF, 2020a).

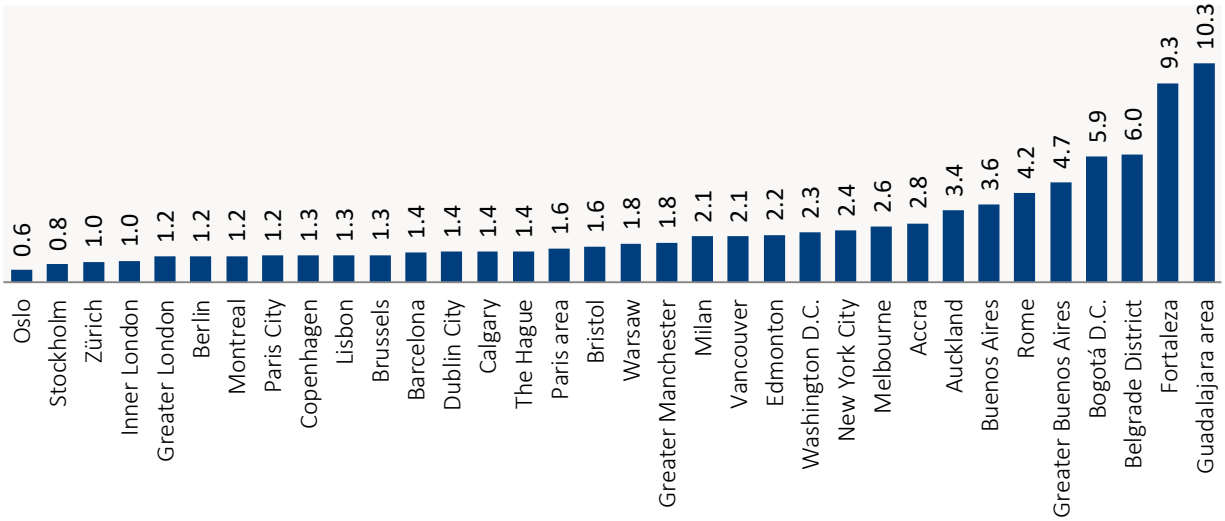
Benchmarking urban road safety

The ITF published its first global benchmark for urban road safety in November 2018 (Santacreu, 2018b). With data collected from 31 cities in 20 countries, the report revealed striking differences in road safety performance between cities. The number of road fatalities in the benchmarked cities ranged from 0.9 to 24 deaths per 100 000 inhabitants, for the 2011-2015 period. The present report uses data over 2016-2018 to re-examine the differences between cities.

Mortality

Mortality is a concept widely adopted for the comparison of road deaths across countries. It is defined as the ratio of road traffic deaths over the number of inhabitants. In cities, however, the number of inhabitants does not always account for the true level of activity, and daytime population is used instead to better reflect urban mobility (ITF, 2019). The number of fatalities recorded ranges from 0.6 to 10.3 per 100 000 daytime population (Figure 8). These new figures confirm the large performance gaps between cities, and the scope for rapid progress where solutions are transposed from one city to another.

Figure 8. Road traffic deaths per 100 000 daytime population



Note: 2016-2018 average. Daytime population is the sum of the resident population and the net influx of commuters.

Source: ITF Safer City Streets database.

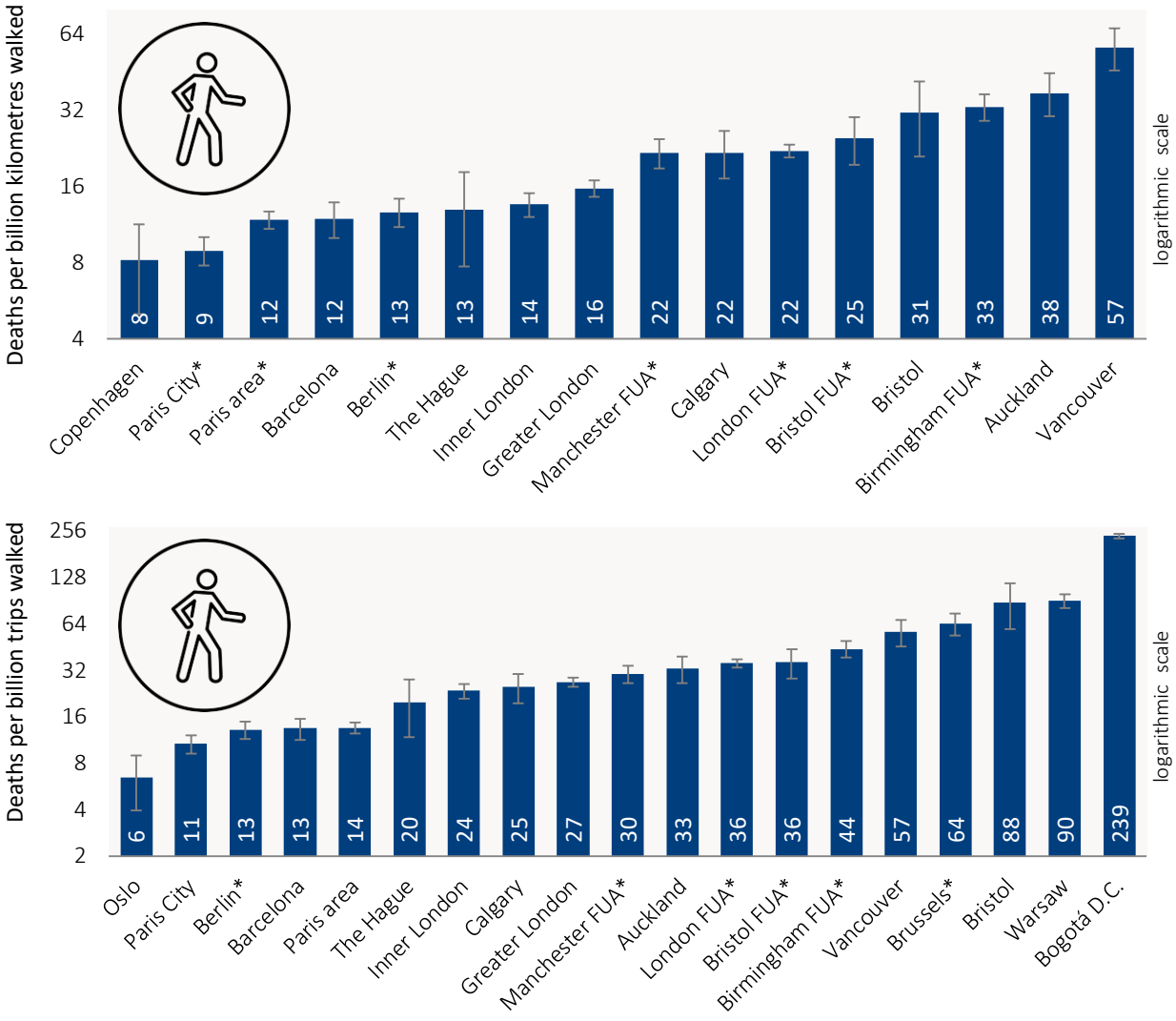
Mortality is lower in Inner London, Paris and Buenos Aires than in their respective metropolitan areas. These recent observations confirm earlier analysis by the ITF (2019) showing that population density

correlates with safety. The analysis revealed that mortality falls 20% as density doubles, which is likely due to lower vehicle speed and greater use of public transport in more densely developed areas.

Pedestrian safety

This report measures the safety of walking. It computes two indicators that capture the likelihood of dying in a crash while controlling for the number of trips walked or the number of kilometres walked. Santacreu (2018b) first computed such risk indicator for benchmarking safety in cities. ITF (2019) subsequently scaled up the analysis by including functional urban areas in England where walking data was available.

Figure 9. Pedestrian fatality risk across cities, 2014-2018 average



Note: Data was collected for the cities marked with (*) between 2011 and 2015. Vertical bars represent 80% confidence intervals, based on the observed number of deaths.

Source: ITF Safer City Streets database.

Oslo, Copenhagen, Paris, Berlin and Barcelona are the five safest cities to walk in. Together, the cities average 11 pedestrian fatalities per billion trips walked, and ten pedestrian fatalities per billion kilometres walked. Figure 9 shows consistent conclusions, whether one looks at risk per trip or per kilometre. Analysis of the figure leads to the conclusion that Auckland and Vancouver must reduce pedestrian risk by a factor of four to catch up with the "top five" cities.

Figure 9 includes confidence intervals, which reflect the statistical uncertainty that comes from the observation of a relatively small number of events. The higher the number of pedestrian deaths in a city, the more accurate the walking risk estimate.

Cycling safety

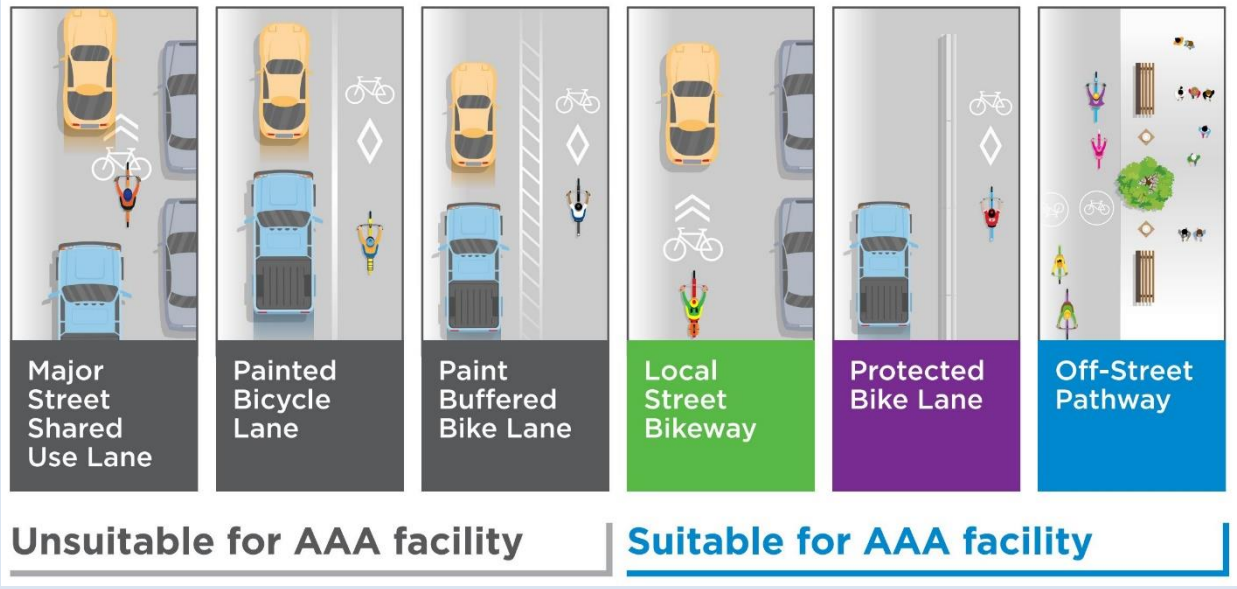
Figure 11 identifies Vancouver, Copenhagen, Oslo, Berlin and Montreal as the five safest cities for riding a bike, averaging 18 fatalities per billion trips and five fatalities per billion kilometres. Several cities have substantive room for progress, recording a risk at least ten times higher: these include Bogotá, Rome, and the functional urban areas around the cities of Rome, Turin and Lisbon.

Box 3. Cycling safety in Vancouver: Design for all ages and abilities

In the past years, Vancouver has encouraged active mobility and the use of public transport. The city's Transportation Plan goal for 2020 of more than 50% of trips made by foot, bike or transit was already achieved by 2016. Cycling deaths in Vancouver are rare. Only one such casualty occurred between 2014 and 2018, in spite of growing bicycle traffic, as measured by automated counters. The growth in cycling and the low number of fatalities is the result of Vancouver's efforts to make cycling safe.

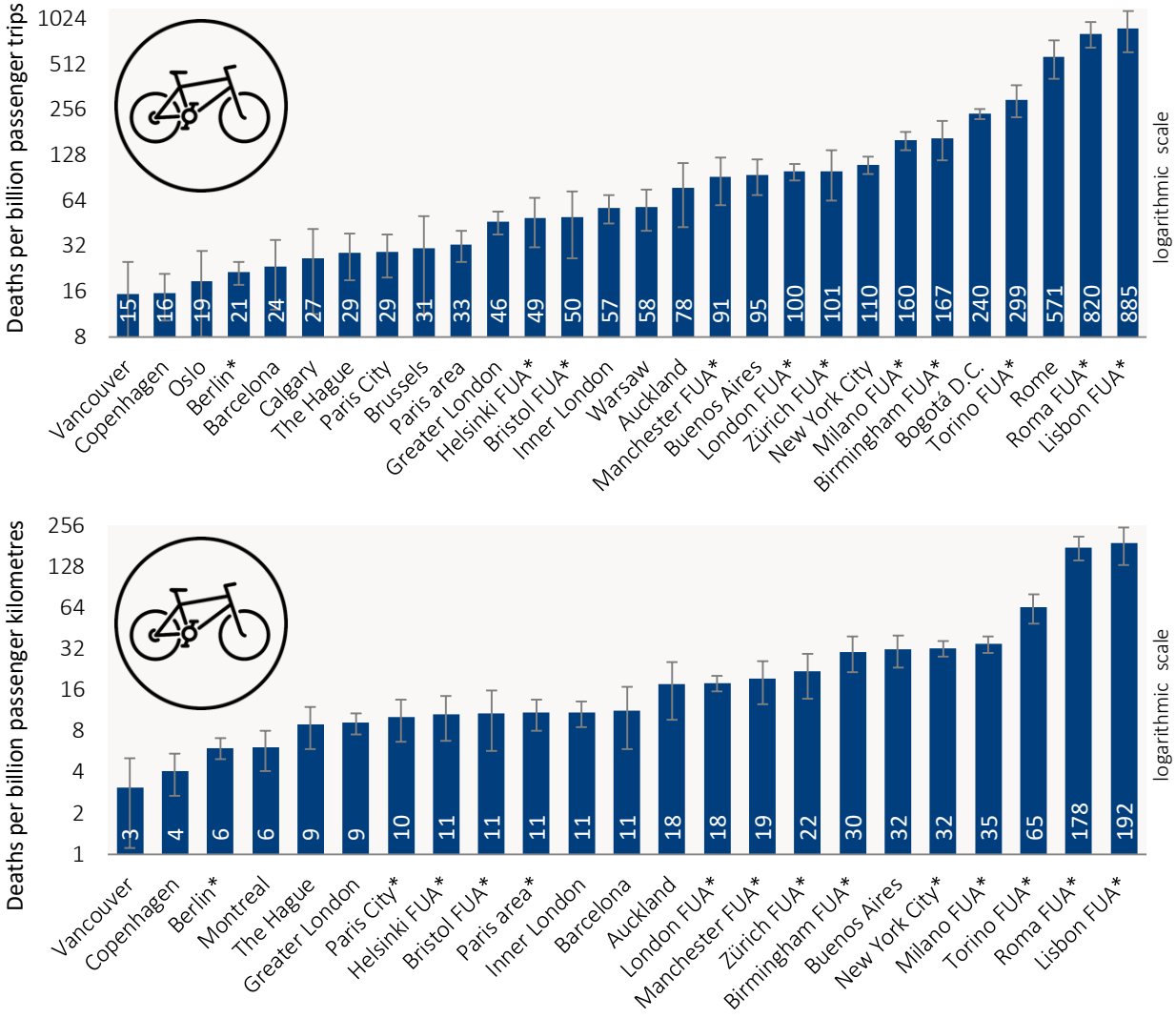
To encourage the uptake of cycling, Vancouver placed safety high on the list of specifications for bike infrastructure. The goal was that a larger spectrum of the population, including women, adopt the new infrastructure. From the current bike network of 325 kilometres, 25% qualifies as safe and comfortable for people of all ages and abilities (rated AAA) and follows specific design guidelines (Figure 10).

Figure 10. Vancouver's guidelines for cycling facilities for people of all ages and abilities



Sources: City of Vancouver (2016, 2019).

Figure 11. Cycling fatality risk across cities, 2014-2018 average



Note: Data was collected for the cities marked with (*) between 2011 and 2015. Vancouver and Calgary: 2011-2018. Vertical bars represent 80% confidence intervals, based on the observed number of deaths.

Source: ITF Safer City Streets database.

To reduce risk, policy makers can reduce the speed of motor vehicles. This improves safety across all user groups (ITF, 2018). To improve cycling safety specifically, the ITF recommends investing in protected and connected cycle routes. A wide range of solutions exists. One consists of changing the circulation plan to remove motorised through-traffic from residential streets. Another consists of allocating space for cycling, with a physical separation. (Santacreu, 2018a).

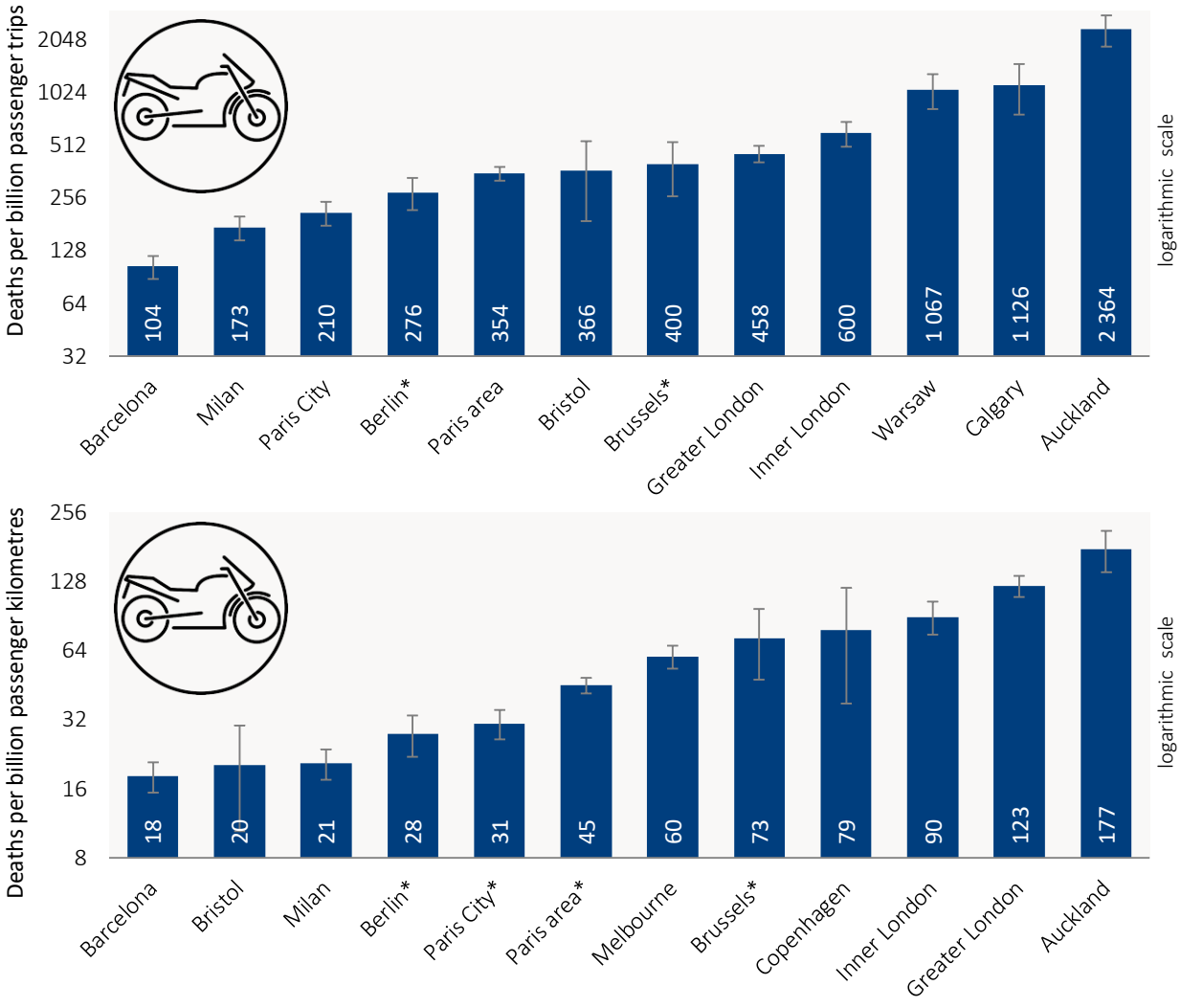
The Covid-19 pandemic strongly affected mobility patterns during lockdown periods (ETSC, 2020) but may also have triggered a permanent shift towards cycling in cities. Automatic counters in French cities recorded a 33% increase in bicycle traffic in May and June 2020 (post-lockdown) in comparison to 2019 (Vélo et Territoires, 2020). Collecting bicycle traffic data – which is essential for monitoring the level of risk – will be more important than ever in a context of disruption.

Powered two-wheeler safety

Barcelona, Bristol, Milan, Paris and Berlin provide the safest environments for riding motorcycles and scooters, with an average of 190 fatalities per billion trips or 24 fatalities per billion kilometres. In comparison with risk levels observed in other modes, the risk of riding a motorcycle or a moped is very high. In particular, the risk is five times higher than that of riding the same distance on a bicycle.

Warsaw, Calgary and Auckland record a powered two-wheeler fatality risk ten to 20 times higher than that observed in Barcelona. This demonstrates once again that there remains considerable room for progress in urban road safety policies.

Figure 12. Powered two-wheeler fatality risk across cities, 2014-2018 average



Note: Data was collected for the cities marked with (*) between 2011 and 2015. Vertical bars represent 80% confidence intervals, based on the observed number of deaths.

Source: ITF Safer City Streets database.

Road user behaviour

Between 19% and 89% of cyclists use a helmet, according to surveys and roadside observations in seven locations (Table 1). Relatively few cities choose to monitor this indicator, as their cycling safety priorities lie elsewhere. National level figures were submitted in lieu of city-level figures in Copenhagen and Warsaw. Table 1 reveals the absence of a direct relationship between helmet wearing rates and cycling safety levels. Denmark is one of the world's safest countries for cycling (Santacreu, 2018a), despite only 35% of riders wearing a helmet. With a helmet wearing rate of 89%, cycling in Auckland still remains five times more likely to result in the loss of life than cycling in Copenhagen.

Table 1. Protective equipment wearing rate by city

City	Helmet		Seat belt in passenger cars			
	Bicycle	Powered two-wheeler	Child restraint	Driver	Front seat passengers	Rear seat passengers
Accra		72%	12%	80%		
Auckland	89%		92%		97%	86%
Belgrade District		93%	57%	80%	76%	10%
Bogotá D.C.		97%	26%	90%	80%	8%
Bristol				98%	96%	88%
Brussels	44%	99%	92%	94%	93%	
Buenos Aires	19%	82%	54%	65%	50%	17%
Copenhagen	35%	90%		96%		85%
Dublin City	44%	99%		94%	95%	80%
Fortaleza		86%	34%	82%	77%	30%
Melbourne		96%		97%	96%	96%
Montreal	44%			98%	98%	
Oslo				95%	95%	95%
Stockholm	78%		100%	97%	97%	
The Hague			68%	97%	97%	82%
Warsaw		99%	95%	94%	96%	60%

Note: average values of figures available between 2014 and 2018. Helmet wearing rates of Copenhagen and Warsaw refer to national rates. Seat belt wearing rates of Auckland, Copenhagen and Oslo refer to national rates.

Source: ITF Safer City Streets database.

The value of helmets in protecting riders of motorcycles is uncontested and most cities record a rate of helmet use above 90%. Table 1 nevertheless shows significant variation. Frequent collection of this indicator could help authorities evaluate the success of their education and enforcement campaigns.

The use of seat belts remains far from universal in cities: it ranges from 50% to 98% on front seats. On rear seats, the use of seat belts remains much lower. In Belgrade and Bogotá, no more than 10% of rear-seat

passengers wear a seat belt, whereas over 80% of drivers wear one. Policy makers should investigate which behavioural and vehicle design factors explain this phenomenon.

Survey methods and definitions vary across countries. The figures in Table 1 thus require careful interpretation. More behaviours and attitudes are also worth monitoring and comparing across cities. Speed is, of course, a key factor in the occurrence and severity of crashes (ITF, 2018). The monitoring of speed and of attitudes towards speeding should be integrated into the Safer City Streets database but a consistent approach to monitoring speeds must first be developed.

Who is killed in cities? Road deaths by mode and gender

Pedestrians, cyclists and riders of powered two-wheelers represent over 50% of road traffic deaths in almost all cities taking part in ITF's Safer City Streets initiative (Figure 13).

Vulnerable road users (VRUs) represent between 77% and 94% of road fatalities in the six most densely populated cities, those with over 10 000 inhabitants per square kilometre. The over-representation of VRUs in casualty statistics explains why road safety policies in urban areas tend to focus on protecting these users. This involves measures such as lowering speed limits, enforcing speed limits and redistributing road space.

Figure 13 is valuable in setting policy priorities. It should not, however, be interpreted as a risk analysis: the very high proportion of cyclists killed in The Hague and Copenhagen is due to a large proportion of cycling trips, rather than a risky cycling environment. Figure 11 earlier showed that the two cities are among the world's safest places to ride a bicycle.

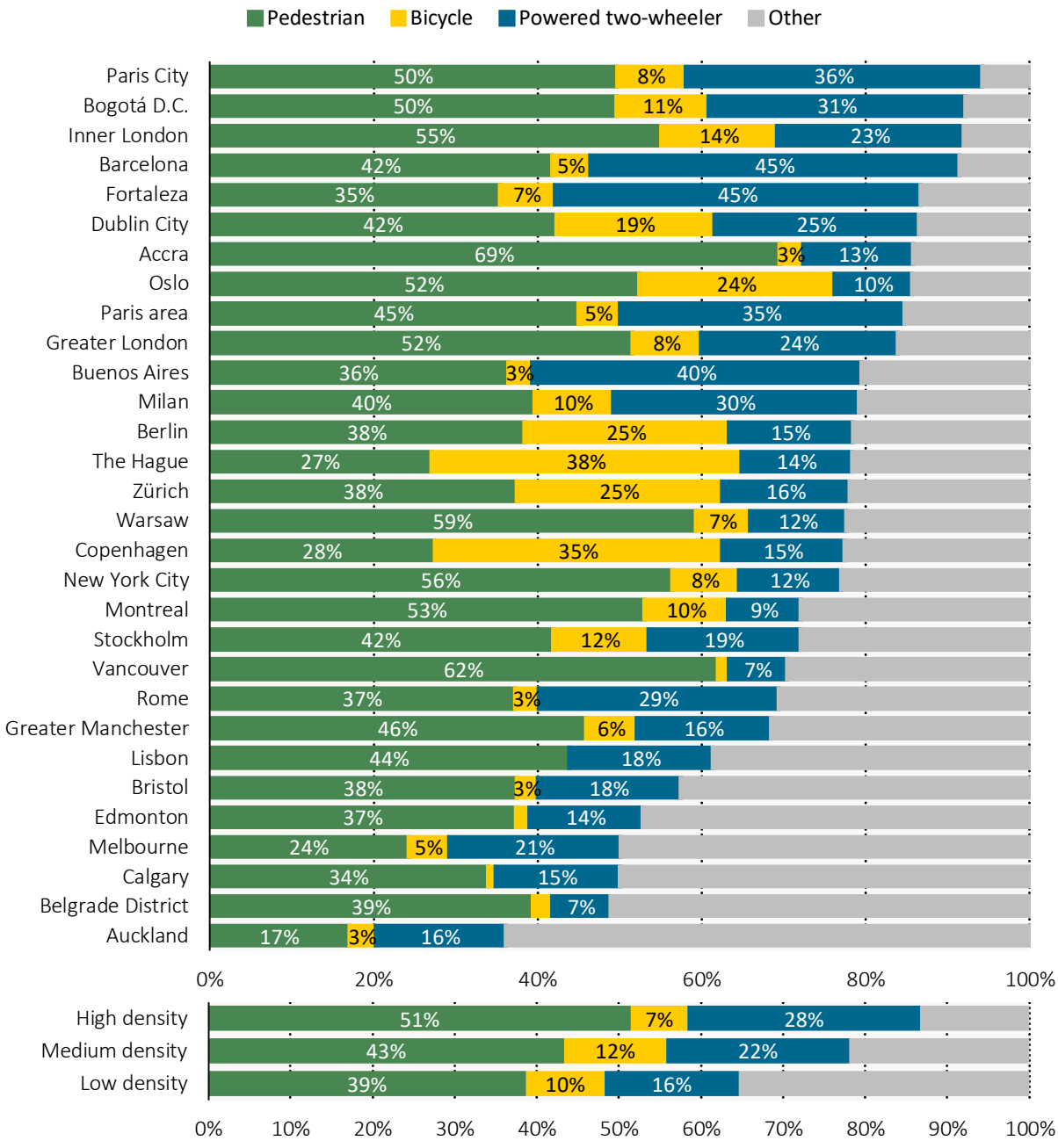
Men are over-represented in road traffic deaths. In the vast majority of cities, they are two or more times more likely to die in traffic, in comparison to women (Figure 14).

The use of powered two-wheelers could explain some of the differences between cities. Riders of motorcycles and mopeds represent at least three in ten road fatalities in Barcelona, Bogotá, Buenos Aires, Fortaleza and Rome, the cities in which men are at least three times more likely than women to die in traffic.

The city of Buenos Aires explored road fatalities by gender and age to better understand the victims' profiles. What emerged is a gender-specific pattern of traffic deaths: around 70% of women who died in traffic were pedestrians, while 60% of the men were motorcyclists. The differences also apply by age group: fatalities of pedestrians are most common among people over 55 years old, while motorcyclist deaths peak between 25 and 34 years old. (GCBA, 2020)

A policy focus on male drivers and riders could help some cities reduce their overall mortality figures. Cities with the highest overall mortality are those where male and female mortality differs the most. The five cities with a male/female mortality ratio greater than three are also the cities with the highest mortality rates (Figure 8). These are Fortaleza, Belgrade District, Bogotá, Rome and Buenos Aires.

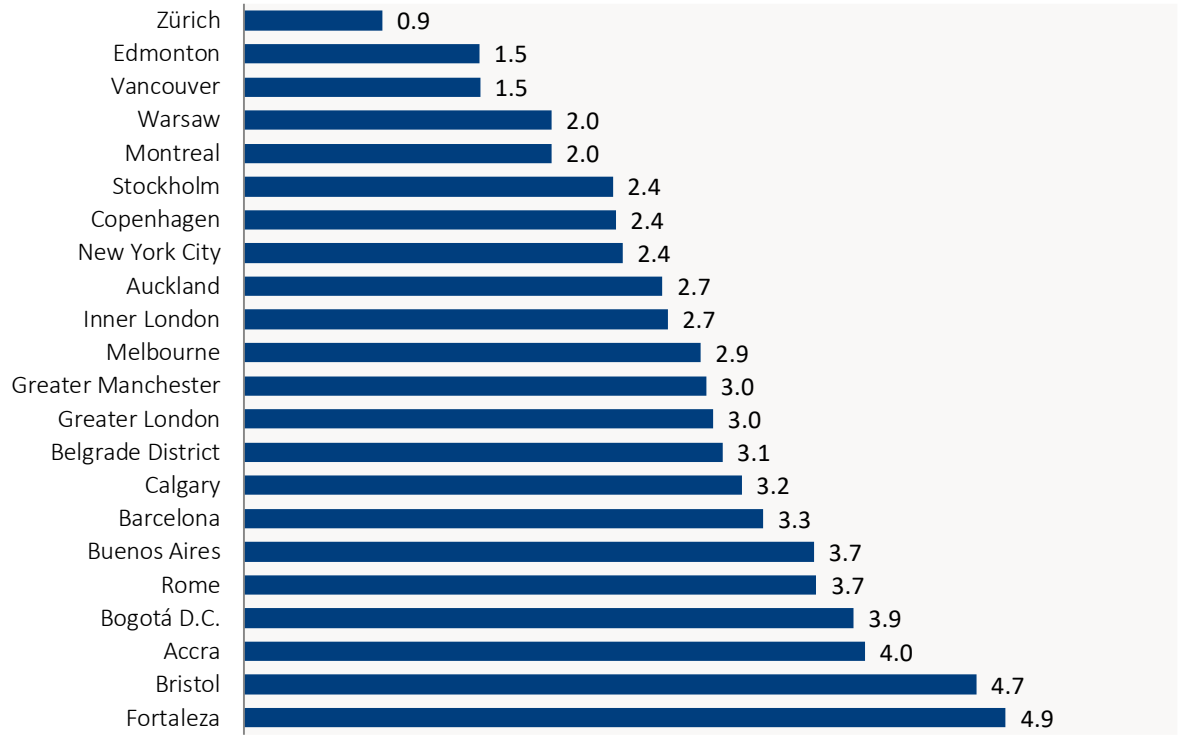
Figure 13. Modal share of road fatalities by city, 2014-2018



Note: average values of figures available between 2014 and 2018. Low population density (n=13) is less than 5 000 inhabitants per square kilometre, medium (n=11) is less than 10 000, high (n=6) is 10 000 and above. Where cities are grouped, the chart presents the unweighted average across cities in the group.

Source: ITF Safer City Streets database.

Figure 14. Ratio between male and female fatalities



Note: 2014-2018 average. The ratio controls for male and female resident population but does not control for differences in mobility patterns.

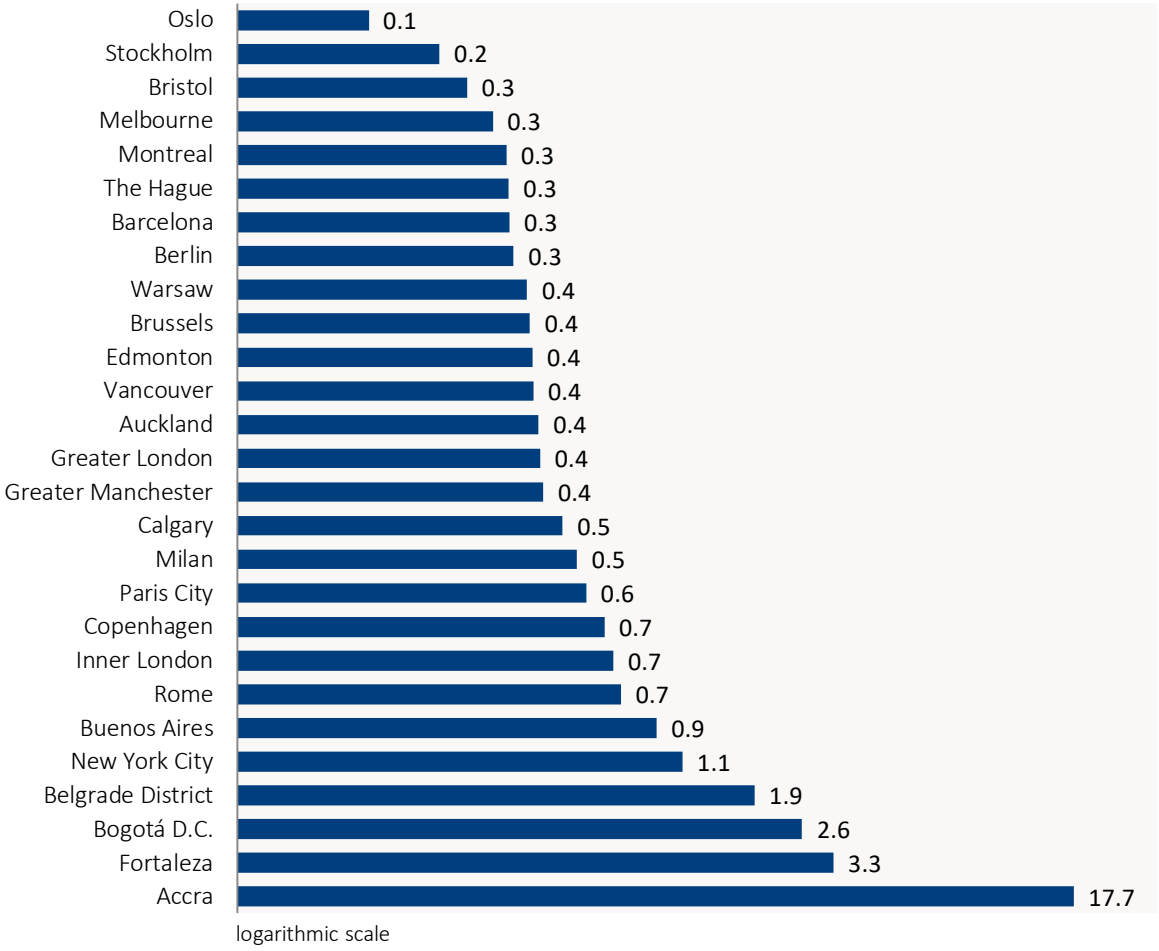
Source: ITF Safer City Streets database.

Alternative road safety indicators

There are several alternative road safety indicators, frequently used for the additional insights they provide. All three indicators presented in this section share a common focus on the number of road traffic fatalities – that is the sum of road deaths across all modes – but differ in the choice of denominator: the value used to normalise the absolute number of fatalities and make it comparable across cities. The first controls for the size of the vehicle fleet, the second for the volume of traffic, and the third for the length of the road network.

Figure 15 shows a number of fatalities over thirty times higher in Fortaleza than in Oslo and over one hundred times higher in Accra than in Oslo, controlling for fleet size[6]. This supports the case for an alignment towards high vehicle safety standards all over the world. Standards for safe vehicles include active safety technologies, such as Intelligent Speed Assistance, but also passive safety solutions to reduce the impact of a crash not just on car occupants but also on pedestrians and on all third parties in general. ITF (2019) reported figures from Bogotá where seven out of eight people killed in a crash involving a car were vulnerable road users.

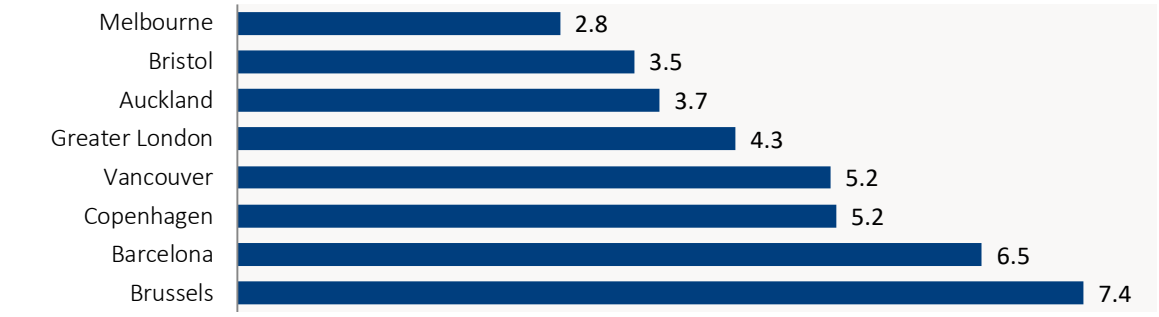
Figure 15. Number of fatalities per year per 10 000 vehicles registered, 2014-2018



Note: average values of figures available between 2014 and 2018.

Source: ITF Safer City Streets database.

Figure 16. Number of fatalities per billion vehicle-kilometres, 2014-2018



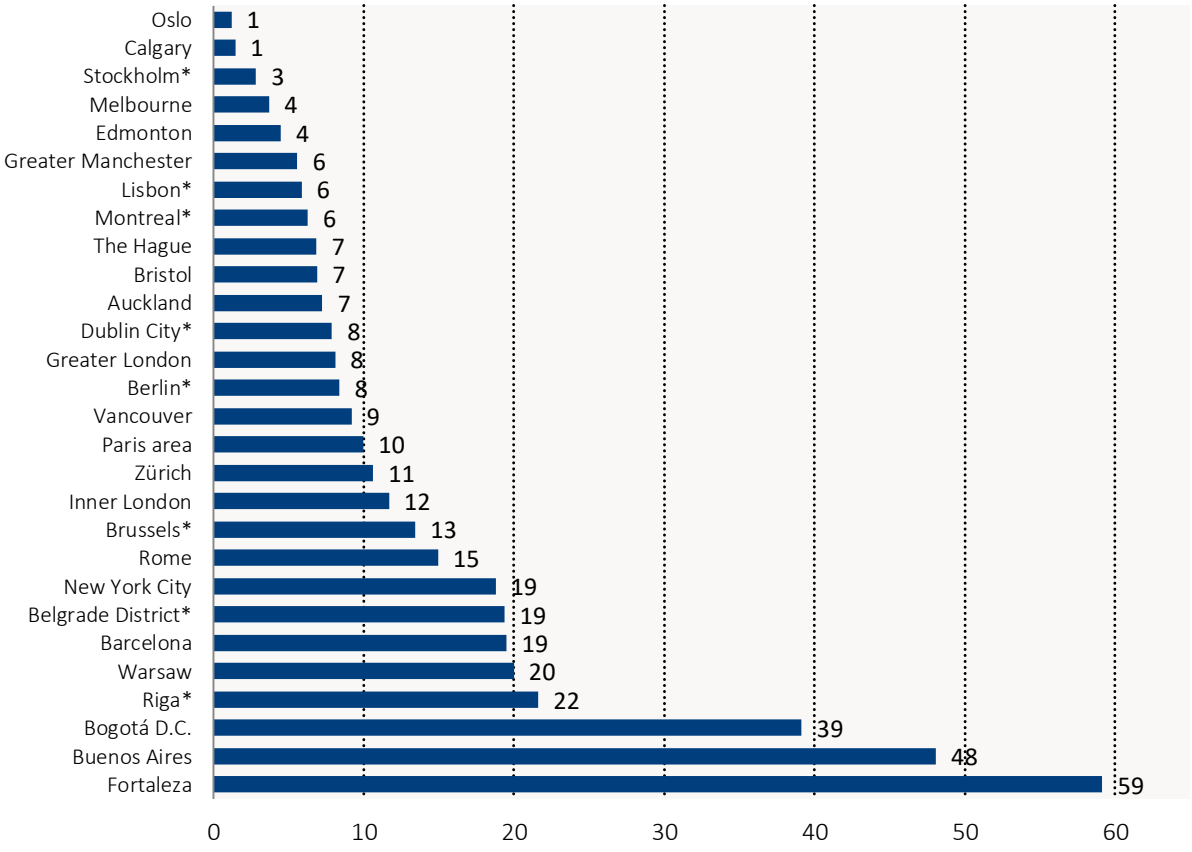
Note: average values of figures available between 2014 and 2018. Vehicle traffic includes all types of road motor vehicles subject to registration. It excludes pedal cycles but includes mopeds, motorcycles, cars, goods vehicles and buses.

Source: ITF Safer City Streets database.

Figure 16 shows that Brussels has almost three times more fatalities than Melbourne, when controlling for traffic volumes. This indicator generally reveals higher fatality rates in areas that are the most densely populated, likely because of a high number of vulnerable road users (VRUs) and the high likelihood of conflict between VRUs and motor vehicles.

Figure 17 shows that Fortaleza has fifty times more fatalities than Oslo, controlling for the length of the road network. This indicator reflects differences in the urban fabric, with some cities having larger blocks served by wider, busier streets. Such cities would particularly benefit from considerable changes in street design. New street design could prevent speeding and reallocate space to safer transport options: walking, cycling and public transport.

Figure 17. Number of road deaths per year and per 1 000 kilometres of road network length



Notes: 2016-2018 average. Cities marked with (*) have their data collected over 2013-2015.

Source: ITF Safer City Streets database.

Notes

1 The FUA perimeters used in this report were defined by Eurostat (2015) as part of the Urban Audit 2011-2014. Casualty figures at FUA level were taken from CARE, a database managed by the European Commission's Directorate General for Mobility and Transport (DG MOVE).

2 Adopted in 2020 by the United Nations 75th assembly is the resolution called "Improving Road Safety" which sets a goal of reducing road traffic deaths and injuries by at least 50% from 2021 to 2030. https://www.un.org/pga/74/wp-content/uploads/sites/99/2020/08/Draft-Resolution-Road-Safety.pdf.

3 One could seek to control for population growth. This requires an indicator called mortality, defined as the number of deaths per unit resident population. Across cities, a median 29% reduction in mortality occurred over the 2010-2018 period. The inter-quartile range is -21% to -38%. Figures are computed using three-year moving averages to mitigate the random fluctuation of annual fatality figures at the level of a single city.

4 The seven cities with the highest absolute numbers of fatalities are Melbourne, Paris area, Greater London, Rome, New York City, Fortaleza and Bogotá D.C.

5 Speed measurements from the Warsaw Public Roads Authority revealed that 56% of all vehicles were exceeding the speed limit (Warsaw Public Roads Authority, 2020).

6 Vehicles include all types of road motor vehicles subject to registration. It excludes pedal cycles but includes mopeds, motorcycles, cars, goods vehicles and buses. One should bear in mind that some vehicle fleets (e.g. ride hailing, delivery or construction vehicles) often operate outside the municipality where they are registered. This may lead to a certain disconnect, relatively modest at country-level but more significant at city-level, between the number of vehicles registered in an area and the number of vehicles actually operating in an area.

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Annex A. City population statistics

Table A.1. Population and density for cities mentioned in this report

Country	Code	City	Land area (km^2)	Population	Population density ($/km^2$)
Argentina	ARG01	Buenos Aires	203	3 068 000	15 110
Argentina	ARG02	Greater Buenos Aires	4 036	14 457 000	3 580
Australia	AUS02	Melbourne	8 836	4 653 000	530
Belgium	BEL01	Brussels (a)	161	1 212 000	7 510
Brazil	BRA03	Fortaleza	313	2 643 000	8 440
Canada	CAN01	Montreal (b)	365	2 029 000	5 560
Canada	CAN02	Vancouver	115	642 000	5 580
Canada	CAN03	Calgary	858	1 273 000	1 480
Canada	CAN04	Edmonton	685	978 000	1 430
Colombia	COL01	Bogotá D.C.	1 587	8 181 000	5 160
Denmark	DNK01	Copenhagen	86	613 000	7 130
Finland	FIN61	Helsinki FUA	3 795	1 367 000	360
France	FRA01	Paris City	105	2 190 000	20 860
France	FRA02	Paris area (c)	762	6 828 000	8 960
Germany	DEU01	Berlin	892	3 690 000	4 140
Ghana	GHA01	Accra (d)	173	2 037 000	11 770
Ireland	IRL01	Dublin City	115	565 000	4 920
Italy	ITA01	Rome	1 285	2 856 000	2 220
Italy	ITA02	Milan	182	1 369 000	7 520
Italy	ITA61	Roma FUA	5 753	4 198 000	730
Italy	ITA62	Milano FUA	2 637	4 182 000	1 590
Italy	ITA64	Torino FUA	1 781	1 785 000	1 000
Latvia	LVA01	Riga	304	697 000	2 290
Mexico	MEX01	Mexico City	1 568	8 999 000	5 740
Mexico	MEX03	Guadalajara	151	1 460 000	9 670
Mexico	MEX04	Guadalajara area (e)	2 393	4 891 000	2 040

Country	Code	City	Land area (km^2)	Population	Population density ($/km^2$)
Netherlands	NLD03	The Hague	80	533 000	6 660
New Zealand	NZL01	Auckland (f)	4 942	1 619 000	330
Norway	NOR01	Oslo	427	673 000	1 580
Poland	POL01	Warsaw	517	1 778 000	3 440
Portugal	PRT01	Lisbon	84	506 000	6 020
Portugal	PRT61	Lisbon FUA	3 912	2 816 000	720
Serbia	SRB01	Belgrade District (g)	3 237	1 688 000	520
Spain	ESP01	Barcelona	101	1 642 000	16 250
Spain	ESP02	Madrid	608	3 142 000	5 170
Sweden	SWE01	Stockholm	187	962 000	5 140
Switzerland	CHE01	Zürich	88	429 000	4 870
Switzerland	CHE61	Zürich FUA	1 089	1 207 000	1 110
United Kingdom	GBR01	Inner London (h)	319	3 600 000	11 290
United Kingdom	GBR02	Greater London (i)	1 572	8 908 000	5 670
United Kingdom	GBR03	Greater Manchester	1 276	2 818 000	2 210
United Kingdom	GBR04	Bristol	111	463 000	4 170
United Kingdom	GBR61	London FUA	8 000	12 207 000	1 530
United Kingdom	GBR62	Birmingham FUA	2 068	2 873 000	1 390
United Kingdom	GBR68	Manchester FUA	1 810	2 783 000	1 540
United Kingdom	GBR71	Bristol FUA	981	900 000	920
United States	USA01	New York City	792	8 399 000	10 600
United States	USA02	Washington D.C.	177	684 000	3 860

Note: (a) Brussels Capital Region, made of 19 municipalities, (b) Urban agglomeration of Montreal, also known as Montreal Island, made of 16 municipalities, (c) City of Paris and three surrounding administrative units: Hauts-de-Seine, Seine St-Denis, Val de Marne, (d) Accra refers to the Accra Metropolitan Area, made of 12 separate local government districts, (f) Auckland council, amalgamated council since 2010, (g) Belgrade District, also called Belgrade City or Belgrade, is made of 17 municipalities, (i) Greater London, also known as London, is made of 33 local government districts, (h) Inner London in its statutory definition is made of 13 local government districts, (e) Guadalajara area is made of six municipalities (Guadalajara, Zapopan, San Pedro Tlaquepaque, Tonalá, Tlajomulco de Zúñiga, El Salto) together making up 99% of the population of the official metropolitan area.

All figures refer to 2018, apart from FUAs (2011-2015), Riga (2015), Guadalajara (2015) and Madrid (2015).

Each city comes with a code serving as unique identifier in the online Safer City Streets database.

Source: Direct data collection from cities, except for FUAs, where land area is derived from Eurostat (2015) Urban Audit FUA 2011-2014 geography shapefile and where population is taken from Eurostat (2010-2014 average).

International Transport Forum

Monitoring Progress in Urban Road Safety

This report tracks the progress in reducing the number of road traffic fatalities and serious injuries in cities since 2010. It presents traffic safety data collected in 48 cities participating in the ITF Safer City Streets network and compares urban with national road safety trends. It provides indicators for the risk of traffic death for different road user groups, thereby enhancing the evaluation, monitoring and benchmarking of road safety outcomes.

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